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Opening, Prizes and Awards / 1403

Welcome by the Chair of the ICRC 2015

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Opening, Prizes and Awards / 1400

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Opening, Prizes and Awards / 1401

Address from the President of the University of Groningen

Opening, Prizes and Awards / 1402

Prizes and Awards Ceremony

Parallel CR01 Aniso / 390

Anisotropy in Cosmic Ray Arrival Directions Using IceCube and IceTop

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We provide an update on the continued observation of anisotropy in the arrival direction distribution of cosmic rays in the southern hemisphere. The IceCube neutrino observatory recorded more than 250 billion events between May 2009 and May 2014. Subtracting dipole and quadrupole fit maps, we can use these increased statistics to see significant small-scale structure that approaches our median angular resolution of 3 degrees. The expanded dataset also allows for a more detailed study of the anisotropy for various cosmic-ray median energies. The large-scale structure observed at median energies near 20 TeV appears to shift around 150 TeV, with the high-energy skymap showing a strong deficit also present in IceTop maps of similar energies.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

163

Parallel SH 01 SEP I / 799

The Longitudinal Distribution of Solar Energetic Particles

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Using observations from the High Energy Telescopes on STEREO A and B and similar observations from SoHO, near-Earth, we have identified ~250 individual solar energetic particle events that include >14 MeV protons since the beginning of the STEREO mission (Richardson, et al., Solar Physics, 2014). Between the end of December 2009, when the STEREO A and B spacecraft were, respectively, ahead and behind Earth by ~65° in ecliptic longitude, and the end of December 2013, 43 different events were clearly detected at all three locations. The observed intensities of such an event are usually fit with a Gaussian which is a function of the longitudes of the Parker Spiral footpoints at the Sun for each observer. This neglects the fact that the interplanetary magnetic field may have large deviations from Parker Spirals, e.g. due to coronal mass ejections from prior events. Nonetheless, we have fit Gaussians to the peak intensities observed simultaneously at three spacecraft for all 43 events, taking into account particles coming around the Sun both from the east and from the west. The Gaussian peak intensity is poorly correlated with the corresponding CME speed and the FWHM is uncorrelated with the CME speed. Surprisingly, however, there appear to be distinctly non-random variations of the FWHM values from event to event. We will investigate possible causes of this effect.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

564

Parallel GA01 EGAL / 696

Revisiting the starburst galaxy NGC 253 with H.E.S.S.

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NGC 253 is one of only two starburst galaxies that is found to emit γ -ray emission from hundreds of MeV to multiple TeV energies. An accurate measurement of the GeV and TeV spectra is crucial to determine the underlying particle accelerators, to probe the dominant emission loss mechanism(s) and to probe the importance of cosmic-ray interaction and transport. The precision of the measurement of the γ -ray emission of the starburst galaxy NGC 253 published in 2012 by H.E.S.S. was dominated by the large associated systematic uncertainties.

With the improved understanding of the response of the H.E.S.S. experiment, we present an evaluation of systematic uncertainties of the measurement. We show that they are of the same order of magnitude as the statistical uncertainties. The spectral analysis is discussed for H.E.S.S. separately as well as in combination with the Fermi-LAT measurement. No significant deviation from a single power law is observed. The obtained flux parameters are found to be consistent with the previous measurement within systematic uncertainties. However a $\sim 35\%$ enhanced flux is now observed. The results of the combined spectral fit strengthen the conclusions presented in Abramowski et al. (2012).

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

569

Parallel CR02 Hadr Int / 304

Status of the LHCf experiment

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Observations of UHECRs' by extensive air showers rely on understanding of hadron interactions at very high energies. Recent LHC experiments have provided useful hadron interaction data at the collision energy which is almost equivalent to 10^{17} eV in the laboratory frame.

Among them, the LHCf experiment is dedicated measurement of neutral particle productions at very forward region of LHC IP1.

Two detectors consisting of a pair of compact electromagnetic sampling calorimeters installed at 140 m apart from the IP1, covering the pseudorapidity range η from 8.6 to infinity.

So far measurements of energy spectra for gamma rays, neutral pions, and neutrons have been measured for 7TeV or 0.9 TeV p-p collisions. LHCf has also reported neutral pions from p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV.

Obtained results are compared with the existing cosmic ray interaction models, SYBILL, QGSJETII, DPMJET3, and EPOS. The measured data are well bracketed by these models, although none of them could completely reproduce the data.

In 2015 LHCf revisits LHC to obtain p-p collision data at 13 TeV. Current achievement of LHCf experiment and the first look of 13 TeV data as well as future prospects for possible very forward measurement for p-p or p-light ions at RHIC or future LHC will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

226

Parallel GA02 GAL / 849

Study of the diffuse gamma ray emission from the Galactic plane with ARGO-YBJ

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The data recorded by ARGO-YBJ in more than 5 years have been analyzed to determine the diffuse gamma ray emission from the Galactic plane. The spatial distribution of the diffuse gamma rays and their energy spectra at Galactic longitudes $25^\circ < l < 100^\circ$ and Galactic latitudes $|b| < 5^\circ$ have been studied. The regions with $40^\circ < l < 100^\circ$ and $65^\circ < l < 85^\circ$ have been focused, where Milagro observed an excess with respect to the predictions of current models. The energy range investigated covers from ~ 350 GeV to ~ 2 TeV, connecting the region explored by Fermi-LAT with the multi-TeV energies studied by Milagro. Great care has been taken in masking the TeV point sources observed by ARGO-YBJ and other experiments. Our results are consistent with the predictions of the Fermi model and do not show any excess as observed by Milagro.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

420

Parallel SH 01 SEP I / 118

Resolving multiple sources of solar relativistic particles

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We perform a comparative study of the time-profile morphology of solar high-energy particle emissions including relativistic electrons in three energy channels of SOHO/EPHIN, relativistic protons as registered by the worldwide network of neutron monitors, and ~ 100 MeV/n protons and helium in several energy channels of SOHO/ERNE. Based on numerical modeling of the interplanetary transport, we formulate a simple method for resolving the high-energy particle sources operating in solar corona during first hour of the high-energy particle events. The method is applied to Ground Level Enhancement (GLE) and Solar Energetic Particle (SEP) events of the solar cycle 23. We conclude that depending on the GLE-SEP event scenario and detector's vantage point, the observed particles originate from up to three sources. Possible nature of the sources is discussed in the framework of previous and new models of the high-energy particle production associated with global coronal (EIT) waves and CME bow shocks within five solar radii from the Sun.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

127

Parallel GA02 GAL / 247

TeV Gamma-Ray Emission Observed from Geminga by HAWC

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Geminga is a radio-quiet pulsar ~ 250 parsecs from Earth that was first discovered as a GeV gamma-ray source and then identified as a pulsar. Milagro observed an extended TeV source spatially consistent with Geminga. HAWC observes a similarly extended source. Observations of Geminga's flux and extension will be presented.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

1160

Parallel CR02 Hadr Int / 655

The TOTEM experiment at LHC for proton-proton cross section measurements.

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The precise knowledge of the proton-proton cross section is extremely important to model the development, in the atmosphere, of the showers induced by the interaction of ultra high energy cosmic rays.

The TOTEM (TOTAl cross section, Elastic scattering and diffraction dissociation Measurement at the LHC) experiment at LHC, has been designed to measure the total proton-proton cross-section with a luminosity independent method, based on the optical theorem, and study the elastic and diffractive scattering at the LHC energy. This method relies on the capability of the simultaneous measurements of inelastic and elastic rates; in the TOTEM experiment this is possible thanks to two forward inelastic telescopes, covering the pseudorapidity range $3.1 < |\eta| < 6.5$, and Roman Pot detectors, that can be inserted down to few hundred microns to the beam centre.

Thanks to dedicated runs, taken between 2011 and 2012, with special beam optics, TOTEM experiment was able to measure the elastic, inelastic and total cross-section at $\sqrt{s} = 7 \text{ TeV}$ and 8 TeV , using the luminosity independent method, along with the pseudorapidity distribution of charged particles.

In this contribution the latest results of the TOTEM experiment will be described along with its performance and the future physics program for the LHC run 2.

Collaboration:

TOTEM

Registration number following "ICRC2015-I":

575

Parallel GA01 EGAL / 547

Spectral characteristics of Mrk 501 during the 2012 and 2014 flaring states

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The BL Lac object Mrk 501 was observed at Very High Energies ($E > 100 \text{ GeV}$) with H.E.S.S. (High Energy Stereoscopic System) between 2004 and 2014. The source is detected with high significance above $\sim 2 \text{ TeV}$ in $\sim 13.6 \text{ h}$ livetime. The observations include periods of low flux and active phases. This led to the detection of strong flaring events, which in 2014 showed a flux level comparable to the 1997 historical maximum. Such high flux states enabled spectral variability and flux variability studies down to a timescale of a few minutes in the 2-20 TeV energy range. During the 2014 flare,

the source is clearly detected in each time bin. The spectrum does not show intrinsic curvature in this energy range. Flux dependent spectral analyses are also carried out. The peculiarity of this study resides in the unprecedented combination of short timescales and an energy coverage that extends significantly above 10 TeV. The high energies allow us to probe the effect of EBL absorption at low redshifts, jet physics and LIV. The multiwavelength context of these VHE observations will be presented as well.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

488

Parallel CR01 Aniso / 221

Search for High Energy Neutron Point Sources in IceTop

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IceTop can detect an astrophysical flux of neutrons from Galactic sources as an excess of cosmic ray air showers arriving from the source direction. Neutrons are undeflected by the Galactic magnetic field and can typically travel 10 (E / PeV) pc before decay. Two searches through the IceTop dataset are performed to look for a statistically significant excess of events with energies above 10 PeV (10^{16} eV) arriving within a small solid angle. The blind search method covers from -90° to approximately -50° in declination. A targeted search is also performed, looking for significant correlation with candidate sources in different target sets. Flux upper limits can be set in both searches.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

232

Parallel GA02 GAL / 737

TeV Observations of the Galactic Plane with HAWC and Joint Analysis of GeV Data from Fermi

Author: Hao Zhou¹**Co-authors:** C. Michelle Hui¹; Petra Huentemeyer²¹ *Michigan Technological University*² *urn:Google***Corresponding Author:** hzhou1@mtu.edu

A number of Galactic sources emit GeV-TeV gamma rays that are produced through leptonic and/or hadronic mechanisms. Spectral analysis in this energy range is crucial in order to understand the emission mechanisms. The HAWC Gamma-Ray Observatory, with a large field of view and location at 19° N latitude, is surveying the Galactic Plane from high Galactic longitudes down to

near the Galactic Center. Data taken with partially-constructed HAWC array in 2013-2014 exhibit TeV gamma-ray emission along the Galactic Plane. A high-level analysis likelihood framework for HAWC, also presented at this meeting, has been developed concurrently with the Multi-Mission Maximum Likelihood (3ML) architecture to deconvolve the Galactic sources and to perform multi-instrument analysis. It has been tested on early HAWC data and the same method will be applied on HAWC data with the full array. I will present preliminary results on Galactic sources from TeV observations with HAWC and from joint analysis on Fermi and HAWC data in GeV-TeV energy range.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

427

Parallel CR02 Hadr Int / 1196

Study of high muon multiplicity cosmic ray events with ALICE at the CERN Large Hadron Collider

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ALICE is one of four large experiments at the CERN Large Hadron Collider. Located 52 meters underground with 28 meters of overburden rock, it has also been used to detect atmospheric muons produced by cosmic ray interactions in the upper atmosphere. We present the multiplicity distribution of these cosmic ray muon events and their comparison with Monte Carlo simulation. This analysis exploits the large size and excellent tracking capability of the ALICE Time Projection Chamber. A special emphasis is given to the study of high multiplicity events containing more than 100 reconstructed muons and corresponding to a muon areal density larger than $6.7 m^{-2}$. Similar high muon multiplicity events have been studied in previous underground experiments such as ALEPH and DELPHI at LEP. While these experiments were able to reproduce the measured muon multiplicity distribution with Monte Carlo simulation at low and intermediate multiplicities, they failed to reproduce the frequency of the highest multiplicity events.

We demonstrate that the high muon multiplicity events observed in ALICE stem from primary cosmic rays with energies above 10^{16} eV.

The frequency of these events can be successfully described by assuming a heavy mass composition of primary cosmic rays in this energy range and using the most recent hadronic interaction models to simulate the development of the resulting air showers.

This observation narrows the scope alternative, more exotic, production mechanisms for these events.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0933

Parallel SH 01 SEP I / 516**SOLAR ENERGETIC PARTICLE EVENTS: TRAJECTORY ANALYSIS AND FLUX RECONSTRUCTION WITH PAMELA****Author:** Alessandro Bruno¹**Co-authors:** Eric R. Christian²; Georgia A. de Nolfo²; James M. Ryan³; Steven J. Stochaj⁴; Ulisse Bravar³¹ *Department of Physics, University of Bari, I-70126 Bari, Italy*² *Heliophysics Division, NASA Goddard Space Flight Center, Greenbelt, MD, USA*³ *Space Science Center, University of New Hampshire, Durham, NH, USA*⁴ *Electrical and Computer Engineering, New Mexico State University, Las Cruces, NM, USA***Corresponding Author:** alessandro.bruno@ba.infn.it

The PAMELA satellite experiment is providing the first direct measurements of Solar Energetic Particles (SEPs) with energies from about 80 MeV to several GeV in near-Earth space, bridging the low energy data from space-based instruments and the Ground Level Enhancement (GLE) data from the worldwide network of neutron monitors. Its unique observational capabilities include the possibility of measuring the flux angular distribution and thus investigating possible anisotropies related to SEP events. This work reports the analysis methods developed to estimate SEP energy spectra as a function of the particle asymptotic pitch angle. The crucial ingredient is provided by an accurate simulation of the asymptotic exposition of the PAMELA apparatus, based on a realistic reconstruction of particle trajectories in the Earth's magnetosphere. Results for the 2006 December 13 and the 2012 May 17 events are presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

469

Parallel GA01 EGAL / 59**Discovery of very-high-energy gamma-ray emission from a hard-X-ray bright HBL RX J1136.5+6737****Author:** Masaaki Hayashida¹**Co-authors:** Hajime Takami²; Ryosuke ITOH³; Yusuke Konno⁴¹ *Institute for Cosmic-Ray Research, University of Tokyo*² *KEK*³ *Hiroshima University*⁴ *Kyoto University***Corresponding Author:** mahaya@icrr.u-tokyo.ac.jp

RX J1136.5+6737 ($z=0.1342$) is a hard X-ray bright high-peaked frequency BL Lac object as listed in the MAXI 3-year catalog as well as the Swift-BAT catalog. The source has also been detected by

Fermi-LAT with a hard photon index of 1.68 ± 0.12 , and belongs to the first Fermi-LAT catalog of > 10 GeV sources, showing bright (photon flux = 11.7×10^{-11} ph cm $^{-2}$ s $^{-1}$) emission above 10 GeV. MAGIC observed the source for about 30 hours in 2014 and discovered very-high-energy (VHE) gamma-ray emission from the source with $> 5\sigma$ significance. The averaged flux measured by MAGIC during the 2014 observations corresponds to about 1.5% of the Crab Nebula flux at energies above 200 GeV without significant variability. The measured spectrum shows evidence of extending into the TeV energy range, even though most extragalactic background light models predict the distance of $z=0.1342$ is beyond the “Cosmic gamma-ray horizon” at 1 TeV. Along with the MAGIC observations, we coordinated simultaneous multi-band observations in X-ray and UV bands by Swift, and in optical-IR bands by ground-based telescopes such as Kanata and KVA. In this contribution, the first results of the MAGIC discovery of VHE emission from RX J1136.5+6737 will be reported. We will also discuss origins of the gamma-ray emission with a broad-band spectral energy distribution using our emission model, which takes into account secondary gamma-ray photons produced from cascades induced by ultra-high-energy gamma-ray or protons propagating through intergalactic space.

Collaboration:

MAGIC

Registration number following “ICRC2015-I”:

81

Parallel CR01 Aniso / 1342

Full-Sky Analysis of Cosmic-Ray Anisotropy with IceCube and HAWC

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During the past two decades, experiments in both the Northern and Southern hemispheres have observed a small but measurable energy-dependent sidereal anisotropy in the arrival direction distribution of galactic cosmic rays. The relative amplitude of the anisotropy is $10^{-4} - 10^{-3}$. However, each of these individual measurements is restricted by limited sky coverage, and so the pseudo-power spectrum of the anisotropy obtained from any one measurement displays a systematic correlation between different multipole modes C_ℓ . To address this issue, we present the current state of a joint analysis of the anisotropy on all angular scales using cosmic-ray data from the IceCube Neutrino Observatory located at the South Pole (90° S) and the High-Altitude Water Cherenkov (HAWC) Observatory located at Sierra Negra, Mexico (19° N). We present a combined skymap and an all-sky power spectrum in the overlapping energy range of the two experiments at ~ 10 TeV. We describe the methods used to combine the IceCube and HAWC data, address the individual detector systematics and study the region of overlapping field of view between the two observatories.

Collaboration:

IceCube

Registration number following “ICRC2015-I”:

997

Parallel GA02 GAL / 1268

RCW 86 - A shell-type supernova remnant in TeV gamma-rays

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RCW 86 (also known as G315.4-2.3 or MSH 14-3) is a young supernova remnant about 1800 years old with a shell-like structure in the optical, radio, infrared and X-rays regimes with a diameter of about 40'.

We will show detailed morphological and spectral studies of the TeV gamma-ray data measured with the H.E.S.S. telescope system. These studies reveal for the first time a shell-like structure in this energy range that correlates with non-thermal X-rays (2 keV - 5 keV) in the south west region of the remnant. The TeV gamma-ray spectrum is best described by an exponential cutoff power law. Leptonic and hadronic gamma-ray emission scenarios are probed for RCW 86 in a multi-wavelength approach, and the implications of these studies will be discussed.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

674

Parallel SH 01 SEP I / 558

Systematic Behavior of Heavy Ion Spectra in Large Gradual Solar Energetic Particle Events

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Our Sun accelerates ions and electrons up to near-relativistic speeds in at least two ways; magnetic reconnection during solar flares is believed to produce the impulsive or ³He-rich solar energetic particles (SEPs), while diffusive shock acceleration at fast coronal mass ejection - or CME-driven shock waves are thought to produce the larger gradual SEPs. Despite recent advances in our understanding of the properties (e.g., time variations, spectral behavior, longitudinal distributions, compositional anomalies etc.) of large SEP events, the relative roles played by many important physical processes remain poorly understood. These effects include variations in the seed populations, the geometry and speed of the shock, the presence or absence of a preceding CME from the same active region, scattering by ambient turbulence or by self-generated Alfvén waves during acceleration and transport, and the direct presence of flare accelerated material at energies above ~10 MeV/nucleon. Observations and theoretical studies have indicated that many of these effects may manifest in the spectral properties of H and other heavy elements. In this paper, we present results from a survey of

the energy spectra of ~ 0.1 -500 MeV/nucleon H-Fe nuclei in 46, isolated and well-connected large gradual SEP events observed by instruments onboard ACE, GOES, SAMPEX & SoHO and determine how the spectral fit parameters such as the break or roll-over energies vary with the ion's Charge-to-Mass (Q/M) ratio. In particular, we compare our results with predictions of existing and developing models to understand why some large SEP events exhibit species-dependent spectral breaks that vary strongly with the ion's Q/M ratio while others do not.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

503

Parallel CR02 Hadr Int / 779

Results from pion-carbon interactions measured by NA61/SHINE for better understanding of extensive air showers

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The interpretation of extensive air shower measurements, produced by ultra-high energy cosmic rays, relies on the correct modelling of the hadron-air interactions that occur during the shower development. The majority of hadronic particles is produced at equivalent beam energies below the TeV range. NA61/SHINE is a fixed target experiment using secondary beams produced at CERN using the SPS. Hadron-hadron interactions have been recorded at beam momenta between 13 and 350 GeV/c with a wide-acceptance spectrometer. In this talk we present measurements of the identified secondary hadron spectra and the resonance production from pion-carbon interactions, which are essential for modelling air showers.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

496

Parallel CR01 Aniso / 147

Observation of Anisotropy in the Arrival Direction Distribution of TeV Cosmic Rays With HAWC

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The High-Altitude Water Cherenkov (HAWC) Observatory, located 4100 m above sea level near Pico de Orizaba (19° N) in Mexico, is sensitive to gamma rays and cosmic rays at TeV energies. The arrival direction distribution of cosmic rays at these energies shows significant anisotropy on several angular scales, with a relative intensity ranging between 10^{-3} and 10^{-4} . We present the results of a study of cosmic-ray anisotropy based on more than 100 billion cosmic-ray air showers recorded with HAWC since June 2013. The HAWC cosmic-ray sky map, which has a median energy of 2 TeV, exhibits several regions of significantly enhanced cosmic-ray flux. We present the energy dependence of the anisotropy and the cosmic-ray spectrum in the regions of significant excess.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

1224

Parallel GA01 EGAL / 602

The Denoised, Deconvolved, and Decomposed Fermi gamma-ray sky

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We analyze the 6.5 year all-sky data from the Fermi Large Area Telescope restricted to gamma-ray photons with energies between 0.6-307.2 GeV. Raw count maps show a superposition of diffuse and point-like emission structures and are subject to shot noise and instrumental artifacts. Using the D3PO inference algorithm, we model the observed photon counts as the sum of a diffuse and a point-like photon flux, convolved with the instrumental beam and subject to Poissonian shot noise. The D3PO algorithm performs a Bayesian inference in this setting without the use of spatial or spectral templates; i.e., it removes the shot noise, deconvolves the instrumental response, and yields estimates for the two flux components separately. The non-parametric reconstruction uncovers the morphology of the diffuse photon flux up to several hundred GeV. We present an all-sky spectral index map for the diffuse component. We show that the diffuse gamma-ray flux can be described phenomenologically by only two distinct components: a soft component, presumably dominated by hadronic processes, tracing the dense, cold interstellar medium and a hard component, presumably dominated by leptonic interactions, following the hot and dilute medium and outflows such as the Fermi bubbles. A comparison of the soft component with the Galactic dust emission indicates that the dust-to-soft-gamma ratio in the interstellar medium decreases with latitude. The spectrally hard component exists in a thick Galactic disk and tends to flow out of the Galaxy at some locations. Furthermore, we find the angular power spectrum of the diffuse flux to roughly follow a power law with an index of 2.47 on large scales, independent of energy. Our first catalog of source candidates includes 3106 candidates of which we associate 1381 (1897) with known sources from the second (third) Fermi source catalog. We observe gamma-ray emission in the direction of a few galaxy clusters hosting known radio halos.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

533

Parallel GA02 GAL / 423

RCW 86 an extended SNR viewed at high energy with the new Fermi-LAT Pass 8 event reconstruction

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Supernovae Remnants (SNRs) are thought to be the primary source of galactic cosmic rays observed on Earth. Detected in radio, infrared, X-rays and at high (GeV) and very high energy (TeV) gamma rays, RCW 86 is a good candidate for efficient particle acceleration and might be the remnant of the historical supernova SN 185. Using more than 6 years of data acquired by the Fermi Large Area Telescope with the new Pass 8 event reconstruction, RCW 86 is now detected as a significant extended source at GeV energies, with a radius of 0.37°. The results of our deep morphological and spectral analysis provide new constraints on the origin of the gamma-ray emission and on key parameters such as the asymmetry of the morphology, the density of the surrounding medium and the total energy in accelerated particles. These new constraints will be presented and discussed in the light of existing estimates.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

1170

Parallel CR02 Hadr Int / 1108

The impact of a fixed-target experiment with LHC beam for astroparticle physics

Authors: Anatoli Fedynitch¹; Colin Baus¹; Ralf Matthias Ulrich¹; Ralph Engel²; Tanguy Pierog³; Uwe Kraemer⁴; felix riehn³¹ KIT - Karlsruhe Institute of Technology (DE)² Forschungszentrum Karlsruhe³ KIT⁴ Karlsruhe Institute of Technology**Corresponding Author:** ralf.ulrich@cern.ch

There are two main points, where the data from a fixed-target experiment with LHC beam will contribute unique information. Firstly, to better understand the inclusive flux of atmospheric neutrinos at very high, PeV, energies. Secondly, to the apparent over-abundance of GeV muons in ultra-high energy extensive air showers. To contribute towards answering these questions, the experimental limitations and requirements for a fixed-target experiment at LHC are presented and discussed. The

investigation of forward D-meson production at high-xF is essential in order to distinguish if PeV neutrinos are indeed astrophysical or may also be produced partly within the atmosphere. Furthermore, the production of GeV muons is deeply related to the pion cascade within air showers, and the corresponding pion-air interactions. More precise fixed-target data for pion-Carbon at LHC beam energies will contribute significantly to a better modelling of the muon content of air showers.

Registration number following "ICRC2015-I":

887

Collaboration:

– not specified –

Parallel GA01 EGAL / 675

Searching for TeV gamma-ray emission associated with IceCube high-energy neutrinos using VERITAS

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A potential clue to finding the long-sought-after sources of cosmic rays is the recent observation of an astrophysical flux of high-energy neutrinos by the IceCube detector, since these possibly originate in hadronic interactions near cosmic-ray accelerators. While the neutrino sky map shows no indication of point sources so far, it is possible to utilize the sensitivity of TeV Cherenkov telescopes, such as VERITAS, to search for hadronic gamma-ray emission at the neutrino locations.

Over the last 2 years, the positions of neutrino events detected by IceCube have been observed using the VERITAS array. Observations have been limited to muon neutrino events, since their typical angular reconstruction uncertainty is below 1°, smaller than the 3.5° diameter of the VERITAS field of view. The location of VERITAS further constrains the neutrino event positions that can be observed to those located in the northern sky, or at moderate southern declinations. The list of observed positions was selected from published results and a set of high-energy muon tracks provided by IceCube. We present the current status and some preliminary results from this program.

Collaboration:

IceCube & VERITAS

Registration number following "ICRC2015-I":

534

Parallel SH 01 SEP I / 915

A statistical study of 90-MeV proton events observed with SOHO/ERNE

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To understand what kind of solar or interplanetary events are capable of producing solar energetic particle (SEP) events with proton energies > 90 MeV, and where and when acceleration of such protons starts. We have selected 40 energetic proton events with intensities $> 10\text{--}3\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}\text{MeV}^{-1}$ at 93.8–94 MeV, detected by the Energetic and Relativistic Nuclei and Electrons (ERNE) instrument onboard SOHO during solar cycle 23, in 1997–2003. We have estimated the first injection times of the particles using two different methods, the fixed path length method (1.2 AU) and the velocity dispersion analysis. We evaluated the injection time results by comparing each to the estimated height of radio type II/IV burst emission, and then compared the estimated times and heights with related flare and coronal mass ejection (CME) characteristics. Results. We find that all the analysed proton events were associated with CMEs and 82% were associated with on-the-disk GOES X-ray flares (six of the seven non-associated were concluded to show behind-the-limb flaring). Radio type II/IV burst emission association was 95% (of the non-associated two events, one was completely void of radio emission and one showed metric continuum and tilted type III burst lane emission). Most of the first protons were injected when the CME leading edges were below 5 solar radii, and most of the protons reached their maximum intensity while the CMEs were above 10 solar radii. The maximum proton intensities were achieved much earlier than the possible passage of an interplanetary shock, suggesting that the majority of high-energy protons at 90 MeV were accelerated as a result of earlier processes. In roughly half of the events the CME front was above the estimated type II burst location. We suggest that in these cases the type II bursts may be related to CME interaction processes and shocks at the CME flanks.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

774

Parallel CR01 Aniso / 458

A study of the first harmonic of the large scale anisotropies with the KASCADE-Grande experiment

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In this contribution we present the results of a search for large scale anisotropies performed, using the East-West method, with the whole data set of the KASCADE-Grande experiment. The counts distribution in sidereal time intervals of 20 minutes, obtained applying the East-West

analysis technique (correctly removing instrumental and atmospheric effects), is analyzed in terms of a dipole component. The amplitude obtained with the whole data set has a 3.5 sigma significance,

therefore an upper limit is derived: $A < 0.47 \times 10^{-2}$.

To investigate a possible variation of the phase of the first harmonic with energy the search has been repeated in shower size intervals. The errors on the phases obtained in all energy intervals are of the

order of 20-30 degrees. The phases obtained point at a sky direction that agrees with those measured at

lower energies by the EAS-TOP, IceCube and IceTop experiments and at higher energy by the low energy

extension of the Pierre Auger Observatory.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I/":

0412

Parallel CR02 Hadr Int / 803

Air Shower Development, pion interactions and modified EPOS Model

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In detailed air shower simulations, the uncertainty in the prediction of shower observable for different primary particles and energies is currently dominated by differences between hadronic interaction models. With the results of the first run of the LHC, the difference between post-LHC model predictions has been reduced at the same level than experimental uncertainties of cosmic ray experiments. At the same time new type of air shower observable, like the muon production depth, has been measured adding new constraints on hadronic models. Currently no model is able to reproduce consistently all mass composition measurement possible within the Pierre Auger Observatory for instance. Using new modifications in EPOS and LHC data, we will show how air shower measurements can be used to constrain pion-air interactions in kinematic phase space which can not be tested by laboratory experiments. The goal being a model which can reproduce all primary mass composition measurements from air showers in a consistent way.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

32

Parallel GA02 GAL / 1299

Search for new supernova remnant shells in the Galactic plane with H.E.S.S.

Author: Gerd Puehlhofer¹

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Amongst the population of TeV gamma-ray sources detected with the High Energy Stereoscopic System (H.E.S.S.) in the Galactic plane, clearly identified supernova remnant (SNR) shells constitute a small but precious source class. TeV-selected SNRs are prime candidates for efficient cosmic-ray acceleration. In this work, we present new SNR candidates that have been identified in the entire H.E.S.S.-I data of the Galactic plane recorded over the past ten years. Identification with known SNR shells from other wavebands are rare but were successful at least in one case. In a few other cases, TeV-only shell candidates are a major challenge for identification as SNR objects due to their lack of detected non-thermal emission in lower frequency bands. We will discuss how these objects may present an important link between young and evolved SNRs, since their shell emission may be dominated by hadronic processes.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

1212

Parallel CR01 Aniso / 524

Measurement of (p+He)-induced anisotropy in cosmic rays with ARGO-YBJ

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Deviations from isotropy in the cosmic ray arrival direction distribution indicate the laboratory reference frame moving with respect to the cosmic radiation. When data are ordered in sidereal time, any effect is of great importance, as it may trace potential sources of cosmic rays and probe their propagation through magnetic fields. For the same reason, to decipher results implies unfolding effects from source distribution, energy spectrum and mass composition of cosmic rays, as well as magnetic field on regular and turbulent scales. Any efficient selection of cosmic ray mass would have a major impact on this scenario, as parameters related to cosmic rays production site, acceleration and propagation mechanisms would be importantly constrained in terms of rigidity. So far, no experiment managed to implement efficient mass selections and save high statistics at the same time.

The ARGO-YBJ experiment (located at the YangBaJing Cosmic Ray Observatory, Tibet, China, 4300 m asl) is the only detector able to select the cosmic ray light (p+He) component with high efficiency in the wide energy range few TeV - 10 PeV. In this contribution a preliminary measurement of the anisotropy for the p+He primary component is reported for the first time.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

478

Parallel GA01 EGAL / 680

AMON Searches for Jointly-Emitting Neutrino + Gamma-Ray Transients

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We present the results of archival coincidence analyses between public neutrino data from the 40-string and 59-string configurations of IceCube (IC40 and IC59) with contemporaneous public gamma-ray data from Fermi LAT and Swift. Our analyses have the potential to discover statistically significant coincidences between high-energy neutrinos and gamma-ray signals, and hence, possible jointly-emitting neutrino/gamma-ray transients. This work is an example of more general multimessenger studies that the Astrophysical Multimessenger Observatory Network (AMON) aims to perform. AMON, currently under development at Penn State, will link multiple current and future sensitive high-energy neutrino, cosmic rays and follow-up observatories as well as gravitational wave facilities. This single network enables near real-time coincidence searches for multimessenger astrophysical transients and their electromagnetic counterparts. We will present the component high-energy neutrino and gamma-ray datasets, the statistical approaches that we used, and the results of analyses of the IC40/59+LAT and IC40/59+Swift datasets.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

252

Parallel SH 01 SEP I / 1248

Unseen GLEs (Ground Level Events)

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Over the last seventy years, solar energetic particle (SEP) ground level events (GLEs) have been observed by ground-based neutron monitors and muon telescopes at a rate of slightly more than one per year. Ground-based detectors only measure secondary particles, and matching their observations with SEP in-situ measurements at lower energies from spacecraft has been difficult. Now, the Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics (PAMELA) instrument provides in-situ measurements that also include composition and pitch-angle distribution and bridge the energy between long-term SEP monitors in space (e.g. ACE and GOES) and the ground-based observations. The PAMELA data show that there are some SEP events (e.g. 23 Jan 2012) where PAMELA sees high-energy (> 1 GeV) particles, yet these are not registered as GLEs. The PAMELA observations indicate that it is possible for the anisotropic distribution of the highest energy SEPs to miss the global network of neutron monitors.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

923

Parallel CR03 Aniso / 1065

Large-Scale Distribution of Arrival Directions of Cosmic Rays Detected at the Pierre Auger Observatory and the Telescope Array above 10^{19} eV

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The large-scale distribution of arrival directions of high-energy cosmic rays is a key observable in attempts to understand their origin. The dipole and quadrupole moments are of special interest in revealing potential anisotropies. An unambiguous measurement of these moments as well as of the full set of spherical harmonic coefficients requires full-sky coverage. This can be achieved by combining data from observatories located in both the northern and southern hemispheres. To this end, a joint analysis using data recorded at the Pierre Auger Observatory and the Telescope Array above 10^{19} eV has been performed. For the first time, thanks to the full-sky coverage, the measurement of the dipole moment reported in this study does not rely on any assumption on the underlying flux of cosmic rays. As well, the sensitivity on the quadrupole and higher order moments is the best ever obtained. The resulting multipolar expansion of the flux of cosmic rays allows a comprehensive description of the angular distribution, and in particular to report on the first angular power spectrum of cosmic rays above 10^{19} eV.

Collaboration:

Pierre Auger & Telescope Array

Registration number following "ICRC2015-I":

607

Parallel DM 01 / 336

Recent results and status of the XENON program

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The XENON program aims at the direct detection of dark matter WIMPs with liquid xenon as target and detecting material. With detectors of increasing target mass and decreasing background, XENON has achieved competitive limits on WIMP-nucleon interaction couplings, but also on axions and axion-like particles. The XENON100 detector has been ongoing at the Laboratori Nazionali del Gran Sasso in Italy since 2009 with a dual phase xenon Time Projection Chamber employing 161 kg of liquid xenon. The most recent results will be presented. Current run mainly focuses on additional calibration for the low energy response of the detector and the validation of new calibration techniques in view of the next generation experiment, XENON1T. XENON1T will be the first experiment to use liquid xenon in a time projection chamber at the ton scale. It is designed to achieve two orders of magnitude higher sensitivity than the current best limits.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1146

Parallel NU 01 / 583

Photon-neutrino flux correlations from hadronic models of AGN?

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Neutrino production in jetted AGN is linked to hadronic processes such as photomeson production. The same interaction predicts also high-energy photons, mostly via neutral pion decay. While neutrinos escape the source unattenuated, the hadronically produced high-energy photons and pairs initiate pair cascades in most cases which re-distribute their energy to lower frequencies where photons can escape the emission region. Realistic hadronic emission models of AGN jets take into account competing energy losses of injected/accelerated particles as well as all leptonic processes (owing to primary and secondary electrons). This may smear out any intrinsic correlation between emerging photon and neutrino fluxes.

The goal of this work is to investigate the degree of observable photon-neutrino flux correlations that is expected from hadronic AGN jet emission models. For this purpose the expected neutrino spectra from a number of hadronically modeled broadband spectral energy distributions (SEDs) of powerful blazars is calculated and compared to the photon fluxes at various frequencies by means of a correlation analysis. The results have implications for the search of the photon sources that are associated to the TeV-PeV neutrino events reported by neutrino observatories.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

519

Parallel GA03 Pulsars / 563

Constraining photon dispersion relation from observations of the Vela pulsar with H.E.S.S

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Constraining photon dispersion relation from observations of the Vela pulsar with H.E.S.S

M. Chrétien, J. Bolmont, A. Jacholkowska, for the H.E.S.S. collaboration

Some approaches to Quantum Gravity (QG) predict a modification of the dispersion relations also known as a Lorentz Invariance Violation. The effect is expected to affect photons near an effective QG energy scale. This value has been constrained by observing gamma rays emitted from variable astrophysical sources such as gamma-ray bursts and flaring active galactic nuclei. Pulsars are periodic transient sources with an extreme variability of ms time scale. In 2014, the H.E.S.S. experiment reported the detection above 30 GeV of gamma rays emitted every 89 ms from the Vela pulsar. Using a likelihood analysis, calibrated with a dedicated Monte-Carlo procedure, we obtain the first limit on QG energy scale with the Vela pulsar. In this talk, the method and calibration procedure in use will be described and the results will be discussed.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

504

Parallel GA 04 / 113

Re-examination of the Expected Gamma-Ray Emission of Supernova Remnant SN 1987A

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A nonlinear kinetic theory of cosmic ray (CR) acceleration in supernova remnants (SNRs) is employed to re-examine the nonthermal properties of the remnant of SN 1987A for an extended evolutionary period of 5-50 yr. This spherically symmetric model is approximately applied to the different features of the SNR which consist of a Blue Supergiant (BSG) wind and bubble, and the swept-up red Supergiant (RSG) wind structures in the form of an HII region, the "Equatorial Ring" (ER) and the "hourglass" region, all of which are part of a RSG wind whose mass loss rate significantly decreases with elevation above the equatorial plane. The model adapts recent three-dimensional hydrodynamical simulations by Potter et al. (2014). The SNR shock has recently swept up the ER which is the densest region in the immediate circumstellar environment. Therefore the expected gamma-ray energy flux at TeV-energies at the current epoch has already reached its maximal value $\sim 10^{-13}$ erg cm⁻²s⁻¹. The general nonthermal strength of the source is expected to decrease roughly by a factor of two over the next 10 yrs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

142

Parallel DM 01 / 442

The XMASS Experimental Program and its Current Implementation

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XMASS is an experimental program at the Kamioka Observatory in Japan designed for low energy, low background dark matter searches and neutrino physics. The core technology is a self shielding single-phase liquid xenon detector optimized for maximum scintillation light collection. In this talk we describe its current implementation and discuss its general performance after its 2013 refurbishment.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

411

Parallel GA 04 / 242

Search for gamma-ray emission from AGNs with ultra-fast-outflows as candidate cosmic-ray accelerators**Author:** Yayoi Tomono¹**Co-authors:** Junko Kushida²; Kyoshi Nishijima²; Masaaki Hayashida³; Susumu Inoue⁴¹ Tokai University² Department of Physics, Tokai University³ Institute for Cosmic Ray Research, University of Tokyo⁴ Max-Planck-Institut für Physik**Corresponding Author:** 4bsnm008@mail.tokai-u.jp

Recent X-ray observations of active galactic nuclei (AGNs) have revealed the widespread existence of ultra fast outflows (UFOs), i.e. powerful outflows of baryonic material with velocities $>10,000 \text{ km s}^{-1}$ ($\sim 0.03 c$), seen as variable, blueshifted absorption lines of ionized heavy elements. They have been interpreted as winds driven by the accretion disk, and may be responsible for feedback onto their host galaxies that result in the observed M-sigma relation. In such outflows, various types of shocks are likely to form, either external shocks due to interaction with the ambient medium, or internal shocks due to inhomogeneities within the flow. Such shocks can accelerate electrons and protons to high energies and potentially induce nonthermal emission in various wavebands. In this context, we have searched for gamma-ray emission from AGNs with known UFOs, using Fermi-LAT data $>100 \text{ MeV}$ spanning more than 6 years. The AGN sample of Tombesi et al 2010 is used, with 42 radio-quiet AGNs listed as UFO candidates based on a systematic search for blueshifted Fe K absorption lines. In our current analysis, no significant gamma-ray excess is found from any object in the sample. We compute 95% confidence level gamma-ray upper limits (UL) for all analyzed sources, yielding a mean value for the integrated photon flux ($\geq 100 \text{ MeV}$) UL of $\sim 3 \times 10^{-9} \text{ photons cm}^{-2} \text{ s}^{-1}$, and in the range of 10^{41} - $10^{45} \text{ erg s}^{-1}$ for ULs on the gamma-ray luminosity (100 MeV-100 GeV). To assess the properties of this UFO sample, we systematically compared these results with infra-red and radio observations, as well as the estimated kinetic power of the outflow. Our Fermi-LAT upper limits can constrain the ratio of gamma-ray luminosity to outflow kinetic power down to values as low as 0.001. The obtained results impose important constraints on emission models.

Collaboration:

FERMI

Registration number following "ICRC2015-I/":

88

Parallel CR03 Aniso / 970

Indications of anisotropy at large angular scales in the arrival directions of cosmic rays detected at the Pierre Auger Observatory

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The large-scale distribution of arrival directions of high-energy cosmic rays carries major clues to understand their origin. The Pierre Auger Collaboration has implemented different analyses to search for dipolar and quadrupolar anisotropies in different energy ranges spanning four orders of magnitude. A common phase $\approx 270^\circ$ of the first harmonic modulation in right-ascension was found in adjacent energy intervals below 1 EeV, and another common phase $\approx 100^\circ$ above 4 EeV. A consistency of phase measurements in ordered energy intervals is expected to manifest with a smaller number of events than those needed for the detection of anisotropies with amplitudes standing-out significantly above the background noise. This led us to design a prescribed test aimed at establishing whether this consistency in phases is real at 99% CL. The test required a total independent exposure of 21,000 km²sr yr. Now that this exposure has been reached, we report here the results for the first time. We also report the results of the search for a dipole anisotropy for cosmic rays with energy above 4 EeV including events with zenith angle between 60° and 80° . Compared to previous analyses of events with zenith angles smaller than 60° , this extension increases by 30% the size of the data set, and enlarges the fraction of exposed sky from 71% to 85%. The largest departure from isotropy is found in the energy range above 8 EeV, with an amplitude for the first harmonic in right ascension $r_1^\alpha = (4.4 \pm 1.0) \times 10^{-2}$, that has a chance probability $P(\geq r_1^\alpha) = 6.4 \times 10^{-5}$, reinforcing the hint previously reported with vertical events alone.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

474

Parallel GA03 Pulsars / 635

A Population of TeV Pulsar Wind Nebulae in the H.E.S.S. Galactic Plane Survey

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The H.E.S.S. Galactic Plane Survey (HGPS) constitutes the deepest scan of the inner Milky Way in TeV gamma rays to date. The dominant class of objects in this 10-year survey are Galactic pulsar wind nebulae (PWNe). Aside from a uniform reassessment of the observational parameters of PWNe already found in the past years, the HGPS for the first time allows for the extraction of flux upper limits in regions around pulsars without a detected TeV PWN. Including these limits, we systematically investigate the evolution of quantities such as the TeV luminosity and extension over over $\sim 10^5$ years after the birth of the pulsar. We find that there are trends in their evolution, but also large variations around the average behaviour. This is likely due to the diversity of the surrounding medium and intrinsic starting conditions of the systems. To put the results into context, we present a time-dependent modeling that reproduces both the general trends and the scatter found in the available data of this population.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

563

Parallel NU 01 / 55**Neutrinos from Clusters of Galaxies and Radio Constraints****Author:** Fabio Zandanel¹**Co-authors:** Irene Tamborra ; Shin'ichiro Ando ¹; Stefano Gabici ²¹ *University of Amsterdam*² *APC Paris***Corresponding Author:** fabio.zandanel@gmail.com

Cosmic-ray (CR) protons can accumulate for cosmological times in clusters of galaxies. Their hadronic interactions with protons of the intra-cluster medium (ICM) generate secondary electrons, gamma-rays and neutrinos. In light of the high-energy neutrino events recently discovered by the IceCube observatory, we estimate the contribution from galaxy clusters to the diffuse gamma-ray and neutrino backgrounds. For the first time, we consistently take into account the synchrotron emission generated by secondary electrons and require the clusters radio counts to be respected. For a choice of parameters respecting current constraints from radio to gamma-rays, and assuming a proton spectral index of -2 , we find that hadronic interactions in clusters contribute by less than 10% to the IceCube flux, and much less to the total extragalactic gamma-ray background observed by Fermi. They account for less than 1% for spectral indexes <-2 . The high-energy neutrino flux observed by IceCube can be reproduced without violating radio constraints only if a very hard (and speculative) spectral index >-2 is adopted. However, this scenario is in tension with the high-energy IceCube data, which seem to suggest a spectral energy distribution of the neutrino flux that decreases with the particle energy. We stress that our results are valid for all kind of sources injecting CR protons into the ICM, and that, while IceCube can test the most optimistic scenarios for spectral indexes ≥ -2.2 by stacking few nearby massive galaxy clusters, they cannot give any relevant contribution to the extragalactic gamma-ray and neutrino backgrounds in any realistic scenario.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

72

Parallel GA03 Pulsars / 953**Search for gamma rays above 100 TeV from the Crab Nebula using the Tibet air shower array and the 100 m² muon detector****Author:** Takashi SAKO¹**Co-author:** The Tibet ASgamma COLLABORATION ²¹ *Institute for Cosmic Ray Research, University of Tokyo*² *The Tibet ASgamma Experiment*

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The Crab Nebula is the standard calibration candle for TeV cosmic gamma-ray experiments.

None of those experiments has detected gamma rays above 100 TeV from the Crab Nebula, and the best upper limits have been given by the CASA-MIA experiment.

In the circumstances, it is a common understanding that the energy spectrum of the Crab Nebula can be reproduced well by a mechanism based on the synchrotron self-Compton emission of high energy electrons.

The observation of the energy spectrum of the Crab Nebula above 100 TeV with high sensitivity is important, in order to confirm the leptonic origin of the TeV gamma-ray emission from the Crab Nebula.

To improve the sensitivity of the Tibet air shower array to TeV cosmic gamma rays, we are planning to add an underground

10,000 m² muon detector array to the existing Tibet air shower array.

A small prototype muon detector, 100 m² in area, was constructed under the Tibet air shower array in the late fall of 2007.

In this work, we search for continuous gamma-ray emission from the Crab Nebula above 100 TeV, using the data collected from March 2008 to February 2010 by the Tibet air shower array and the 100 m² muon detector.

We find that our MC simulation is in good agreement with the experimental data.

No significant excess is found, and the most stringent upper limit is obtained above 140 TeV.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

106

Parallel NU 01 / 34

Neutrinos and the origin of the cosmic rays

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We discuss the interplay between the high-energy neutrino flux observed by IceCube and cosmic ray observations. One question is if the neutrino flux can be reconciled with the paradigm that it comes from the sources of the UHECRs. Another one is how many of these neutrinos can stem from cosmic ray interactions with hydrogen in the Milky Way if the chemical composition of the cosmic rays is taken into account.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

36

Parallel DM 01 / 949

Results from the fiducial volume analysis of the XMASS-I dark matter data

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XMASS-I, the first phase of the XMASS project, is a direct detection dark matter experiment using 832 kg of liquid xenon.

The key idea to reduce the background at low energies in XMASS is to use liquid xenon itself as a shield.

In this analysis the clean core of the 832 kg liquid xenon volume is used as sensitive fiducial volume by eliminating the volume near the wall which suffers from beta and gamma rays from the outside.

In this talk, we will present the physics results for our direct dark matter search using this fiducial volume of the XMASS-I detector.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

745

Parallel GA 04 / 1220

Flat Spectrum Radio Quasars through the MAGIC glasses

Author: Josefa Becerra Gonzalez¹

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The detection of Flat Spectrum Radio Quasars (FSRQs) in the Very High Energy (VHE, $E > 100$ GeV) range is challenging, mainly because of their steep soft spectra in this energy band. Up to now only four FSRQs have been detected in VHE, three of them discovered by MAGIC. The gamma-ray observations at such high energies are crucial to understand their emission, especially to constrain the localization of the emitting region within the jet due to the absorption from their broad line region (BLR). Typically, FSRQs are detected during high flux states, enhancing the probability of detection with the current instruments' sensitivities. However, the last observation campaigns performed with the MAGIC telescopes show emission during moderate-quiescent states, thus challenging our understanding of the emission mechanisms in FSRQs. In this contribution, we give an overview and present the most recent results of the three FSRQs 3C279, PKS1222+21 and PKS1510-089 in a multiwavelength context with special focus on MAGIC and Fermi-LAT.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

939

Parallel CR03 Aniso / 650

Arrival directions of the highest-energy cosmic rays detected with the Pierre Auger Observatory

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We present the results of a search for small scale anisotropies in the distribution of arrival directions of ultra-high energy cosmic rays recorded at the Pierre Auger Observatory. The data set, gathered in ten years of operation, includes arrival directions with zenith angles up to 80° , and is about three times larger than that used in earlier studies. We update the test based on correlations with active galactic nuclei (AGNs) from the Veron-Cetty and Veron catalog, which does not yield a significant indication of anisotropy with the present data set. We perform a blind search for localized excess fluxes and for self-clustering of arrival directions at angular scales up to 30° and for different energy thresholds between 40 EeV and 80 EeV. We search for correlations with the Galactic Center, the Galactic Plane and the Super-Galactic Plane. We also examine the correlation of arrival directions with relatively nearby galaxies in the 2MRS catalog, AGNs detected by Swift-BAT, a sample of radio galaxies with jets and with the Centaurus A galaxy. None of the searches shows a statistically significant evidence of anisotropy. The two largest departures from isotropy that were found have a post-trial probability $\approx 1.4\%$. One is for cosmic rays with energy above 58 EeV that arrive within 15° of the direction toward Centaurus A. The other is for arrival directions within 18° of Swift-BAT AGNs closer than 130 Mpc and brighter than 10^{44} erg/s, with the same energy threshold.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I/":

0570

Parallel GA03 Pulsars / 348

Observations of the Crab Nebula with Early HAWC Data

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The High Altitude Water Cherenkov (HAWC) Observatory is a TeV gamma-ray detector which has been completed in early 2015. HAWC started science operations in August 2013 with a fraction of the detector taking data. Several known gamma-ray sources have been already detected with the first HAWC data. Among these sources, the Crab Nebula, the brightest steady gamma-ray source at very high energies in our Galaxy, has been detected with high significance. In this contribution I will present the results of the observations of the Crab Nebula with HAWC, including time variability, and the detector performance based on early data.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

332

Parallel CR03 Aniso / 765**TA Anisotropy Summary**

Authors: Atsushi Taketani¹; Benjamin Stokes²; Daisuke Ikeda³; Dmitri Ivanov^{None}; Gordon Thomson²; Grigory Rubtsov⁴; Hiroyuki Sagawa¹; Hisao Tokuno⁵; Igor Tkachev⁶; John Matthews⁷; Kazumasa Kawata^{None}; Masahiro Takeda³; Masaki Fukushima⁷; Nobuyuki Sakurai⁸; Peter Tinyakov⁹; Ryuji Takeishi¹⁰; Sergey Troitsky⁶; Shigehiro NAGATAKI¹¹; Takeshi Okuda^{None}; Toshiyuki Nonaka³

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The Telescope Array has collected 7 years of data and accumulated the largest UHECR data set in the Northern hemisphere. We make use of these data to search for large- and small-scale anisotropy of UHECR. At small angular scales we examine the data for clustering of events and correlations with various classes of putative sources. At large angular scales we will present a blind search for localized excesses of events anywhere on the sky, and find an excess – the “hot spot” – at the highest energies by oversampling using a radius of 20 degrees, centered in the constellation Ursa Major. We will estimate the statistical significance of this excess and show how it manifests itself in various other tests. Finally, we will examine the data for correlations with the large-scale structures in the nearby Universe.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

451

Parallel GA 04 / 1188**Origin of cosmic rays excess in the Galactic Center****Author:** Lea Jouvin¹

Co-authors: Anne Lemiere¹; Regis Terrier¹

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The center of our Galaxy hosts a Super-Massive Black Hole (SMBH) of about $4 \times 10^6 M_{sun}$. Since it has been argued that the SMBH might accelerate particles up to very high energies, its current and past activity could contribute to the population of Galactic cosmic-rays (CRs). Additionally, the condition in the Galactic Center (GC) are often compared with the one of a starburst system. The high supernovae (SN) rate associated with the strong massive star formation in the region must create a sustained CR injection in the GC via the shocks produced at the time of their explosion.

Indeed, the presence of an excess of very high energy (VHE) cosmic rays in the inner 100 pc of the Galaxy has been revealed in 2006 by the H.E.S.S. collaboration. On very large scale (≈ 10 kpc), the non-thermal signature of the escaping GC cosmic rays could have been detected recently as the spectacular “Fermi bubbles”. The origin of the CRs over-abundance in the GC still remains mysterious: is it due to a single impulsive or stationary accelerator at the center or to multiple accelerators filling the region? In order to answer these questions, we build a 3D model of CR injection and propagation with a realistic 3D gas distribution. We then compare with existing data (H.E.S.S., Fermi).

We discuss the CR injection in the region by a spectral and morphology comparison. We place constraints on the SNR rate and on the diffusion parameters.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

842

Parallel DM 01 / 878

The DAMIC dark matter experiment

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The DAMIC (Dark Matter in CCDs) experiment uses high resistivity scientific grade CCDs to search for dark matter. The CCD’s low electronic noise allows an unprecedentedly low energy threshold of few tens of eV that makes it possible to detect silicon recoils resulting from interactions of low mass WIMPs. In addition the CCD’s high spatial resolution and the excellent energy response results in very effective background identification techniques. The experiment has a unique sensitivity to dark matter particles with masses below 10 GeV. Previous results have demonstrated the potential of this technology, motivating the construction of DAMIC100, a 100 grams silicon target detector currently being installed at SNOLAB.

In this presentation, the mode of operation and unique imaging capabilities of the CCDs, and how they may be exploited to characterize and suppress backgrounds will be discussed, as well as the expected physics results after one year of data taking.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

668

Parallel NU 01 / 733

On the neutrino emission from BL Lacs

Author: Maria Petropoulou¹

Co-authors: Apostolos Mastichiadis²; Elisa Resconi³; Paolo Padovani⁴; Stavros Dimitrakoudis⁵

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The recent IceCube discovery of 0.1-1 PeV neutrinos of astrophysical origin opens up a new era for high-energy astrophysics. There are various astrophysical candidate sources, including active galactic nuclei (AGN) and starburst galaxies. Yet, a firm association of the detected neutrinos with one (or more) of them is still lacking. This talk will focus on the possible association of IceCube neutrinos with BL Lacs, a sub-class of radio loud AGN. We present the results from leptohadronic modeling of six individual BL Lacs, including the closest to Earth, Mrk 421, that were selected as probable counterparts of the IceCube neutrinos. We also show the cumulative neutrino emission from BL Lacs, which was calculated by incorporating our results from the modeling of individual sources to Monte Carlo simulations for the blazar evolution. We finally discuss our results in the light of current IceCube limits (above 2 PeV) and a possible future detection.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

644

Parallel NU 01 / 100

Detectability of GRB blast wave neutrinos in IceCube

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Accelerated ultrahigh-energy cosmic rays (UHECRs) in long-lived gamma-ray burst (GRB) blast waves are expected to interact with X-ray to optical-infrared photons of GRB afterglow to produce PeV-EeV neutrinos. These long-lived neutrino fluxes can last for a time scale of days to years, in contrast to the prompt neutrino fluxes under the internal shocks model with a time scale of seconds to minutes and which has been constraint by recent IceCube GRB search. We calculate the expected

neutrino events in IceCube in the PeV–EeV range from the blast wave of long-duration GRBs, both for individual nearby GRBs and for the diffuse flux. We show that EeV neutrinos from the blast wave of an individual GRB can be detected with long-term monitoring by a future high-energy extension of IceCube for redshift up to $z \sim 0.5$. We also show that with 5 years operation IceCube will be able to detect the diffuse GRB blastwave neutrino flux and distinguish it from the cosmogenic GZK neutrino flux if the UHECRs are heavy nuclei.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

132

Parallel GA03 Pulsars / 707

Six years of VERITAS observations of the Crab Nebula

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The Crab Nebula is the brightest source in the very-high-energy (VHE) gamma-ray sky and one of the best studied non-thermal objects. The dominant VHE emission mechanism is believed to be inverse Compton scattering of low energy photons on relativistic electrons. While it is unclear how the electrons are accelerated to energies of 10^{16} eV, it is general consensus that the ultimate source of energy is the Crab pulsar at the center of the nebula. Studying VHE gamma-ray emission provides valuable insight into the emission mechanisms and ultimately helps to understand the remaining mysteries of the Crab, for example, how the Poynting dominated energy flow is converted into a particle dominated flow of energy. We report on the results of six years of Crab observations with VERITAS comprising 115 hours of data taken between 2007 and 2013. VERITAS is an array of four 12-meter imaging air Cherenkov telescopes located in southern Arizona. We report on the energy spectrum, light curve, and a study of the VHE extension of the Crab Nebula.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

633

Parallel DM 01 / 320

Search for Dark Matter annihilations in the Sun using the completed IceCube neutrino telescope.

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If Dark Matter consists of Weakly Interacting Massive Particles (WIMPs), these might be gravitationally captured in the Sun where they could self-annihilate into standard model particles. Terrestrial neutrino detectors such as IceCube can observe this as an enhanced neutrino flux in the direction of the Sun. Sensitivity has improved with respect to previous searches due to better analysis methods and reconstructions. In addition, improved veto techniques using the outer layers of the cubic kilometre array have been used to reduce the atmospheric muon background and thus improve sensitivity during the Austral Summer. We will present results from an analysis of 341 days of livetime of IceCube-DeepCore in the 86 string configuration.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

159

Parallel GA 04 / 736

Prospects for Measuring the Positron Excess with the Cherenkov Telescope Array

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The excess of positrons in cosmic rays above ~ 10 GeV has been a puzzle since it was discovered. Possible interpretations of the excess include acceleration of positron secondaries in local supernova remnants or pulsars, or the annihilation or decay of dark matter particles. To distinguish between these interpretations, the measurement of the positron fraction must be extended to higher energies. One technique to perform this measurement is using the Earth-Moon spectrometer: observing the deflection of positron and electron moon shadows by the Earth's magnetic field. The measurement has been attempted by previous imaging atmospheric Cherenkov telescopes without success. The Cherenkov Telescope Array (CTA) will have unprecedented sensitivity and background rejection that could make this measurement successful for the first time. In addition, the possibility of using silicon photomultipliers in some of the CTA telescopes could greatly increase the feasibility of making observations near the moon. Estimates of the capabilities of CTA to measure the positron fraction using simulated observations of the moon shadow will be presented.

Collaboration:

CTA

Registration number following "ICRC2015-I":

1113

Parallel CR03 Aniso / 414

Ultra-High-Energy Cosmic-Ray Hotspot Observed with the Telescope Array Surface Detectors

Author: Kazumasa Kawata¹

Co-authors: Akimichi Taketa²; Benjamin Stokes³; Daisuke Ikeda¹; Dmitri Ivanov³; Eiji Kido¹; Gordon Thomson³; Grigory Rubtsov⁴; Hiroyuki Sagawa¹; Hisao Tokuno¹; Igor Tkachev⁴; John Matthews³; Masahiro Takeda¹; Masaki Fukushima¹; Nobuyuki Sakurai⁵; Peter Tinyakov⁶; Ryuji Takeishi¹; Shigehiro NAGATAKI⁷; Takeshi Okuda⁸; Toshiyuki Nonaka¹

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The Telescope Array Experiment has observed a cluster of ultrahigh energy cosmic rays, $E > 57$ EeV, called the Hotspot. This was reported in (Abbasi et al., ApJ, 790, L21 (2014)), and was centered in Ursa Major. Using the first five years of data collected by the TA surface detector, the chance probability of this hotspot in an isotropic cosmic-ray sky was calculated to be 3.4σ . In this work, we update this result using the latest data collected by the TA surface detector. We also discuss possible origins of the hotspot

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

0107

Parallel CR03 Aniso / 747

The Possible Extragalactic Source of Ultra-High-Energy Cosmic Rays at the Telescope Array Hotspot

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The Telescope Array (TA) collaboration has reported a hotspot, a cluster of 19 cosmic ray events with energies above 57 EeV in a circle of 20° radius centered at R.A.(α) = 146.°7, Dec.(δ) = 43.°2.

We explore the hypothesis that the hotspot could originate from a single source. By considering the energy dependent deflections that are expected to affect arrival directions of cosmic rays propagating in cosmic magnetic fields, we identify the nearby starburst galaxy M82 and the bright nearby blazar Mrk 180 as two likely candidates. We discuss prospects of discriminating between the candidate sources with current and future spectral data.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

649

Parallel GA03 Pulsars / 940

The most precise measurements of the Crab nebula inverse Compton spectral component

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Co-authors: Daniel Mazin²; Diego Torres³; Dieter Horns⁴; Jonathan Martin³; Manuel Meyer⁵; Oscar Blanch Bigas⁶; Ruben Lopez-Coto⁷

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The Crab pulsar wind nebula (PWN) is one of the best studied astrophysical objects. Due to its brightness at all wavelengths, precise measurements are provided by different kind of instruments, allowing for many discoveries, later seen in other non-thermal sources, and a detailed examination of its physics. Most of the theoretical models for PWN emission are, in fact, based on Crab nebula measurements. The Crab nebula shows a broad-band spectrum spanning from radio frequencies up to VHE gamma rays and consists of two components, one of synchrotron origin and the other one due to radiative inverse Compton losses, starting at a few GeV. We will report the most precise measurements of the inverse Compton component from the Crab Nebula by combining data by the LAT detector on board of the Fermi satellite (1-300 GeV) and by the stereoscopic MAGIC system (>50 GeV). At low energies, the MAGIC results, combined with the Fermi/LAT data, show a flat and broad inverse Compton peak. The overall fit to the data between 1 GeV and 30 TeV is well-described by a modified log-parabola function with an exponent of 2.5, and places the position of the inverse Compton peak at around 53 GeV. The spectral measurements obtained by the MAGIC collaboration cover more than three decades in energy, allowing to address the still-open question about the maximum energy reached by the parent electron population. The broadness of the inverse Compton peak cannot be reproduced by either the constant B-field model or the MHD flow model. The conclusion, based on earlier data, that simple models (constant B-field, spherical symmetry) can account for the observed spectral shape has to be revisited at the light of the new MAGIC results. On the other hand, the time-dependent 1D spectral model provides a good fit of the new VHE results when considering a 80uG magnetic field. However, it fails to match the data when including the morphology of the nebula at lower wavelengths.

Collaboration:

MAGIC

Registration number following "ICRC2015-I/":

1195

Parallel DM 01 / 243**The indirect search for dark matter with the ANTARES neutrino telescope****Author:** Christoph Tönnis¹¹ *Universitat de Valencia***Corresponding Author:** ctoennis@ific.uv.es

The indirect search for dark matter is a topic of utmost interest in neutrino telescopes. The ANTARES detector is located on the bottom of the Mediterranean Sea 40 km off the southern french coast. ANTARES has been taking data since 2007 when the first half of the detector was installed. In this talk the results of the different analyses for dark matter signals from different potential sources, including the Sun and the Galactic Center, produced with different analysis methods will be presented. The specific advantages of neutrino telescopes in general and of ANTARES in particular will be explained. As an example, the indirect search for Dark Matter towards the Sun performed by neutrino telescopes currently lead to the best sensitivities and limits on the spin dependent WIMP-nucleon cross section with respect to existing direct detection experiments.

Collaboration:

ANTARES

Registration number following "ICRC2015-I/":

258

Parallel NU 01 / 1010**A HADRONIC SCENARIO FOR THE GALACTIC RIDGE EMISSION****Author:** Antonio Marinelli¹**Co-authors:** Alfredo Urbano ²; Daniele Gaggero ²; Dario Grasso ³; Mauro Valli ²¹ *Physics Institute, Pisa University*² *SISSA*³ *INFN Pisa***Corresponding Author:** antonio.marinelli@pi.infn.it

During the last decade the innermost part of our galaxy has been observed as a gamma-ray emitting region described by a ridge-like surface. In particular, in 2005 the H.E.S.S. collaboration reported the measurement of a power-law spectrum with index close to -2.3, between 0.1 and 10 TeV, strongly correlated with dense molecular clouds in that region. Last year the VERITAS collaboration confirmed

that finding. Below that energy a diffuse non-thermal emission was also found by the Fermi-LAT observatory with a spectrum, related to this region, which can be smoothly connected to that measured by H.E.S.S.

Although several hypotheses have been proposed for the origin of that emission - e.g. flaring activity of the SgrA* supermassive black hole as well as steady leptonic and hadronic emission from freshly accelerated cosmic rays (CR) - it was recently shown as those results can be consistently interpreted in terms of hadronic emission produced by the Galactic CR population in the presence of radial dependent transport.

Since the Galactic CR spectrum extends at least up to several PeVs, a very high energy neutrino emission is expected from the considered Galactic Center region which should exceed the atmospheric background for a kilometric scale neutrino telescope.

Here, we adopt such scenario to estimate the expected signal in the IceCube observatory and compare it with its recent results.

Moreover, we will discuss the detecting chances of neutrino telescopes in the North hemisphere, as ANTARES and the future KM3NeT, which are better positioned for the observation of the Galactic Ridge.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

838

Poster 1 CR - Board: 149 / 1085

Calibration of the LOFAR antennas

Author: Jörg Hörandel¹

Co-authors: A. Corstanje²; A. Nelles²; H. Falcke²; J.E. Enriquez²; J.P. Rachen²; L. Rossetto²; O. Scholten³; P. Schellart²; S. Buitink⁴; S. Thoudam²; S. ter Veen²; T.N.G. Trinh³

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Extensive air showers create short nanosecond-scale pulses in the radio frequencies. These pulses have been measured successfully in the past years at the Low-Frequency Array (LOFAR).

Due to the short duration and emission of the signal in the atmosphere, methods based on flux calibration of known sources as used in radio astronomical observations cannot be applied to establish an absolute calibration. To overcome this, we present three approaches that were used to check and improve the antenna model of LOFAR, and to provide an absolute calibration for air shower measurements. In future work these results can be used as an absolute scale for measurements of astronomical transients with LOFAR.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

868

Poster 1 CR - Board: 227 / 883

Search for UHE Photons with the Telescope Array Hybrid Detector

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In order to understand sources of ultra high energy cosmic rays, we search for ultra high energy photons with the Telescope Array experiment. The Telescope Array is a hybrid detector consisting of an array of scintillation detectors, which measure the lateral profile of air showers, and fluorescence detectors, which measure the longitudinal profile of air showers. This information is used to search for photon-like events. We will report on the analysis method, and the result of a photon search using five years of TA data.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

756

Poster 1 CR - Board: 154 / 667

Simulations for CALET Energy Calibration Confirmed Using CERN-SPS Beam Tests

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CALorimetric Electron Telescope (CALET) is a detector for the precise measurement of cosmic ray electrons, gamma-rays and nuclei on the International Space Station. CALET has an imaging and a thick calorimeter, which provide excellent energy resolution and particle identification. For the on-orbit calibration, we plan to use the minimum ionizing particles of cosmic rays such as protons and helium nuclei. We have carried out MC simulations to develop an algorithm of penetrating event selection by event reconstruction and to estimate the on-orbit event rate for the calibration. We have also carried out the beam tests at the CERN-SPS to assess the detector performance and the validity of our MC simulation and calibration methods. In this paper, we present the calibration methods and expected detector performance with beam test results.

Collaboration:

CALET

Registration number following "ICRC2015-I/":

591

Poster 1 GA - Board: 61 / 1042

Sensitivity of the LHAASO-WCDA for various Gamma ray sources

Author: Hanrong Wu¹

Co-authors: Bo Gao¹; Huicai Li²; Mingjun Chen¹; Xiaojie Wang¹; Zhiguo Yao¹

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The Large High Altitude Air Shower Observatory (LHAASO) will be constructed at Mt. Haizi in Sichuan Province, China. As a major component of the LHAASO project, the Water Cherenkov Detector Array (WCDA) is designed to record air showers produced by cosmic rays and gamma rays in the energy range from 100 GeV to 100 TeV. Complementing the Imaging Atmospheric Cherenkov Telescopes with large field-of-view and long duty cycle, and the space-based gamma-ray detectors with high energy reach, WCDA is well-suited to study particle acceleration in Pulsar Wind Nebulae, Supernova Remnants, Active Galactic Nuclei and Gamma-ray Bursts. Results of the sensitivity calculation of the detector on steady point sources, extended sources, transient sources and GRBs are presented in this talk.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

770

Poster 1 GA - Board: 126 / 186

High energy emission from extended region within the blazar jet during quiet gamma-ray state

Author: Piotr Banasiński¹

Co-author: Wlodek Bednarek¹

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During the quiet γ -ray state of blazars the high energy emission is likely to be produced in the extended part of the inner jet in which the conditions can change significantly. Therefore, homogeneous SSC model is not expected to describe correctly the quiet state emission features. We consider inhomogeneous SSC model for the large part of the inner jet in which synchrotron and IC emission of relativistic electrons is taken into account self-consistently by applying the Monte Carlo method. The results of calculations are compared with the observations of some BL Lacs in the low state.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

198

Poster 1 SH - Board: 8 / 480

Calculation of injection of solar energetic particles of Easter 2001 Solar Particle Event

Author: Anastasia Petukhova¹

Co-authors: Ivan Petukhov¹; Stanislav Petukhov¹

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Acceleration of solar energetic particles by the shock generated by the coronal mass ejection is calculated. The external boundary of coronal mass ejection and the shock front are specified as the segments of spherical surfaces with the different radii moving in coordination. Nonstationarity of process, spherical symmetry and adiabatic losses of particle energy in the extending environment are considered in the calculation. It is supposed that near the Sun there is the abrupt change region of the particle diffusion coefficient from coronal to the interplanetary. The calculation results are compared with the SEP injection of the Easter 2001 Solar Particle Event (April 15). From the comparison the particle diffusion coefficients before and behind the shock front and location of the abrupt change region are determined.

Registration number following "ICRC2015-I":

265

Poster 1 GA - Board: 81 / 1081

Fermi Gamma-ray Burst Monitor Capabilities for multi-messenger time-domain astronomy

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Owing to its wide sky coverage and broad energy range, the Fermi Gamma-ray Burst Monitor (GBM) is an excellent observer of the transient hard X-ray sky. GBM detects about 240 triggered Gamma-Ray Bursts (GRBs) per year, including over 30 which also trigger the Swift Burst Alert Telescope (BAT). The number of GRBs seen in common with Swift is smaller than expected from the overlap in sky coverage because GBM is not as sensitive as the BAT and the GBM GRB population is thus skewed to the brighter, closer bursts. This population includes about 45 short GRBs per year, giving GBM an excellent opportunity to observe the electromagnetic counterpart to any gravitational wave candidate resulting from the merger of compact binary members. The same characteristics make GBM an ideal partner for neutrino searches from nearby GRBs, and for the elusive Very-High Energy (VHE) counterparts to GRBs. With the deployment of the next-generation gravitational-wave detectors (Advanced LIGO/VIRGO) and VHE experiments (CTA and HAWC) within the lifetime of the Fermi Gamma-ray Space Telescope, the prospects for breakthrough observations are good.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

741

Poster 1 SH - Board: 5 / 206

Dependence of 100 MeV solar proton events on the solar activities: flares and coronal mass ejections

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To investigate the possible acceleration mechanism for high energy ($E > 100$ MeV) protons, the correlation coefficients (CCs) are calculated between the prompt component intensity (PCI) of $E > 100$ MeV solar proton events (SPEs) and the speed of coronal mass ejections (CMEs), and the soft X-ray (SXR) emission of solar flares. Data analysis shows that the CCs between the PCI of $E > 100$ MeV SPEs and the concurrent SXR emission are much higher than those between the PCI of $E > 100$ MeV SPEs and the speed of the concurrent CMEs. The results suggest that both the solar flares and the CMEs are important to the high energy SPEs, however, the concurrent solar flares appears to make more contribution to the high energy SPEs at the early phases of the SEP events.

Registration number following "ICRC2015-I":

272

Poster 1 DM and NU - Board: 289 / 1093

The optical module of the Baikal-GVD neutrino telescope

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The BAIKAL-GVD neutrino telescope in Lake Baikal is intended for studying astrophysical neutrino fluxes by recording the Cherenkov radiation of the secondary muons and showers generated in neutrino interactions. The first stage of BAIKAL-GVD will be equipped with about 2400 optical modules. Each of these optical modules consists of a large area photomultiplier R7081-100 made by Hamamatsu Photonics and its associated electronics housed in a pressure resistant glass sphere. We describe the design of the optical module, the front-end electronics and the laboratory characterization and calibration before deployment.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

893

Poster 1 SH - Board: 1 / 80

Solar Energetic Particle Event Onsets: Far Backside Solar Sources and the East-West Hemispheric Asymmetry

Author: Stephen Kahler¹

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Prompt onsets and short rise times to peak intensities I_p have been noted in a few solar energetic ($E > 10$ MeV) particle (SEP) events from far behind the west limb. We discuss 14 archival and recent examples of these prompt events, giving their source longitudes, onset and rise times, and associated CME speeds. Their timescales and CME properties are not exceptional in comparison to a larger set of SEP events from behind the west limb. A further statistical comparison of observed timescales of SEP events from behind the west limb with events similarly poorly magnetically connected to the eastern hemisphere shows the longer timescales of the latter group. We interpret this result in terms of a difference between SEP production at parallel shocks on the east flanks of west backside events and at perpendicular shocks on the west flanks of eastern hemisphere events.

Registration number following "ICRC2015-I":

22

Poster 1 CR - Board: 146 / 57

The Cosmic Ray Nuclear Composition Measurement Performance of the Non-Imaging Cherenkov Array (NICHE)

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The Non-Imaging Cherenkov Array (NICHE) will eventually measure the flux and nuclear composition of cosmic rays from below 10^{15} eV to 10^{18} eV by using measurements of the amplitude and time-spread of the air-shower Cherenkov signal to achieve a robust event-by-event measurement of XMax and energy. NICHE will have sufficient area and angular acceptance to have significant overlap with TA/ TALE, within which NICHE is located, in both fluorescence and Cherenkov measurements allowing for energy cross-calibration. In order to quantify NICHE's ability to measure the cosmic ray nuclear composition, two different cosmic ray composition models, one based on the poly-gonato model of J. Hörandel (AstroPart 19, 2003) and the other based on the H4a model of T. Gaisser (AstroPart 35, 2012), using simulated X_{Max} distributions of the composite composition as a function of energy. These composition distributions were then unfolded into individual components via an analysis technique that included NICHE's simulated X_{Max} and energy resolution performance as well as the effects of finite event statistics as a function of measured energy. In this talk, NICHE's ability to distinguish between these two CR composition evolution models and determine the individual components as a function of energy will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

109

Poster 1 CR - Board: 216 / 557

Search for energy dependent patterns in the arrival directions of cosmic rays at the Pierre Auger Observatory

Author: Tobias Winchen¹

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Energy-dependent patterns in the arrival directions of cosmic rays could arise from deflections in galactic and extragalactic magnetic fields. We report on searches for such patterns in the data of the surface detector of the Pierre Auger Observatory at energies above $E = 5$ EeV in regions within approximately 15° of the arrival directions of events with energy $E > 60$ EeV. No significant patterns are found with this analysis which can be used to constrain parameters in propagation scenarios.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

499

Poster 1 GA - Board: 116 / 985

Water quality monitoring and measurement for the LHAASO-WCDA with the cosmic muon signals

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The Large High Altitude Air Shower Observatory (LHAASO) project is to be built at Daocheng, Sichuan Province, 4400 m a.s.l., in a few years. As one of the major components of the LHAASO project, LHAASO-WCDA, a water Cherenkov detector array with an area of 90000 m², contains around 400,000 tons of purified water. To gain full knowledge of the water Cherenkov technique and to investigate the engineering issues, a 9-cell detector array has been built at the Yang-Ba-Jing site. With the array, a method of water quality monitoring and measurement with cosmic muon signals is studied, whose results show that a precision at some ten percentages can be achieved, satisfying the requirement of the experiment. The results are compared with those from a full Monte Carlo simulation. This method is proposed to be applied in the LHAASO-WCDA project.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

811

Poster 1 GA - Board: 119 / 842

Study on the large dimensional refractive lens for the future large field-of-view IACT

Author: Tianlu Chen¹**Co-authors:** Cheng Liu²; Haiyan Yang²; Hongbo Hu²; Hui Cai²; Luobu Danzeng¹; Maoyuan Liu¹; Qi Gao³; Quanbu Gou²; Yi Zhang²; Yiqing Guo²; Zhen Wang²¹ *Tibet University*² *Key Laboratory of Particle Astrophysics, Institute of High Energy Physics, Chinese Academy of Sciences*³ *Tibet University***Corresponding Authors:** danzengluobu@ihep.ac.cn, chentl@ihep.ac.cn

Sub-100GeV to TeV is a crucial energy window in gamma ray astronomy because of its important role connecting the space experiments and the ground-based observations. The observations in this energy range are expected to provide rich information about the high energy emission from GRBs and AGNs, with which EBL can be measured, and knowledge about the galaxy formation and the evolution of the early universe can be obtained. One pursuit of the next generation Imaging Atmospheric Cherenkov Telescopes (IACT) is to achieve larger field of view by using a refractive optics system as light collector. In this work, preliminary test results on the optical properties (transmittance, angular resolution, etc.) of a prototype 0.9m diameter water lens are presented and discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

130

Poster 1 SH - Board: 23 / 161

New very local interstellar spectra for galactic protons, helium, carbon and electrons below 50 GeV.

Author: Marthinus Potgieter¹**Co-authors:** Donald Ngobeni²; Driaan Bisschoff³; Etienne Vos³; Rendani Nndanganeni³; Sibusiso Nkosi⁴¹ *North-West University*² *Vaal University of Technology*³ *Centre for Space Research, North-West University, 2520 Potchefstroom, South Africa.*⁴ *Vaal University of Technology, Dept of Physics and NDT, Vanderbijlpark, 1900***Corresponding Author:** donaldng@vut.ac.za

Low-energy galactic electrons (1-200 MeV) are significantly modulated, almost extraordinary, in the heliosheath in contrast to the rest of the heliosphere, indicating that modulation conditions in the heliosheath are quite different for these particles. In addition, Jovian electrons completely dominate

galactic electrons at Earth below about 30 MeV. Low-energy protons and helium (1-100 MeV/nuc), on the other hand, are dominated by the anomalous component which originates inside the inner heliosheath so that the very local interstellar spectra for these particles had been properly concealed until recently. However, this is not the case for cosmic ray carbon. Basic mechanisms responsible for these effects are been studied with comprehensive numerical models for the transport of these particles, from the modulation boundary, through the inner heliosheath, across the solar wind termination shock, up to Earth. Together with measurements made by the two Voyager spacecraft, now with Voyager 1 beyond the heliopause and entering the very local interstellar medium, it is possible to determine heliopause spectra (HPS) at these low energies for the first time. Together with PAMELA spectra observed at Earth, these HPS can be determined accurately up to at least 50 GeV. Such spectra should be considered as the lowest possible very local interstellar spectra for galactic electrons, protons, helium and carbon, and are of great relevance to solar modulation and galactic propagation studies as tested by utilizing the well-known GALPROP code.

Registration number following "ICRC2015-I":

71

Poster 1 CR - Board: 200 / 1150

ELLIPTIC FLOW in nuclear interaction of astroparticle at energy 10^{16} eV.

Author: OLEG DALKAROV¹

Co-authors: Konstantin Kotelnikov ²; Sergey Kotelnikov ²

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107 cascades, created by secondary particles of astroparticle interaction at 10^{16} eV, were detected in the stratospheric emulsion chamber. Their azimuth distribution reveals a distinct anisotropy. Estimation of the elliptic flow coefficient v_2 gives a value 0.35 ± 0.02 . The distribution of cascade $p(t)$ is also azimuth anisotropic and its maximal value coincides with the direction of the impact parameter.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

116

Poster 1 DM and NU - Board: 292 / 1166

Status and prospects for the Askaryan Radio Array (ARA) cosmogenic neutrino detector

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The Askaryan Radio Array (ARA) is an ultra-high energy >100 PeV cosmic neutrino detector which is in phased construction near the South Pole. ARA searches for radio Cherenkov-like emission from particle cascades induced by neutrino interactions in the ice using radio frequency antennas (~ 150 -800MHz) deployed at a design depth of 200m in the Antarctic ice. A prototype ARA Testbed station was deployed at ~ 30 m depth in the 2010-2011 season and the first three full ARA stations were deployed in the 2011-2012 and 2012-2013 seasons. We present the status of the array and plans for the near-term construction of a full ARA-37 detector with profound discovery potential for most models of cosmogenic neutrinos from 100 PeV to 100 EeV in energy.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

261

Poster 1 CR - Board: 240 / 1117

Improving the universality reconstruction using independent measurements of water-Cherenkov detectors and additional muon counters

Author: Mariela Josebachuili¹

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³ _

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Shower universality has demonstrated to be a sturdy tool to describe particle showers produced by primary cosmic rays. The secondary particles at the observation level can be described by a four component model: the well known electromagnetic and muonic components, the contribution due to the electromagnetic halo of the muons, and the electromagnetic particles originating from pion decays close to ground following closely the development of the muonic component. Due to the high amount of particles produced, those distributions can be described within three parameters: The total energy E , the depth of shower maximum X_{\max} , and the muon content N_{μ} . The energy and X_{\max} are governed by the pure electromagnetic component, while the muon scale (N_{μ}) gives cause to differences between hadronic interaction models and primary particles, affecting the three remaining components. Though predictions on these macroscopic parameters are already viable with a single detector type (e.g. an array of water-Cherenkov detectors), large correlations between the quantities are apparent and need to be taken into account when interpreting the data. To overcome the degeneracy, additional muon counters allow for an independent measurement of the muon number at ground and at the same time reduce systematic uncertainties due to the hadronic interaction model used. The procedure is exemplified for the case of the Pierre Auger Observatory by parameterizing the signal response of particles in the water-Cherenkov array operating with underground muon detectors. The universal parameterizations allow us to estimate independently the E and N_{μ} on an event-by-event basis. The incorporation of muon detectors evidences e.g. the possibility of an unbiased energy estimation based only on the universality description of the shower.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

330

Poster 1 CR - Board: 220 / 714

Energy Spectrum and Mass Composition of Ultra-High Energy Cosmic Rays Measured with the Telescope Array Fluorescence Detector Using a Monocular Analysis

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The Telescope Array (TA) experiment is the largest hybrid detector to observe ultra-high energy cosmic rays (UHECRs) in the northern hemisphere. We report on results of the energy spectrum of UHECRs covering a wide energy range, and the mass composition using the maximum shower depth, from analyzing data collected in monocular mode by the fluorescence detectors of TA during the first seven years.

Registration number following "ICRC2015-I/":

619

Collaboration:

Telescope Array

Poster 1 GA - Board: 115 / 25

Gamma-rays from accretion process onto millisecond pulsars

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We consider a simple scenario for the accretion of matter onto rotating, magnetised neutron star in order to understand the processes in the inner pulsar magnetosphere during the transition stage between different accretion modes. We analyse a quasi-spherical accretion process onto rotating, magnetized compact object in order to search for radiative signatures which could accompany the accretion process onto a millisecond pulsar close to the transition stage. It is argued that different accretion modes can be present in a single object for specific range of parameters characterising the millisecond pulsar and the surrounding medium. We show that the radiation processes characteristic for the ejecting pulsar, i.e. curvature and synchrotron radiation produced by primary electrons in the pulsar outer gap, can be accompanied by the inverse Compton radiation produced by secondary leptons which up-scatter thermal radiation from the hot polar cap region caused by the matter accreting onto the neutron star surface. We conclude that during the transition from the pure ejector to the pure accretor mode (intermediate accretion state) additional components

can appear in the γ -ray spectra of millisecond pulsars. This additional spectral component could allow to constrain the particle content of the pulsar inner magnetosphere such as the multiplicity and energies of secondary leptons.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

14

Poster 1 CR - Board: 196 / 966

Astrophysical expectations for the variation of the UHECR composition across the sky

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Using an integrated propagation code that takes into account particle energy losses, nuclear photo-dissociation and deflections by Galactic and extragalactic magnetic fields, we simulate representative sky maps of ultra-high-energy cosmic rays over the entire sky, for a wide range of astrophysical scenarios, with different source density, spectrum and composition. We analyze these sky maps from the point of view of composition variations in different regions of the sky, and present a statistical analysis of the significance of such variations. In particular, we apply the study to the typical differences that might be expected between the northern and southern hemispheres.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

560

Poster 1 CR - Board: 181 / 44

CORSIKA modification for rigidity dependent primary selection based on Geomagnetic cutoff rigidity for GRAPES-3 simulations

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For the analysis of the GRAPES-3 Muon data, large scale Monte Carlo simulations are required. These simulations are performed using the CORSIKA simulation package developed by the KIT group. However, the geomagnetic cutoff rigidity varies with direction, therefore, a constant threshold for selection of primary energy results in generation of a large number of events that are subsequently rejected due to their rigidity being below the cutoff value in some directions. We have implemented an efficient mechanism in CORSIKA to select only those primary cosmic rays that lie above the cutoff rigidity in a given direction resulting in rejection of those primary cosmic rays that would have otherwise been rejected subsequently. Results based on actual simulations of GRAPES-3 Muon data have shown that by using this rigidity based cut, the actual computation time was reduced by a factor of two without compromising the reliability of the results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

54

Poster 1 DM and NU - Board: 276 / 1276

Time synchronization and time calibration in KM3NeT

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The KM3NeT neutrino telescope is a next generation Cherenkov array containing thousands of optical modules being installed in deep sea at a depth larger than 2500 m and more than 40 km distance from the shore. For the precise event reconstruction sub-nanosecond precision synchronization between modules is required. Its realization exploits the White Rabbit system to synchronize clocks between nodes through Ethernet over optical fiber. This system was modified for the KM3NeT architecture that is designed for clock distribution based on a common broadcast line. The calibration procedure for electronics latencies, fiber path asymmetries and wavelength dependent light velocity on fiber is described. LED beacons installed on optical modules, laser beacons at the sea bottom and K40 decays are also used to monitor the detector time synchronization in situ.

Application of the time calibration procedure to the first detection unit string with 18 optical modules and its performance will be presented.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

1291

Poster 1 CR - Board: 137 / 751

Atmospheric monitoring at the Pierre Auger Observatory using the upgraded Central Laser Facility

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The Fluorescence Detector (FD) at the Pierre Auger Observatory measures the intensity of the scattered light from laser tracks generated by the Central Laser Facility (CLF) and the eXtreme Laser Facility (XLF) to monitor and estimate the aerosol optical depth ($\tau(z,t)$). These measurements are important to have unbiased and reliable FD reconstruction of the energy of the primary cosmic ray, and the depth of the maximum shower development.

In 2013 the CLF was upgraded substantially with the addition of a solid state laser, new generation GPS, a robotic beam calibration system, better thermal and dust isolation, and improved software. The upgrade also includes a back-scatter Raman LIDAR receiver, capable of providing independent measurements of $\tau(z,t)$.

We describe the new features and applications of the upgraded instrument, including an automated energy calibration system, a steered firing system used for arrival direction studies, and the atmospheric monitoring measurements. We also present the first results after the upgrade using three different procedures to calculate $\tau(z,t)$. The first procedure compares the FD hourly response to the scattered light from the CLF (or XLF) against a reference hourly profile measured during an extremely clear night where zero aerosol contents are assumed. The second procedure measures $\tau(z,t)$ by comparing simulated FD responses under different aerosol attenuation parameters and selecting the best fit to the actual FD response. The third procedure uses the new Raman LIDAR receiver in-situ to measure the back-scattered light from the CLF laser.

The comparison shows a good agreement for the first and second procedures for all FDs located at similar distances from the facilities. However we found higher values of $\tau(z,t)$ using the Raman measurements. This difference may indicate that the assumption of a zero aerosol content during the reference night selection may not be accurate.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

1043

Poster 1 SH - Board: 29 / 425

Five-year correlation of the Sun shadow in cosmic rays observed by ARGO-YBJ with the Interplanetary Magnetic Field variability

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The shadow that the Sun casts on high energy cosmic rays is affected by the interplanetary and solar magnetic fields and has been shown to vary according to the solar rotation and activity cycle. Using the data of the ARGO-YBJ experiment, a large-area air shower detector located at high mountain altitude (4300 m a.s.l., in Tibet, China), the deficit of ~ 5 TeV cosmic rays due to the Sun shadowing effect has been monitored on a three-month basis from 2007 November to 2013 February, a time interval that includes a period of very low solar activity, followed by an activity increase towards the sunspot maximum. We found that the Sun shadow deficit started to decrease significantly in early 2010, about one year before the sunspot number had a fast increase, in early 2011. We observed indeed a significant anti-correlation between the Sun shadow deficit and the Interplanetary Magnetic Field (IMF) variability. This variability became more evident from early 2010, when the IMF showed frequent fluctuations and reversals, that could account for the observed decreased deficit of the shadow.

Registration number following "ICRC2015-I":

110

Poster 1 DM and NU - Board: 254 / 384

Software framework and reconstruction software of the DAMPE gamma-ray telescope

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An overview is given for the offline software framework and reconstruction software of the DAMPE (Dark Matter Particle Explorer) gamma-ray telescope. DAMPE is one of the five satellite missions in the framework of the Strategic Pioneer Research Program in Space Science of the Chinese Academy of Sciences, with a launch date scheduled for the fall 2015. The telescope consists of silicon-tungsten tracker-converter, comprising 6 layers of double-sided silicon-strip detectors, interleaved with 3 layers of tungsten converters, BGO calorimeter, and plastic scintillator, serving as anti-coincidence detector, and a layer of neutron detector in the bottom of the calorimeter. DAMPE analysis and reconstruction software is implemented based on the custom-made software framework, where the core software is written in C++, while the management part is done in Python. We take advantage of the boost-python libraries, whereby the bridge between the core and management part is done, allowing us to fully exploit the computational power of modern CPUs, while keeping the framework flexible and easy to deploy. The building blocks of the framework are the algorithms, which are stacked together and configured in the the job-option files. The geometry of the detector is implemented in the GDML format, through the direct conversion from the CAD drawings of the detector to the geant4-compatible format. The data flow is handled by the dedicated input-output service, based on ROOT. The simulation algorithms are implemented with the Geant4 tool kit. In the heart of the reconstruction software lies the pattern recognition for the initial track finding, which is refined further by the track filtering algorithm, based on the adaptation of Kalman technique. The software has been extensively put on test during the beam test campaigns at CERN, in 2014-2015 years, proving its sustainability to a wide range of data-processing challenges, encountered in a particle-physics experiment.

Registration number following "ICRC2015-I":

367

Poster 1 CR - Board: 178 / 487

Heavy ion beam test at CERN-SPS with the CALET Structure Thermal Model

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We will report testing and calibration of the heavy-ion energy and charge resolution of the CALET cosmic-ray instrument that will fly on the International Space Station in 2015. The beam tests were carried out using a test instrument that is functionally equivalent to CALET. CALET will measure the energy spectra and arrival directions of cosmic-ray electrons to 20 TeV and hadrons to 1 PeV with exceptional resolution. It will measure the spectra of high-energy nuclei to about $Z=40$. It will also measure the cosmic gamma radiation with superior resolution to search for signatures of dark matter annihilation in the gamma-ray and electron spectra. We performed beam tests at CERN-SPS in February and March 2015 to calibrate energy, angular and charge resolution with direct primary beams and secondary fragments of Ar of 13, 19, and 150 A GeV/c. The beam tests were carried out using a test instrument that is functionally equivalent to the calorimeter (CAL) of CALET. I will present our ion run purpose and experimental method and setups, and preliminary results.

Collaboration:

CALET

Registration number following "ICRC2015-I":

440

Poster 1 CR - Board: 191 / 653

Modelling muon and neutron fluxes and spectra on the Earth's ground induced by primary cosmic rays

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The SecondaryCR model evaluates particle fluxes and spectra of secondary e^- , e^+ , μ^+ , μ^- , gammas, protons, neutrons, Cherenkov light etc. at different positions, altitudes and times in the Earth atmosphere.

We developed this model of secondary cosmic rays production in the Earth's atmosphere in the previous studies. It is based on existing models evaluating particles transport in heliosphere, magnetosphere and interactions of primary cosmic rays with the atmosphere. For the evaluation at 1AU on magnetopause we use results of HelMod model. Transparency of magnetosphere was obtained by GeoMag model and finally secondary production in the Earth's magnetosphere was simulated by Corsika package.

The fluxes and spectra of neutrons and muons propagated to the ground over the globe during 22nd and 23rd solar cycle were simulated. The results are discussed in connection with neutron monitor measurements. Possibility to evaluate a neutron monitor response function from the SecondaryCR model simulations is discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

567

Poster 1 CR - Board: 184 / 133

A Look at the Cosmic Ray Anisotropy with the Nonlocal Relativistic Transport Approach

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Cosmic Ray anisotropy is a key element in the quest to find the origin of the enigmatic particles. A well known problem is that although most of the likely sources are in the Inner Galaxy, the direction from which the lowest energy particles (less than about 1 PeV) come is largely from the Outer Galaxy. We show that this can be understood taking into account a possible reflection of charged particles by some 'walls' in the Interstellar Medium. This effect is too subtle to be explained by an ordinary diffusion theory and becomes apparent within the frames of the nonlocal relativistic transport theory, which involves conceptions of free motion velocity and path lengths with probability distribution of nonexponential type taken for a turbulent interstellar medium.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1134

Poster 1 CR - Board: 172 / 960

FAMOUS - A fluorescence telescope using SiPMs

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The FAMOUS telescope is a prove-of-concept study for the usage of silicon based photo sensors (SiPMs) in fluorescence telescopes. Such telescopes detect the fluorescence light emitted by ultra-high energy cosmic ray particles impinging on the Earth's atmosphere. Available instruments, like the fluorescence telescopes of the Pierre Auger Observatory in Argentina, are using photo multiplier tubes for photon detection. The FAMOUS camera aims to make use of the advantages of recent developments in photo detection by SiPM sensors, like increasing the duty cycle due to the ability to operate SiPMs under bright moon light. Build in a 50 cm-diameter aluminum tube, and employing refractive optics driven by a Fresnel-lens, a seven-pixel prototype camera has been installed and developed. First results look very promising. The next stage of the prototype will be equipped with a 61-pixel camera, a more lightweight tube, more efficient light concentrators, and a customized and more stable power supply. The results of the test measurements and the status of the next stage prototype will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

809

Poster 1 SH - Board: 21 / 1242

A 360° Survey of Solar Energetic Particle Events

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During solar cycle 23 it has been possible to routinely measure Solar Energetic Particle (SEP) Events over ~360 deg. in longitude with the combination of STEREO and near-Earth assets like ACE, SOHO, and GOES. It is found that SEPs are distributed more broadly in longitude than was appreciated based on single-point measurements. We report on a survey of large SEP events from 3 points of view as the STEREO spacecraft circle the Sun at ~22.5° per year. During 2010 through September, 2014 (when data from all three locations are available) there were 34 events at Earth that met the NOAA criterion of 10 protons/cm²sr-s (10 PFU) with energies >10 MeV. Taking into account the STEREO data through September 2015, there were 76 events that reached 10 PFU at at least one spacecraft, including 27 events that reached this criterion at 2 or 3 spacecraft. We compare the fluences and examples of the energy spectra at the three separated spacecraft. We also compare the distribution of peak proton intensities with those of previous solar cycles.

Registration number following "ICRC2015-I":

0376

Poster 1 SH - Board: 37 / 898

Rapid determination of cutoff rigidities and asymptotic directions using predetermined parameters in a database

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The investigation of solar cosmic ray events based on neutron monitor measurements requires detailed knowledge about the trajectories of charged particles in the Earth's magnetic field. This information is needed with a high time resolution and for the current level of disturbance of the geomagnetic field. The determination of cutoff rigidities and asymptotic directions by the standard technique of trajectory computation is a time-consuming process. Furthermore, the magnetic field controlling the transport of charged particles near Earth is dynamic and exhibits variations on different time scales ranging from minutes to millenia. Today's space weather applications request computations in near real-time. Therefore it is reasonable to compute trajectories of cosmic ray particles in the magnetic field of the Earth in advance and to stack parameters to describe cutoff rigidities and asymptotic directions at the locations of the neutron monitors of the worldwide network into a database for quick computation.

In this work we investigate the possibility to rapidly describe the cutoff rigidity and the asymptotic directions of neutron monitor locations for specific times and geomagnetic activity by a quick procedure based on a limited number of parameters archived in a database.

Registration number following "ICRC2015-I":

764

Poster 1 DM and NU - Board: 293 / 1298

The data acquisition system of the KM3NeT detector

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The KM3NeT neutrino telescope is part of a deep-sea research infrastructure being constructed in the Mediterranean Sea. The basic element of the detector is the Detection Unit, a 700 meter long vertical

structure hosting 18 Digital Optical Modules (DOMs). The DOM comprises 31 3" photomultiplier tubes (PMTs), various instruments to monitor environmental parameters, and the electronic boards for the digitization of the PMT signals and the management of data acquisition.

Dedicated readout electronics have been developed and are installed inside each DOM, allowing to measure the time of arrival and the duration of photon hits, on each of the 31 photomultiplier tubes, with a time resolution of 1 ns. Moreover, the data transmission system of the DOMs supports a data transfer rate up to 250 Mbps, which corresponds to a photon-hit rate of 15 kHz on each PMT.

Due to the extreme operation conditions of the abyssal site, the all-data-to-shore concept is used in order to minimize the complexity of the offshore detector. The processing of the data transmitted to onshore is performed by the Trigger and Data Acquisition System (TriDAS). The networking infrastructure and computing resources are conceived to be modular and scalable in order to manage the full data rate from the final cubic-kilometer scale telescope.

The electronics and the DAQ system described in the poster are currently under test in the first Detection Unit deployed offshore Toulon and operated since spring 2015.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

549

Poster 1 GA - Board: 102 / 936

Simulation study on a large field of view cherenkov telescope

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The large field of view and low threshold energy are highly desirable properties for the ground based observations of high energy GRBs. However, larger field of view is difficult to achieve for current imaging atmospheric cherenkov telescopes (IACT), and the threshold below O(100)GeV is also a challenging for current EAS arrays. An alternative solution is to adopt the refractive optics system for IACTs to enlarge the field of view while keeping the low threshold energy. In this work, simulation studies on the effective area, angular resolution and gamma-ray sensitivity for such large field of view IACT are presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

752

Poster 1 GA - Board: 78 / 1157

Recent pulsar results from VERITAS on Geminga and the missing link binary pulsar PSR J1023+0038

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In recent years, the Fermi-LAT gamma-ray telescope has detected a population of over 160 gamma-ray pulsars, which has enabled the detailed study of gamma-ray emission from pulsars at energies above 100 MeV. Further, since the surprising detection of the Crab pulsar in very high-energy (VHE; $E > 100$ GeV) gamma rays by the MAGIC and VERITAS collaborations, there has been an ongoing effort in the gamma-ray astrophysics community to detect new pulsars in the VHE band. However, the Crab remains the only pulsar so far detected in VHE gamma rays, raising the question of whether or not the Crab is unique and also making it more difficult to constrain model predictions that attempt to explain the VHE emission. Presented here are recent VERITAS results from observational campaigns on the brightest northern-hemisphere high-energy gamma-ray pulsar Geminga and the missing link binary pulsar PSR J1023+0038, which have both resulted in upper limits on a possible gamma-ray flux. These limits are placed into context with the current theoretical framework attempting to explain the origin of VHE gamma-ray emission from pulsars. Additionally, future plans for pulsar observations with VERITAS will be briefly discussed.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

918

Poster 1 SH - Board: 18 / 983

Proton energy spectra during ground level enhancements as measured by EPHIN aboard SOHO

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Ground Level Enhancements (GLEs) are solar energetic particle (SEP) events that are recorded by ground-based instrumentation. The energy of the particles is so high that they produce secondary particles, i.e. protons and neutrons, which are detected as sudden increases in cosmic ray intensities measured by e.g. neutron monitors. Since the launch of SOHO in December 1995 the neutron monitor network recorded 16 GLEs. The Electron Proton Helium INstrument on board SOHO has been designed to measure protons and helium up to 53 MeV/nucleon as well as electrons up to 8.3 MeV. Above these energies, particles penetrate all detector elements and thus, a separation between different particle species becomes more complicated. Recently we developed a method that allows deriving the energy spectrum for penetrating protons up to almost 1 GeV/nucleon. In this contribution we present the integrated fluences of solar energetic protons for the 16 above-mentioned GLEs and compare them to previous results.

Registration number following "ICRC2015-I":

863

Poster 1 CR - Board: 182 / 64

Understanding the anisotropy of cosmic rays at TeV and PeV energies

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The anisotropy in cosmic-ray arrival directions in the TeV-PeV energy range shows both large and small-scale structures. While the large-scale anisotropy may arise from diffusive propagation of cosmic rays, the origin of the small-scale structures remains unclear. We perform three-dimensional Monte-Carlo test-particle simulations, in which the particles propagate in both magnetostatic and electromagnetic turbulence derived from a three-dimensional isotropic power spectrum. However, in contrast to earlier studies, we do not use a backtracking method for the computation of the particle trajectories, and hence anisotropy must build up from a large-scale isotropic (or dipole) boundary condition. It has been recently argued that the turbulent magnetic field itself generates the small-scale structures of the anisotropy if a global cosmic-ray dipole moment is present. Our code is well suited to test that hypothesis. We also investigate the impact of a finite phase velocity of interstellar turbulence.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

82

Poster 1 SH - Board: 6 / 230

Unusual cosmic ray increases observed during several solar flares in 2011-2013

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We present and discuss the cosmic ray increases detected with the CARPET cosmic ray instruments during several solar flares in 2011-2013. The CARPET cosmic ray detectors were installed at El

Leoncito Astronomical Complex (CASLEO; Argentina) in 2006 and at CERN (Switzerland) in 2009. We compare the CARPET data with the X-ray and proton data from GOES and Fermi LAT/GBM measurements as well as with the RHESSI observations. The neutron monitor network cosmic ray measurements are also included in the analysis. We summarize the common features of the recorded events and discuss their association with solar flare activity and near-Earth conditions.

Registration number following "ICRC2015-I":

243

Poster 1 CR - Board: 204 / 140

Testing for uniformity of UHECR arrival directions

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Arrival directions of ultra-high energy cosmic rays (UHECRs) exhibit mainly isotropic distribution with a hint of small deviations in particular energy bins. In this paper available UHECR data are tested for circular uniformity of arrival directions using methods developed in directional statistics.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

61

Poster 1 DM and NU - Board: 262 / 893

Self Consistent Simulation of Dark Matter Annihilation And Background

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Future space based experiments such as CALET and DAMPE will measure the electron and positron cosmic-ray spectrum with better energy resolution and up to higher energy, making detection of small features in the spectrum, which might originate from Dark Matter annihilation or decay in the galactic halo, possible. For precise prediction of these features, the numerical cosmic ray propagation code GALPROP is used, and was extended to calculate the flux at Earth from different Dark Matter scenarios with any given injection spectrum. The results from GALPROP for both the cosmic-ray background spectrum and the component from Dark Matter annihilation are strongly dependent on the bin size in energy used in the calculation, due to energy loss playing a major role in the

propagation of electrons. A modification to partly compensate the influence of the discretization of the energy shifted particles has been implemented in the code. The effect of this improvement is demonstrated with examples of the expected spectra for the cosmic ray background in combination with several Dark Matter candidates calculated at different energy binning.

<http://www.crlab.wise.sci.waseda.ac.jp/eng/wp-content/uploads/downloads/2015/03/icrc.png>

This figure shows the background electron flux is subjected to a shift in power law index due to finite energy bin size, as shown by the difference between the results for calculation with a bin size of 4% (magenta line), and 30% (orange dots) of the energy. In the result for the modified code (green dots) the change is compensated, giving results matching the finer energy binning. The AMS-02 results and a possible Dark Matter Contribution (electron+positron channel, Mass of DM=400GeV, Boost Factor=130) are shown in maroon and grey respectively.

Registration number following "ICRC2015-I":

740

Poster 1 DM and NU - Board: 265 / 43

GSL in Unified DE-DM Dominated LQC

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Thermodynamic study is the common approach to understand dark energy (DE) and dark matter (DM) riddle. The respective approach is still not comparatively matured in loop quantum cosmology (LQC). Our present work follows the study of the status of generalized second law (GSL) in unified DE-DM dominated LQC scenario.

Registration number following "ICRC2015-I":

56

Poster 1 GA - Board: 75 / 965

Redshift measurement of Fermi Blazars for the Cherenkov Telescope Array

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Blazars are active galactic nuclei, and the most numerous High Energy (HE) and Very High Energy (VHE) gamma-ray emitters. Their optical emission is often dominated by non-thermal, and, in the case of BL Lacs, featureless continuum radiation. This renders the determination of their redshift extremely difficult. Indeed as of today only about 50% of gamma-ray blazars have a measured spectroscopic redshift.

The knowledge of redshift is fundamental because it allows the precise modeling of the VHE emission and also of its interaction with the extragalactic background light (EBL). The beginning of the Cherenkov Telescope Array (CTA) operations in the near future will allow detecting several hundreds of new BL Lacs. Using the first Fermi catalogue of sources above 10 GeV (1FHL), we performed simulations which demonstrate that at least half of the 1FHL BL Lacs detectable by CTA will not have a measured redshift. Indeed the organization of observing campaigns to measure the redshift of these blazars has been recognized as a necessary support for the AGN Key Science Project of CTA.

Taking advantage of the recent success of an X-shooter GTO observing campaign, we thus devised an observing campaign to measure the redshifts of as many as possible of these candidates. The main characteristic of this campaign with respect to previous ones will be the use of higher resolution spectrographs and of 8 meter class telescopes. We are starting submitting proposals for our observations.

In this paper we will briefly describe the selection of the candidates, the characteristics of our observation and the expected results.

Collaboration:

CTA

Registration number following "ICRC2015-I":

814

Poster 1 CR - Board: 229 / 905

Telescope Array measurement of UHECR composition from stereoscopic fluorescence detection

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The chemical composition of ultra-high-energy cosmic rays (UHECRs) affects the observable distribution of air-shower X_{\max} values, the atmospheric slant depth at which the number of secondary shower particles reaches its maximum. The observed X_{\max} distributions at various primary UHECR energies can be compared with the distributions predicted by detailed detector simulations for any assumed composition and high-energy hadronic interaction model. In this poster, we present measurements of X_{\max} by the Telescope Array (TA) fluorescence detectors with stereoscopic shower reconstruction. We find that for all hadronic models considered, the data collected since TA operation began in 2007 is consistent with a chiefly light UHECR composition.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

772

Poster 1 CR - Board: 174 / 1109

The Sites of the Latin American Giant Observatory

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The Latin American Giant Observatory (LAGO) is an extended cosmic ray observatory, which consists in a wide network of water Cherenkov detectors (WCDs) located in nine different countries. The geographic distribution of the LAGO sites, with different altitudes and geomagnetic rigidity cut-offs, combined with the new electronic system for control, atmospheric sensing and data acquisition on board of each detector, allow the realization of multiple and varied astrophysics, space physics and atmospheric physics studies at regional scale. This work will describe the LAGO sites and the capabilities of the LAGO detection network spanned across Latin America.

Collaboration:

LAGO

Registration number following "ICRC2015-I":

1009

Poster 1 GA - Board: 105 / 896

Progress on the electromagnetic particle detector and the prototype array of LHAASO-KM2A

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A prototype array for the LHAASO-KM2A, which consists of 39 detector units, was set up at the Yangbajing cosmic ray observatory(4300m a.s.l., Tibet, P.R. China) and has been in stable operation since October 2014. In this paper, we present the performances of the prototype electromagnetic particle detector and the prototype array.

Collaboration:

LHAASO

Registration number following "ICRC2015-I/":

757

Poster 1 CR - Board: 173 / 658

The TUS orbital detector simulation

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The TUS space experiment is aimed to study energy spectrum and arrival distribution of UHECR at energy range above 1020 eV by the measurement of the EAS fluorescent radiation in atmosphere. The TUS mission is planned for launch at the end of 2015 at the dedicated "Lomonosov" satellite. TUSSIM program package was developed to simulate the TUS detector performance including the Fresnel mirror optical parameters, the light concentrator of the photo detector and the front end and trigger electronics. In order to investigate the detector response, we employ the software package ESAF of JEM-EUSO experiment for the fluorescent radiation of EAS. Trigger efficiency is crucially dependent on the background level that is changed from ~ 0.2106 to ~ 15106 ph/(m²microsecr) at moonless and full moon nights respectively. The TUSSIM algorithms is described and the expected TUS statistics is presented for 5 years of data collection from 500 km solar-synchronized orbit taking into account the background light intensity change during the space flight.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0436

Poster 1 CR - Board: 147 / 833

LHAASO-WFCTA Optical System Optimization for High Precision Cherenkov Shower Reconstruction

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Wide Field-of-view air Cherenkov Telescope Array (WFCTA) is an essential component of the Large High Altitude Air Shower Observatory (LHAASO). WFCTA comprises 24 movable identical telescopes specialized for measuring the energy spectrums of the cosmic ray ingredients. In this paper, we describe the synthesis optimization design of the optical system, including the mirror segments, the camera and the Winston cone light collectors for individual telescope. We also evaluate the imaging performance through Monte Carlo simulation as well as spot scanning experiments. Finally,

based on these properties, a high precision Cherenkov image reconstruction technique is discussed, which is implemented to improve the imaging resolution so as to fulfill the precise Cherenkov shower reconstruction.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

723

Poster 1 CR - Board: 170 / 365

An IceTop Module for the IceCube MasterClass

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The IceCube MasterClass is an outreach project of the IceCube experiment at South Pole for 9th to 12th grade school students. The MasterClass is designed to provide an authentic astrophysics research experience by demonstrating typical elements of IceCube research. It is a full-day experience of engaging activities, educational talks, and scripted analyses, where students can reproduce the main science results of IceCube with real data.

Interactive applications are a central aspect of the analysis activities, which run directly in standard web browsers and offer students intuitive insights into data processing. This contribution describes a new analysis module which reproduces the measurement of the energy spectrum of cosmic rays with IceTop, the surface component of IceCube. The module features a web application that allows students to interactively fit representative IceTop events to recover the direction and size estimator S125 from the raw data. Data from the web application is processed with a simple spreadsheet application to compute the cosmic-ray flux, which can be compared to the official result.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

1044

Poster 1 DM and NU - Board: 272 / 1086

Time and amplitude calibration of the Baikal-GVD neutrino telescope

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The first stage of the Baikal-GVD neutrino telescope will be composed of more than two thousand light sensors, Optical Modules (OMs), installed deep underwater in Lake Baikal. We describe developed calibration methods which use OM LEDs, the calibration laser source, atmospheric muons etc. and discuss the performance of these methods.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

893

Poster 1 CR - Board: 139 / 507

Automated procedures for the Fluorescence Detector calibration at the Pierre Auger Observatory

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The quality of the physics results, derived from the analysis of the data collected at the Pierre Auger Observatory depends heavily on the calibration and monitoring of the components of the detectors. It is crucial to maintain a database containing complete information on the absolute calibration of all photomultipliers and their time evolution. The low rate of the physics events implies that the analysis will have to be made over a long period of operation. This requirement imposes a very organized and reliable data storage and data management strategy, in order to guarantee correct data preservation and high data quality.

The Fluorescence Detector (FD) consists of 27 telescopes with about 12,000 phototubes which have to be calibrated periodically. A special absolute calibration system is used. It is based on a calibrated light source with a diffusive screen, uniformly illuminating photomultipliers of the camera. This absolute calibration is performed every few years, as its use is not compatible with the operation of the detector. To monitor the stability and the time-behavior, another light source system operates every night of data taking. This relative calibration procedure yields more than 2×10^4 raw files each year, about 1 TByte/year.

In this paper we describe a new web-interfaced database architecture to manage, store, produce and analyze FD calibration data. It contains the configuration and operating parameters of the detectors at each instant and other relevant functional parameters that are needed for the analysis or to monitor possible instabilities, used for the early discovery of malfunctioning components. Based on over 10 years of operation, we present results on the long term performance of FD and its dependence on environmental variables. We also report on a check of the absolute calibration values by analyzing the signals left by stars traversing the FD field of view.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

463

Poster 1 SH - Board: 44 / 1256

The LAGO Space Weather Program: Directional Geomagnetic Effects, Background Fluence Calculations and Multi-Spectral Data Analysis

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The Latin American Giant Observatory (LAGO) is an extended Cosmic Ray (CR) observatory operating in nine Latin American countries. Within the LAGO framework, several scientific and academic programs are being developed and conducted. One of them, the LAGO Space Weather program, aims to produce real time, high time resolution and high quality data of the flux of secondary particles at each site of the LAGO detection network, complementing and expanding present measurements of the influence of Solar activity from ground level observations. The geographic distribution of the LAGO water-Cherenkov detectors (WCD) allows the measurement of simultaneous transient events at different geomagnetic rigidity cut-offs and atmospheric reaction levels. Moreover, the usage of this type of detectors combined with the new electronic system, allow the discrimination of individual pulses at the detector and to study the flux of secondary particles at each site at different bands of deposited energy in the detector. This program is intensively supported by a complex chain of simulations that accounts for geomagnetic and atmospheric effects and the different detectors response. In this work, the complete simulation chain is described, and the first multi-spectral analysis of the Forbush decrease of March of 2012 is presented.

Collaboration:

LAGO

Registration number following "ICRC2015-I":

881

Poster 1 DM and NU - Board: 252 / 1145

Space qualification of the Silicon Tungsten Tracker of DAMPE

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Silicon Tungsten Tracker (STK) is one of the key payloads of Dark Matter Particle Explorer (DAMPE), which is planned to be launched at the end of 2015. In order to verify the design of STK, an Engineering Qualification Model (EQM) of STK was developed in 2014 and qualified for several space

environmental tests, including vibration test, shock test, thermal vacuum test, thermal balance test and thermal cycling test. All the test results demonstrate the high reliability and good performance of STK, which also trigger the following production of flight model (FM).

Registration number following "ICRC2015-I":

734

Poster 1 DM and NU - Board: 271 / 342

Progress on the development of a wavelength-shifting optical module

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We report on the development of a photon sensor sensitive to single photons that employs wavelength-shifting and light-guiding techniques to maximize the collection area and to minimize the dark noise rate. The sensor is tailored towards applications in ice-Cherenkov neutrino detectors using inert and cold, low-radioactivity and UV transparent ice as a detection medium, such as IceCube-Gen2 or MICA. The goal is to decrease the energy threshold as well as to increase the energy resolution and the vetoing capability of the neutrino telescope, when compared to a setup with optical sensors similar to those used in IceCube. The detector captures photons with wavelengths between 250 nm to 400 nm. These photons are re-emitted with wavelengths above 400 nm by a wavelength shifter coating applied to a 90 mm diameter polymer tube which guides the light towards a small-diameter PMT via total internal reflection. By scaling the results from smaller laboratory prototypes, the total efficiency of the proposed detector for a Cherenkov spectrum is estimated to exceed that of a standard IceCube optical module by a factor of 2.7. The status of the prototype development and performance of its main components as well as the potential for future IceCube extensions will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

236

Poster 1 CR - Board: 156 / 810

Muon Array with RPCs for Tagging Air showers (MARTA)

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We discuss the concept of an array with Resistive Plate Chambers (RPC) for muon detection in ultra-high energy cosmic ray (UHECR) experiments. RPC have been used in particle physics experiments due to their fast timing properties and spatial resolution. The operation of a ground array detector poses challenging demands, as the RPC must operate remotely under extreme environment, with limited power and minimal maintenance.

In its baseline configuration, each MARTA unit includes one 1.5x1.2 m² RPC, with 64 pickup electrodes (pads). The DAQ system is based on a ASIC, allowing to readout the high number of channels with low power consumption. Data is recorded using a dual technique: single particle counting with a simple threshold on the signal from each pad and charge integration for high occupancy. The RPC, DAQ, High Voltage and monitoring systems are enclosed in an aluminum-sealed case, providing a compact and robust unit suited for outdoor environments, which can be easily deployed and connected. The RPCs developed at LIP-Coimbra are able to operate using very low gas flux, which allows running them for few years with a small gas reservoir. Several full-scale units are already installed and taking data in several locations and with different configurations, proving the viability of the MARTA concept.

By shielding the detector units with enough slant mass to absorb the electromagnetic component in the air showers, a clean measurement of the muon content is allowed, a concept to be implemented in a next generation of UHECR experiments. The specificities of a MARTA unit are presented, which include particle counting with high efficiency, time resolution and spatial segmentation. The potential of the MARTA concept for muon measurements in air showers is assessed, as well as tentative methods for calibration and cross-calibrations with existing detectors.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

589

Poster 1 SH - Board: 36 / 815

A Project to Install Water-Cherenkov Detectors in the Antarctic Peninsula as part of the LAGO Detection Network

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The Latin American Giant Observatory (LAGO) consist in a network of water-Cherenkov detectors (WCD) located in nine countries of Latin America, to study with extreme detail the flux of cosmic rays (CRs) from ground level. The main scientific aims are oriented to address several problems of astrophysics, space physics and atmospheric physics. In particular, LAGO has started to develop an extensive Space Weather program. Due to the geomagnetic shielding, particle detectors located at high latitudes allow the observation of CRs with lower energies than those located at middle or low latitudes. Antarctica is therefor a privileged place to study CRs, allowing access to the lowest energies that can be observed from ground. A project to install WCDs in the Argentinean Marambio station, located at the Antarctic Peninsula, aims at operating a first antarctic node of LAGO. In this work, several aspects of the project, including information about the site, the detector, the building, and numerical simulations of the expected flux at this location will be presented. Results from this new LAGO site will provide important insight for Space Weather and the Sun-Earth coupling.

Registration number following "ICRC2015-I":

713

Poster 1 CR - Board: 177 / 712

Measurement of the water-Cherenkov detector response to inclined muons using an RPC hodoscope

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The Pierre Auger Observatory operates a hybrid detector composed of a Fluorescence Detector and a Surface Detector array. Water-Cherenkov detectors are the building blocks of the array and as such play a key role in the detection of secondary particles at the ground. A good knowledge of the detector response is paramount to lower systematic uncertainties and thus to increase the capability of the experiment in determining the muon content of the extensive air showers with a higher precision. In this work we report on a detailed study of the detector response to single muon traversals as a function of traversal geometry. A dedicated Resistive Plate Chambers (RPC) hodoscope was built and installed around one of the detectors. The hodoscope is formed by two stand-alone low gas flux segmented RPC detectors with the test water-Cherenkov detector placed in between. The segmentation of the RPC detectors is of the order of 10 cm. The hodoscope is used to trigger and

select single muon events in different geometries. The signal recorded in the water-Cherenkov detector and performance estimators were studied as a function of the trajectories of the muons and compared with a dedicated simulation.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

584

Poster 1 GA - Board: 51 / 1068

VERITAS Observations of M31 (the Andromeda Galaxy)

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Diffuse gamma rays are tracers of cosmic rays, providing information on their origin and diffusion. M 31 (the Andromeda Galaxy) is the closest spiral galaxy to the Milky Way ($d = 750$ kpc) and is very well studied at all wavelengths, thus it is a prime target for the study of diffuse gamma-ray emission. The very-high-energy (VHE, $E > 100$ GeV) gamma-ray observatory VERITAS has conducted 45 hours of observations of M 31 and an upper limit on the VHE flux will be presented. An updated Fermi-LAT ($100 \text{ MeV} < E < 300 \text{ GeV}$) analysis will also be presented. These observations will be compared with predictions of the gamma-ray flux derived from the inelastic scattering of VHE cosmic rays of the interstellar medium (ISM) and the interstellar radiation field. M 31 provides an ideal opportunity to probe these mechanisms. Its proximity and spatial extent, significantly larger than the VERITAS point spread function but smaller than the field-of-view, enables the star-forming ring, 10 kpc from the galaxy core, with its dense ISM and numerous supernova remnants to be resolved.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

884

Poster 1 GA - Board: 94 / 1258

New concepts of timing calibration systems for large-scale Cherenkov arrays in astroparticle physics experiments

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We present new concepts of timing calibration systems for large-scale Cherenkov arrays in astroparticle physics experiments like Cherenkov arrays detecting extensive air showers (EAS) and water Cherenkov neutrino arrays. The concepts are based on a fast powerful LED light source on

board of a pilotless remotely controlled helicopter in case of EAS Cherenkov arrays and on multiple LED sources driven by a single driver. We describe parameters of LED sources developed especially for these kinds of applications and discuss some preliminary results of laboratory and in-situ tests.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

951

Poster 1 GA - Board: 83 / 290

The stereo Topo-trigger: a new concept of stereoscopic trigger system for imaging atmospheric Cherenkov telescopes

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Imaging atmospheric Cherenkov telescopes such as the MAGIC telescopes are built to achieve the lowest possible energy threshold. The trigger system of these telescopes is one of the most important parts to achieve it. The main problem when decreasing the energy threshold is the rapid increase of accidental triggers caused by the ambient light and the after pulses of the photomultipliers. The coincidence trigger between the telescopes strongly suppresses the accidental rate recorded by the telescope. At lower trigger threshold, however, it is difficult to discriminate at the trigger level between the triggers produced by accidental triggers or real cosmic events.

In this contribution we present a topological trigger, dubbed Topo-trigger, a novel technique that discriminates between the events triggered by cosmic rays and accidental triggers. This allows a decrease of up to 85 % of the accidental events triggering the MAGIC system in stereo. We have simulated and tested this algorithm in the MAGIC telescope while keeping more than 99 % of the gamma rays triggered. According to simulations, this trigger system increases the collection area at the analysis level of about 30 % at the lowest energies and between 10-20 % at the energy threshold. The decrease in the analysis energy threshold of the telescope is ~8 %. The selection algorithm proposed here was tested on real MAGIC data taken with the current trigger configuration and we find that no triggers are lost due to the algorithm proposed. A full implementation of the Topo-trigger was installed in MAGIC at the end of 2014 and the first results of its performance will also be shown.

Collaboration:

MAGIC

Registration number following "ICRC2015-I/":

297

Poster 1 CR - Board: 205 / 195

Investigation of angular distributions in the interaction of cosmic-ray particles with a dense target and comparison with data of the Large Hadron Collider.

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Cosmic ray measurements are carried out on at a detector station located in the Tian Shan mountains at an altitude of 3340 meters above sea level using the complex installations “Hadron-9” and “Hadron-44”. The main objective of these studies is the interaction of cosmic rays with nuclei, in particular the study of anomalous events occurring in the cores of extensive air showers (EAS). Analysis was performed for 10199 detected events, of which 2657 events interacted directly in the target. 462 events with a Gamma-ray number of $n \geq 4$ could be identified. For these events angular correlations were investigated using two-dimensional correlation functions of the form $\Delta\eta$ - $\Delta\phi$. Here $\Delta\eta$ is the difference of pseudorapidities ($\eta = -\ln(\tan(\theta/2))$) with θ the polar angle measured by the deviation from the beam axis deviation, and $\Delta\phi$ is the difference between the azimuth angles of two particles. As a result we received a well-defined structure for the paired $0.5 < \Delta\eta < 4.5$, $0.4 < \Delta\phi < 2.6$ two-particle correlation functions, almost similar to the results obtained in the “Observation of long-range, near-side angular correlations in proton-proton collisions at the LHC”. This is the first observation of such a structure in the two-particle correlation function of the interaction of cosmic rays with matter.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

199

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A numerical simulation of cosmic ray modulation near the heliopause

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Based on a hybrid galactic cosmic ray transport model, which incorporated MagnetoHydroDynamics (MHD) global heliospheric data into Parker’s cosmic ray transport equation, we studied the behaviour of the transport of galactic cosmic rays near the heliopause (HP). We found that: (1) By increasing the ratio of the parallel diffusion coefficient to the perpendicular diffusion coefficient in the interstellar magnetic field of the outer heliosheath, the simulated radial flux near the HP increases as well. As this ratio multiplying factor reaches $10e10$, the radial flux experience a sudden jump near the HP, similar to what Voyager 1 had observed in 2012. (2) The effect of changing the

diffusion coefficients ratio on the radial flux variation depends on the energy of the cosmic rays, the lower the energy, the more pronounced the effect is. (3) The magnitude of the diffusion coefficients also affect the radial flux near the HP; the modulation beyond the HP varies by adjusting the magnitude multiplying factor. (4) After increasing the ratio of the diffusion coefficients beyond the HP, more pseudo-particles in our SDE approach which have been traced from the upwind nose region exit in the downwind tail region. It is thus possible that they diffuse more directly from the tail region to the nose region.

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Poster 1 GA - Board: 52 / 276

Divergent pointing with the Cherenkov Telescope Array for surveys and beyond

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The galactic and extragalactic surveys are two of the main proposed legacy projects of the Cherenkov Telescope Array (CTA). Considering Cherenkov telescopes field of view ($<10^\circ$), the time needed for those projects is large. The many telescopes of CTA will allow taking full advantage of new pointing modes in which telescopes point slightly offset from one another. This divergent pointing mode leads to an increase of the array field of view ($\sim 14^\circ$ or larger) with competitive performance compared to normal pointing. We present here a study of the performance of the divergent pointing for different array configurations and number of telescopes. We show that for a fixed survey sensitivity, using divergent pointing instead of normal pointing results in a non-negligible gain in observing time and reduced fluctuations in survey depth. We review multiple science cases benefiting from the large field-of-view offered by the divergent pointing.

Collaboration:

CTA

Registration number following "ICRC2015-I":

626

Poster 1 GA - Board: 53 / 277

The H.E.S.S. multi-messenger program

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Based on fundamental particle physics processes like the production and subsequent decay of pions in interactions of high-energy particles, close connections exist between the acceleration sites of high-energy cosmic rays and the emission of high-energy gamma rays, high-energy neutrinos and other messengers like gravitational waves. In most cases these connections provide both spatial and temporal correlations of the different emitted particles. The combination of the complementary information provided by these messengers allows to lift ambiguities in the interpretation of the data and enables novel and very sensitive analyses.

In this contribution we'll introduce and describe the H.E.S.S. multi-messenger program. The core of this newly installed program is the combination of high-energy neutrinos and high-energy gamma rays. We'll furthermore present searches for high-energy gamma-ray emission in coincidence with Fast Radio Bursts (FRBs) and gravitational waves. We'll provide an overview over current and planned analyses and present recent results.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

288

Poster 1 SH - Board: 14 / 601

Galactic Cosmic Ray Spectra During Solar Cycle 23 and 24 - Measurement Capabilities of the Electron Proton Helium Instrument on board SOHO

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The solar modulation of galactic cosmic rays (GCR) can be studied in detail by long term variations of the GCR energy spectrum (e.g. on the scales of a solar cycle). With almost 20 years of data, the Electron Proton Helium INstrument (EPHIN) aboard SOHO is well suited for these kind of investigations.

Although the design of the instrument is optimized to measure proton and helium isotope spectra up to 50 MeV/nucleon the capability exist that allow to determine energy spectra above 800 MeV/nucleon. Therefore we developed a sophisticated inversion method to calculate such proton spectra. The method relies on a GEANT4 Monte Carlo simulation of the instrument and a simplified spacecraft model that calculates the energy response function of EPHIN for electrons, protons and heavier ions. In order to determine the energy spectra the resulting inversion problem is solved numerically. As a result we present galactic cosmic ray spectra from 1995 to 2015. For validation, the derived spectra are compared to PAMELA data from 2006-2009. Furthermore we discuss the spectra with respect to the solar modulation.

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Poster 1 GA - Board: 84 / 523

FACT –Novel mirror alignment using Bokeh and enhancement of the VERITAS SCCAN alignment method

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Imaging Air Cherenkov Telescopes, including the First G-APD Cherenkov Telescope (FACT), use segmented reflectors. These offer large and fast apertures for little resources.

However, one challenge of segmented reflectors is the alignment of the single mirrors to gain a sharp image. For Cherenkov telescopes, high spatial and temporal resolution is crucial to reconstruct air shower events induced by cosmic rays. Therefore one has to align the individual mirror positions and orientations precisely. Alignment is difficult due to the large number of degrees of freedom and because most techniques involve a star. Most current methods are limited, because they have to be done during good weather nights which overlaps with observation time. In this contribution, we will present the mirror alignment of FACT, done using two methods.

Firstly, we show a new method which we call Bokeh alignment. This method is simple, cheap and can even be done during daytime.

Secondly, we demonstrate an enhancement of the SCCAN method by F. Arqueros et al., and first implemented by the McGill VERITAS group. Using a second camera, our enhanced SCCAN is optimized for changing weather, changing zenith distance, and changing reference stars. Developed off site in the lab on a 1/10th scale model of FACT, both our alignment methods resulted in a highly telescope independent procedure, e.g. both our methods run without communication to the telescope's drive.

We compare alignment results by using the point spread function of star images, ray tracing simulations, and overall muon rates before and after the alignment.

Collaboration:

FACT

Registration number following "ICRC2015-I":

184

Poster 1 GA - Board: 85 / 1015

Exploiting the time of arrival of Cherenkov photons at the 28 m H.E.S.S. telescope for background rejection: Methods and performance

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In 2012, the High Energy Stereoscopic System (H.E.S.S.) was expanded by a fifth telescope (CT5). With an enormous effective mirror diameter of 28 m, CT5 is able to detect the Cherenkov light of very faint gamma-ray air showers, thereby significantly lowering the energy threshold of this telescope compared to the other four telescopes. Extracting as much information as possible from the recorded shower image is crucial for background rejection and to reach an energy threshold of a few tens of GeV.

The camera of CT5 is conceived to register the time of the charge pulse maximum with respect to the beginning of the 16 ns integration window of each pixel. This information can be utilised to improve the event reconstruction. It also helps to reduce the background contamination at low energies. We present new techniques for background rejection based on CT5 timing information and evaluate their performance.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

852

Poster 1 GA - Board: 54 / 1232

VERITAS Observations of HESS J1943+213

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HESS J1943+213 is a very-high-energy (VHE; > 100 GeV) gamma-ray point source detected during the H.E.S.S. Galactic Plane Survey. Radio, infrared, X-ray, and GeV gamma-ray counterparts have been identified for HESS J1943+213; however, the classification of the source is still uncertain. Recent publications have argued primarily in favor of either an extreme BL Lac object behind the Galactic plane or a young pulsar wind nebula. We present deep VERITAS observations of HESS J1943+213, which provide the most significant VHE detection of the source so far, with >20 sigma excess. The source is detected at ~2% Crab Nebula flux above 200 GeV, consistent with the H.E.S.S. detection. The source spectrum is well fit by a power-law function. Moreover, no significant flux variability is detected over the course of VERITAS observations. We place the VERITAS results in a multi-wavelength context to comment on the HESS J1943+213 classification.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

616

Poster 1 CR - Board: 163 / 1238

The Guane Array of the LAGO Project

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The Space Weather program of the Latin American Giant Observatory (LAGO) is based on the installation of single or small arrays of water-Cherenkov detectors (WCD) spanned across Latin America. The Guane Array is one of the LAGO detection network nodes and it is located in the city of Bucaramanga, Colombia, at 986 m a.s.l. The array is composed of three autonomous LAGO WCD installed at the vertices of a 105 m side equilateral triangle. Each WCD is locally operated by a low power consumption single board computer and the first steps of the data analysis are done on board of the detector to reduce data transfer, as a test for the operation of WCD in remote sites. The array operates with two complementary analysis modes: the counting mode, a single particle technique implementation at each individual detector, and the shower mode, which allows the offline identification of spacetime correlated signals over the array. In this work it will be presented the capabilities, characterization and first results of the Guane Array.

Collaboration:

LAGO

Registration number following "ICRC2015-I":

881

Poster 1 SH - Board: 30 / 445

Cosmic Radiation and the Earths atmospheric processes

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ABSTRACT: In this paper, we have provided an overview of effects of cosmic radiation on terrestrial processes such as cloud formation, cloud coverage, lightning, global electrical circuit, etc. It is evolved empirically that cosmic rays control short-term and long-term variations in climate. We also explained that how additional ionization produced by cosmic rays could enhance charging rate and charge moment of thunderstorms. There are many basic phenomena which need further study and require new and long-term data set. Some of these have been pointed out.

Registration number following "ICRC2015-I":

605

Poster 1 GA - Board: 111 / 102

Observation of the ^{26}Al emission distribution throughout the Galaxy with INTEGRAL/SPI

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We present ^{26}Al map distribution throughout the Galaxy measured by the SPI spectrometer aboard the INTEGRAL observatory. This emission at 1.809 MeV is associated with the ^{26}Al decay and to the production of heavy elements in the Galaxy.

The only available ^{26}Al map to date has been released, more than fifteen years ago, thanks to the COMPTEL instrument.

However, at the present time, SPI offers a unique opportunity to enrich this first result. The data accumulated between 2003 and 2013 which amounts to 2×10^8 s of observing time are used to perform a dedicated analysis, aiming to deeply investigate the spatial morphology of the ^{26}Al emission.

The data are first compared with several sky maps based on observations at various wavelengths to model the ^{26}Al distribution throughout the Galaxy. For most of the distribution models, the inner Galaxy flux is compatible with a value of 3.3×10^{-4} ph. cm⁻².s⁻¹ while the preferred template maps correspond to young stellar components such as core-collapse supernovae, Wolf-Rayet and massive AGB stars. To get more details about this emission, an image reconstruction is performed using an algorithm based on the maximum-entropy method.

In addition to the inner Galaxy emission, several excesses suggest that some sites of emission are linked to the spiral arms structure.

Lastly, an estimation of the ^{56}Fe line flux, assuming a spatial distribution similar to ^{26}Al line emission, results in a ^{56}Fe to ^{26}Al ratio around 0.14, which agrees with the most recent studies and with the SN explosion model predictions.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

114

Poster 1 SH - Board: 3 / 106

Multi-spacecraft observations of heavy-ion solar energetic particles

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Solar Energetic Particles (SEPs) released during flares and coronal mass ejections can be detected by spacecraft widely separated in longitude. The mechanism by which this transport across the magnetic field takes place remains unclear.

Studies of SEP events simultaneously detected by multiple spacecraft have mostly focussed on electron and proton data. Here we consider multi-spacecraft events observed by the LET instrument on STEREO A and B, and by SIS on board ACE, located near Earth, and analyse the properties of heavy ion SEPs. We study the intensity time profiles and spectra, and the time variations of heavy ion

ratios. We verify how these measurements depend on the relative location between the magnetic footprint of the spacecraft and the associated solar eruptive events. We discuss how the results provide information on possible mechanisms for particle cross field transport, including drift processes.

Registration number following "ICRC2015-I":

120

Poster 1 CR - Board: 228 / 902

Cascade showers initiated by muons in the Cherenkov water detector NEVOD

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Measurements of the energy spectra of cascade showers generated due to interactions of penetrating cosmic ray particles in massive water/ice detectors is one of the main methods of the study of the energy characteristics of the fluxes of muons and neutrinos. In the present paper, results of investigations of cascades initiated by inclined muons in the Cherenkov water detector NEVOD with a volume of 2000 m³, located at the ground surface and equipped with a spatial lattice of 91 quasi-spherical modules (QSMs), detecting Cherenkov light from any direction with nearly equal efficiency, are discussed. A brief description of the setup features is given. The approaches to the reconstruction of energy and spatial parameters of the showers registered in a dense lattice of QSMs, and questions of the absolute calibration of the QSM response are considered. Preliminary results of the measurements of the energy spectrum of the cascades in the energy range 30 GeV – 10 TeV based on the data accumulated in 2013 – 2015 experimental series (about 11,000 live observation time) and their comparison with expectation for some models of the muon energy spectrum are presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

46

Poster 1 CR - Board: 230 / 906

Energy Spectrum and Mass Composition of Ultra-High Energy Cosmic Rays Measured by the hybrid technique in Telescope Array

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The energy spectrum and mass composition of Ultra-High Energy Cosmic Rays (UHECRs) measured using a hybrid analysis will be presented. TA consists of three FD stations and 507 SDs. A hybrid analysis reconstructs the position and direction of the air shower more accurately than the monocular FD analysis and measures the longitudinal development and calorimetric energy of the shower precisely. Information of the mass composition of UHECR, X_{\max} , is obtained from the measured longitudinal development. The analysis performance, energy spectrum and mass composition of the UHECR obtained from the TA hybrid mode will be presented.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I/":

773

Poster 1 GA - Board: 112 / 33

Advanced models for AGN emission

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Active Galactic Nuclei have been in the focus of gamma-ray telescopes for the past years. With the ever growing sample of AGN the need for physically motivated, self-consistent modeling is also growing.

The major questions to be answered by models are: What are the main constituents of AGN jets? What are the acceleration mechanisms? Are AGN possible accelerators for UHECR and possible source of UHE neutrinos?

We will present new modeling approaches for AGN, which have a focus on the self-consistent approach. Two types of models have emerged from our work: A homogeneous model containing acceleration via Fermi mechanisms, leptonic and photo-hadronic radiation mechanisms and time variability. And a spatially extended model containing the same radiation processes, but a pitch-angle resolved acceleration process.

The results contain the radio signature of extended jets with predictions for the motion of radio cores correlated with TeV emissions and also possible discrimination criteria for hadronic and leptonic radiation models.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

Poster 1 DM and NU - Board: 273 / 420

Development of the time domain simulation of impulsive radio signals for ARAcAlTA

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The Askaryan effect is the coherent radio emission of an electron excess in a particle cascade. ARA (Askaryan Radio Array) is being built to observe the Askaryan radiation from ultra high energy neutrino ($E > 10\text{PeV}$) induced showers in ice around the South Pole. In order to study further the characteristics of the coherent emission, and also validate ARA detection system response, we set up a replica of the ARA experiment, the ARAcAlTA. We used the electron linear accelerator on Telescope Array site to shoot 40MeV electron bunch in an ice target, the electron excess in ice provokes the coherent radiation that is detected by the ARA sensors. Because of the impulsive nature of the expected signal, we developed a simulation chain entirely in the time domain (instead of frequency). We present the simulation combining a Geant4 particle tracking and a particle per particle radio emission calculation. These results are in turn linked to the detector calibration and simulation to obtain the final expected waveform. We demonstrate that in absence of other background, the coherent radiation can be observed and characterized with ARAcAlTA.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

422

Poster 1 GA - Board: 86 / 908

Status of Water Cerenkov Detector Array of LHAASO project

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A Large High Altitude Air Shower Observatory (LHAASO) is planned to be built in next year. As an important component of LHAASO project, Water Cherenkov Detector Array (WCDA) is a high sensitivity gamma ray and cosmic ray detector, which is mainly to survey the northern sky for VHE gamma ray sources. Currently, the R&D is quite finished, including a prototype water Cherenkov detector and an engineering array at 1% scale (3×3 cells). In this paper, the basic design, performance and R&D work of WCDA will be described.

Collaboration:

LHAASO

Registration number following "ICRC2015-I/":

769

Poster 1 GA - Board: 113 / 35

Selection of AGN to study the extragalactic background light with HAWC

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The extragalactic background light (EBL) is all the electromagnetic energy released by resolved and unresolved extragalactic sources since the recombination era. Its intensity and spectral shape provide information about the evolution of galaxies throughout cosmic history. Since direct observations of the EBL are very difficult to perform, the study of the interaction between the low energy EBL photons and high energy photons from distant sources becomes relevant to constrain the EBL intensity. The main goal of this study is to investigate the opacity of the EBL to gamma rays by observing a sample of active galaxies with the High Altitude Water Cherenkov (HAWC) Gamma-Ray Observatory. Current gamma-ray observations up to 20 TeV performed by Imaging Atmospheric Cherenkov Telescopes (IACTs) have constrained the EBL intensity in the 0.1 – 50 μm region. HAWC which monitors the gamma-ray sky in the 100 GeV to 100 TeV energy range, will be able to detect at least 12 active galaxies at redshifts below 0.3 and thus constrain the EBL in the poorly-measured 1 – 100 μm region.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

608

Poster 1 CR - Board: 201 / 1241

New software package of modelling of cosmic rays transport in the atmosphere

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In this paper the RUSCOSMICS software package based on the GEANT4 toolkit and its possibilities in the cosmic rays are considered. Energy spectra of secondary cosmic rays particles resulting from the proton transport modeling through the Earth atmosphere are presented. A calculations error is estimated and a comparison with experimental data is carried out. Also on the basis of the secondary cosmic rays flux intensity we investigate a contribution of different particles (protons, muons, electrons, positrons) in the ionization process in the atmosphere. The altitude profiles of ionization are presented and also a radiation absorbed dose calculation is carried out. The obtained data are compared with results of other authors.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

861

Poster 1 GA - Board: 62 / 335

Exploring the gamma ray sky above 30 TeV with LHAASO

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The gamma ray sky at energies above a few tens of TeV is almost completely unexplored. Sources of photons above ~ 30 TeV must however exist because cosmic rays are accelerated in the Milky Way at least up to the knee energy. Photon emission in this energy range, with a high degree of confidence, has an hadronic origin and traces the proton and nuclei acceleration sites. Gamma ray astronomy above 30 TeV is therefore of fundamental importance for the identification of cosmic ray sources.

LHAASO is a project of a multi-component air shower detector, to be built in Sichuan, China, at 4410 m of altitude. One element of the detector, the KM2 array, a grid of scintillators and muon detectors distributed over an area of ~ 1 Km² will be able to monitor in one year the northern sky at 100 TeV with a sensitivity of 1% of the Crab Nebula flux.

In this paper the capabilities of LHAASO in gamma ray astronomy above 30 TeV are reviewed, and the scientific potential in identifying or constraining galactic and extragalactic cosmic ray sources is discussed.

Collaboration:

LHAASO

Registration number following "ICRC2015-I/":

207

Poster 1 GA - Board: 87 / 330

Analysis of the first observations with the new MAGIC Sum-Trigger-II

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The MAGIC telescopes were built with the aim of achieving the lowest possible energy threshold among the current generation of Cherenkov telescopes. This was mandatory to detect sources with emission mainly below 100 GeV, as distant AGNs and pulsars. In 2009, the second MAGIC telescope started operation, and in the last years, a major upgrade of the system took place. One of the main improvements has been the development of a new version of the Sum-Trigger concept, valid for stereoscopic observations. This Sum-Trigger-II system was installed during Winter 2013/14, and since then, we have collected the first test data to characterize its scientific capabilities. In this contribution the results of the analysis of the first Crab pulsar data taken with the Sum-Trigger-II are shown, demonstrating the potential of this new system to study gamma-ray sources with high sensitivity above 40 GeV.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

333

Poster 1 CR - Board: 140 / 473

Education, Outreach and Public Relations of the Pierre Auger Observatory

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The scale and scope of the physics studied at the Pierre Auger Observatory continue to offer significant opportunities for original outreach work. Education, outreach and public relations of the Auger Collaboration are coordinated in a dedicated task whose goals are to encourage and support a wide range of efforts that link schools and the public with the Auger scientists and the science of cosmic rays, particle physics, and associated technologies. The presentation will focus on the impact of the Collaboration in Mendoza Province, Argentina and beyond. The Auger Visitor Center in Malargüe has hosted over 95,000 visitors since 2001, and a fifth collaboration-sponsored science fair was held on the Observatory campus in November 2014. The Rural Schools Program, which is

run by Observatory staff and which brings cosmic-ray science and infrastructure improvements to remote schools, continues to broaden its reach. Numerous online resources, video documentaries, and animations of extensive air showers have been created for wide public release. Increasingly, collaborators draw on these resources to develop Auger related displays and outreach events at their institutions and in public settings to disseminate the science and successes of the Observatory worldwide. The presentation will also highlight education and outreach activities associated with the planned upgrade of the Observatory's detector systems and future physics goals.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

426

Poster 1 GA - Board: 63 / 745

Multiwavelength Analyses of Long-Term Lower Flux State Observations of Intermediate-Frequency-Peaked BL Lacertae Sources: W Comae and 3C 66A

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Intermediate-frequency-peaked BL Lacertae objects (IBLs) are a class of blazars characterized by a spectral energy distribution (SED) with a lower-energy synchrotron peak than a majority of extragalactic sources detected by ground-based imaging atmospheric Cherenkov telescopes (IACTs). Because of this shift in the SED, the peak gamma-ray flux falls outside the very-high-energy regime (VHE, >100 GeV) covered by IACTs such as VERITAS, making IBLs difficult to detect except during infrequent times of elevated flux. However, the study of these sources in a lower flux state is essential for developing a complete understanding of the blazar paradigm. We present the results of multiwavelength analyses of long-term lower flux state observations completed for two IBL sources: W Comae and 3C 66A. For both sources, data from VERITAS were analyzed for the VHE regime. The study of W Comae extends from 2008 to 2014, resulting in a 6 standard deviation (σ) detection from ~40 observing hours. Analysis of 3C 66A from 2007 to 2015, totaling ~67 hours, resulted in a 17 σ lower flux state detection. We will report on the results from these VHE analyses as well as contemporaneous multiwavelength data and comment on how these lower state IBL detections fit within the context of the blazar paradigm.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

670

Poster 1 CR - Board: 148 / 859

Development of the TALE Surface Detector Array

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TALE, the Telescope Array Low Energy extension is designed to lower the energy threshold to about $10^{16.5}$ eV. The TALE surface detector will include an infill array of 76 scintillation counters (40 with 400 m spacing and 36 with 600 m spacing) and an addition to the TA SD of 27 counters. We have already deployed 35 counters with 400 m spacing in April 2013. For the additional 68 counters, we will use refurbished AGASA scintillation counters, each of which consists of AGASA scintillators, a new PMT and an improved the Telescope Array surface detector electronics. Here we report the status of the detectors and simulation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

739

Poster 1 GA - Board: 64 / 1187

Rapid variability at very high energies in Mrk 501

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Flaring states of the BL Lac object, Mrk 501 were observed by the High Energy Stereoscopic System (H.E.S.S.) during 2012 and 2014. Observations in 2014 recorded flux levels higher than one Crab unit and revealed rapid variability at very high energies (~ 2 -20 TeV). The high statistics afforded by the flares allowed us to probe the presence of minutes timescale variability and study its statistical characteristics at purely TeV energies owing to the high threshold energy of approximately 2 TeV. Doubling times of a few minutes are estimated for fluxes, $F(> 2 \text{ TeV})$. Statistical tests on the lightcurves show interesting temporal structure in the variations including deviations from a normal flux distribution similar to those found in the PKS 2155-304 flare of July 2006, at nearly an order of magnitude higher threshold energy. Rapid variations at such high energies put strong constraints on the physical mechanisms in the blazar jet.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

928

Poster 1 CR - Board: 150 / 150

LHAASO-KM2A PMT test

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To fulfill the requirements of testing the photomultiplier tubes (PMTs) of the electromagnetic detector at the Large High Altitude Air Shower Observatory, a multifunctional PMT test bench with a two-dimensional (2D) scanning system is developed. With this 2D scanning system, 16 PMTs are scanned simultaneously to test their uniformity and cathode transit time difference. The di-distance method is developed to measure the linear dynamic range of the PMTs using the test bench. The primary test results are presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

757

Poster 1 DM and NU - Board: 274 / 743

Multi-PMT optical modules for IceCube-Gen2

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Following the first observation of astrophysical high-energy neutrinos by IceCube, planning for a next-generation neutrino detector at the South Pole is under way, which will expand IceCube's sensitivity both towards high and low neutrino energies. In parallel to upgrading the proven IceCube design, new optical sensor concepts are explored which have the potential to further significantly enhance the performance of IceCube-GenTwo. One concept pursued is the multi-PMT optical module which, in contrast to the "conventional" layout with a single 10" photomultiplier (PMT), features 24 3" PMTs inside a pressure vessel. This design results in several advantages such as increased effective area, improved angular acceptance and directional sensitivity. The layout is based on the proven design of the KM3NeT optical module which is now being adapted and enhanced for the use in the deep ice. We present the current state of the hardware developments as well as first simulations investigating the impact of multi-PMT modules on detector performance.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

665

Poster 1 CR - Board: 221 / 746

The AMIGA Muon Counters of the Pierre Auger Observatory: Performance and Studies of the Lateral Distribution Function

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The AMIGA enhancement (Auger Muons and Infill for the Ground Array) of the Pierre Auger Observatory consists of a 23.5 km² infill area where air shower particles are sampled by water-Cherenkov detectors at the surface and by 30 m² scintillation counters buried 2.3 m underground. The Engineering Array of AMIGA, completed since February 2015, includes 37 scintillator modules (290 m²) in a hexagonal layout. In this work, the muon counting performance of the scintillation detectors is analysed over the first 22 months of operation. A parametrisation of the detector counting resolution and the lateral trigger probability are presented. Finally, preliminary results on the observed muon lateral distribution function (LDF) are discussed.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

667

Poster 1 SH - Board: 32 / 552

The South Atlantic Anomaly drift on the proton flux data of satellite experiments

Author: Sergey Aleksandrin¹**Co-authors:** Ekaterina Ramakoti¹; Sergei Koldashov¹¹ *National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)***Corresponding Author:** syaleksandrin@mephi.ru

Dynamics of flux of high-energy charged particles trapped by geomagnetic field has been studied in this paper. As is known the Earth's magnetic field changes in direction and magnitude, as a result of this the South Atlantic Anomaly (SAA) region drifts. Using data of satellite experiments ARINA and VSPLESK geographical distributions of proton flux (80-100 MeV) were studied since 2006 to 2014. The ARINA and VSPLESK satellite experiments are designed with the aim to study the physics origin of high-energy charged particle variations and bursts. ARINA placed on Resurs-DK1 satellite, which launched in 2006 and is still operating. VSPLESK was installed on board of the International Space Station, which worked from 2008 to 2013. Detail analysis of SAA drift was fulfilled. The SAA region (L=1.15-2.2) was divided by separate zone with 0.05 step value. Maximum of proton flux was determined for each zone. Position of maximum drifts in west direction, which corresponds to the

dynamics of the geomagnetic field. Average speed of SAA longitude drift is almost independent of the L-shell and amount about 0.5 degrees a year.

Registration number following "ICRC2015-I":

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Poster 1 SH - Board: 39 / 996

Jovian electrons and magnetic traps with inner acceleration regions

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Simultaneously with 27-day variations of Jovian electrons of MeV energies, observed during the deep solar minimum in 2007-2008 in 14 consequent solar rotations, short duration (2-3 days) enhancements of the fluxes of 0.1-1 MeV electrons and protons were registered. These enhancements took place at each solar rotation simultaneously at SOHO (EPHIN and LION) and ACE (EPAM) and appeared earlier and later at STEREO B and STEREO A (SEPT), respectively, usually before the flux of high-energy Jovian electrons started to rise, so the lower energy peaks did not coincide with their maxima. The Sun was extremely quiet throughout the whole period considered (no 10.7 cm radio or soft X-ray emission) and could not be the origin of these low energy particles. We consider the hypothesis that a magnetic trap with trapped Jovian electrons, corotating with the Sun, had some specific regions - "ridges" - inside with enhanced level of turbulence capable to accelerate electrons and protons to energies up to 1 MeV. The formation of such a "ridge" is natural at the front part of the trap; differently located accelerating regions may appear under invasion of new field lines into the trap. These ridges are rather stable, much of them are observed during few solar rotations, disappear and appear again, initiating series of short-living risings of low energy electrons and protons, separated by 27-day intervals. According to this hypothesis, electrons registered during 2007-2008 solar activity minimum have two components: (a) periodic 27-day gradual Jovian-originated variations; (b) quasi-periodic short (3-4 days) increases of low-energy electrons and protons, accelerated directly inside magnetic trap. Numerical simulations to model the propagation of energetic protons and electrons in the presence of such magnetic configuration is presented.

Registration number following "ICRC2015-I":

497

Poster 1 CR - Board: 188 / 234

The effect of geomagnetic field on radio signal patterns from cosmic ray air showers

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Abstract: Different type of mechanisms are involved in generation and propagation of radio signals from cosmic ray air showers. The geomagnetic origin is one of such mechanisms which is very important especially in low frequency band studies. Based on CORSIKA and CoREAS we investigate the influence of earth magnetic field parameter on filtered peak radio amplitude patterns in 32–64 MHz frequency band using a specifically designed computer code. Simulated showers are from Proton and Iron primary particles with 10^{17} eV initial energy. It is found that radio signal patterns are heavily dependent on the Earth magnetic field values so that they change fundamentally as we go from southern to northern hemisphere. We have chosen Pierre Auger Observatory in South and Tehran in North hemisphere for comparison purposes. Analyzing these patterns can clearly show the importance and influence of the Earth magnetic field parameter on the radio signal patterns from cosmic ray air showers.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

91

Poster 1 CR - Board: 207 / 235

ENERGY THRESHOLD DETERMINATION FOR AMIGA MUON COUNTERS VIA GEANT4 SIMULATION

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One of the first improvements of the Pierre Auger Observatory is the Auger Muons and Infill for the Ground Array (AMIGA) detector, in order to measure the cosmic ray spectrum and the chemical composition in the energy range from 10^{17} eV. The muon detectors of the AMIGA *infill* count muons from extensive air showers observed by Auger Observatory, which are then reconstructed by the surface and fluorescence detectors. Muons with energy greater than or equivalent to 1 GeV propagating in the soil are able to reach the muon detector. Although the air shower muonic component is attenuated much less than the electromagnetic component, the shielding of approximately 2.25 m of soil adds 540 g/cm^2 of vertical mass (approximately 60% more than the atmosphere above the Pierre Auger Observatory). Thus, in order to better understand attenuation mechanisms (shielding effects) of muons, a Monte Carlo simulation with Geant4 was made to determine the muon energy threshold, i.e., the minimum kinetic energy the muon should have to go through the 2.25 m of soil and produce a signal in the AMIGA counters. The energy threshold is determined by taking into account the primary particle as well as the secondary particles produced in the soil above the detector. The information on the energy threshold is important to understand the process of data analysis. This threshold can be used to test the Geant4 simulation program, since the muon energy threshold is well calculated via the Bethe-Bloch formula. From the energy thresholds and the energy distribution at ground level for different particles from extensive air showers, the contribution of those particles to the data recorded by the detectors can be calculated. This contribution is crucial to correctly determine the number of muons in an extensive air shower, which is one of the main aims of the AMIGA enhancement.

Keywords: AMIGA detectors, Geant4 simulation, muons, energy threshold, Bethe-Bloch formula.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

248

Poster 1 GA - Board: 88 / 1052**Development of a SiPM Camera for a Schwarzschild-Couder Cherenkov Telescope for the Cherenkov Telescope Array****Author:** Nepomuk Otte¹**Co-authors:** Akira Okumura²; Amanda Weinstein³; Caitlin Johnson⁴; David Williams⁴; Hidaka Naoya²; Hiroyasu TAJIMA⁵; Hugh Dickinson³; Jonathan Biteau⁶; Justin Vandenbroucke⁷; Kevin Meagher⁸; Leonid Sapozhnikov⁵; Luigi Tibaldo⁵; Marcos Santander⁹; Peter Karn¹⁰; Stefan Funk¹¹; Thanh Nguyen; Tobias Jogler⁵¹ *Georgia Institute of Technology*² *Nagoya University*³ *Iowa State University*⁴ *UCSC*⁵ *SLAC*⁶ *UC Santa Cruz*⁷ *University of Wisconsin*⁸ *Georgia Tech*⁹ *Barnard College, Columbia University*¹⁰ *University of Wisconsin - Madison*¹¹ *University Erlangen***Corresponding Author:** otte@gatech.edu

We present a development of a novel 11328 pixel silicon photomultiplier (SiPM) camera for use with a ground-based Cherenkov telescope with Schwarzschild-Couder optics as a possible mid-size telescope for the Cherenkov Telescope Array (CTA), which is the next generation very-high-energy gamma-ray observatory. The finely pixelated camera samples air-shower images with more than twice the optical resolution of cameras that are used in current Cherenkov telescopes. Advantages of the higher resolution will be a better event reconstruction yielding improved background suppression and angular resolution of the reconstructed gamma-ray events, which is crucial in morphology studies of, for example, Galactic particle accelerators and the search for gamma-ray halos around extragalactic sources. Packing such a large number of pixels into an area of only half a square meter and having a fast readout directly attached to the back of the sensors is a challenging task. For the prototype camera development SiPMs from Hamamatsu with through silicon via (TSV) technology are used. We give a status report of the camera design and highlight a number of technological advancements that made this development possible.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

731

Poster 1 CR - Board: 236 / 1054

Initial results of a direct comparison between the Surface Detectors of the Pierre Auger Observatory and of the Telescope Array

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The Pierre Auger Observatory (Auger) in Mendoza, Argentina and the Telescope Array (TA) in Utah, USA aim at unraveling the origin and nature of Ultra-High Energy Cosmic Rays (UHECR). At present, there appear to be subtle differences between Auger and TA results and interpretations. Joint working groups have been established and have already reported preliminary findings. From an experimental standpoint, the Surface Detectors (SD) of both experiments makes use of different detection processes not equally sensitive to the components of the extensive air showers making it to the ground. In particular, the muonic component of the shower measured at ground level can be traced back to the primary composition, which is critical for understanding the origin of UHECRs. In order to make direct comparisons between the SD detection techniques used by Auger and TA, a two-phase approach is followed. First, one water Cherenkov detector ("Auger North" design) was deployed and operated locally at the TA Central Laser Facility. After a couple of months of operation before the summer, we expect to observe about 20 Auger SD events in coincidence with nearby TA stations. And a regular Auger station and a TA station will be added to the setup to allow for station-level comparisons. In a second phase, event-level comparisons of relatively low-energy showers with energies in the 10^{18} eV range will be possible as a result of co-locating six additional Auger North stations contiguous to TA surface detector stations. In this contribution, we present the status and prospects of this joint research project, including the first Auger SD data that were recorded in coincidence with the TA SD shower triggers.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

855

Poster 1 CR - Board: 176 / 1190

Data Accessibility, Reproducibility and Trustworthiness with LAGO Data Repositories

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Nowadays, one of the most challenging scenarios scientists and scientific communities are facing is the huge amount of data emerging from vast networks of sensors and from computational simulations performed in a diversity of computing architectures and e-infrastructures. In this work we present the strategy of the Latin American Giant Observatory (LAGO) to catalog and preserve a vast amount of data produced by the water-Cherenkov Detector network and the complete LAGO simulation chain that characterize each site. Metadata, Permanent Identifiers and the facilities from the LAGO Data Repository are described. These initiatives allow researchers to find data and directly use them in a code running by means of a Science Gateway that provides access to different clusters, Grid and Cloud infrastructures worldwide.

Collaboration:

LAGO

Registration number following "ICRC2015-I/":

26

Poster 1 DM and NU - Board: 275 / 1310

The Mechanical structure and deployment procedure of the KM3NeT detection unit.

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In this paper we provide a detailed description of the mechanical structure of the 750 m high KM3NeT detection unit. The choices made for the different materials and their behaviour under the loads expected during deployment and during the lifetime of the experiment will be discussed, as will the motion of the unit under influence of the sea currents. The unique method of deployment, which entails unfurling of the unit from the seabed using a purpose built launcher, will be described.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I/":

985

Poster 1 CR - Board: 189 / 495

A branching model for hadronic air showers

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We introduce a simple branching model for the development of hadronic showers in the Earth's atmosphere.

Based on this model, we show how the size of the pionic component followed by muons can be estimated.

Several aspects of the subsequent muonic component are also discussed.

We focus on the energy evolution of the muon production depth.

We also estimate the impact of the primary particle mass on the size of the hadronic component.

Even though a precise calculation of the development of air showers must be left to complex Monte Carlo simulations, the proposed model can reveal qualitative insight into the air shower physics.

Collaboration:

– not specified –

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447

Poster 1 SH - Board: 42 / 1194

Near-Earth Cosmic Ray Decreases Associated with Remote Coronal Mass Ejections

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Galactic cosmic ray (GCR) flux is modulated by both particle drift patterns and solar wind structures on a range of time scales. Over solar cycles, GCR flux varies as a function of the total open solar magnetic flux and the latitudinal extent of the heliospheric current sheet. Over time-scales of hours, drops of a few percent in near-Earth GCR flux (Forbush decreases, FDs) are well known to be associated with the near-Earth passage of solar wind structures resulting from corotating interaction regions (CIRs) and transient coronal mass ejections (CMEs). We present four FDs seen at ground-based neutron monitors which cannot be immediately associated with significant structures in the local solar wind. Similarly, there are significant near-Earth structures which do not produce any corresponding GCR variation. Three of the FDs are shown to be during the STEREO era, enabling in-situ

and remote observations from three well-separated heliospheric locations. Extremely large CMEs passed the STEREO- A spacecraft, which was behind the West limb of the Sun, approximately 2-3 days before each near-Earth FD. Solar wind simulations suggest that the CMEs combined with pre-existing CIRs, enhancing the pre-existing barriers to GCR propagation. These events are compared to the well-documented extreme event of July 2012 as a good comparison. Our observations provide strong evidence for the modulation of GCR flux by remote solar wind structures and a potential to detect these remote structures using neutron monitor data.

Registration number following "ICRC2015-I":

0932

Poster 1 CR - Board: 231 / 918

Seasonal variations in the intensity of muon bundles detected at the ground level

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Experimental data accumulated in a 3-year long series of measurements (from May 2012 to April 2015) of cosmic ray muon bundles with the coordinate-tracking detector DECOR are analyzed. It has been found that the measured rate of the events exhibits clear seasonal variations, repeated every year of observations. The amplitude of the first annual harmonic of the event rate has been estimated as (5.7 +/- 0.1) % with the maximal intensity in January, and the minimal one in July. Thus, the difference between the average intensity of muon bundles recorded in winter and in summer exceeds 10 %. Taking into account that the mean energy of muons registered in the bundles is of the order of several tens GeV, the observed difference cannot be described in frame of a well-known mechanism of the formation of the temperature effect due to decays of low energy particles in the atmosphere, which is typical for single muons detected at the ground level. An alternative explanation related with changes of the shape of the lateral distribution function of EAS muons in the atmosphere with a variable temperature profile is discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 1 SH - Board: 35 / 613

Robust regression analysis of energy spectrum evolution in time for relativistic electron bursts in the Earth's magnetosphere

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Various local geophysical phenomena, like thunderstorms and earthquakes can be the cause for particle precipitation from Earth radiation belt. Longitudinal particle drift period is known to be dependent from its energy, due to this fact: using particles energy spectrum data change in time, it is possible to determine distances between locations of precipitation and registration on board of satellite. Using results of numerical model calculations of longitudinal particle drift, the energy spectrum dynamics of particle burst electrons detected in satellite experiments ARINA (on board the Russian satellite Resurs-DK1) and VSPLESK (on board the International Space Station) have been analyzed. The robust regression method is proposed to be used for detection of burst electrons in data with high levels of background albedo electron fluxes. The research has shown that this method provides the way to increase signal to noise ratio in experimental data and achieve more precise burst precipitation area detection in compare to linear regression analysis.

Registration number following "ICRC2015-I":

535

Poster 1 CR - Board: 167 / 510

CALET measurements with cosmic nuclei: expected performances of tracking and charge identification

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CALET is a space mission currently in the final phase of preparation for a launch to the International Space Station (ISS), where it will be installed on the Exposed Facility of the Japanese Experiment Module (JEM-EF). In addition to high precision measurements of the electron spectrum, CALET will also perform long exposure observations of cosmic nuclei from proton to iron and will detect trans-iron elements with a dynamic range up to $Z=40$. The energy measurement relies on two calorimeter systems: a fine grained imaging calorimeter (IMC) followed by a total absorption calorimeter (TASC) for a total thickness of $30 X_0$ and 1.3 proton interaction length.

A dedicated module (a charge detector, CHD), placed at the top of the apparatus, identifies the atomic number Z of the incoming cosmic ray, while the IMC provides tracking capabilities and a redundant charge identification by multiple dE/dx measurements. In this paper, the expected performances of the tracking and charge identification systems of CALET will be discussed. The CALET mission is funded by the Japanese Space Agency (JAXA), the Italian Space Agency (ASI), and NASA.

Collaboration:

CALET

Registration number following "ICRC2015-I":

462

Poster 1 SH - Board: 45 / 1284

Annual and Semi Annual Variations of the Galactic Cosmic Ray Intensity and Seasonal Distribution of the Cloudless Days and Cloudless Nights in Abastumani (41.75oN, 42.82oE; Georgia): (1) experimental study and (2) theoretical modeling

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We study seasonal distributions of the visually observed cloudless days (CD) and cloudless nights (CN) at Abastumani Astrophysical Observatory (41.75N, 42.82E; Georgia) and the galactic cosmic ray (GCR) intensity in 1957-1993. The annual variations of monthly numbers of CD and CN have been observed, with maximum in August for CD and in September for CN. During geomagnetic disturbances it is also observed the growth of number of CD in September and March (equinoctial months), and for CN, together with September, in June, April and February. We assume that this phenomenon indicates an influence of cosmic factors on cloudiness, as well as the existence of semi-annual and possibly shorter-periodicity variations. Taking GCR flux as a possible proxy to find some relationships with the annual variations of monthly numbers of CD and CN is our working hypothesis. The influence of GCR flux on ionization of lower atmosphere and variations of density of cloud condensation nuclei, also can be connected to the annual and seasonal changes of temperature at Earth surface of this region. We compose a two dimensional (2-D) time dependent transport equation including all important processes in the heliosphere. An analysis of experimentally observed and theoretically obtained results have been carried out.

Registration number following "ICRC2015-I":

801

Poster 1 GA - Board: 123 / 26

TeV gamma-rays from the globular cluster NGC 6624 containing energetic millisecond pulsar J1823-3021A

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Recently very energetic millisecond pulsar, J1823-3021A, has been discovered to emit pulsed GeV gamma-rays in the globular cluster NGC 6624. Assuming that this pulsar injects relativistic leptons into its surrounding (as expected from modelling of radiative processes within the inner pulsar magnetosphere), we calculate the minimum level of expected TeV gamma-ray emission produced by these leptons in the Inverse Compton scattering process of stellar radiation from the globular cluster NGC 6624. The results of calculations are confronted with sensitivities of the present and future Cherenkov telescopes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

14

Poster 1 DM and NU - Board: 259 / 946

A fussy revisitation of antiprotons as a tool for Dark Matter searches

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Antiprotons are regarded as a powerful probe for Dark Matter (DM) indirect detection and indeed current data from PAMELA have been shown to lead to stringent constraints. However, in order to exploit their constraining/discovery power properly and especially in anticipation of the exquisite accuracy of upcoming data from AMS, great attention must be put into effects (linked to their propagation in the Galaxy) which may be perceived as subleading but actually prove to be quite relevant. We revisit the computation of the astrophysical background and of the DM antiproton fluxes fully including the effects of: diffusive reacceleration, energy losses including tertiary component and solar modulation (in a force field approximation). We show that their inclusion can somewhat modify the current bounds, even at large DM masses, and that a wrong interpretation of the data may arise if they are not taken into account. The numerical results for the astrophysical background are provided in terms of fit functions; the results for Dark Matter are incorporated in the new release of the PPC4DMID.

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802

Poster 1 SH - Board: 46 / 1288

Solar particle events contribution in the space radiation exposure on electronic equipment at the polar orbit

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In the paper we are presenting processing results of flight data from METEOR-M spacecraft, which are been supplying in the Roscosmos space radiation exposure on electronic components Monitoring

System by Fedorov Institute of Applied Geophysics. METEOR-M spacecraft operates in polar orbit 832 km altitude with inclination of ~ 99 degrees. The spacecraft contains spectrometers to measure particle fluxes with several energy ranges. In the previous paper we analyzed solar particle events contribution in the space radiation exposure at the middle-Earth orbit placed in outer radiation belt. In the present paper we are analyzing solar particle's influence on electronics at the polar orbit which is more geomagnetically shielded than middle-Earth orbits. We analyzed several big solar particle events in 2010-2014 and calculated its contribution in particle's fluxes at the polar orbit. We showed that solar protons can give considerable or even main contribution in particle's fluxes at the polar orbit comparing with radiation belts and, as consequence, the considerable contribution in electronic equipment failure due to single event effects as well as dose effects. This results are similar to one in the our previous paper for less geomagnetically shielded orbit. But by contrast with polar orbits there are no radiation belt protons at middle-Earth orbits (and geostationary orbit), so solar protons gives decisive contribution in single events effects in electronics at middle-Earth orbits (and geostationary orbit) and just fractional contribution at polar orbits.

Registration number following "ICRC2015-I/":

976

Poster 1 CR - Board: 175 / 1191

Calibration and sensitivity of large water-Cherenkov Detectors at the Sierra Negra site of LAGO

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The Latin American Giant Observatory (LAGO) is an international network of water-Cherenkov detectors (WCD) set in different sites across Latin America. In México, on the top of the Sierra Negra volcano at 4530 m a.s.l., LAGO has completed its first instrumented detector of an array, consisting of a cylindrical WCD with 7.3 m in diameter and 1 m of height, with a total detection area of 40 m² and sectioned in four equal slices. Each one of these slices is instrumented with an 8" photo-multiplier tube installed at the top of the detector and looking downwards. The final setup will have three WCD as the one mentioned, distributed in triangular shape and one WCD with 7.3 m in diameter and 5 m of height located in the centre. The data acquisition of this first WCD started in June 2014. In this work the full calibration procedure of this detector will be discussed, as well as the report on the preliminary measurements of stability in rate. Effective area and sensitivity to gamma-ray bursts are derived from the LAGO simulation chain, based on Magnetocosmics, CORSIKA and GEANT4. From these results, we discuss the capability of this detector to separate the EM-muon component of extensive air showers.

Collaboration:

LAGO

Registration number following "ICRC2015-I/":

1127

Poster 1 DM and NU - Board: 277 / 687

PINGU camera

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IceCube is the world's largest neutrino telescope located at the geographic South Pole, that utilizes more than 5000 optical sensors to observe Cherenkov light from neutrino interactions. A hot water drill was used to melt holes in the ultra-pure Antarctic ice, in which strings of optical sensors were deployed at a depth of 1500m to 2500m. The recent observation of high energy neutrinos consistent with astrophysical origin, as well as measurements of neutrino oscillation parameters and world-leading searches for dark matter, have demonstrated the great potential of this detector type. Extensions to the IceCube detector are now being considered. Ice properties, including the refrozen hole ice, have emerged as major source of uncertainty for event reconstruction. A camera system integrated with optical sensor modules could be tremendously beneficial in order to better understand ice properties and interpret calibration measurements. In this presentation we will describe the merits of the camera system and present a preliminary design. The preliminary design foresees a system of high resolution cameras located inside the DOM, to study the refrozen and surrounding ice. The impact of the camera system on geometry calibration, sensor location and orientation will be discussed.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

169

Poster 1 CR - Board: 218 / 683

Investigation of the energy deposit of inclined muon bundles in the Cherenkov water detector NEVOD

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An excess of multi-muon events in comparison with simulations performed in frame of widely used hadron interaction models was found in several cosmic ray experiments at very- and ultra-high energies of primary particles. In order to solve this so-called 'muon puzzle', investigations of the energy characteristics of EAS muon component are required. A possible approach to such investigations is the measurement of the energy deposit of EAS muons in the detector material: the appearance of an excessive fraction of very high-energy muons should be reflected in the dependence of the energy deposit on the energy of primary particles. The experiment on the study of the energy deposit of muon bundles is being conducted at the NEVOD-DECOR experimental complex. As a measure of the energy deposit, the sum of the responses of quasi-spherical modules of the Cherenkov calorimeter

NEVOD is used. The local muon density in the event and the muon bundle arrival direction are estimated from the data of coordinate-tracking detector DECOR. Registration of inclined muon bundles of different multiplicities at various zenith angles allows to evaluate primary particle energies and to explore the energy interval from $\sim 10^{16}$ to 10^{18} eV. Experimental data accumulated from May 2012 to April 2015 (about 17,000 hours live observation time) have been analyzed and compared with CORSIKA based simulations. It is found that the average specific energy deposit (i.e., the calorimeter response normalized to the local muon density in the events) appreciably increases with zenith angle, thus reflecting the increase of the muon energy in the bundles near horizon. An evidence for an increase of the energy deposit at primary energies above 10^{17} eV is seen in the measured dependence of the specific energy deposit on the muon density. Possible methodical and physical reasons of such anomalous behavior are analyzed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

53

Poster 1 GA - Board: 114 / 1306

Gamma-ray properties of low luminosity AGNs

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We present results of the analysis of the Fermi-LAT data from low-luminosity Seyfert galaxies, whose X-ray spectra are consistent with predictions of the hot flow (ADAF) model. We use our precise hot flow model (fully GR and with a Monte Carlo computation of radiative processes) to fit the X-ray data and then we estimate the gamma-ray flux from hadronic processes in the two-temperature plasma forming the flow. We find that the strongest gamma-ray signal may be expected from NGC 4258 and NGC 4151 and at the positions of both objects we find marginally significant signals, with $\sigma \sim 3$. For all studied objects we derive upper limits (UL) for the gamma-ray flux. By comparing them with predictions of the ADAF model we find that the Fermi-LAT ULs strongly constrain non-thermal acceleration processes in hot flows (with the energy content in the non-thermal component of proton distribution amounting to at most $\sim 10\%$) as well as the values of some crucial parameters, most significantly the magnetic field strength. We also find that the component above 4 GeV in the gamma-ray spectrum of Cen A may be due to hadronic emission from a hot accretion flow with parameters consistent with the above constraints. Under the assumption that this emission is produced by protons accelerated up to $\sim 10^{16}$ eV, as predicted by some acceleration models, we calculate the expected neutrino flux.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

954

Poster 1 CR - Board: 226 / 873

Results from the Telescope Array from data collected in hybrid-trigger mode

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The Telescope Array is a hybrid detector which consists of a surface detector (SD) and three air fluorescence detector sites surrounding the SD array. Hybrid data collection began in May 2008, with independent triggering of the two detector systems. Since October 2010, the SD array has been triggered with an external trigger from the fluorescence detectors (called a “hybrid-trigger”) designed to collect SD information for events at primary energies where the standard SD trigger is inefficient. In this paper, we introduce our hybrid-trigger performance and report on analysis results using this trigger. 4 years of data will go into this analysis.

Collaboration:

Telescope Array

Registration number following “ICRC2015-I”:

753

Poster 1 SH - Board: 28 / 132

On Non-Universality of Solar-Terrestrial Connections

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The discussion on the principal possibility of a causal chain from solar activity –Space Weather to the earth climate and up to agriculture response continues over 200 years (Herschel,1801). We show that the root of the critics of this possibility lies in the conception (accepted default) of the universality of the solar-terrestrial connection (STC). This default paradigm of universality of STC leads to natural expectation that the effect, if it exists in really, must be observed in any historical period and in any geographical region. We show that this approach is not correct because of the solar-terrestrial connections are generated by different elements of solar activity with different agents of solar magnetic dynamo that have different and non-stable phase patterns, changed in phase and amplitude. We illustrate it by demonstration instability of STC manifestation in parameters of the Earth magnetic activity, cosmic rays and global atmospheric circulation. We show that the realization of the long causal chain “solar activity/space weather” - “earth weather” - “crops” - “market reaction” may have a place only in specific historical periods and in specific zones where and when the three necessary conditions hold. We show that the critical arguments used for rejecting a principal possibility of the causal connection “solar activity” –“Earth agriculture response” are based on neglecting of non-universality of STC and using for analysis selected periods and location when and where at least one from three necessary conditions does not performed.

Registration number following “ICRC2015-I”:

0144

Poster 1 CR - Board: 155 / 499

A Novel CubeSat-Sized Antiproton Detector for Space Applications

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Measuring cosmic antimatter fluxes probes many astrophysical processes. The abundancies and energy spectra of antiparticles support the understanding of the creation and propagation mechanisms of cosmic rays in the Universe. Deviations from theoretical predictions may hint to exotic sources of antimatter or inaccuracies in our understanding of the involved processes. Specifically, geomagnetically trapped antiprotons in Earth's inner radiation belt are directly linked to the production of secondary cosmic ray particles and their motion in Earth's magnetic field.

The planned Antiproton Flux in Space (AFIS) experiment is designed to measure this antiproton flux using a novel CubeSat-sized particle detector. This active-target detector consists of 900 scintillating fibers read out by silicon photomultipliers and is sensitive to antiprotons in the energy range below 100 MeV. With its almost 4π angular acceptance, it covers a geometrical acceptance of $270 \text{ cm}^2 \cdot \text{sr}$. The particle identification scheme for antiprotons relies on a combination of Bragg curve spectroscopy and the characteristics of the annihilation process.

In order to verify the detection principle, a prototype detector with a reduced number of channels was tested at a stationary proton beam. Its energy resolution was found to be less than 1 MeV for stopping protons of about 50 MeV energy.

We will give an overview of the AFIS mission and explain the working principle of the detector. We will also discuss the results from the beam test and the construction of the first full-scale detector.

This research was supported by the DFG cluster of excellence "Origin and Structure of the Universe" (www.universe-cluster.de).

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

580

Poster 1 DM and NU - Board: 278 / 497

Fiber laser design and measurements for fiber optical hydrophones in their application for ultra-high energy neutrino detection

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The detection of ultra-high energy neutrinos with energies above 10^{18} eV requires a neutrino telescope that is at least an order of magnitude larger than what has been achieved today [1]. A potential technology for a large scale neutrino telescope, which is sensitive enough to detect the low thermo-acoustic signals induced by the cosmic rays in water, is offered by fiber optical hydrophones [2].

Optical fibers form a natural way to create a distributed sensing system in which several transducers are attached to a single fiber. The detection system in this case will consist of several transducers,

erbium doped fiber lasers and an interferometric interrogator. Next to the advantage of having multiple sensors on a single fiber, this technology has a low power consumption and no electromagnetic interference with other read-out electronics. Maybe even more important, fiber optics technology provides a cost-effective and straightforward way to implement a large number of hydrophones.

In this paper we will show the results of investigations on one of the key components of the technology, i.e. the optical fiber laser. For the targeted application in a fiber optical hydrophone, the fiber laser technology requires a development beyond the present state of the art. In this light, design studies on in the various laser types and laser geometries have been carried out and trade-offs are made, supported with lab measurements. Moreover the multiplexing and cross-talk between several lasers on a single fiber have been investigated. Finally, the integration of the fiber laser in to the acoustical transducer will be shown.

[1] E.Waxman. Neutrino astrophysics: A new tool for exploring the universe. *Science*, 315(5808):63-65, 2007.

[2] E. J. Buis et al. Fibre laser hydrophones for cosmic ray particle detection. *Journal of Instrumentation*, 9(03):C03051, 2014.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1168

Poster 1 DM and NU - Board: 279 / 937

Calibration, performances and tests of the first detection unit of the KM3NeT neutrino telescope

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KM3NeT is the next generation neutrino telescope being installed in the Mediterranean Sea. The first detection unit of the telescope is ready for installation in the deep Mediterranean Sea in the summer of 2015. Eighteen digital optical modules have been mounted on a vertical string for the detection of the Cherenkov light emitted by muons induced by up-going neutrinos. This paper reports on the integration and calibration of the optical modules and of the full detection unit, as well as the future installation in the deep sea and the on-shore operation. The additional information carried out by the new type of photo-detection units when comparing to the old generation of optical modules is also discussed.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

477

Poster 1 CR - Board: 210 / 378

MEASUREMENT OF THE ISOTOPIC COMPOSITION OF HYDROGEN AND HELIUM NUCLEI IN COSMIC RAYS WITH THE PAMELA-EXPERIMENT

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The cosmic-ray hydrogen and helium (1H,2H,3He,4He) isotopic composition between 100 MeV/n and 1.4 GeV/n has been measured with the satellite-borne experiment PAMELA. The rare isotopes 2H and 3He in cosmic rays are believed to originate mainly from the interaction of high energy protons and helium with the galactic interstellar medium. The energy spectrum of these components carries fundamental information regarding the propagation of cosmic rays in the galaxy which are competitive with those obtained from other secondary to primary measurements such as B/C. The isotopic composition was measured between 100 and 1100 MeV/n for hydrogen and between 100 and 1400 MeV/n for helium isotopes using two different detector systems over the 23rd solar minimum from July 2006 to December 2007.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

365

Poster 1 DM and NU - Board: 280 / 828

Site Characterization and Detector Development for the Greenland Neutrino Observatory

Author: Stephanie Wissel¹

Co-authors: Abigail Vieregg¹; Andrew Romero-Wolf²; Christian Miki³; David Saltzberg⁴; Gary Varner³; Keith Bechtol; Peter Gorham³; Ryan Nichol⁵

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The PeV neutrinos discovered by IceCube are of astrophysical origin, and their progenitors could be any of several source classes, including active galactic nuclei, gamma-ray bursts, or pulsars. Such high-energy accelerators would produce neutrinos up to hundreds of PeV, which motivates the development of neutrino telescopes with the sensitivity, energy resolution, and pointing resolution required to distinguish among models of the IceCube neutrinos as well as cosmogenic neutrinos. Radio detection of Askaryan radiation from neutrino showers in ice is well-suited to the detection of the highest energy neutrinos, with degree-scale pointing resolution and the ability to build sparse arrays, but the energy threshold of current experiments is currently set by the temperature of the ice. The uncorrelated thermal noise can be averaged away by combining the signals from several antennas in a phased array. We report here on a June 2015 trip to Summit Station in Greenland for testing a phased array of dipoles, including the sensitivity of the array and background measurements of the site. We also discuss prospects for the Greenland Neutrino Observatory.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

715

Poster 1 GA - Board: 95 / 824**Construction of a medium size prototype Schwarzschild-Couder telescope as candidate instrument for the Cherenkov Telescope Array: Overview of mechanical and optical sub-systems.****Author:** Vladimir Vassiliev¹

Co-authors: Akira Okumura²; Andrew Peck³; Andriy Petrashyk⁴; Brandon Stevenson¹; Brian Humensky⁴; Daniel Nieto Castano⁴; David Kieda⁵; David Williams⁶; Deivid Ribeiro⁴; Dirk Naumann⁷; Emmet Roache⁸; Frank Krennrich⁹; Huyue Zhao¹⁰; Isaac Mognet¹; James Buckley¹¹; Julien Rousselle¹; Karen Byrum¹⁰; Kevin Meagher¹²; Manel Errando¹³; Marcos Santander⁴; Nepomuk Otte¹²; Peter Jenke¹⁴; Peter Yu¹; Philip Kaaret¹⁵; Reshmi Mukherjee¹³; Richard Northrop¹⁶; Robert Cameron¹⁷; Ronny Sternberger⁷; Scott Griffiths¹⁵; Scott Wakely¹⁶; Stefan Schlenstedt⁷; Stephen Criswell⁸; Valerie Connaughton¹⁴; Victor Guarino¹⁰; Wytan Benbow⁸

¹ *University of California Los Angeles*² *Nagoya University*³ *University of California*⁴ *Columbia University*⁵ *University of Utah*⁶ *University of California Santa Cruz*⁷ *Deutsches Elektronen-Synchrotron*⁸ *Smithsonian Astrophysical Observatory*⁹ *Iowa State University*¹⁰ *Argonne National Lab*¹¹ *Washington University*¹² *Georgia Institute of Technology*¹³ *Barnard College*¹⁴ *University of Alabama in Huntsville*¹⁵ *University of Iowa*¹⁶ *University of Chicago*¹⁷ *Stanford University***Corresponding Author:** vvv@astro.ucla.edu

The design of a 9.5-m prototype Schwarzschild-Couder telescope (pSCT) with an aplanatic two-mirror optical system has been developed to evaluate its capabilities for the future Cherenkov Telescope Array Observatory (CTAO). The construction of this novel imaging atmospheric Cherenkov telescope (IACT) is scheduled for early autumn of 2015 at the Fred Lawrence Whipple Observatory in Southern Arizona, USA. The pSCT is expected to verify superior performance of this instrument (high angular resolution, wide field of view, reduced focal plane plate scale, high channel density low cost camera electronics, single photon counting operation regime, etc.) as compared to the traditional Davies-Cotton IACTs constructed for the VERITAS and HESS ground based gamma-ray observatories. An array of SC telescopes operating as a possible extension of the CTA installation is expected to significantly enhance the research capabilities of the observatory for very high-energy ($E > 100$ GeV) gamma-ray astronomy. In this contribution we present the design overview of the pSCT mechanical and optical sub-systems and the status of the telescope construction.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

706

Poster 1 SH - Board: 16 / 821**Inferred Ionic Charge States for Solar Energetic Particle Events from 2012-2015 with ACE and STEREO****Author:** Allan Labrador¹**Co-authors:** Alan Cummings¹; Christina Cohen¹; Edward Stone¹; Glenn Mason²; Luke Sollitt³; Mark Wiedenbeck⁴; Richard Leske¹; Richard Mewaldt¹; Tycho von Rosenvinge⁵¹ *California Institute of Technology*² *JHU/APL*³ *The Citadel*⁴ *Jet Propulsion Laboratory*⁵ *NASA/Goddard Space Flight Center***Corresponding Author:** labrador@srl.caltech.edu

Mean ionic charge states for SEP events can reflect source temperatures, stripping during acceleration and transport, and the composition of source material. Multi-spacecraft measurements of mean ionic charge states for single SEP events can also demonstrate longitudinal dependence. At previous conferences, we have reported estimates of inferred high-energy ionic charge states for SEP events. The method fits the energy dependence of decay times for each element in SEP events, combined with charge-to-mass ratios relative to a calibration element, and derives mean charge state estimates for other elements from O to Fe. At the ICRC 2013 conference, we attempted to apply the method using ACE and STEREO data to SEP events through the beginning of 2012, in order to elucidate evidence on seed populations or longitudinal variations with charge state for single SEP events, with varying results.

In this paper, we will continue to apply the method to new SEP events from 2012 to 2015 in the ACE and STEREO data. With the three spacecraft widely spread apart during this time period, we are less likely to analyze single SEP events with multi-spacecraft data, but the wide spacing allows more SEP candidate events to be considered, separately, than would be available with just a single spacecraft. Candidate SEP events for new analysis are 5 Mar 2013 and 7 Nov 2013 for STEREO A; 13 May 2013, 25 February 2014, and 1 August 2014 for STEREO B; and 8 March 2012, 11 April 2013, 22 May 2013, and 8 January 2014 for ACE. These SEP events are selected as promising candidates for fitting the model to the data based on the abundance of Fe detected by STEREO/LET and ACE/SIS as well as on past experience at fitting similar decay time profiles.

Registration number following "ICRC2015-I/":

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Poster 1 GA - Board: 132 / 1334**Gamma-Ray and Cosmic Ray Escape in Intensely Star-Forming Systems**

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Regions of intense star-formation naturally generate high number densities of cosmic rays and as such, they are of particular interest as potential contributors to the extragalactic gamma-ray background (EGRB) and as potential sources of very high-energy cosmic rays (VHECRs). While models of the starburst contribution to the EGRB often assume cosmic rays are confined in starbursts, cosmic rays must escape from these galaxies if they contribute to the spectrum of VHECRs as observed at Earth. The conditions in star-forming galaxies which are responsible for such high cosmic-ray injection rates also lead to large gamma-ray fluxes, except in the case of Compton thick systems where the highest energy photons are prevented from escaping. To address these contrasting ideas, we model the gamma-ray fluxes from galaxies where cosmic rays are confined and from galaxies with strong galactic winds and explore the relationship between cosmic-ray confinement and gamma-ray absorption. We present results for the nearby starburst galaxy M82 and the ultraluminous infrared galaxy Arp 220 as examples.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

995

Poster 1 CR - Board: 219 / 704

Search for Ultra-relativistic Magnetic Monopoles with the Pierre Auger Observatory

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Ultra-relativistic magnetic monopoles, possibly a relic of phase transitions in the early universe, would deposit an amount of energy comparable to UHECRs in their passage through the atmosphere, producing highly distinctive air shower profiles. We have performed a search for ultra-relativistic magnetic monopoles in the sample of air showers with profiles measured by the Fluorescence Detector of the Pierre Auger Observatory. No candidate was found to satisfy our selection criteria and we establish upper limits on the isotropic flux of ultra-relativistic magnetic monopoles - the first from an UHECR detector - improving over previous results by up to an order of magnitude.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

619

Poster 1 GA - Board: 96 / 397

HAWC: Design, Operation, Reconstruction and Analysis

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The High-Altitude Water Cherenkov (HAWC) Observatory was completed and began full operation in early 2015. The detector consists of an array of 300 water tanks, each containing ~200 tons of purified water and instrumented with 4 PMTs. Located at an elevation of 4100m a.s.l. near the Sierra Negra volcano in central Mexico, HAWC has a threshold for gamma-ray detection well below 1 TeV and a sensitivity to TeV-scale gamma-ray sources an order of magnitude better than previous air-shower arrays. The detector operates 24 hours/day and observes the overhead sky (~2 sr), making it an ideal survey instrument. We describe the configuration of HAWC with an emphasis on how the design was optimized, including the size depth and spacing of the water tanks, the positioning of the PMTs and the requirements of the readout system. We also describe how the data are acquired, reconstructed, and analyzed. Finally, we will demonstrate the sensitivity of the detector using the observation of the Crab plerion. This paper serves as a detailed technical description of the foundations of the numerous analyses presented at this meeting by members of the HAWC collaboration.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

381

Poster 1 SH - Board: 2 / 82

Coronal Sources of Impulsive Fe-Rich Solar Energetic Particle Events

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We review recent work on 111 Fe-rich impulsive solar energetic (~3 MeV/nuc) particle (SEP) events observed from 1994 to 2013. Strong elemental abundance enhancements scale with A/Q , the ion mass-to-charge ratio, as $(A/Q)^{\alpha}$, where $2 < \alpha < 8$ for different events. Most Fe-rich events are associated with both flares and coronal mass ejections (CMEs), and those with larger α are associated with smaller flares, slower and narrower CMEs, and lower SEP event fluences. The narrow equilibrium temperature range required to fit the observed A/Q enhancements is 2.5–3.2 MK, far below the characteristic flare temperatures of > 10 MK. Only a small number of SEP events slightly outside this temperature range were found in an expanded search of impulsive Fe-rich events. Event characteristics are similar for events isolated in time and those occurring in clusters. The current challenge is to determine the solar sources of the Fe-rich events. Ambient coronal regions in the 2.5–3.2 MK range are broadly distributed both in and outside active regions. We explore the possibility of acceleration from thermal plasmas at reconnecting current sheets in the context of observed standard and blowout jets. Recent current sheet reconnection modelling provides a basis for the A/Q enhancements

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Poster 1 GA - Board: 65 / 86

Search for Gamma-ray Production in Supernovae located in a dense interstellar medium with Fermi LAT

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Supernovae (SNe) exploding in a dense circumstellar medium (CSM) are hypothesized to accelerate cosmic rays in collisionless shocks and emit GeV gamma rays and TeV neutrinos on a time scale of several months. We perform the first systematic search for gamma-ray emission in Fermi LAT data in the energy range from 100 MeV to 300 GeV from the ensemble of SNe exploding in dense CSM. We study a sample of 147 SNe Type II_n and search for a gamma-ray excess at each SNe location using the maximum likelihood method for each source in a one year time window. In order to enhance a possible weak signal, we simultaneously study the closest and optically brightest sources of our sample in a joint likelihood analysis in three different time windows (1 year, 6 months and 3 months). We do not find a significant excess in gamma rays for any individual source nor for the combined sources and provide flux upper limits at 95% confidence level (CL) for both cases. We calculate model independent limits on the gamma-ray flux for individual sources as well as the combined source sample. In addition, we derive limits on the gamma-ray luminosity and the ratio of gamma-ray to optical luminosity as a function of the index of the proton injection spectrum assuming a generic gamma-ray production model.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

100

Poster 1 GA - Board: 66 / 85

On the On-Off Problem: an Objective Bayesian Analysis

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The On-Off problem, aka. Li-Ma problem, is a statistical problem where a measured rate is the sum of two parts. The first is due to a signal and the second due to a background, both of which are unknown. Mostly frequentist solutions are being used, but they are only adequate for high count numbers. When the events are rare such an approximation is not good enough. Indeed, in high-energy astrophysics this is often the rule, rather than the exception.

I will present a universal objective Bayesian solution that depends only on the initial three parameters of the On/Off problem: the number of events in the on-source region, the number of events on the off-source region, and their ratio-of-exposure.

With a two-step approach it is possible to infer the signal's significance, strength, uncertainty or upper limit in a unified way. The approach is valid without restrictions for any count number including zero and may be widely applied in particle physics, cosmic-ray physics and high-energy astrophysics. I apply the method to gamma-ray burst data.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 1 CR - Board: 161 / 790

Predicted CALET Measurements of Heavy and Ultra-Heavy Cosmic Ray Nuclei

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The CALorimetric Electron Telescope (CALET) is a Japanese-Italian-US astroparticle observatory expected to be installed on the ISS in 2015. The main calorimeter (CAL) on CALET is comprised from top to bottom of a charge detector (CHD) with two crossed layers of scintillator paddles, an imaging calorimeter (IMC) with planes of scintillating fibers interleaved with tungsten sheets, and a total absorption calorimeter (TASC) made of lead tungstate logs. The main science objectives of CAL are to measure the combined cosmic ray electron and positron spectrum to 20 TeV, gamma rays to 10 TeV, and nuclei $1 \leq Z \leq 40$ to 1,000 TeV. In this paper we present the expected numbers and energy spectra of heavy ($26 \leq Z < 30$) and ultra-heavy (UH) ($30 \leq Z \leq 40$) Cosmic Ray (CR) nuclei that CAL will measure in a planned 5 year mission in the full detector geometry accounting for geomagnetic screening and interactions in the CHD. We will also present the numbers of UH CR nuclei that it will measure using the expanded acceptance permitted utilizing the earth's geomagnetic field to screen for events above ~ 600 MeV/nucleon. Above this threshold the UH charges can be resolved using the CHD with a trajectory correction from the top half of the IMC without the need for energy measurement in the TASC.

Collaboration:

CALET

Registration number following "ICRC2015-I":

677

Poster 1 GA - Board: 67 / 798

Systematically characterizing regions of the First Fermi-LAT SNR Catalog

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While supernova remnants (SNRs) are widely thought to be powerful cosmic-ray accelerators, indirect evidence comes from a small number of well-studied cases. Here we systematically determine the gamma-ray emission detected by the Fermi Large Area Telescope (LAT) from all known Galactic SNRs, disentangling them from the sea of cosmic-ray generated photons in the Galactic plane. Using LAT data we have characterized the 1-100 GeV emission in 279 regions containing SNRs, accounting for systematic uncertainties caused by source confusion and instrumental response. We have also developed a method to explore some systematic effects on SNR properties caused by the modeling of the interstellar emission (IEM). The IEM contributes substantially to gamma-ray emission in the regions where SNRs are located. To explore the systematics we consider different model construction methods, different model input parameters, and independently fit the model components to the gamma-ray data. We will describe this analysis method in detail. In the First Fermi-LAT SNR Catalog there are 30 sources classified as SNRs, using spatial overlap with the radio position. For all the remaining regions we evaluated upper limits on SNRs' emission. In this work we will present a study of the aggregate characteristics of SNRs, such as comparisons between GeV and radio sizes as well as fluxes and spectral indexes and with TeV.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

687

Poster 1 GA - Board: 124 / 1270

Naima: a Python package for inference of particle distribution properties from nonthermal spectra

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The ultimate goal of the observation of nonthermal emission from astrophysical sources is to understand the underlying particle acceleration and evolution processes, and few tools are publicly available to infer the particle distribution properties from the observed photon spectra from X-ray to VHE gamma rays. Naima is an open source Python package that provides models for non-thermal radiative emission from homogeneous distribution of relativistic electrons and protons. Contributions from synchrotron, inverse Compton, nonthermal bremsstrahlung, and neutral-pion decay can be computed for a series of functional shapes of the particle energy distributions, with the possibility of using user-defined particle distribution functions. In addition, Naima provides a set of functions that allow to use these models to fit observed nonthermal spectra through an MCMC procedure, obtaining probability distribution functions for the particle distribution parameters. In this contribution I will present the models and methods available in Naima and an example of their application to the understanding of a galactic nonthermal source.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

571

Poster 1 GA - Board: 68 / 1130

FACT –Influence of SiPM Crosstalk on the Performance of an Operating Cherenkov Telescope

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The First G-APD Cherenkov telescope (FACT) is the first operational telescope of its kind with a camera equipped with silicon photon detectors (G-APD aka. SiPM). SiPMs have a high photon detection efficiency (PDE), while being more robust to bright light conditions than the commonly used photo-multiplier tubes. This technology has allowed us to increase the duty cycle beyond that of the current generation of imaging air Cherenkov telescopes. During the last four years, the operation of FACT has proven that SiPMs are a suitable photon detectors for an application in the field of earth-bound gamma-ray astronomy.

Nevertheless, it has been argued that crosstalk, after-pulses and dark counts are the main drawback of SiPMs, as these effects produce photon-like signals that would add up the signal background. Consequently, it is necessary to understand their impact on the analysis of data from FACT.

In this presentation, we will show results of a study about the influence of different settings of crosstalk and dark counts on the performance of FACT i.e. its energy resolution and energy threshold. For that purpose, we used Monte Carlo simulations and compared them to actual data from the SiPM camera of FACT.

Collaboration:

FACT

Registration number following "ICRC2015-I":

910

Poster 1 GA - Board: 133 / 1275

FIPSER a novel low cost and high performance readout for astrophysics

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Low-cost and low-power digitization systems become increasingly important in particle-physics and particle-astrophysics experiments as the number of channels is continuously rising. Specialized readout concepts have been developed in the past that aimed at lower costs and made detector systems with many ten thousand channels feasible. As the number of channels in experiments is still on the rise new readout concepts are needed that meet upcoming demands.

We propose a novel readout system FIPSER (Fixed Pulse Shape Efficient Readout) that is primarily aimed for the digitization of detector signals that are a few nanoseconds long and vary in amplitude, but do not change their shape. FIPSER has the potential to lower the costs of the readout, including the front-end electronics, by an order of magnitude to less than \$10 and power consumption to less than 50mW per channel. FIPSER will make new groundbreaking experiments possible that have previously not been feasible due to conflicting power, thermal, and performance requirements.

Collaboration:

– not specified –

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731

Poster 1 GA - Board: 55 / 246

The measurement of the expansion rate of the Universe from gamma-ray attenuation

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The extragalactic background light (EBL) contains fundamental cosmological and galaxy evolution information. Very high energy observations of extragalactic sources, such as blazars, can be used to extract this information because of the pair-production interaction between gamma-ray and EBL photons. We present (almost) simultaneous broad-band data of a dozen BL Lacs that allow us to make the first statistically significant detection of the cosmic gamma-ray horizon (CGRH), which is a measure of how far gamma-ray photons of different energies can travel through the Universe due to EBL attenuation. From a comparison of our CGRH detection with an EBL model built from multi-wavelength data taken with deep galaxy surveys, we conclude that there is no significant amount of light escaping to galaxy surveys, at least, in the low redshift Universe. This CGRH detection also allow us to present an independent and novel technique aimed at measuring the expansion rate of the Universe from gamma-ray observations.

Collaboration:

– not specified –

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239

Poster 1 GA - Board: 125 / 1178

GAMERA - a new modeling package for non-thermal spectral modeling

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GAMERA is a new open-source C++ package which handles the spectral modelling of non-thermally emitting astrophysical sources in a simple and modular way. It allows the user to devise time-dependent models of leptonic and hadronic particle populations in a general astrophysical context (including SNRs, PWNs and AGNs) and to compute their subsequent photon emission. Moreover, this package also contains the necessary tools to create Monte-Carlo population synthesis models. In this poster, I will explain the basic design concept of GAMERA and present several examples of its implementation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

556

Poster 1 SH - Board: 43 / 1213

LAGO Ecuador, Implementing a set of WCD detectors for Space weather research: first results and further developments

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The Latin American Giant Observatory (LAGO) is an astroparticle network focused in the study of the phenomenology of Cosmic Rays (CR) in different energy ranges, using water Cherenkov Detectors(WCD). Ecuador has been working in the LAGO project for almost 3 years in which three detectors had been placed in different universities of the country (one in the city of Riobamba and two in the city of Quito). A complete set of simulations have been performed within the LAGO simulation framework, based on a combination of Magnetocosmics, CORSIKA and GEANT4 codes. In this work, the detector characterization, calibration and the first Ecuadorian data is presented.

Registration number following "ICRC2015-I":

396

Poster 1 CR - Board: 158 / 419

Search for isotropic microwave radiation from electron beam in the atmosphere

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We report a search for 12.5 GHz microwave radiation from electron beams in the atmosphere. Ultrahigh-energy cosmic rays (UHECRs) are observed indirectly through extensive air showers (EASs) by particle detectors on the ground or fluorescence detectors using a remote sensing method. If isotropic radiation of microwave from EAS is detected, it can be used for future observation of the UHECR based on a remote sensing method just like fluorescence detector with 100 % duty cycle like particle detectors. Weak attenuation in the atmosphere is another advantage to measure microwave radiation.

To study microwave radiation from EAS, we used Electron Light Source (ELS) located at the Telescope Array Observatory in Utah, USA. The ELS emitted electron beams vertically into the atmosphere. Energy of the electron in the beam is 40 MeV which is similar to that in the EAS.

About 600 million electrons are contained in a beam, which is equivalent to the shower maximum of an air shower created from 10 to 17 eV cosmic ray. The beam is triangular pulse of which the base is 20 ns.

Commercial equipment for the satellite television are utilized for the microwave detection system. 1.2 m diameter parabola with 12.5 GHz receiver which measures vertical and horizontal polarizations is fixed on a concrete pad which is located at 80 m away from the electron beam.

About 1500 beam shots were observed and no microwave signal has been detected. In this contribution we will report details of this detector, its calibration and obtained upper-limit on the intensity of isotropic radiation of 12.5 GHz microwave.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

395

Poster 1 CR - Board: 214 / 519

PAMELA'S MEASUREMENT OF GEOMAGNETICALLY TRAPPED AND ALBEDO PROTONS

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Data from the PAMELA satellite experiment were used to perform a detailed measurement of under-cutoff protons at low Earth orbit. On the basis of a trajectory tracing approach using a realistic description of the magnetosphere, protons were classified into geomagnetically trapped and albedo. The former includes stably-trapped protons in the South Atlantic Anomaly, which were analyzed in the framework of the adiabatic theory, investigating energy spectra, spatial and angular distributions. PAMELA data were compared with other spacecraft measurements and with predictions of recent theoretical models. The albedo protons were classified into quasi-trapped, concentrating in the magnetic equatorial region, and un-trapped, spreading over all latitudes and including both short-lived (precipitating) and long-lived (pseudo-trapped) components. Features of the penumbra region around the geomagnetic cutoff were investigated in detail. PAMELA results significantly improve the characterization of the high energy proton populations in near Earth orbits.

Collaboration:

– not specified –

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469

Poster 1 CR - Board: 166 / 518

The muon detector prototype AMD for the determination of the muon content in UHECRs

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Precise measurements of the muon content of extensive air showers are essential for the identification of the chemical composition of ultra-high-energy cosmic rays. We therefore propose a new scintillator detector prototype, the Aachen Muon Detector (AMD). It can complement existing ground arrays composed of e.g. water Cherenkov detector stations. The detector consists of 64 scintillator tiles read out by silicon photomultipliers (SiPM) which are located in a steel housing which could be placed beneath the existing detector stations. SiPMs promise a photon detection efficiency which outperforms current photomultiplier tubes. In combination with their compact package, low cost per light sensor and a moderate bias voltage (< 100 volts) a modular and robust design can be achieved. We present the current status of the AMD prototype, including first characterization measurements of the scintillator tiles and first promising simulation studies. We use a detailed detector simulation based on Geant4 to determine the efficiency of the AMD detector to reconstruct the simulated muon number in air showers.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

457

Poster 1 SH - Board: 9 / 511

Analysis of multi-eruption solar energetic particle event on March 17-18, 2003

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On March 17-18, 2003 the Energetic and Relativistic Nuclei and Electrons (ERNE) instrument on board the Solar and Heliospheric Observatory (SOHO) spacecraft observed three solar energetic particle (SEP) events in rapid succession (within ≈ 26 hours) from the same active region of the Sun. The first event was weak and proton intensity enhancement was observed only below ≈ 25 MeV. No coincident coronal mass ejection (CME) was found, but the event was associated with an impulsive H α flare starting at 10:09 UT on March 17 at location S16W33 and with a type III radio burst. The second particle event was associated with an X1.5-class X-ray flare starting on March 17 at 18:50 UT and a fast and wide (1020 km/s, 96 $^\circ$) CME. The CME has been reported to be radio quiet (Gopalswamy et al., 2008). Enhanced proton intensities reached up to 60 MeV. The third SEP event occurred about 18 hours later on the tail of the second one, reached proton energies up to ≈ 60 MeV, and lasted for roughly 2 days at energies >10 MeV. The event was associated with another X1.5-class flare, fast and wide (1601 km/s, 206 $^\circ$) CME, and decametric-hectometric type II radio burst. This last event was associated with a shock observed at the ACE spacecraft on March 19. We analyse these particle events based on the velocity dispersion of protons, helium-to-proton ratio, and the observed anisotropy of the particle intensities.

Gopalswamy et al. (2008), Coronal mass ejections, type II radio bursts, and solar energetic particle events in the SOHO era, *Ann. Geophys.* 26, 3033-3047.

Registration number following "ICRC2015-I":

467

Poster 1 CR - Board: 233 / 1004

Anisotropy search in the Ultra High Energy Cosmic Ray Spectrum in the Northern Hemisphere using the Telescope Array surface detector

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The Telescope Array (TA) experiment is located in the western desert of Utah, USA and observes ultra high energy cosmic rays in the northern hemisphere. In the highest part of the energy region, the cosmic ray energy spectrum shape carries information of the source density distribution. We search for directional differences in the energy spectrum shape. In this study, observed cosmic ray energy distributions are compared between sky areas that contain nearby objects, such as the supergalactic plane, and others that do not.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

831

Poster 1 CR - Board: 213 / 517

PAMELA'S MEASUREMENT OF GEOMAGNETIC CUTOFF VARIATIONS DURING SOLAR ENERGETIC PARTICLE EVENTS

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Data from the PAMELA satellite experiment were used to measure the geomagnetic cutoff for high-energy (above 80 MeV) protons during the solar particle events on 2006 December 13 and 14. The variations of the cutoff latitude as a function of rigidity were studied on relatively short timescales, corresponding to single spacecraft orbits (about 94 minutes). Estimated cutoff values were cross-checked with those obtained by means of a trajectory tracing approach based on dynamical empirical modeling of the Earth's magnetosphere. We find significant variations in the cutoff latitude, with a maximum suppression of about 6 degrees for 80 MeV protons during the main phase of the storm. The observed reduction in the geomagnetic shielding and its temporal evolution were compared with the changes in the magnetosphere configuration, investigating the role of IMF, solar wind and geomagnetic (Kp, Dst and Sym-H indexes) variables and their correlation with PAMELA results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

469

Poster 1 DM and NU - Board: 260 / 1340

Isospin violating dark matter in Stückelberg portal scenarios

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In this work we study the phenomenological aspects of Stückelberg portals where the mediator between the Standard Model and the dark matter (DM) is a massive Z' boson. Those scenarios are well motivated by certain string theory constructions and naturally lead to isospin violating interactions of DM particles with nuclei. We show that within this construction the relations between the DM coupling to neutrons and protons for both, spin-independent (f_n/f_p) and spin-dependent (a_n/a_p) interactions are generically different from plus and minus 1 (i.e. different couplings to protons and neutrons) leading to a potentially measurable distinction from other popular portals. Finally, we perform a scan over all the parameters of the model and we incorporate bounds from searches for dijet and dilepton resonances at the LHC as well as LUX bounds on the elastic scattering of DM off nucleons to determine the experimentally allowed values of f_n/f_p and a_n/a_p . We also obtain the phenomenological consequences of this kind of constructions for direct detection and indirect detection signals.

Registration number following "ICRC2015-I":

996

Poster 1 DM and NU - Board: 251 / 451

Development of an automatic test system for the PMTs used in the BGO ECAL of DAMPE

Authors: Changqing Feng¹; Jianing Dong²; Shubin Liu²; Sicheng Wen²; Xiaolian Wang³; Zhiyong Zhang²; Zhongtao Shen²; Zizong Xu²; Yunlong Zhang²

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An automatic system has been developed for the batch test of the photomultiplier tubes (PMTs) in the BGO electromagnetic calorimeter (ECAL) of Dark Matter Particle Explorer (DAMPE). There are 616 PMTs (Hamamatsu R5610A-01) used in the BGO ECAL, which are critical for the realization of high dynamic readout and high precision measurement of the scintillation light from BGO crystals. In order to cover the large dynamic range of energy measurement of DAMPE, signals are read out from three dynodes of the PMTs. The charge ratios of the dynodes are of paramount importance to the energy reconstruction of high energy incident particles so that all the PMTs must be tested and calibrated. In addition, considering of the high reliability and quality requirements as a space-borne experiment, over 800 PMTs were tested during the mass production and screening procedure both for the Qualification Model and the Flight Model. Therefore, a light-emitting diode (LED) based system was designed to test the performance of PMTs automatically. The test system is composed of a signal generator, a LED driver module, a dark box, and a readout system which consists of front end electronics (FEE) board, data acquisition (DAQ) board and a data acquisition software based on Labwindows/CVI. An arbitrary waveform generator drives the LED source for illuminating 22 PMTs through optical fibers in one dark box. Then 66 dynode signals are read out by a FEE board, sent to DAQ module, stored in the computer and finally analyzed with a root program. As two dark boxes can be controlled simultaneously by the readout system, it takes about 30 minutes to test 44 PMTs per time, which reduces the workload greatly and guarantees the project schedule. The details about this system and the test results are presented in this paper.

Registration number following "ICRC2015-I":

400

Poster 1 CR - Board: 211 / 452

Sidereal anisotropy of Galactic cosmic ray observed by the Tibet Air Shower experiment and the IceCube experiment

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The IceCube experiment presented in 2012 the declination dependence of the first and second harmonic coefficients of the sidereal cosmic-ray anisotropy at 20 TeV and 400 TeV. In this presentation, we calculate the coefficients for the cosmic ray data observed by the Tibet ASgamma experiment at median energies of 12 TeV and 300 TeV during a period between November 1999 and May 2010. By using these coefficients combined, we analyze the sidereal anisotropy for the first time based on the two-hemisphere observations by the IceCube and the Tibet ASgamma experiments.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

126

Poster 1 CR - Board: 169 / 1345

Calibration of a fluorescence detector using a flying standard light source for the Telescope Array observatory

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The main calibration items of Fluorescence Detector (FD) observation are the fluorescence yield, the atmospheric attenuation and the detector sensitivity.

In 2012-2013, we conducted a joint TA-Augger calibration campaign by a flying device mounted with an ultraviolet LED as a standard light source. This device is called an octocopter, and was built by KIT. An octocopter has excellent portability and is suitable for calibration for FDs at a variety of remote locations. In TA FD observation of the octocopter, a difference in the number of detected photons between measurement and simulation is $\pm 5\%$, in the range of systematic error of the light source.

In TA, we have begun developing a similar flying standard light source. By mounting a high-performance GPS, the systematic errors of the measured light source position will be improved to less than 1 m. A photodiode mounted directly near the light source measures the relative light intensity of each pulse.

We report the progress of development for the octocopter, and the analysis results of the joint calibration campaign using the previous octocopter.

Collaboration:

IceCube & Pierre Auger & Telescope Array

Registration number following "ICRC2015-I":

1000

Poster 1 SH - Board: 20 / 1228**3D simulations of heliospheric propagation of heavy-ion solar energetic particles****Author:** Silvia Dalla¹**Co-authors:** Micheal Marsh ²; Peter Zelina ¹; Timo Laitinen ¹¹ *University of Central Lancashire*² *UK Met Office***Corresponding Author:** sdalla@uclan.ac.uk

In recent years, a wealth of spacecraft measurements of heavy ion solar energetic particles have become available, thanks to data from the ACE and STEREO spacecraft. Interesting features in heavy ion time intensity profiles, such as the decay of the Fe/O ratio over time in some events, have been observed. Heliospheric propagation effects have been invoked in the literature as a possible cause of Fe/O decays. Recent modelling work has shown that drifts due to the gradient and curvature of the large scale Parker spiral magnetic field, are a significant source of perpendicular transport for partially ionised heavy ions. Modelling these effects requires a fully 3D description. Here we present results of 3D test particle simulations of heavy ion SEP propagation in the heliosphere, for a Parker spiral magnetic field in a variety of scattering conditions. We simulate intensity profiles of heavy ions as would be observed at 1 AU, and compare them with recent data from STEREO and ACE.

Registration number following "ICRC2015-I":

676

Poster 1 GA - Board: 56 / 172**FACT - Performance of the First SiPM camera****Author:** Dominik Neise¹¹ *ETH Zurich***Corresponding Author:** neised@phys.ethz.ch

The First G-APD Cherenkov Telescope (FACT) is the first operational test of the performance of silicon photomultipliers (SiPM) in Cherenkov Astronomy. These novel photon detectors promised to be an inexpensive and robust alternative for vacuum photomultiplier tubes, but had never been applied in an imaging airshower cherenkov telescope (IACT) up to now. For more than three years FACT has operated on La Palma, Canary Islands (Spain), for the purpose of long-term monitoring of astrophysical sources.

Stable performance of the photo detectors is crucial and therefore has been studied in great detail. Special care has been taken in regards to their temperature and overvoltage dependence through implementation of a feedback method in order to keep their properties stable. Several independent long term measurements were conducted to analyse and verify SiPM gain stability. Dark count spectra, which also make for an excellent self calibration mechanism, were used to study and correct for temperature dependencies. Ratescans make it possible to derive a method, for quickly finding appropriate trigger thresholds by measuring pixel currents, and thus allow for a consistent data acquisition rate. Dedicated measurements with an LED flasher are used to study the correct application of SiPM bias voltages.

In this talk, the results of the long term studies will be presented and the applicability of SiPMs in IACTs for long term monitoring will be shown.

Collaboration:

FACT

Registration number following "ICRC2015-I":

181

Poster 1 SH - Board: 25 / 10

Atmospheric- Weighted Temperature and its influence on Cosmic Ray muons

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To study the dependence of the muon rate flux on temperature we need to have some measure of atmospheric temperature above the detection site. Atmospheric weighted temperature, known also as the effective temperature, is defined as the temperature of an isothermic atmosphere that reflects the temperature of the real atmosphere with its varying conditions. In this paper, the influence of the atmospheric temperature on the observed muon flux was investigated and the obtained results were discussed. Cosmic ray data were obtained from KACST muon detector, which was in operation since 2002, located at Riyadh, Saudi Arabia, (Rc, is ~ 14 GV). Corresponding Radiosonde data were used to calculate the Atmospheric weighted temperatures for different atmospheric heights.

Registration number following "ICRC2015-I":

16

Poster 1 SH - Board: 17 / 975

Improved $^3\text{He}/^4\text{He}$ isotope separation in EPHIN data based on simulations

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In order to improve the separation of helium isotopes ³He and ⁴He measured by the Electron Proton Helium Instrument (EPHIN) aboard the Solar and Heliospheric Observatory (SOHO), we used Monte Carlo simulations to understand the instrument's response to incoming particles. The identification of different isotopes is based on the dE/dx-E-method. For an ideal telescope with the energy loss ΔE much smaller than the energy E : $\Delta E * E \propto Z^2 * m * \Delta x$. Herein Z , m are the charge and mass of the particle and Δx the path length in the detector. In order to separate isotopes from each other, it is mandatory to know Δx with a high precision and to correct for a non-ideal telescope. Our simulations allow to determine the above mentioned effects and have been used to develop a correction method and thus improve the resolution significantly. Furthermore, we examine the ratio of the aforementioned isotopes during solar events and in the cosmic background using this new method.

Registration number following "ICRC2015-I":

0539

Poster 1 CR - Board: 232 / 972

Local density spectra of electron and muon EAS components in primary energy range from 10^{14} to 10^{18} eV

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Co-authors: Alexey Bogdanov¹; Anatoly Petrukhin¹; Igor Yashin¹; Ivan Shulzhenko¹; Rostislav Kokoulin¹; Semen Khokhlov¹

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The system of calibration telescopes (SCT) of the Cherenkov water detector (CWD) NEVOD is used as a shower array. SCT consists of two planes (80 m^2) with 40 scintillation counters ($40 \times 20 \times 2 \text{ cm}^3$) in each. One plane is located on the roof of the CWD, and another one on its bottom. The distance between two planes is 9.45 m. Each registration channel of SCT is able to evaluate the counter response amplitude in the range from ~ 1 to ~ 50 relativistic particles, which corresponds to electron densities up to ~ 500 particles/sq.m.

The triggering system identifies three types of events in SCT. The telescope trigger allows selecting muon tracks for calibration of the CWD photomultipliers and scintillation counters themselves. Other two triggers provide registration of the multiparticle events in each plane of SCT. The top plane is used as a detector of electron component of EAS, and the bottom one provides registration of the EAS muon bundles. The technique of EAS investigations with the SCT is based on the phenomenology of local density of charged particles because each plane of the setup has an area much less than transverse sizes of EAS. We have measured the spectrum of charged particle local density in the range from 0.5 to 200 m^{-2} with the top plane, and the spectrum of local muon density in the range from 0.2 to 56 m^{-2} with the bottom plane. Comparison with EAS simulations shows that the primary particle energy range which can be investigated with the SCT extends from 10^{14} to 10^{18} eV. This energy range includes the interval of 10^{14} – 10^{15} eV which is still insufficiently studied both in satellite and EAS experiments.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

51

Poster 1 CR - Board: 192 / 656

Effects of Turbulent Magnetic Fields in Cosmic Ray Anisotropy

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Cosmic ray anisotropy has been observed to be present in a wide energy range by a variety of experiments such as Milagro and the IceCube Observatory. However, a satisfactory explanation has been elusive for more than fifteen years now. A possible solution for the TeV-PeV cosmic ray anisotropy is the introduction of turbulent magnetic interactions on the arrival direction. We perform test particle simulations in compressible magnetohydrodynamic turbulence to study how cosmic rays' arrival direction distribution is perturbed when they stream along the local turbulent magnetic field. In this work, we discuss the effects arising from propagation in this inhomogeneous and turbulent interstellar magnetic field.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

309

Poster 1 DM and NU - Board: 281 / 184

A Precision Optical Calibration Module for IceCube-Gen2

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A next generation of IceCube is under design targeting the Precision IceCube Next Generation Upgrade (PINGU) for the neutrino mass ordering and an extended array for astrophysical neutrino sources. A new level of precision is needed in order guarantee improved performances respect IceCube. A better calibration system will enable a better understanding of the ice and will therefore significantly reduce systematic effects. We present a new instrument called the Precision Optical Calibration Module (POCAM). By keeping the outer topology identical to that of the IceCube Digital Optical Module (DOM), cost effective construction and deployment is ensured. The design of

the POCAM is based on the principle of an inverted integrating sphere. An appropriately placed LED in combination with a diffusing layer on the inside of the sphere results in an isotropic light emission from the apertures in the spherical housing. The output of the LED is monitored in-situ to high precision, it therefore ensures control over the output from the apertures. The POCAM has been simulated and tested in the framework of Geant4. A prototype POCAM is under construction. We will report about the status of the POCAM R&D.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

201

Poster 1 GA - Board: 57 / 1123**H.E.S.S. discovery of very-high-energy gamma-ray emission of PKS 1440-389****Author:** Heike Prokoph¹**Co-authors:** Catherine Boisson ²; Iurii Sushch ³; Jean-Philippe Lenain ⁴; Markus Boettcher ³; Yvonne Becherini ¹¹ *Linnaeus University*² *LUTH*³ *North-West University*⁴ *LPNHE***Corresponding Author:** heike.prokoph@lnu.se

Blazars are the most abundant class of known extragalactic very-high-energy (VHE, $E > 100$ GeV) gamma-ray sources. However, one of the biggest difficulties in investigating their VHE emission resides in their limited number, since less than 60 of them are known by now.

In this contribution we report on the H.E.S.S. observations of the BL Lac object PKS 1440-389. This source has been selected as target for H.E.S.S. based on its high-energy gamma-ray properties measured by Fermi-LAT. The extrapolation of this bright, hard-spectrum gamma-ray blazar into the VHE regime made a detection on a relatively short time scale very likely, despite its uncertain redshift. H.E.S.S. observations were carried out with the 4-telescope array from March to May 2012 and resulted in a clear detection of the source. Contemporaneous multi-wavelength data will be used to construct its spectral energy distribution and we will discuss possible emission mechanisms explaining the observed broad-band emission of PKS 1440-389.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

601

Poster 1 GA - Board: 58 / 764

VERITAS long-term (2006-2014) observations of the BL Lac object 1ES 0806+524

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The high-frequency-peaked BL Lac object 1ES 0806+524 ($z=0.138$) was discovered as a source of very-high-energy (VHE, $E>100$ GeV) gamma-ray photons in 2008 with the VERITAS telescope array, at a level of 1.8% of the Crab Nebula flux above 300 GeV. Since then, VERITAS has continued observing the source over multiple seasons, significantly improving the significance of the detection. We report the results of the analysis of the 2006-2014 VERITAS data, corresponding to a total exposure of about 80 hours. We present the new, average VHE spectrum of the source, together with the multi-year light-curve constraining long-term VHE variability.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

486

Poster 1 SH - Board: 26 / 19

Effective dose calculation at flight altitudes with the newly computed yield function

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An important topic in the field of space weather research is estimation of the expected effective dose of aircrew at flight altitudes due to cosmic rays of solar and galactic origin. The primary cosmic ray particles induce a complicated nuclear-electromagnetic-muon cascade in the Earth atmosphere. The secondary particles form the main source of increased exposure at flight latitudes compared to the sea level. In this work we propose a numerical model for computation of the effective dose at flight altitude. It represents a full chain analysis, namely estimation of the solar particle spectral and angular characteristics from neutron monitor data and application of the newly computed yield function for the effective/ambient dose. The new computed yield functions for conversion of secondary particle flux to dose were obtained on the basis of extensive Monte Carlo simulation of the atmospheric cascade induced by primary protons and alpha particles and subsequent application of recently computed conversion coefficients. A comparison with the reference data is performed. A good agreement is achieved. Several example calculations are demonstrated.

Registration number following "ICRC2015-I":

17

Poster 1 SH - Board: 31 / 478

On the influence of the coronal hole latitude and polarity on the geomagnetic activity and cosmic ray variations.

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Changes of indices of geomagnetic activity, and also cosmic ray density and anisotropy in high-speed streams of a solar wind from various solar coronal holes are studied. About 350 coronal holes observed in 1996-2013 were divided into groups taking into account their polarity and heliolatitude. It is shown that northern holes with negative polarity and the southern holes with positive polarity are more effective than other holes in creation of geomagnetic activity. The behavior of vector anisotropy of the cosmic rays (especially its North-South component) depends substantially on polarity of a magnetic field in a high-speed stream. The obtained results have to be useful to forecasting of geomagnetic activity and diagnostics of large-scale interplanetary disturbances.

Registration number following "ICRC2015-I":

432

Poster 1 CR - Board: 136 / 1226

Lightning Detection at the Pierre Auger Observatory

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As part of the Auger Engineering Radio Array, an extension of the Pierre Auger Observatory with antennas in the MHz range, it is necessary to monitor the local atmospheric conditions. These have a large influence on the radio emission induced by air showers. In particular, amplified signals up to an order of magnitude have been detected as an effect of thunderstorms. For a more detailed investigation and the detection of thunderstorms, a new lightning detection system has been installed at the Pierre Auger Observatory in Argentina. In addition, an electric field mill measures the electric field strength at ground level at the antenna array. With these measurements, data periods can be classified for their influence by thunderstorms. Additionally, a lightning-based trigger for the water-Cherenkov detectors was developed to read individual stations when lightning strikes nearby. With these data a possible correlation between the formation of lightning and cosmic ray showers can be investigated even at low energies of about 10^{15} eV. In this talk the structure and functionality of the lightning detection system are described, and first data analyses are shown.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

19

Poster 1 GA - Board: 59 / 882

Creating a high-resolution picture of Cygnus with the Cherenkov Telescope Array

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The Cygnus region hosts one of the most remarkable star-forming regions in the Milky Way. Indeed, the total mass in molecular gas of the Cygnus X complex exceeds 10 times the total mass of all other nearby star-forming regions. Surveys at all wavelengths, from radio to gamma-rays, reveal that Cygnus contains such a wealth and variety of sources—supernova remnants (SNRs), pulsars, pulsar wind nebulae (PWNe), Hii regions, Wolf-Rayet binaries, OB associations, microquasars, dense molecular clouds and superbubbles—as to practically be a galaxy in microcosm. The gamma-ray observations along reveal a wealth of intriguing sources at energies between 1 GeV and tens of TeV. However, a complete understanding of the physical phenomena producing this gamma-ray emission first requires us to disentangle overlapping sources and reconcile discordant pictures at different energies. This task is made more challenging by the limited angular resolution of instruments such as the Fermi Large Area Telescope, ARGO-YBJ, and HAWC and the limited sensitivity and field of view of current imaging atmospheric Cherenkov telescopes (IACTs). The Cherenkov Telescope Array (CTA), with its improved angular resolution, large field of view, and order of magnitude gain in sensitivity over current IACTs, has the potential to finally create a coherent and well-resolved picture of the Cygnus region between a few tens of GeV and a hundred TeV. We describe a proposed strategy to study the Cygnus region using CTA data, which combines a survey of the whole region at $65^\circ < l < 85^\circ$ and $-3.5^\circ < b < 3.5^\circ$ with deeper observations of two sub-regions that host rich groups of known gamma-ray sources.

Collaboration:

CTA

Registration number following "ICRC2015-I":

750

Poster 1 GA - Board: 127 / 884

The FRaNKIE code: a tool for calculating multi-wavelength interstellar emissions in galaxies

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The Fast Radiation transport Numerical Calculation for Interstellar Emission (FRaNKIE) code is a Monte Carlo code for calculating the electromagnetic emissions in galaxies. The code is highly parallel and optimised for both CPUs and co-processor accelerators. The code takes into account the interaction of the photon field with the interstellar medium in a self-consistent way, providing a detailed model for the interstellar radiation field. I will describe the implementation details of the code and present results of its application to the problem of calculating the interstellar radiation field of the Milky Way. The radiation field is an essential input to CR propagation codes for calculating the cosmic-ray lepton energy losses from inverse Compton scattering and the resulting gamma-ray emission.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

697

Poster 1 GA - Board: 128 / 756

Cosmic-Ray Induced Gamma-Ray Emission From Starburst Galaxies

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In star-forming galaxies, gamma rays are mainly produced through the collision of high-energy protons in cosmic rays and protons in the interstellar medium (ISM) (i.e. cosmic ray-induced π^0 γ -radiation). For a "normal" star-forming galaxy like the Milky Way, most cosmic rays escape the Galaxy before such collisions, but in starburst galaxies with dense gas and huge star formation rate, most cosmic rays do suffer these interactions. We construct a "thick-target" model for starburst galaxies, in which cosmic rays are accelerated by supernovae, and escape is neglected. This model gives an upper limit to the gamma-ray emission and tests the calorimetry relation between gamma rays and cosmic rays for starbursts. Only two free parameters are involved in the model: cosmic-ray proton acceleration energy rate from supernova and the proton injection spectral index. We apply the model to five observed starburst galaxies: M82, NGC 253, NGC 1068, NGC 4945 and Circinus, and find the calorimetric relation holds for most of the starbursts, but for Circinus, other gamma-ray sources must be presented to explain for its GeV excess. The pionic gamma-ray emission is calculated from 10 MeV to 10 TeV, which covers the Fermi Gamma-ray Space Telescope (Fermi) energy range. We also apply the model to the extragalactic gamma-ray background emission (EGB) by assuming

all star-forming galaxies are calorimetric, finding that star-forming galaxies cannot make the entire signal, other gamma-ray sources must also exist.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

672

Poster 1 SH - Board: 13 / 599

On the perpendicular diffusion of solar energetic particles

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Observations show that solar energetic particles, even those accelerated during smaller impulsive events, are transported very effectively across the background magnetic field; at 1 AU, particle intensities may extend up to 360 degrees in longitude in extreme cases. We present modeling results of such events, examining the effectiveness of mainly perpendicular diffusion. In our model, we include theoretically motivated transport parameters (for both pitch-angle scattering and perpendicular diffusion) based on some of the latest and most comprehensive transport theories. We also examine if, from a modeling point-of-view, it is possible to find observational quantities that can be used to disentangle whether extended sources or perpendicular diffusion, or some combination of the two processes, are primarily responsible for the longitudinal transport of these particles.

Registration number following "ICRC2015-I":

530

Poster 1 CR - Board: 237 / 1083

A method for reconstructing the muon lateral distribution with an array of segmented counters with time resolution

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Although the nature of ultra high energy cosmic rays is still largely unknown, significant progress has been achieved in last decades with the construction of the large arrays that are currently taking data. One of the most important pieces of information comes from the chemical composition of primary particles. It is well known that the muon content of air showers generated by the interaction of cosmic rays with the atmosphere is rather sensitive to primary mass. Therefore, the measurement of the number of muons at ground level is an essential ingredient to infer the cosmic ray mass composition. The energy range from 3×10^{17} eV to 10^{20} eV is considered using two triangular arrays spaced at 750 m and 1500 m respectively. We introduce here a novel method for reconstructing the muon lateral distribution function with an array of segmented counters. The reconstruction builds on a previous method we recently presented by considering the time resolution of the detectors. We show that the new method improves the statistical uncertainty of the measured number of muons with respect to the previous alternative. The new reconstruction has also the additional advantage of estimating uncertainties in the number of muons without bias. These improvements make a difference in composition analyses. While the increased resolution allows for a better separation between different primary masses, correct uncertainties are required for a meaningful classification of cosmic rays on an event-by-event basis.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

667

Poster 1 GA - Board: 60 / 322

Search for VHE gamma-ray emission from the Geminga pulsar and nebula with the MAGIC telescopes

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Geminga pulsar appears to be one of the most promising candidates to emit VHE gamma-ray pulsed emission.

In order to detect the third pulsar with power-law spectral component above of the measured cutoff, after Crab and Vela, we analyzed 63 hours of data taken with MAGIC. To discuss the connection with

HE gamma rays, 6 years of Fermi-LAT data were also analyzed. No significant pulsation was found with MAGIC observations.

The obtained flux upper limits above 50 GeV are above the power law extrapolation above 10 GeV based on Fermi-LAT data.

We also searched for steady emission from the pulsar wind nebula in the same dataset, resulting in no significant detection.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

333

Poster 1 CR - Board: 143 / 327

Calibration of the absolute amplitude scale of the Tunka Radio Extension (Tunka-Rex)

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The Tunka Radio Extension (Tunka-Rex) is an array of 44 radio antenna stations, constituting a radio detector for air showers.

It is an extension to Tunka-133, an air-Cherenkov detector in Siberia, which is used as an external trigger for Tunka-Rex and

provides a reliable reconstruction of energy and shower maximum.

Each antenna station consists of two perpendicularly aligned active antennas, called SALLAs.

An antenna calibration of the SALLA with a commercial reference source enables us to reconstruct the incoming radio signal on an absolute scale.

Since the same reference source was used for the calibration of LOPES and, in a calibration campaign in 2014, also for LOFAR,

these three experiments now have a consistent calibration and, therefore, absolute scale.

This was a key ingredient to resolve a longer standing contradiction between measurements of two calibrated experiments.

We will present how the calibration was performed and compare radio measurements of air showers from Tunka-Rex to model calculations

and published results from other calibrated experiments.

Collaboration:

Tunka-Rex

Registration number following "ICRC2015-I/":

334

Poster 1 CR - Board: 199 / 79

Cosmic-ray positron measurements: on the origin of the e^+ excess and limits on magnetar birthrate

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Positrons were discovered in cosmic rays 50 years ago.

During the last 25 years, reliable magnetic

spectrometer observations consistently revealed an excess of these particles above a few GeV with respect to the expected secondary component. The most recent measurements of the positron flux and the $e^+/(e^++e^-)$ ratio carried out by the Pamela and AMS experiments confirm the average trend of previous magnetic spectrometer observations up to 50 GeV and indicate that this excess is observed up to about 500 GeV. Many different hypotheses were suggested in the literature to explain these observations.

However, when the characteristics of possible sources of e^+ are taken into account, astrophysical objects and in particular, pulsars and, possibly, magnetars, remain the most plausible candidates even if disk formation may critically affect the actual contribution of these stars to cosmic-ray positrons.

The magnetar birthrate is revised within the proposed scenario.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0001

Poster 1 CR - Board: 179 / 594

Development of the Waseda CALET Operations Center (WCOC) for Scientific Operations of CALET

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The CALET project aims at a long duration observation of high energy cosmic rays onboard the International Space Station (ISS). The CALET detector features a very thick calorimeter of 30 radiation-lengths which consists of imaging and total absorption calorimeters. It will directly measure the cosmic-ray electron spectrum in the energy range of 1GeV–20TeV with 2-% energy resolution.

The data obtained with CALET onboard ISS will be transferred to JAXA using two data relay satellite systems operated by NASA and JAXA, respectively. To operate the CALET onboard ISS, the CALET Ground Support Equipment (CALET-GSE) is being prepared in JAXA. Simultaneously, Waseda CALET Operations Center (WCOC) is being established to perform operations and monitoring related to the scientific mission. The real-time data received by CALET-GSE is immediately transferred to WCOC. Scientific raw data are also transferred to WCOC on an hourly basis after time-order correcting and complementing replay data.

Mission operations at WCOC includes (1) real-time monitoring and operations, (2) operations planning, and (3) and processing raw, level-0, scientific data to level-1 data that will be used for scientific analysis. In this paper we will review the role of WCOCC and report on its development.

Collaboration:

CALET

Registration number following "ICRC2015-I":

219

Poster 1 DM and NU - Board: 282 / 1040

The Calibration Units of the KM3NeT Neutrino Telescope

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KM3NeT is a network of deep-sea neutrino telescopes to be deployed in the Mediterranean Sea, that will perform neutrino astronomy and oscillation studies. It consists of three-dimensional arrays of thousands of optical modules that detect the Cherenkov light induced by charged particles resulting from the interaction of a neutrino with the surrounding medium.

The performance of the neutrino telescope relies on the precise timing and positioning calibration of the detector elements. The exact location of optical modules (which is affected by sea currents) can be monitored through an acoustic positioning system, while external light sources are used to achieve the required sub-nanosecond time resolution and to measure water optical properties. Other environmental conditions which may affect light and sound transmission, such as water temperature, pressure and salinity, must also be continuously monitored.

For these purposes, KM3NeT foresees the deployment of several dedicated Calibration Units (CUs), whose base will host the detector calibration devices (Laser beacon, acoustic emitter and hydrophone). A few of these CUs will additionally be equipped with an Instrumentation Unit with a semi-autonomous and recoverable inductive line supporting the environmental monitoring instruments. This contribution describes the technical design and construction of the first Calibration Unit, to be deployed on the French site as part of KM3NeT Phase 1, as well as the purpose and characteristics of the different instruments that it will support.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

0522

Poster 1 DM and NU - Board: 283 / 1045

Development of new data acquisition system at Super-Kamiokande for nearby supernova bursts

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Super-Kamiokande (SK) is a 50-kiloton water Cherenkov detector. It is one of the most sensitive neutrino detectors and can be used for supernova observations by detecting supernova burst neutrinos.

Recently, it is reported that Betelgeuse (640ly) is shrinking 15% in 15 years (C. H. Townes et al., 2009). Although this report does not immediately imply the supernova explosion of Betelgeuse, it triggered

the possibility of the nearby supernova. The simulation study based on the Livermore model predicts the 30MHz neutrino event during a burst from a supernova within a few hundred light years. The current SK data acquisition (DAQ) system can record only the first 20% of these events and a large fraction of the data afterwards will be lost. To overcome this problem, we developed a new DAQ system to record the number of hit PMTs. This system enabled us to store high-rate events and study a time profile of the number of neutrinos emitted at the supernova.

This new system uses the number of hits from existing frontend electronics modules as inputs and is synchronized with them. Therefore, we can easily correlate the data from the new system and the existing system. The data is transferred to the computers via Ethernet with SiTCP. High frequency detailed data are stored for 1 minute in the 4GB DDR2 memory and they are transferred when a supernova burst is detected. The summarized data are constantly read out by the computers and stored in the disk for a week. We will monitor the event rate by this data and pre-scale the data of the existing DAQ system. The controlled pre-scaling enables us to measure the energy spectrum. Now the system is under commissioning. We will report the status of the operation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

862

Poster 1 GA - Board: 134 / 1049

Simulation of diffusive particle propagation and related TeV γ -ray emission at the Galactic Center

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Observations of the Galactic Center with the H.E.S.S. instrument have led to the detection of an extended region of diffuse TeV γ -ray emission.

The origin of this emission is not yet fully understood, although the spatial correlation between the density distribution of giant molecular clouds located at the center of our Galaxy and the intensity of the observed γ -ray excess points towards a hadronic production scenario.

The energy amount required to accelerate charged hadrons producing a γ -ray emission as observed could have been delivered by a single supernova explosion.

Assuming that highly energetic particles have been released by a single central source, we analyzed if the diffusion of relativistic hadrons is fast enough to produce an extended TeV emission through interactions with ambient matter as observed.

We numerically analyzed charged-particle motion in turbulent magnetic fields with regard to the environmental conditions of the Galactic Center region.

We present diffusion coefficients derived from a statistical analysis of the tracking of ensembles of particles in such a turbulent environment.

The derived diffusion coefficients were used to simulate the diffuse γ -ray emission from the Galactic Center region via a discretization of the diffusion equation.

The results of this modeling are presented and compared to the H.E.S.S. measurement, including both spectral and morphological analysis.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

502

Poster 1 SH - Board: 19 / 1048

Iron-rich solar particle events measured by SOHO/ERNE

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We have surveyed the SOHO/ERNE data from the beginning of the mission until the end of 2014 for solar particle events with enhancements in the Fe/C and Fe/O intensity ratio in energy ranges 5-15 MeV per nucleon and 50-150 MeV per nucleon. We have studied the relative abundances and spectral properties of heavy ions (C, N, O, Ne, Mg, Si, S, Ca, Fe) in these events. We have also studied the possible correlations of the heavy-ion enhancements with properties of associated flares and coronal mass ejections, event sizes and level of solar activity. In addition, we have compared the properties of heavy ions in these events with those of ~68 MeV proton events in the SEPServer catalogue [1], and the so-called impulsive solar particle events [2][3].

[1] Vainio R, Valtonen E, Heber B, Malandraki O, Papaioannou A, et al.: The first SEPServer event catalogue - ~68-MeV proton events observed at 1 AU in 1996-2010. *J. Space Weather Space Clim.*, 2013, 3, A12.

[2] Mason G, Mazur J, Dwyer J, Jokipii J, Gold R, Krimigis S: Abundances of heavy and ultraheavy ions in 3He-rich solar flares. *ApJ*, 2004, 606, 555.

[3] Reames D, Ng C: Heavy-element abundances in solar energetic particle events. *ApJ*, 2004, 610, 510.

Registration number following "ICRC2015-I":

467

Poster 1 GA - Board: 129 / 358

Analysis of GeV-band gamma-ray emission from SNR RX J1713.7-3946

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RX J1713-3946 is the brightest shell-type supernova remnant (SNR) of the TeV gamma-ray sky. Earlier Fermi-LAT results on low energy gamma-ray emission suggested that, despite large uncertainties in the background determination, the spectrum is inconsistent with a hadronic origin. We update the

GeV-band spectra using improved estimates for the diffuse galactic gamma-ray emission and more than double the volume of data. We further investigate the viability of hadronic emission models for RX J1713-3946. We produced a high-resolution map of the diffuse Galactic gamma-ray background corrected for the HI self-absorption and used it in the analysis of more than five years worth of Fermi-LAT data. We used hydrodynamic scaling relations and a kinetic transport equation to calculate the acceleration and propagation of cosmic rays in SNR. We then determined spectra of hadronic gamma-ray emission from RX J1713-3946, separately for the SNR interior and the cosmic-ray precursor region of the forward shock, and computed flux variations that would allow us to test the model with observations. We find that RX J1713-3946 is now detected by Fermi-LAT with very high statistical significance, and the source morphology is best described by that seen in the TeV band. The measured spectrum of RX J1713-3946 is hard with index $\gamma = 1.53 \pm 0.07$, and the integral flux above 500 MeV is $F = (5.5 \pm 1.1) \times 10^{-9}$ photons $\text{cm}^{-2} \text{s}^{-1}$. We demonstrate that scenarios based on hadronic emission from the cosmic-ray precursor region are acceptable for RX J1713-3946, and we predict a secular flux increase at a few hundred GeV at the level of around 15% over ten years, which may be detectable with the upcoming Cherenkov Telescope Array (CTA) observatory.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1092

Poster 1 CR - Board: 242 / 1143

Measurement of the average electromagnetic longitudinal shower profile at the Pierre Auger Observatory

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In addition to the standard X_{max} and energy, the longitudinal profiles of extensive air showers contain some more interesting information. For energies above $10^{17.8}$ eV, we present the average profiles as a function of depth measured for the first time at the Pierre Auger Observatory. The profile shapes for different energy ranges are all well reproduced by a Gaisser-Hillas function with two parameters. A detailed analysis of the systematic uncertainties is done using data and a full detector simulation, and the results are compared with predictions of hadronic interaction models for different primaries.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

915

Poster 1 DM and NU - Board: 284 / 1265

Acoustic positioning system for KM3NeT

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Co-authors: Carmelo Pellegrino¹; Francesco Simeone¹; Giorgio Riccobene¹; María Saldaña Coscollar²; Miguel Ardid²; Piera Sapienza¹; Robert Lahmann³; Vincent Bertin⁴

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KM3NeT is the next generation neutrino telescope in the Mediterranean Sea employing the technique of Cherenkov photon detection. The Acoustic Positioning System (APS) is a mandatory sub-system of KM3NeT that must provide the position of the telescope's mechanical structures, in a geo-referenced coordinate system. The APS is important for a safe and accurate deployment of the mechanical structures and, for science sake, for precise reconstruction of neutrino-induced events. The KM3NeT APS is composed of three main sub-systems: 1) an array of acoustic receivers (hydrophones and piezos) rigidly connected to the telescope mechanical structures; 2) a Long Base-Line (LBL) of acoustic transmitters (beacons) and receivers, anchored on the seabed in known positions; 3) a farm of PCs for the acoustic data analysis, on-shore. On shore, the positions of the acoustic receivers are calculated by measuring the ToF (Time Of Flight) of the LBL beacons' signals on the acoustic receivers, thus determining, via multi-lateration, the position of the acoustic receivers with respect to the geo-referenced LBL. The synchronized and syntonized electronics and the data transmission/acquisition allows for calculating the latencies of the whole data acquisition chain with accuracy better than 100 ns. The APS, in combination with compass and tilt, pressure, current and sound velocity data, is expected to measure the positions of the digital optical modules in the deep sea with accuracy of about 10 cm. Since data are continuously transmitted to shore and distributed to the local data acquisition network at the shore station, acoustic data are available also for Earth and Sea science users. The KM3NeT APS is also an excellent tool to study the feasibility of a neutrino acoustic detector and a possible correlation between acoustic and optical signals.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

1229

Poster 1 CR - Board: 245 / 1221

Nuclei charge measurement with AMS-02 Silicon Tracker

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The Alpha Magnetic Spectrometer (AMS-02) is an astroparticle physics detector installed on the International Space Station (ISS) on May 16th 2011 during the STS-134 NASA Endeavour Shuttle mission. The purpose of the experiment is to study with unprecedented precision and statistics charged particles and nuclei in an energy range from 0.5 GeV to few TeV. The AMS-02 Tracker System accurately determines the trajectory and absolute charge (Z) of cosmic rays by multiple measurements of the coordinates and energy loss in nine layers of double sided silicon micro-strip detectors.

This energy loss is proportional to the square of the particle charge thus allowing the distinction between different nuclei. The analog readout and the high dynamic range of the front end electronics allows to identify nuclear species from hydrogen up to iron and above. The charge resolution is naturally degraded by a number of detector effects that need to be correctly accounted for.

In this contribution we describe the procedure that has been used to accurately calibrate the Tracker response and optimize its performances in terms of charge resolution. We will discuss the resulting analysis methods available to identify different particle species in the tracker, and present the overall measured performances.

Collaboration:

AMS

Registration number following "ICRC2015-I":

929

Poster 1 CR - Board: 186 / 215

On the correlation of the angular and lateral distributions of electrons after multiple scattering allowing for energy losses

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We calculate analytically the correlation coefficient of the scattering angle and the lateral deflection for electrons being multiply scattered by small angles while losing energy.

We show that when average losses are assumed for the bremsstrahlung process the behaviour of the correlation coefficient with electron energy is completely different from that when only the ionisation losses are assumed. We also show how the correlation changes when fluctuations in the bremsstrahlung are allowed for. Based on these results an attempt to understand the correlation for electrons in EAS is made.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

Poster 1 GA - Board: 69 / 541

Long term variability study for the radio galaxy M87 with MAGIC

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M 87 is the closest extragalactic VHE object located in the Virgo cluster of galaxies at a distance of ~16 Mpc (redshift $z=0.00436$). It is the first and brightest radio galaxy detected in the TeV regime, well studied from radio to X-ray energies. The structure of its relativistic plasma jet, which is misaligned with respect to our line of sight, is spatially resolved in X-ray (Chandra), optical and radio (VLA/VLBA) observations. Thus the time correlation between the TeV flux and emission at different wavelengths provides a unique opportunity to localize the VHE emission process occurring in active galaxy nuclei. In 2005, gamma-ray emission at TeV energies was detected for the first time in M87. The very high energy (VHE, $E>100$ GeV) gamma-ray emission displays strong flux variability on timescales as short as a day. For more than 10 years, along with X-ray, optical and radio bands, it has been monitored in the TeV band by imaging atmosphere Cherenkov telescopes such as MAGIC, HESS and VERITAS. In 2008 and 2010, M87 underwent several periods of TeV activities, and rapid flares with short timescale variability were detected. MAGIC continued to monitor M87 but no major flares were detected since 2010. However, the monitoring data set allows us to study the source in quiescent flux state. Here we present the status of these studies using the data from the last 4 years of MAGIC observations.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

470

Poster 1 CR - Board: 157 / 1018

Performance and Operational Status of Muon Detectors in the Telescope Array Experiment

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Measurement of shower particles using scintillators at ground level, with different absorber thicknesses, enables detailed studies of the Telescope Array experiment's energy scale and of hadronic interaction models. We designed and constructed two types of such detectors. In this report, we present their performance and operational status.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

831

Poster 1 CR - Board: 203 / 1313

A new version of the event generator Sibyll

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The event generator Sibyll can be used for the simulation of hadronic multiparticle production up to the highest cosmic ray energies. It is optimized for providing an economic description of those aspects of the expected hadronic final states that are needed for the calculation of air showers and atmospheric lepton fluxes. New measurements from fixed target and collider experiments, in particular those at LHC, allow us to test the predictive power of the model version 2.1, which was released more than 10 years ago, and also to identify shortcomings. Based on a detailed comparison of the model predictions with the new data we revisit model assumptions and approximations to obtain an improved version of the interaction model. In addition a phenomenological model for the production of charm particles is implemented as needed for the calculation of prompt lepton fluxes in the energy range of the astrophysical neutrinos recently discovered by IceCube. After giving an overview of the new ideas implemented in Sibyll and discussing how they lead to an improved description of accelerator data, predictions for air showers and atmospheric lepton fluxes are presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

975

Poster 1 GA - Board: 131 / 1318

Cosmic ray acceleration and nonthermal emission from ultra-fast outflows in active galactic nuclei

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There is mounting evidence for the widespread existence of ultra-fast outflows in active galactic nuclei, which are powerful outflows of baryonic material approaching mildly relativistic velocities, observed as variable, blue-shifted X-ray absorption lines of ionized heavy elements. Occurring in both radio-loud and radio-quiet objects, they are plausibly interpreted as winds driven by the accretion disk, and their interaction with their environment may be the key cause of known correlations between the properties of supermassive black holes and their host galaxies. In such outflows, collisionless shocks are likely to form at different locations, either external shocks due to interaction with the ambient medium, or internal shocks due to inhomogeneities within the flow. We discuss the possibility of acceleration of electrons and hadrons at such shocks, including that of ultra-high-energy cosmic rays. Expectations for the consequent nonthermal emission from the radio band up to high-energy gamma-rays are also presented, and compared with existing data on selected objects of interest, such as ESO 323-G77 and 3C 120. Prospects for further observations with current and future instruments are addressed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

249

Poster 1 GA - Board: 130 / 998

Shaping the GeV-spectra of bright blazars

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The non-thermal spectra of jetted Active Galactic Nuclei (AGN) show a variety of shapes and degrees of curvature in their low and high energy components. From some of the brightest Fermi-LAT blazars prominent spectral breaks at a few GeV have been regularly detected which is

inconsistent with conventional cooling effects. We propose that the broad variety of spectral shapes including prominent breaks can be understood as an impact of injection modes.

We therefore present an injection model embedded in a leptonic blazar emission model for external Comptonloss dominated jets of AGN which aims towards bridging jet emission with acceleration models using a phenomenological approach.

In our setup we consider the effects of continuous time-dependent injection of electrons into the jet with differing rates, durations, locations and power-law spectral indices, and evaluate its impact on the ambient emitting particle spectrum observed at a given snapshot time. We found that varying the injection parameters has indeed notable influence on the spectral shapes, which in turn can be used to set interesting constraints on the particle injection scenario. We apply our model to the flare state spectral energy distribution of 3C 454.3 and PKS 1510-089 to constrain the required injection parameters. Our results indicate that impulsive-like particle injection is disfavored here.

With this model we provide a basis for analyzing ambient electron spectra in terms of injection requirements, with implications for particle acceleration modes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

519

Poster 1 CR - Board: 183 / 124

Neutrons produced by the Earth's crust due to Lunar and Solar tides

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The results presented in the report are based on the measurements of thermal neutrons flux produced by the Earth's surface during the experiment carried out in Pamir region at the altitude of 4200 m above sea level for the period from August 1 till August 14, 1994.

The neutrons in the Earth's atmosphere are produced mainly during the interactions between the primary cosmic rays nucleons and nuclei with energy over 1 GeV with the nuclei of the elements of the atmosphere at the fission of the atmosphere's elements nuclei. At this energy over 90% of the primary cosmic rays are protons. So we consider that the neutrons in the Earth's atmosphere are mainly produced during the interactions between the primary cosmic rays protons with energy over 1 GeV and the nuclei of the atmosphere's atoms. Consequently, neutrons intensity variations in the atmosphere can be associated with the variations of the protons flux. Geomagnetic cut-off rigidity for the experimental site (Moskvina meadow) is 9.2 GV, so energy threshold for the primary protons is 8.3 GeV.

The period from August 1 till August 14, 1994 was quiet in terms of heliophysical and geophysical conditions. No essential variations of cosmic rays in the interplanetary space and neutrons at the ground-based neutron monitors were observed, geomagnetic conditions was quiet, no chromospheric flares on the Sun were detected. During the period from August 1 till August 9 Kp-index did not exceed 2, on August 8 for a long time it was about 0. At the end of August 9 Kp-index began to increase and reached 4 at the evening of August 10. It left at this level till August 14 and then decreased. Under quiet geomagnetic conditions and absence of chromospheric flares the intensity of the secondary cosmic rays neutrons at the Moskvina meadow was expected to stay almost constant. Although spatial anisotropy of the cosmic rays intensity leads to cosmic rays daily variations due to the Earth's rotation, their value is small: for energy of several GeV daily variations are less than 1%. Nevertheless, according to the measurements during the period from August 1 till August 14, 1994 neutrons counting rate changed twofold and more throughout the day. Neutrons flux increased with approaching to the crossing of the local meridian by the Moon or the Sun, and then it decreased to the former level. The mentioned circumstances exclude the possibility for explanation of these variations by the known extraterrestrial factors.

In the present report the authors show that the observed increases of the neutron intensity are caused by lunar and solar tides.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

136

Poster 1 GA - Board: 97 / 127

NectarCAM : a camera for the medium size telescopes of the Cherenkov Telescope Array

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NectarCAM is a camera proposed for the medium-sized telescopes of the Cherenkov Telescope Array (CTA) covering the central energy range of ~ 100 GeV to ~ 30 TeV. It has a modular design and is based on the NECTAr chip, at the heart of which is a GHz sampling Switched Capacitor Array and 12-bit Analog to Digital converter. The camera will be equipped with 265 7-photomultiplier modules, covering a field of view of 8 degrees. Each module includes the photomultiplier bases, high voltage supply, pre-amplifier, trigger, readout and Ethernet transceiver. The recorded events last between a few nanoseconds and tens of nanoseconds. The camera trigger will be flexible so as to minimize the read-out dead-time of the NECTAr chips. NectarCAM can sustain a data rate of more than 4 kHz with less than 5% dead time. The camera concept, the design and tests of the various subcomponents and results of thermal and electrical prototypes are presented. The design includes the mechanical structure, cooling of the electronics, read-out, clock distribution, slow control, data-acquisition, triggering, monitoring and services.

Collaboration:

CTA

Registration number following "ICRC2015-I":

133

Poster 1 DM and NU - Board: 253 / 312

A method of electromagnetic shower identification by using isolated bars with the DAMPE BGO calorimeter

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A method is proposed for electron/hadron discrimination for 3D imaging BGO calorimeter DAMPE (DARK Matter Particle Explorer) experiment. The technique uses isolated bars which are extracted by comparing to their nearby bars in the same layer. We find that the energy distribution and location of isolated bars are highly sensitive to the type of interaction of incident particle. Based on the Monte Carlo investigation of the characters of isolated bars, we demonstrate a particle identification algorithm that can efficiently distinguish electromagnetic shower and hadronic shower. The method is verified by using beam test data taken at CERN PS and SpS.

Registration number following "ICRC2015-I":

321

Poster 1 GA - Board: 70 / 410

The VHE gamma-ray periodicity of PG1553+113: a possible probe of a system of binary supermassive black hole

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The blazar PG1553+113 is an active galaxy with uncertain redshift detected at very high energies (VHE; $E > 100$ GeV) both during high and quiescent states. We have observed with the MAGIC telescopes from La Palma PG 1553+113 at VHE since 2005, making this blazar one of the best studied MAGIC sources.

Recently, the Fermi/LAT collaboration has reported the detection of a hint of a ~ 2 -year periodicity in the integral flux emitted by the source both at high energy gamma rays ($E > 100$ MeV) and at optical wavelengths. Remarkably, this periodicity, if confirmed, might be interpreted as an evidence of the presence of a binary supermassive black hole system in the nucleus of PG1553+113.

In this contribution, we present the result of our analysis of 10 years of PG 1553+113 MAGIC data. In particular, we test the hypothesis of a periodic modulation of the overall emitted flux at VHE, search for evidences of correlation with the emission detected at other wavelengths, and critically discuss our findings in the framework of the binary supermassive black hole model.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

267

Poster 1 GA - Board: 98 / 922

TAIGA experiment –status, first results and perspectives

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The aim of the TAIGA (Tunka Advanced Instrument for cosmic ray physics and Gamma Astronomy) is to construct in the Tunka Valley (50 km from Lake Baikal) a complex, hybrid array for multi-TeV gamma-ray astronomy and CR studies. The array will consist of a wide angle Cherenkov array - Tunka-HiSCORE with ~3 km² area, a net of IACT telescopes and muon detectors with total area of up to 2000 m². We present the current status of the array construction, sensitivity to local sources of gamma-rays and first results from operation of the array prototype.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

784

Poster 1 CR - Board: 162 / 1335

In-flight operations and status of the AMS-02 silicon tracker

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The AMS-02 detector is a large acceptance magnetic spectrometer operating on the International Space Station since May 2011. More than 60 billion events have been collected by the instrument as of today. One of the key subdetectors of AMS-02 is the silicon microstrip Tracker, designed to precisely measure the trajectory and absolute charge of cosmic rays in the GeV-TeV energy range. In addition with the magnetic field is also measuring the particles rigidity and the sign of the charge. This report presents the Tracker online operations and calibration during the first four years of data taking in space. The track reconstruction efficiency and the resolution will be also reviewed.

Collaboration:

AMS

Registration number following "ICRC2015-I/":

1156

Poster 1 CR - Board: 190 / 521**The Influence of Magnetic Fields on UHECR Propagation from Virgo A****Author:** Oleh Kobzar¹**Co-authors:** Bohdan Hnatyk²; Olexandr Sushchov³; Volodymyr Marchenko⁴¹ *Institute of Nuclear Physics, Polish Academy of Sciences*² *Astronomical Observatory of Taras Shevchenko National University of Kyiv, Ukraine*³ *Chernihiv National Pedagogical University, Ukraine*⁴ *Astronomical Observatory of the Jagiellonian University, Poland***Corresponding Author:** oleh.kobzar@ifj.edu.pl

Active galactic nuclei (AGN) are considered as one of the most appropriate sources of cosmic rays with energy exceeding $\sim 10^{18}$ eV. Virgo A (M87 or NGC 4486) is the second closest to the Milky Way active galaxy. According to existing estimations it can be a prominent source of ultra high energy cosmic rays (UHECR). However not many events have been registered in the sky region near Virgo A, possibly due to magnetic field influence.

In present work we check UHECR events from recent sets of data (AUGER, Telescope Array etc.) for possibility of their origination in this AGN. We carried out the simulation of UHECR motion from Virgo A taking into account their deflections in galactic (GMF) as well as extragalactic (EGMF) magnetic fields according to several latest models. The maps of expected UHECR arrival directions have been obtained as a result.

It has been found following: 1) UHECR deflection caused by EGMF is comparable with GMF one, moreover the influence of EGMF sometimes is dominating; 2) effect of EGMF demonstrates obvious asymmetry in final distribution of expected UHECR arrival directions; 3) the results of simulation depend on chosen GMF model and are still open for further discussion.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

304

Poster 1 GA - Board: 71 / 313**HESS observations of PKS 1830-211****Author:** Jean-Francois Glicenstein¹**Co-authors:** Carlos ROMOLI²; Felix Aharonian²; François Brun³; Iurii SUSHCH⁴; Markus BOETTCHER⁴; Michael Zacharias; Sergio COLAFRANCESCO⁵; Tania GARRIGOUX⁶

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PKS 1830-211 is a lensed blazar located at $z=2.5$. The recent addition of a 28 m Cherenkov telescope (CT5) to the H.E.S.S. array extended the experiment's sensitivity towards low energies, providing access to gamma-ray energies down to 30 GeV. Data towards PKS1830-211 were taken with CT5 in August 2014, following a flare alert by the Fermi collaboration at the beginning of the month. The H.E.S.S observations were aimed at detecting a gamma ray flare delayed by ~ 25 days from the Fermi flare. These HESS data are presented and discussed.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

133

Poster 1 CR - Board: 144 / 831

R&D of EAS radio detection in China

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In order to study ultra-high-energy cosmic-ray (UHECR) sources, we need not only to know their direction, energy and chemical composition, but also large statistics of experimental data, which requires that the detector should have a large effective area and a high duty cycle. Radio antennas present some attractive aspects in this perspective, with very low unit costs, easiness of deployment over large areas and 100% duty cycle; they are therefore suitable for detecting UHECRs.

In the Tianshan Mountain range (Xinjiang Autonomous Region, China), a radio-interferometer named 21 CMA was deployed, which aims at studying the epoch of reionization by detecting the hydrogen 21 cm radiation. On this site, the Sino-French cooperation experiment TREND (Tianshan Radio Experiment for Neutrino Detection) has performed autonomous detection and identification of EAS with a stand-alone and self-triggered array of 50 radio antennas. This inspires us to investigate the polarization characteristics of the radio signal with a hybrid array of 21 scintillators and 35 antennas measuring the x, y and z components of the electric field emitted by air showers. This hybrid setup is expected to provide a quantitative evaluation of the EAS identification & background rejection of the radio technique. If successful, this experiment would open the door for stand-alone, giant radio arrays dedicated to the study of high energy cosmic particles, such as the GRAND project.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

755

Poster 1 CR - Board: 160 / 837

The NICHE Array: status and plans

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The Non-Imaging Cherenkov Array (NICHE) will be a low energy extension to Telescope Array and TALE using an array of closely spaced (~200 m) light collectors covering an area of ~2 square km. It will be deployed in the field of view of TALE and will overlap it in energy range. Showers with energies 1-100 PeV will be reconstructed using both the Cherenkov light Lateral Distribution and the Cherenkov time Width Lateral Distribution. These two methods will allow shower energy and Xmax to be determined. A prototype of the array, called j-NICHE, is currently being built and deployed. The design and plans for the full array are presented along with a plan to deploy the first 25 counters to get a true Cherenkov hybrid air shower measurement.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I/":

712

Poster 1 CR - Board: 223 / 808

The distribution of shower longitudinal profile widths as measured by Telescope Array in stereo mode

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Observing UHECR air showers in stereo mode provides a precise measurement of their longitudinal profiles. The Gaisser-Hillas function fits air shower profiles well on average. The range of shower widths can be sensitive to details of average inelasticity and multiplicity in the early part of the shower. Such a measurement can then also be used to constrain the interaction models used in simulating UHECRs. This work can augment the conventional stereo composition measurement. The distribution of the Gaisser-Hillas function FWHM value will be made in bins of energy, matching the bins used in the stereo composition analysis. These distribution will then be compared to Monte Carlo simulations using standard interaction models (QGSJet, Sibyll, EPOS).

Collaboration:

Telescope Array

Registration number following "ICRC2015-I/":

712

Poster 1 DM and NU - Board: 261 / 368**Confronting recent AMS-02 positron fraction and Fermi-LAT Extragalactic γ -ray Background measurements with gravitino dark matter****Authors:** Edson Carquin Lopez¹; German Gomez-Vargas²; Marco Aurelio Diaz Gutierrez³¹ Pontificia Universidad Católica de Chile² Pontifical Catholic University of Chile³ Pontificia Univ. Catolica de Chile (CL)**Corresponding Author:** ggomezv@uc.cl

The positron fraction measured by the space-based detectors PAMELA, Fermi-LAT and AMS-02 presents anomalous behaviour as energy increase. In particular AMS-02 observations provide compelling evidence for a new source of positrons and electrons. Its origin is unknown, it can be non-exotic (e.g. pulsars), be dark matter (DM) or maybe a mixture. We test the gravitino of bilinear R-parity violating supersymmetric models as this source. As the gravitino is a spin 3/2 particle, it offers particular decay channels, $W^\pm l_i^\mp$, $Z\nu_i$, and $H\nu_i$. We compute the electron, positron and γ -ray fluxes produced by each gravitino decay channel as it would be detected at the Earth's position. Combining the flux from the different decay modes we can fit AMS-02 measurements of the positron fraction, as well as the electron and positron fluxes, with a gravitino dark matter mass in the range 1 – 2 TeV and lifetime of $\sim 1.0 - 0.8 \times 10^{26}$ s. The high statistics measurement of electron and positron fluxes, and the flattening in the behaviour of the positron fraction recently found by AMS-02 allow us to determine that the preferred gravitino decaying mode by the fit is $W^\pm \tau^\mp$, unlike previous analyses. Then we study the viability of these scenarios through their implication in γ -ray observations. We set limits on the gravitino lifetime using the Extragalactic γ -ray Background recently reported by the Fermi-LAT Collaboration and a state-of-the-art model of its known contributors. These limits exclude the gravitino parameter space which provides an acceptable explanation of the AMS-02 data. Therefore, we conclude that the gravitino of bilinear R-parity violating models is ruled out as the unique primary source of electrons and positrons needed to explain the rise in the positron fraction.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0355

Poster 1 CR - Board: 209 / 369**Measuring the Muon Production Depth in Cosmic Ray Air Showers with IceTop****Author:** Hershhal Pandya¹

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IceTop, the surface component of the IceCube Neutrino Observatory, detects air showers initiated by cosmic ray nuclei and gamma rays. The ground level muons are correlated with the energy and mass of the primary particle. This correlation is enhanced by resolving those muons which are produced early in the shower. The muon production depth (MPD) is reconstructed as a function of muon arrival time at ground level and distance from the shower core. This technique is most efficient when there are numerous muons that can be separated from the electromagnetic component of the shower. We use CORSIKA simulations to study the ability of IceTop to reconstruct the MPD distribution as a function of the shower's impact point, energy, and zenith angle. We explore the improvement of the measurement of the primary particle energy and mass that the reconstructed MPD can provide.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

356

Poster 1 CR - Board: 247 / 1330

Study of UHECR Composition Using Telescope Array's Middle Drum Detector and Surface Array in Hybrid Mode

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The seven year Telescope Array (TA) Middle Drum hybrid composition measurement shows agreement between Ultra-High Energy Cosmic Ray (UHECR) data and a light composition obtained with QGSJetII-03 or QGSJet-01c models. The data are incompatible with a pure iron composition, for all models examined, for energies $\log_{10}(E/eV) > 18.2$. This is consistent with previous TA results. This analysis is presented using an updated version of the pattern recognition analysis (PRA) technique developed by TA.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I/":

992

Poster 1 CR - Board: 249 / 1333

Azimuthal asymmetry in the Cherenkov radiation of EAS

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For the study of Extensive Atmospheric Showers (EAS) is essential the reconstruction method of Cherenkov radiation produced by charged secondary particles. In the recent studies it was shown that to greater accuracy of the reconstruction parameters of the EAS appears as a dependence of the spatial distribution of Cherenkov radiation as function of the azimuth angle, this due to the influence of the geomagnetic field Earth's. The calculation of this dependence, in principle, could improve the accuracy of the determination of the characteristics of the primary particles based on the Cherenkov measurements. In this work, a study is presented to find the azimuth dependence of the data Tunka's.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

981

Poster 1 CR - Board: 248 / 1332

Cosmic Ray Shower Profile Track Finding for Telescope Array Fluorescence Detectors

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A simple cosmic ray track finding pattern recognition analysis (PRA) method for fluorescence detectors (FD) has been developed which significantly improves X_{max} resolution and its dependence on energy. Events which have a clear rise and fall in the FD view contain information on X_{max} that can be reliably reconstructed. Shower maximum must be extrapolated for events with X_{max} outside the field of view of the detector, which creates a systematic dependence on the fitting function. The PRA method is a model and detector independent approach to removing these events, by fitting shower profiles to a set of triangles and applying limits on the allowable geometry.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

992

Poster 1 GA - Board: 72 / 785

Upper limits on diffuse gamma-rays measured with KASCADE-Grande

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KASCADE-Grande was a multi-detector array to measure individual air showers of cosmic rays in the energy range of 10 PeV up to 1 EeV. Based on full data sets measured by KASCADE-Grande, an upper limit to the flux of ultra-high energy gamma rays in primary cosmic rays is determined. The analysis is performed by selecting air showers with low muon contents due to a small fraction of secondary hadrons in gamma ray showers with respect to hadronically induced cosmic ray showers. A preliminary result on the 90% C.L. upper limit to the relative intensity of gamma-ray induced showers with respect to all cosmic-ray primaries will be presented, and discussed with limits reported in previous measurements.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

292

Poster 1 DM and NU - Board: 285 / 786

Generation-2 IceCube Digital Optical Module and DAQ

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With recent exciting observations of astrophysical TeV- to PeV-energy neutrinos and new competitive measurements of GeV-energy atmospheric neutrino oscillations in the IceCube neutrino observatory at the South Pole, the design of a second generation Antarctic neutrino observatory, IceCube-Gen2, is underway. The design calls for two new instrumented volumes, one a denser in-fill array to extend the sensitivity of IceCube to energies low enough to gain sensitivity to the neutrino mass hierarchy, and one approximately ten times larger than IceCube, about 10 cubic kilometers in extent, to improve the sensitivity of IceCube to high energy astrophysical neutrinos and their sources. The detectors will share many common hardware elements and will leverage the successful hardware and software of the first generation experiment. They will feature updated data acquisition electronics using commercially available components and taking advantage of advances in embedded computing power. We will look at the status of the modernized in-ice Digital Optical Module (DOM) and the supporting surface electronics and data acquisition components.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

261

Poster 1 CR - Board: 168 / 1223

Development of a high efficient PMT Winston-cone system for fluorescence measurement of extensive air showers

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Fluorescence telescopes are an important technique to measure extensive air showers initiated by ultra-high energetic cosmic rays. They detect the longitudinal profile of the energy deposited in the atmosphere by the de-excitation of nitrogen molecules in the UV-range. In the past years the development of photomultiplier tubes (PMT) has led to an increase of more than 30% in photon detection sensitivity, by using new super-bialkali (SBA) photocathodes. Thus, the telescopes can detect even fainter signals over a farther area with a significant increase in aperture. To develop a telescope for a next generation cosmic ray observatory, a camera needs to have a maximal sensitive area of the focal plane. Winston-cones can efficiently cover the dead area between the photocathode of the PMTs. Such a highly efficient system composed of a SBA PMT and Winston cone has been developed based on the design of the fluorescence telescopes of the Pierre Auger Observatory. This contribution shows the development of the optical detection system and first tests in one of the fluorescence telescopes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

19

Poster 1 GA - Board: 90 / 1252

Constraining the properties of new gamma-ray MSPs with distance and velocity measurements

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The millisecond pulsar (MSP) luminosity distribution is useful to address e.g. contributions to the distribution of the diffuse positrons and gamma rays within our Galaxy. Gamma-ray luminosity versus spin-down power (\dot{E}) is also a key observable to constrain emission models. The Shklovskii effect consists of an artificial increase of the apparent period derivative value (\dot{P}) over the intrinsic one due to the pulsar's transverse motion. Accounting for this effect can significantly change the \dot{E} value in many cases: it depends on the MSP's distance and proper motion. In this contribution we will focus on the gamma-ray detection of four MSPs with the Fermi Large Area Telescope (LAT) and on parallax and proper motion measurements for an ensemble of gamma-ray MSPs using Nançay radio telescope data, that we use to compute the Shklovskii corrections and update the luminosity vs \dot{E} relation, bringing new constraints on these pulsars' properties.

Collaboration:

FERMI

Registration number following "ICRC2015-I/":

962

Poster 1 CR - Board: 217 / 573

The north-south asymmetry change during solar magnetic field reversal measured by PAMELA.

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The north-south asymmetry of galactic cosmic rays has been measured in the PAMELA experiment during the time period 2010-2014. Inside this period the solar magnetic field has been flipped. This gave the opportunity to follow the variation of the asymmetry effect. The variation of high energy cosmic rays ratio for particles arriving from Nord and South has been measured with aid of PAMELA instrument calorimeter. The solar magnetic field polarity flip has been taking place during part of this time interval. It was obtained that the value of this ratio has changed during the same time. So the obtained result confirm the conclusion about connection of Nord-South particle flux asymmetry with solar magnetic field.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

67

Poster 1 GA - Board: 99 / 869

GRAINE project: Flight data analysis of balloon-borne experiment in 2015 with emulsion gamma-ray telescope

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GRAINE is a balloon-borne experiment to observe cosmic gamma-ray with precise angular resolution and polarization sensitivity.

Main gamma-ray detector is nuclear emulsion which can record three dimensional charged particle track with sub-micron position accuracy. We use multi-stage shifter technique in order to give time information to penetrating tracks of nuclear emulsion. Arrival direction of gamma-ray can be reconstructed to the celestial sphere by combining attitude data from star camera. By measuring the beginning of electron-positron pair with nuclear emulsion, our telescope can be achieved

gamma-ray angular resolution one order of magnitude better than Fermi-LAT, and polarization sensitivity.

First balloon-borne experiment of GRAINE was performed in 2011 in TARF, Japan. Equipment of our telescope operated completely well and we measured atmosphere gamma-ray which are background when we observe cosmic gamma-ray.

Second balloon-borne experiment will be done in May 2015 in Alice Springs, Australia by JAXA international program. We aim to detect the Vela pulsar and also demonstrate the angular resolution best ever gamma-ray telescope.

In this experiment, we overall use new type nuclear emulsion which are researching and developing at Nagoya University to improve sensitivity for charged particle. Emulsion films were transported to the University of Sydney by plane, and emulsion's handling such as resetting, drying, and packing will be performed there.

For the second balloon experiment, the following equipment will be installed on a gondola with fabric pressure vessel: emulsion telescope, 3 star cameras, temperature meters, pressure meters, GPS systems, and batteries.

After development of all emulsion films at University of Sydney, emulsion films will be scanned with fully automated readout system at Nagoya University. We will analyze using these scanned data to search gamma-ray events. Attitude data using star cameras will also be analyzed.

Flight data analysis of GRAINE second balloon-borne experiment in 2015 is presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

581

Poster 1 GA - Board: 73 / 731

VERITAS Discovery of Very High-Energy Gamma-Ray Emission from RGB J2243+203

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In this talk, we report the VERITAS discovery of very high energy ($E > 100$ GeV) gamma ray emission from RGB J2243+204, previously detected in radio and X-ray. This source is also consistent with the Fermi-LAT gamma-ray source 1FHL J2244.0+2020. RGB J2243+204 has been classified both as an intermediate-frequency-peaked BL Lac object and as a high-frequency-peaked BL Lac object in the past. Despite displaying a featureless spectrum, the source distance has been constrained through optical imaging, allowing the redshift of the source to be estimated at greater than 0.39. The source was detected by VERITAS at a statistical significance > 5.7 sigma with 4 hours of VERITAS exposure between 21 Dec 2014 and 24 Dec 2014 (UT). A preliminary flux estimate of $\sim 4\%$ Crab above 180 GeV was previously announced in ATel #6849 (24 Dec 2014). In this talk, the complete VERITAS observations, analysis, and spectral results of RGB J2243+204 will be summarized. Quasi-simultaneous observations with VERITAS, Fermi-LAT and Swift XRT will also be presented.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

1144

Poster 1 GA - Board: 110 / 506

Status and plans for the Array Control and Data Acquisition System of the Cherenkov Telescope Array

Authors: Amanda Weinstein¹; Arnim Balzer²; Claudio Tanci³; David Berge⁴; David Melkumyan⁵; Etienne Lyard⁶; Fulvio Gianotti⁷; Gino Tosti⁸; Igor Oya⁵; Jordi Camprecios⁹; Josep Colomé⁹; Joseph Schwarz¹⁰; Jurek Borkowski¹¹; Matthias Fuessling⁵; Michael Mayer¹²; Peter Wegner¹³; Ralf Wischnewski⁵; Rico Lindemann⁵; Stephan Wiesand¹⁴; Thierry Le Flour¹⁵; Torsten Schmidt⁵; Ullrich Schwanke¹⁶; Vito Conforti¹⁷

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The Cherenkov Telescope Array (CTA) is the next-generation atmospheric Cherenkov gamma-ray observatory. CTA will consist of two installations, one in each hemisphere, containing tens of telescopes of different sizes. The CTA performance requirements and the inherent complexity associated with the operation, control and monitoring of such a large distributed multi-telescope array leads to new challenges in the field of the gamma-ray astronomy. The ACTL (array control and data acquisition) system will consist of the hardware and software that is necessary to control and monitor the CTA array, as well as to time-stamp, read-out, filter and store -at aggregated rates of few GB/s- the scientific data. The ACTL system must be flexible enough to permit the simultaneous automatic operation of multiple sub-arrays of telescopes with a minimum personnel effort on site. One of the challenges of the system is to provide a reliable integration of the control of a large and heterogeneous set of devices. Moreover, the system is required to be ready to adapt the observation schedule, on timescales of a few tens of seconds, to account for changing environmental conditions or to prioritize incoming scientific alerts from time-critical transient phenomena as gamma ray bursts. This contribution provides a summary of the main design choices and plans for building the ACTL system.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

310

Poster 1 CR - Board: 235 / 1037

Investigation of the flux of albedo muons with NEVOD-DECOR experimental complex

Author: Semen Khokhlov¹

Co-authors: Anna Dmitrieva¹; Dmitry Chernov¹; Igor Yashin¹; Konstantin Kompaniets¹; Rostislav Kokoulin¹; Vasily Khomyakov¹; Veronika Kruglikova¹; Victor Kindin¹; Victor Shutenko¹

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Results of investigation of the near-horizontal muons are presented in the range of zenith angles of 85 –95 degrees. In this range, so-called ‘albedo’ muons (atmospheric muons scattered in the soil into the upper hemisphere) are detected.

Measurements have been conducted with the NEVOD-DECOR experimental complex located on the campus of MEPHI. The basis of the complex is the Cherenkov water detector NEVOD with the volume of 2000 m³ equipped with a dense spatial lattice of quasi-spherical modules (91 in total). Each module consists of six FEU-200 PMTs with flat photocathodes directed along the axes of the orthogonal coordinate system. The coordinate detector DECOR is deployed around the NEVOD. DECOR includes eight vertically suspended eight-layer assemblies of plastic streamer tube chambers with resistive cathode coating with the total sensitive area 70 m². Chamber planes are equipped with two-coordinate external strip readout system. Detector DECOR allows to localize tracks of a near-horizontal muons with high angular (better than 1 degree) and spatial (about 1 cm) accuracy and allows to determine the muon direction by time-of-flight technique with probability of error of the order 10⁻². More reliably, muon direction can be obtained from the NEVOD data using the directionality of Cherenkov light. The combination of these two independent methods allows to determine the muon direction with the probability of error less than 10⁻⁸.

The results of the measurements of the flux of albedo muons for experimental series with the duration of about 20,000 hours ‘live’ time and comparison of them with different models of muon scattering in soil are presented.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

52

Poster 1 DM and NU - Board: 286 / 1034

The Dark Box instrument for fast automatic testing of the photo-multipliers for KM3NeT

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Since the early days of experimental particles physics photomultipliers have played an important role in detector design. Also in astroparticle physics research, photomultipliers are largely used, in particular in experiments employing the technique of the detection of Cherenkov photons. Currently, the KM3NeT Collaboration is building a water Cherenkov neutrino telescope in the Mediterranean Sea based on the next generation optical modules with multiple low price 3-inch photomultiplier tubes. In its final layout, the KM3NeT neutrino telescope will host several hundred thousand photomultipliers, which must be tested and calibrated during the production of the optical modules. To overcome a possible bottleneck in the production process of testing and calibration of the massive amount of photomultipliers for KM3NeT, we developed the Dark Box instrument to accelerate the process.

The Dark Box setup is designed to provide fast simultaneous automatic testing of 62 photomultipliers to verify their compliance to requirements for timing and ToT resolution and the occurrence of spurious pulses. In addition, the Dark Box can be easily converted into a general instrument for testing and calibrating large amounts of photomultipliers other than those for KM3NeT.

We report on the design and performance of the Dark Box instrument for the high-statistics measurement of the characteristics of photomultipliers and of their calibration.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I/":

549

Poster 1 GA - Board: 74 / 932

Updated results from VERITAS on the Crab pulsar

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The Crab pulsar and plerion are some of the brightest and best studied non-thermal astrophysical sources. The recent discovery of pulsed gamma-ray emission above 100 GeV from the Crab pulsar with VERITAS (the Very Energetic Radiation Imaging Telescope Array System) challenges commonly accepted pulsar emission models and puts the gamma-ray emission region far out in the magnetosphere –close to or even beyond the light cylinder. We present updated VERITAS results from the analysis of a data set that is twice the original data set published in 2011. The results are discussed in the context of discriminating between different models put forward to explain gamma-ray emission mechanisms and acceleration regions within the Crab pulsar's magnetosphere.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

795

Poster 1 CR - Board: 244 / 1218

Experimental method to measure the positron and electron fluxes in AMS-02

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The Alpha Magnetic Spectrometer AMS-02 is a high energy particle physics detector, operational on the International Space Station since May 2011. The AMS-02 goal is the fundamental physics research in space with high energy cosmic rays, during its 20 year duration mission.

The latest published results, with 30 months of data, show an excess of high energy positrons whose origin is still highly uncertain. These positrons, in addition to being produced by spallation of cosmic rays on interstellar medium, may be produced in nearby pulsars, annihilation of Dark Matter particles, or still unknown processes. In this poster, I will review the analysis technique used for measuring positron flux and electron flux, as well as positron fraction. This analysis is based on three subdetectors: the Transition Radiation Detector (TRD), the silicon tracker, and the Electromagnetic Calorimeter (ECal). I will present a method which allows the combination of estimators constructed from these three subdetectors, in order to separate first leptons and protons, and secondly positrons and electrons. I will also detail the influence and the determination of the charge confusion between the positrons and electrons at high energy. The positron and electron flux, as well as the positron fraction, will be shown and discussed.

Collaboration:

AMS

Registration number following "ICRC2015-I":

0935

Poster 1 GA - Board: 100 / 901

Low multiplicity technique for GRB observation by LHAASO-WCDA

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Detection of GeV photons from GRBs is crucial in understanding the most violent phenomenon in our universe. Due to the limited effective area of space-born experiment, very few GRBs are detected with GeV photons. Large area EAS experiments at high altitude can reach a much larger effective area around 10 GeV, for which single particle technique is usually used to lower the threshold energy but its sensitivity is poor due to losing of primary direction information. To reach an energy threshold as low as 10 GeV and keep the primary direction information at the same time, low multiplicity trigger is required, but random coincidences rather than cosmic ray showers overwhelms the signals, and it is a great challenge for traditional trigger logic and reconstruction algorithm to discriminate the signals from the noises. A new method is developed for LHAASO-WCDA to work under low multiplicity mode. With this technique, the LHAASO detector can even work under multiplicity as low as 2 while keeping the direction information at the same time. The sensitivity and expectation of LHAASO-WCDA with low multiplicity technique to GRBs are presented.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

768

Poster 1 DM and NU - Board: 255 / 168

Performance of the Read-out Electronics of the Qualification Model of DAMPE BGO Calorimeter in Environmental Tests and CERN Beam Experiment

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The DAMPE (DARk Matter Particle Explorer) is a scientific satellite mainly aimed at indirectly searching for dark matter in space. One critical sub-detector of the DAMPE payload is an electromagnetic calorimeter, which consists of 308 BGO (Bismuth Germanate Oxid) crystal bars and 616 PMTs (photomultiplier tubes), for precisely measuring the energy of cosmic rays from 5 GeV to 10 TeV. The calorimeter, with 1848 readout channels and a dynamic range of 2×10^5 for each crystal bar, is equipped with a complex readout system which contains 16 front-end electronics boards (FEE) with a total power consumption of 26 W. The qualification model of the BGO calorimeter, as well as its readout electronics, has been constructed and passed a series of environmental tests, such as EMC (Electromagnetic Compatibility) test, vibration test, thermal cycling test and thermal-vacuum test. The readout electronics system performed well and each electronics channel achieved a dynamic range of 0 to 12.5 pC with a resolution better than 3 fC and nonlinearity less than 1%. Test results showed that it could adapt to the harsh space environments. Later in the fall of 2014, an accelerator beam experiment was successfully carried out at CERN with PS and SPS facilities, which suggested that the design specifications of the BGO calorimeter and its readout electronics were achieved.

Registration number following "ICRC2015-I":

222

Poster 1 GA - Board: 104 / 894

Time calibration for the LHAASO-WCDA project

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As a major component of the LHAASO project, the main physical goal of the Water Cherenkov Detector Array (WCDA) is to survey the northern sky for VHE gamma ray sources. One of the key issues to fulfill this goal is the angular resolution and the pointing precision of the detector, which depends much on the time calibration of the whole array. In this paper, a new time calibration technique based on LED and plastic fibers is introduced. The test results of a prototype system of one cluster consisting of 40 fibers show that a precision of 0.1 ns, which meets the requirement of the experiment, can be achieved. This technique has some advantages such as robustness, scalability and cost effectiveness, so that having a great application potential to some other large area air shower experiments.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

761

Poster 1 DM and NU - Board: 287 / 968

The KM3NeT Multi-PMT Digital Optical Module

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The KM3NeT collaboration is currently constructing the first phase of a cubic kilometer-scale neutrino detector in the Mediterranean Sea. The basic detection element, the Digital Optical Module (DOM), houses 31 three-inch PMT's inside a 17 inch glass sphere. This multi-PMT concept yields a factor three increase in photocathode area, compared to a design with a single 10 inch PMT, leading to a significant cost reduction. Moreover, this concept allows for an accurate measurement of the light intensity (photon counting) and offers directional information with an almost isotropic field of view.

We will discuss these aspects and the enabling technologies, which include 3D-printed support structures, and custom low-powered PMT bases, which provide the HV and digitization of the analog signal. An FPGA based readout system transfers all sub-ns timestamped photon signals to shore via optical fibers. The DOM design has been validated and its physics potential have been proven in currently operational prototypes deployed in the French and Italian sites at 2500m and 3500m depth respectively.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

797

Poster 1 GA - Board: 101 / 608

Performance studies of the new stereoscopic Sum-Trigger-II of MAGIC after one year of operation

Authors: Daisuke Nakajima¹; Diego Herranz²; Francesco Dazzi³; Jezabel Rodriguez Garcia³; Marcos Lopez²; Schweizer Thomas³¹ *University of Tokyo*² *University Complutense of Madrid*³ *Max-Planck-Institute for Physics Munich***Corresponding Author:** dazzi@mppmu.mpg.de

MAGIC is a stereoscopic system of two Imaging Air Cherenkov Telescopes (IACTs) located at La Palma (Canary Islands, Spain) and working in the field of very high energy gamma-ray astronomy. It makes use of a traditional digital trigger with an energy threshold of around 55 GeV. A novel trigger strategy, based on the analogue sum of signals from partially overlapped patches of pixels, leads to a lower threshold. In 2008, this principle was proven by the detection of the Crab Pulsar at 25 GeV by MAGIC in single telescope operation. During Winter 2013/14, a new system, based on this concept, was implemented for stereoscopic observations after several years of development. In this contribution the strategy of the operative stereoscopic trigger system, as well as the first performance studies, are presented. Finally, some possible future improvements to further reduce the energy threshold of this trigger are addressed.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

501

Poster 1 CR - Board: 239 / 1103

Time asymmetries in the Surface Detector signals of the Pierre Auger Observatory.

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The asymmetry in the risetime of signals in Auger surface detector stations with respect to the direction of an incoming air shower is a source of information on shower development. The asymmetry is due to a combination of the longitudinal evolution of the shower and geometrical effects related to the angles of incidence of the particles into the detectors. The magnitude of the effect depends upon the zenith angle and state of development of the shower and thus provides a novel observable sensitive to the mass composition of cosmic rays above 4×10^{18} eV. By comparing measurements with predictions from shower simulations, we find for both of our adopted models of hadronic physics (QGSJETII-04 and EPOS LHC) that the mean cosmic ray mass increases with energy, as has been inferred from other studies. However the absolute values of the mass are dependent on the shower model and on the range of distance from the shower core selected. Thus the method has uncovered further deficiencies in our understanding of shower modelling that ought to be resolved before the mass composition can be inferred from $(\sec \theta)_{max}$.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

885

Poster 1 CR - Board: 145 / 1100

Taiwan Astroparticle Radiowave Observatory for Geo-synchrotron Emissions (TAROG)

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Co-authors: C.-C. Chen ²; C.-H. Chen ¹; C.-W. Chen ¹; J.-J. Huang ²; M.-Z. Wang ²; M.H. Huang ³; Pisin Chen ¹; S.-H. Wang ²; S.-Y. Hsu ²; T.C. Liu ¹; Y.-S. Shiao ⁴

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TAROGÉ is an antenna array on the high mountains of Taiwan's east coast for the detection of ultra-high energy cosmic ray (UHECR) in energy above 10^{19} eV. The antennas will point toward the ocean to detect radiowave signals emitted by the UHECR-induced air-shower as a result of its interaction with the geomagnetic field. Looking down from the coastal mountain, the effective area is enhanced by collecting both direct-emission as well as the ocean-reflected signals. This instrument also provides the capability of detecting Earth-skimming tau-neutrino through its subsequent tau-decay induced shower. A prototype station with 12 log-periodic dipole array antennas for 110-300MHz was successfully built at 1000 m elevation near Heping township, Taiwan in July 2014 to prove the detection concept. It has been operating smoothly for radio survey and optimization of instrumental parameters. We plan to install another station on a higher mountain in summer 2015. In this report, we discuss the design of TAROGÉ, performance of the prototype station, expected sensitivity, and future prospect.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1236

Poster 1 DM and NU - Board: 258 / 1274

Boosting the boost: the effect of tidal stripping on the subhalo luminosity

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In the paradigm of Λ CDM, structures form hierarchically, implying that large structures contain smaller substructures. These so-called subhalos can enhance the dark matter annihilation signal that one expects to see from a given host halo, the effect of which is called the boost factor. In the literature this boost factor is typically calculated assuming a density profile for the substructure, or analogously a concentration-mass relation, corresponding to that of field halos. However, since subhalos accreted in a gravitational potential of their host loose mass through tidal stripping and dynamical friction, they have a quite characteristic density profile, different from that of the field halos of the same mass. In this work we attempt to quantify the effect of tidal stripping on the boost factor. We find that the boost factor increases by a factor few for host halos ranging from sub-galaxy to cluster masses.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

921

Poster 1 DM and NU - Board: 256 / 919

Development of TRBs for Silicon Tracker Detector of DAMPE satellite

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The Silicon Tungsten Tracker (STK) is a detector of the DAMPE satellite to measure the incidence direction of high energy cosmic ray. It consists of 6 layers of silicon micro-strip detectors interleaved with Tungsten converter plates. The entire STK contains 73,728 readout channels totally and can be read out according to external average 50 Hz trig. It's a great challenge for space mission that all data acquisition (DAQ) works of detector signal digitization, data process and transfer are finished in 3 milliseconds dead time.

In order to meet above requirements, 8 identical Tracker Readout Boards (TRB) are developed to control and read the front Application Specific Integrated Circuits (ASIC) signals. 8 TRBs work simultaneously according to every trig. In each TRB, there are 2 Field Programmable Gate Arrays (FPGA), 48 serial ADCs to process front 144 ASICs. A SRAM is also adopted in each TRB for data buffer. LVDS and RS422 are used for scientific data and telemetry communication with payload DAQ. Benefiting from the FPGA's rich resources and feature of work in parallel, data process includes pedestal subtraction, common noise subtraction, cluster finding and data compressing is realized inside two FPGAs.

The TRB readout electronics of hardware and software for STK will be introduced in this poster.

Registration number following "ICRC2015-I/":

786

Poster 1 SH - Board: 33 / 584

Dynamics of relativistic electrons in the region of outer radiation belt, caused by solar events

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The results of the observation of short-term and long-term variations of relativistic electron flux in the region of outer radiation belt in satellite experiments ARINA and VSPLESK are presented. Scintillation spectrometers ARINA (on board the Resurs-DK1 Russian satellite, since 2006) and VSPLESK (on board the International Space Station, since 2008), developed by MEPhI, provide continuous measurements of high-energy particle fluxes in low-Earth orbits, detect and identify electrons and protons with energies in 3-30 MeV and 30-100 MeV ranges correspondingly, give the possibility to study energy spectra, pitch-angle distributions and time profiles of particle fluxes. Additionally to the main objective of experiments (search for high-energy charged particle bursts in the magnetosphere) detail analysis of experimental data on relativistic (5-7 MeV) electrons was fulfilled. It was revealed a large variability of flux of such electrons in zone of the outer radiation belt and was shown that observed effects in electron flux were caused by solar flares and coronal mass ejections. In particular, the period of significant (greater than hundreds times) changing the flux of relativistic electrons in this region during the several months of 2012 was presented in the work. Comparison between ARINA/VSPLESK experimental data on relativistic electrons and the results of Van Allen Probes was carried out.

Registration number following "ICRC2015-I":

319

Poster 1 CR - Board: 212 / 514

Measuring the energy of cosmic-ray helium with the TRD of AMS-02

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Since May 2011 the AMS-02 experiment is installed on the ISS and is observing cosmic radiation. It consists of several state-of-the-art sub-detectors, which redundantly measure charge and energy of traversing particles. Due to the long exposure time of AMS-02 of many years the measurement of cosmic-ray energy spectra is mainly limited not by statistics, but by detector response. The measurement of momentum for protons and ions, for example, is limited by the spatial resolution and magnetic field strength of the silicon tracker. The maximum detectable rigidity (MDR, rigidity is momentum per charge) for protons is about 2 TV, for Helium below 4 TV ($E < 2.1$ TeV/amu). In this contribution we investigate the possibility to extend the range of the energy measurement for heavy nuclei ($Z \geq 2$) with the transition radiation detector (TRD). The main purpose of the TRD of AMS-02 is the discrimination between light particles (electrons and positrons) and heavy particles (protons), and was thus designed as a threshold detector. The response function of the TRD, however, shows a steep increase in signal from the level of ionization at a Lorentz factor γ of about 500 to $\gamma \approx 5000$, where the transition radiation signal saturates. The increase of the signal over this energy range may be used to measure the Lorentz factor for very high energy cosmic-ray ions, e.g. for helium nuclei between about 500 GeV/amu and 5 TeV/amu, well beyond the limits of the silicon tracker. From the response curve and the signal fluctuations in the TRD we derive the energy resolution of the TRD and compare it to the resolution of the silicon tracker. Furthermore, the geometric acceptance available to a TRD-based measurement can be greater by an order of magnitude compared to a standard tracker-based analysis.

Collaboration:

AMS

Registration number following "ICRC2015-I":

1032

Poster 1 SH - Board: 34 / 609

Time dependent Geomagnetic Cutoff estimation along the ISS orbit

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In this contribution we present the calculation of a realistic, time dependent geomagnetic cutoff along the International Space Station orbit, at 400 km above the Earth's surface with an inclination of 51.6 degrees. For this work, based on the analysis of data collected by the AMS02 experiment during the first year of operation, the TS05 and IGRF models have been employed, including the temporal variation of the external component of the geomagnetic field due to the solar activity. The evaluation of the cutoff has been performed every 30 seconds along the ISS orbit by means of a backtracing technique of 1500 random trajectories simulated in the field of view of the AMS-02 experiment at any given ISS location. The technique and its results will be discussed, as well as the relevance of this study to distinguish galactic cosmic rays from trapped secondary components in the geomagnetic field.

Registration number following "ICRC2015-I":

370

Poster 1 GA - Board: 103 / 426

The TIBET AS+MD Project; progress report 2015

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We plan to build a large (approximately 10,000 m²) water Cherenkov muon detector array under the existing Tibet air shower array at

4,300 m above sea level, to observe 10-1000 TeV gamma rays from cosmic-ray accelerators in our Galaxy with wide field of view at very low background level. A gamma-ray induced air shower has significantly less muons compared with a cosmic-ray induced one. Therefore, we can effectively discriminate between primary gamma rays and cosmic-ray background events by means of counting number of muons in an air shower event by the muon detector array. We will make a progress report on the project, as some part of it started data-taking in 2014.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

397

Poster 1 CR - Board: 180 / 877

Calibration of the TA Fluorescence Detectors with Electron Light Source

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The Electron Light Source (ELS) is a linear accelerator used to perform energy calibration of the fluorescence detectors (FD) in the Telescope Array experiment. The ELS shoots a beam of 40 MeV electrons into the atmosphere 100 m in front of the Black Rock Mesa FD. Air fluorescence light is detected from nitrogen molecule excitation by the ELS electron beam. An end-to-end calibration from generation of fluorescence by air to detection of fluorescence photon by FD PMT camera is achieved. We present the calibration method and the comparison between beam data and Monte Carlo simulation.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I/":

1264

Poster 1 CR - Board: 225 / 870

Meteorological effects of muon component at the mountain muon detectors.

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Temperature effect of mountain muon detectors which exceeds a little that expected theoretically, was studied in this work. Meteorological effects of such detectors have their own peculiarities and practically were not investigated before. Data from multidirectional detectors YangBaJing, Mousala, Bure, Mt. Hermon, Yerevan (2000 m) were used for calculations from the created in IZMIRAN database of muon detectors mddb. To exclude model dependence the meteorological effects were studied by different methods.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0144

Poster 1 DM and NU - Board: 288 / 671

Design studies for a neutrino telescope based on optical fiber hydrophones

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Acoustic detection may provide way to observe ultra-high energy cosmic neutrinos, i.e. energies above 10^{18} eV, and their extra-galactic sources [1, 2]. The expected flux of cosmic neutrinos with ultra-high energy is low, so that large scale neutrino telescopes are needed for this emerging field of astroparticle physics. Using the acoustic signals induced by a neutrino interaction in water (or ice) has the advantage that sound can travel for many kilometers with only small attenuation in the relevant frequency range. A hydrophone network that uses the sea as a detection medium may therefore be the solution to detect the ultra-high energy neutrinos.

It has been advocated that fiber optic hydrophone technology is a promising means to establish a sensitive, cost-effective and large scale sensor network [3]. In

this technology several hydrophone sensors are integrated on a optical fiber. The sensors transform the acoustic pressure in to strain in the fiber. Subsequently, this strain causes a wavelength shift of the light that travels through the fiber and that is sensed using an interrogator. Hydrophones based on optical fibers, provide the required sensitivity to detect the small signals from neutrinos. At the same time, optical fibers form a cost-effective and straightforward way for the installation of a large scale network.

In this talk we discuss the system design for a fiber optic hydrophone network. We provide a flow-down from the scientific objectives to the instrument requirements. This has led to the design of a new and improved hydrophone sensor. Measurements to characterize the sensor and to show its performance will be presented. In addition the performance of the interrogator is discussed and measurements are shown, leading to an overall performance prediction of the technology.

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 [3] E. J. Buis et al. Fibre laser hydrophones for cosmic ray particle detection. *Journal of Instrumentation*, 9(03):C03051, 2014.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

454

Poster 1 GA - Board: 76 / 354

Upper limits on the VHE γ -ray flux from the ULIRG Arp 220 and other galaxies with VERITAS

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The cores of Ultra-Luminous InfraRed Galaxies (ULIRGs) are very dense environments, with a high rate of star formation and hence supernova explosions. They are thought to be sites of cosmic-ray acceleration, and are predicted to emit γ -rays in the GeV to TeV range. So far, no ULIRG has been detected in γ -rays. Arp 220, the closest ULIRG to Earth, has been well studied, and detailed models of γ -ray production inside this galaxy have been derived. They predict a rather hard γ -ray spectrum up to several TeV. Due to its large rate of star formation, high gas density, and its close proximity to Earth, Arp 220 is thought to be a very good candidate for observations in very-high-energy (VHE, above 100 GeV) γ -rays. Arp 220 was observed by the VERITAS telescopes for more than 30 hours with no significant excess over the cosmic-ray background. The upper limits on the VHE γ -ray flux of Arp 220 derived from these observations are the most sensitive limits presented so far and are starting to constrain theoretical models. The observations of Arp 220 are compared to the VERITAS flux limits derived for other galaxies.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

225

Poster 1 CR - Board: 195 / 802

Ultra-High Energy Air Shower Simulation without Thinning in CORSIKA

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Interpretation of EAS measurements strongly depends on detailed air shower simulations. One of the big limitations is the calculation time of Monte-Carlo programs like CORSIKA at very high energies. Thinning algorithm has been introduced in the past to reduce the computation time and disk space of the output at the price of the loss of small scale structures in simulated air showers. Thanks to the newly developed parallelization scheme and special tools to study multiple thinning level for a given shower on a limited disk space, it is now possible to compare thinned and unthinned simulation of a single shower to quantify these losses. Preliminary results will be presented together with the details of the last release of CORSIKA.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

32

Poster 1 CR - Board: 222 / 806

Studying Cosmic Ray Composition with IceTop using Muon and Electromagnetic Lateral Distributions

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In this contribution we will consider the methods at our disposal to estimate the mass of primary cosmic rays on an event-by-event basis using IceTop, the surface component of the IceCube detector at the geographical South Pole. We reconstruct the events using two lateral distribution functions, one for the muon component and one for the electrons and gamma rays. This results in a few parameters that are sensitive to primary mass: the muon density at large lateral distances and the steepness of the lateral distribution of the electromagnetic component of the air shower. This approach is complementary to the technique already used in IceCube, whereby one can get a mass sensitive parameter using the air shower size in IceTop together with several observables from the deep portion of the detector. Most importantly, this approach allows the study of composition-dependent anisotropy,

since the zenith angle range is not constrained by the requirement of detecting the air shower in the deep detector.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

711

Poster 1 GA - Board: 77 / 804

Fermi LAT observations of high energy gamma rays from the Moon

Authors: Francesco Loparco¹; Mario Nicola Mazziotta¹**Co-authors:** Alfredo Ferrari²; Francesco Cerutti²; Paola sala³¹ *Universita e INFN, Bari (IT)*² *CERN*³ *INFN***Corresponding Author:** francesco.loparco@ba.infn.it

We have measured the gamma-ray emission spectrum of the Moon using the data collected by the Large Area Telescope onboard the Fermi satellite during its first 77 months of operation, in an energy range from 30 MeV up to a few GeV. We have developed a full Monte Carlo simulation describing the interactions of cosmic rays with the Moon surface and the subsequent production of gamma rays using the FLUKA code. The observations can be explained in the framework of this model, where the production of gamma rays is due to the interactions of charged cosmic rays with the surface of the Moon. From the simulation results we have also inferred the cosmic-ray proton spectrum at low energies starting from the gamma-ray measurements. A time evolution study of the gamma-ray emission will be also presented.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

407

Poster 1 SH - Board: 15 / 769

Search for >30 MeV Neutrons from the 2010 June 12 Impulsive Flare

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Hard X-ray bremsstrahlung, gamma-ray lines, and >100 MeV gamma-ray emission were observed by Fermi during a 50 s burst from the M2-class X-ray flare (Ackermann et. 2012). The neutron-capture line was also observed (25 gamma/cm² indicating that tens of MeV neutrons were produced at the Sun. From this measurement we estimate that the neutron fluence at Earth would have been about 5 neutrons/cm² (Murphy et al. 2012). We present the results of a search for solar neutrons following the flare in the data taken by the neutron detector (SEDA) onboard the International Space Station. A careful analysis of the data is required because only about 10 solar neutrons should have been detected.

Registration number following "ICRC2015-I":

395

Poster 1 GA - Board: 106 / 210

Performance of the Mechanical Structure of the SST-2M GCT Telescope for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) project aims to create the next generation Very High Energy gamma-ray telescope array. It will be devoted to the observation of gamma rays over a wide band of energy, from 20 GeV to 300 TeV. Two sites are foreseen, one in the northern and the other in the southern hemisphere, allowing the viewing of the whole sky. The southern site will be equipped with about 100 telescopes, composed of three different classes, Large, Medium and Small Size Telescopes, covering the low, intermediate and high energy regions, respectively. The energy range of the Small Size Telescopes (SSTs) extends from 1 TeV to 300 TeV. Among them, the Gamma-ray Cherenkov Telescope (GCT), a telescope based on a Schwarzschild-Couder dual-mirror optical formula, is one of the prototypes under construction proposed to be part of the southern site of the future Cherenkov Telescope Array.

This contribution focuses on the mechanical structure of this telescope. It presents the mechanical design and discusses how this in the context of CTA specifications. It also describes recent developments in the assembly and installation of the opto-mechanical prototype of GCT on the French site of the Paris Observatory.

Collaboration:

CTA

Registration number following "ICRC2015-I":

Poster 1 CR - Board: 206 / 211

PROTON AND LIGHT ION INTERACTIONS IN COSMIC RAY EXPERIMENT "STRATOSPHERE" IN COMPARISON WITH RECENT COLLIDER RESULTS

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Co-authors: Aliya Argynova²; Natalya Zastrozhnova²; Nikolay Kochelev³; Serebol Tokmoldin²; Tatyana Kvochkina⁴; Turlan Sadykov²; Yernar Tautayev²

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Estimation of physical properties of exited fireball from complex final pattern of produced particles is key challenge in nucleus-nucleus collisions at high energies. Effective way to better understanding and interpretation of results consists in analyses of interaction of smaller systems, created in proton-proton or in proton-nucleus collisions. On the basis of such approach interactions of cosmic ray light nuclei and protons with different targets have been studied in the experiment "Stratosphere" at energies above 10 TeV in Lab system [1]. Results have shown that in rare events, produced by alpha-particles and light nuclei, transverse momentum spectra of secondary γ -quantum soft region (up to 2 GeV/c) have exponential character with large values of inverse slope of the distributions: $TA \sim 0,8$ GeV/c. On the contrary, in the proton interactions the slope is essentially smaller $Tp \sim 0,2$ GeV/c. For charged secondary particles the high order intermittency analyses have again demonstrated the large difference between events produced by protons and nuclei. So, the essential system size dependence in forward production dynamics has been obtained on limited statistics. Similar events were observed by JASSE and Concorde cosmic ray collaborations. New instanton-induced interpretation has been suggested for explanation. Obtained result is an important issue to be tested at collider experiments.

The launch of the Large Hadron Collider (LHC) open broad new possibilities for high energy physics at TeV scale. Previous RHIC exploration on soft physics at midrapidity [2] were developed in the work of the ALICE collaboration [3].

In the very forward region the new experiments have been performed at LHC forward detector – LHCf. In proton-proton collisions at 900 GeV and at 7 TeV transverse momentum distribution for inclusive neutral pions has been measured in 2010 [4] and in p-Pb collisions at 5.02 TeV in 2013 [5]. All proton induced data (with antiproton-proton collisions at 630 GeV from UA 7 experiment) have shown that there is the weak dependence of average value of the neutral pion PT distribution from CMS energy [6]. The exponential fit for the spectra [4, 5] well enough coincide with the correspond estimation from our Stratosphere experiment.

In the proposal [7] a new forward particle production experiment PHENIX-RHICf has suggested, in which p-p, proton-Nitrogen, and Nitrogen-Nitrogen, Fe-Nitrogen, - as a future options, - are considered. Realization of the direct collider measurements of light ion collisions will be very important both for frontier problems of high energy heavy ion physics and for actual high energy cosmic ray problems.

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Collaboration:

– not specified –

Registration number following "ICRC2015-I":

199

Poster 1 CR - Board: 197 / 1033

The multi-sources M. C. collision generator GHOST for C R simulations at LHC energies

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GHOST (1) is an extension of HDPM (Hybrid dual parton model) originally implemented in CORSIKA(2). It reproduces the pseudo-rapidity charged distribution for NSD events measured by LHCb, CMS and TOTEM up to $\sqrt{s} = 8\text{TeV}$. At this energy, two pairs of normal generators are centered symmetrically, respectively at small rapidity 1.05 and mid rapidity 4.1, with respective widths 0.95 and 1.8 units of rapidity. Together with NSD and inelastic components, we detail the diffractive component (single and double). A more important rise of central rapidity density suggests also an enhancement of the total multiplicity.

The semi-inclusive data is used to evaluate the consequences of the violation of the KNO scaling. The fluctuations of multiplicity are governed by the Negative binomial distribution and the opportunity of an asymptotic form of the energy dependent functions introduced by UA5 is investigated at UHE.; the results in limited pseudo rapidity intervals are used to evaluate a partial scaling, adjust the parameters of GHOST and describe the semi-inclusive pseudo rapidity distributions expected on a large range of rapidity. The validity of the relation between transverse momentum P_t and multiplicity at very high energy is also considered.

Those improvements have consequences in the simulation of EAS suggesting a maximum depth at higher altitude and a muon content more important than with previous models at least for $E_o \geq 2.10^{16}$ eV. Comparisons are performed in addition with unexpected signals observed in EAS and in Gamma ray families in the energy range $\sqrt{s} = 2-14$ TeV (up to 10^{17} eV for EAS).

(1) Proceedings ISVHECRI CERN 2014 (to be published in EPJ)

(2) The simulation program CORSIKA, J.Knapp, D.Heck J.N. Capdevielle, G. Schatz, T.Thouw,

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 1 GA - Board: 107 / 1079

Triggerless scheme and trigger pattern of the LHAASO-WCDA project

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The Water Cherenkov Detector Array (WCDA) of the LHAASO project is to be built in Daocheng, Sichuan Province of China. It comprises of 4 neighboring ponds, each in dimension of 150 m × 150 m, and divided into 900 cells, with a PMT in each cell. A triggerless scheme is to be adopted for the data acquiring system, in which all the single channel signals are synchronized and transferred to an online computing cluster, to build into events based on a dedicated trigger pattern. The trigger pattern is introduced in this paper. The feature of the trigger pattern is noise tolerance and scalability, and it can be generalized for some other air shower experiments.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

883

Poster 1 CR - Board: 208 / 287

High p_T muons from cosmic ray air showers in IceCube

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Cosmic ray air showers with primary energies above ~ 1 TeV can produce muons with high transverse momentum ($p_T > 2$ GeV). These isolated muons can have large transverse separations from the shower core up to several hundred meters. Together with the muon bundle they form a double track signature in km³-scale neutrino telescopes such as IceCube. These muons originate from the decay of heavy hadrons, pions, and kaons produced very early in the shower development, typically in (multiple) high p_T jets. If high p_T muons are produced simultaneously in two jets that are oriented back-to-back such interactions can also produce distinctive triple track signatures in IceCube. The separation from the core is a measure of the transverse momentum of the muon's parent particle and the muon lateral distribution depends on the composition of the incident nuclei. Hence, the composition of high energy cosmic rays can be determined from muon separation measurements. Moreover for $p_T > 2$ GeV particle interactions can be described in the context of perturbative quantum chromodynamics (pQCD) which can be used to calculate the muon lateral separation distribution. Thus these muons may help to test pQCD predictions of high energy interactions involving heavy nuclei.

We discuss the contributions from different components of air showers to the high p_T muon flux. Based on dedicated simulations the prospects of composition measurements using high p_T muons in km³-scale neutrino telescopes are studied. We present analysis methods to study laterally separated muons in IceCube with lateral separations larger than 150 m using data taken from May 2012 to May 2013

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

295

Poster 1 CR - Board: 238 / 1097

Zenithal dependence of muon intensity

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The zenithal dependence of muon intensity which reaches the earth's surface is well known as proportional to $\cos^n(\theta)$. Generally, for practical purposes and simplicity in calculations, n is taken as 2. However, compilations of measurements show dependence on the geographical location of the experiments as well as the muons energy range. Since analytical solutions appear to be increasingly less necessary because of the higher accessibility to low cost computational power, accurate and precise determination of the value of the exponent n , under different conditions, can be useful in the necessary calculations to estimate signals and backgrounds, either for terrestrial and underground experiments. In this work we discuss a method for measuring n using a simple muon telescope and the results obtained for measurements taken at Campinas (SP), Brazil ($22^\circ 54'$ W, $-41^\circ 03'$, 854 m asl) and at Fermilab - Batavia (IL), United States (41.8319° N, 88.2572° W, 220 m). After validation of the method, we intend to extend the measurements for more geographic locations due to the simplicity of the method, and thus collect more values of n that currently exist in compilations of general data on cosmic rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

892

Poster 1 CR - Board: 142 / 679

Status and Prospects of the Auger Engineering Radio Array

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The Auger Engineering Radio Array (AERA) is a low-energy extension of the Pierre Auger Observatory. It is used to detect radio emission from extensive air showers in the 30 - 80 MHz frequency band. A focus of interest is the dependence of the radio emission on shower parameters such as the energy and the distance to the shower maximum. After three phases of deployment, AERA now consists of 153 autonomous radio stations with different spacings, covering an area of about 17 km². The size, station spacings, and geographic location at the same site or near other Auger low-energy

detector extensions, are all targeted at cosmic ray energies above 10^{17} eV. The array allows us to explore different technical schemes to measure the radio emission as well as to cross calibrate our measurements with the established baseline detectors of the Auger Observatory. We will report on the most recent technological developments and experimental results obtained with AERA.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

594

Poster 1 GA - Board: 79 / 261

High energy gamma-ray study of the microquasar 1E 1740.7-2942 with Fermi-LAT

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The microquasar 1E 1740.7-2942, discovered by the Einstein satellite, is located near the Galactic Center at an angular distance of 50' from Sgr A*, and the brightest X-ray source above 20 keV in the Galactic Center region. It has extended radio lobes reaching distances of up to a few parsecs and its core radio emission is variable. In X-ray energies it shows the spectral and timing properties similar to those of black hole candidates like Cyg X-1.

GRANAT/SIGMA reported a burst of soft gamma-ray emission (300-600 keV) in 1990s which was interpreted as an electron-positron annihilation signal, but other satellite observations could not confirm the high energy feature reported by SIGMA, although a high energy tail extending up to 600 keV with a power-law photon index of 1.9 ± 0.1 has been reported by INTEGRAL, indicating a non-thermal process which might accelerate particles to even higher energies.

In this paper we report the result of gamma-ray study of 1E 1740.7-2942 above 100 MeV using the six-year Fermi-LAT archival data, and its implication on particle acceleration process in microquasars is discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

275

Poster 1 SH - Board: 7 / 266

Solar Neutrons in association with Three Large Flares observed in 2012 March 5th, 7th and 9th

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In association with three large solar flares observed in 2012 March 5th (X1.1), 7th (X5.4) and 9th (M6.3), the solar neutron detector SEDA-FIB onboard the International Space Station has detected several events from solar direction. In this paper we present the time profiles of those neutrons and discuss the physics that may be related with a possible acceleration scenario of ions over the solar surface. We will compare our data with the dynamical pictures of the flares obtained by the ultra-violet telescope of Solar Dynamical Observatory from the space and try to elucidate of the acceleration mechanism of ions.

Registration number following "ICRC2015-I":

395

Poster 1 GA - Board: 80 / 1082

A data mining approach to recognizing source classes for unassociated gamma-ray sources

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The Fermi-LAT 3rd source catalog (3FGL) provides spatial, spectral, and temporal properties for 3033 gamma-ray sources. While 2041 sources in the 3FGL are associated with AGNs (58% of the total), pulsars (5%) and the other classes (4%), 992 sources (33%) remain as unassociated sources. In recognizing source classes for unassociated gamma-ray sources of the Fermi-LAT source catalogs, various data mining techniques have been applied, e.g. artificial neural network and classification tree. As a robust alternative to these data mining techniques, we present the Mahalanobis Taguchi (MT) method to recognize source classes. The MT method creates a multidimensional Mahalanobis space from characteristic variables of a normal class (e.g. AGN) to identify sources of the normal class from those of the other classes with Mahalanobis distances. In this paper, we present the results of the source classification for the unassociated gamma-ray sources in 3FGL by applying the MT method.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

523

Poster 1 CR - Board: 224 / 846

New upper limit on strange quark matter flux with the PAMELA space experiment

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Registration number following "ICRC2015-I":

434

Poster 1 CR - Board: 215 / 537

The study on the potential of muon measurements on the determination of the cosmic ray composition using a new fast simulation technique

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In this work we study the energy evolution of the number of muons in air showers. Motivated by future plans for UHECR experiments, the analysis developed here focus on how the evolution of the moments of the shower observables distributions (Xmax and the number of muons at ground) can be used to assess the validity of a mass composition scenario, surpassing the current uncertainties on the shower description.

The cosmic ray composition is an essential ingredient for an astrophysical interpretation of the data. However, the inference of composition from air shower measurements is limited by the theoretical uncertainties on the high energy hadronic interactions. Statistical analyses using the energy evolution of different observables, like the moments of the Xmax and of the moments of the number of muons distributions, can provide an efficient method to surpass these limitations imposed by the uncertainties in hadronic interaction models and provide more reliable information about the cosmic ray abundance.

A new technique is presented here to generate a large set of simulated shower observables minimizing computer processing time. Fast algorithms to simulate the longitudinal development of the shower (i.e. CONEX) are long available. However, the number of muons is measured along the lateral development of the shower, which implies that tridimensional simulations are needed (i.e. CORSIKA).

This paper presents a parameterization of the main shower characteristics that can be used to simulate the muon lateral distribution on ground using fast simulation algorithms. The parametrization was used in CONEX to produce a large library of showers. Xmax and the lateral distribution of muons were simulated. These showers were used to explore and discriminate among hypothetical astrophysical scenarios of mass composition.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

593

Poster 1 CR - Board: 198 / 1051

Modelling the Production of Cosmogenic Radionuclides due to Galactic and Solar Cosmic Rays

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Cosmogenic radionuclides such as ¹⁰Be, ¹⁴C and ³⁶Cl are a product of the interaction of high energetic primary cosmic ray particles, in particular galactic cosmic rays (GCR), with the Earth's atmosphere. Because GCRs are modulated on their way through the interplanetary medium the GCR-induced production of these radionuclides is anti-correlated to the solar cycle. In addition, during phases of strong solar activity also solar energetic particle (SEP) events occur frequently. While the production due to GCRs can be seen as background production, in particular so-called Ground Level Enhancement (GLE) events, strong SEP events which can be detected at the Earth's surface, may strongly contribute to the production of ¹⁰Be, ¹⁴C and ³⁶Cl, a topic by now highly discussed in the literature. Using energy spectra of modern GLE events we will investigate the influence of 58 out of the 71 GLEs and statistically investigate the possibility to detect such events in present ice-core and tree-ring records.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

857

Poster 1 SH - Board: 11 / 535

Solar energetic particle events related to disk-centre full-halo coronal mass ejections

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We investigate occurrence and characteristics of solar energetic particle (SEP) events related to full halo coronal mass ejections (FHCMEs) from source locations close to the central meridian of the Sun. From the halo CME catalog of Gopalswamy et al (2010) we selected CMEs detected between 1996 and end of 2014 which originated from source locations between longitudes E10 and W10 and divided them in three groups according to the latitude: 26 equatorial events in the latitude range [N10, S10], 16 northern events in the range [N20, N10], and 22 southern events in the range [S10, S20]. We then searched for associated solar energetic particle events based on SOHO/ERNE observation of protons and helium nuclei. We characterize the observed particle events based on the CME properties, most notably the initial space speed as given in the halo CME catalog of Gopalswamy et al (2010) and the principal direction of expansion of the full halo CMEs as observed in the coronagraph images. As for SEP events in general, very different characteristics of particle events can result from closely similar CMEs. We investigate possible causes of these different characteristics in the case of this particular subset of CMEs.

Gopalswamy, N. et al. (2010), A catalog of halo coronal mass ejections from SOHO, Sun and Geosphere 5, 7-16.

Registration number following "ICRC2015-I/":

467

Poster 1 SH - Board: 10 / 534

Observations of solar energetic particle events during multiple coronal mass ejections

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We investigate associations of solar energetic particle events with multiple solar eruptions incorporating both coronal mass ejections (CMEs) and intense flares. Searching through the time period from 1996 to the end of 2013 we found three series of eruptions with start times occurring in a time window of less than two days and consisting of at least three fast and wide CMEs from the same active region and associated with intense X-ray flares and clear type II emissions. The selected events, on 24-26 November 2000, 9-11 April 2001, and 22-23 August 2005, were all halo CMEs associated with X- or M-class flares. In all cases, clear type III bursts and interplanetary type II radio emissions were observed, indicative that the CMEs were driving interplanetary shocks. The first two CMEs and flares in each group of multiple eruptions were associated with large solar energetic particle events up to high (~ 100 MeV) proton energies, while the third one in each case was not associated with an observable enhancement of the proton intensity. We investigate the possible solar and interplanetary causes for the absence of solar protons at ~ 1 AU during the third eruptions.

Registration number following "ICRC2015-I/":

467

Poster 1 CR - Board: 165 / 533

The lunar Askaryan technique: a technical roadmap

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The lunar Askaryan technique, which involves searching for Askaryan radio pulses from particle cascades in the outer layers of the Moon, is a method for using the lunar surface as an extremely large detector of ultra-high-energy particles. The high time resolution required to detect these pulses, which have a duration of around a nanosecond, puts this technique in a regime quite different from other forms of radio astronomy, with a unique set of associated technical challenges which have been addressed in a series of experiments by various groups. Implementing the methods and techniques developed by these groups for detecting lunar Askaryan pulses will be important for a future experiment with the Square Kilometre Array (SKA), which is expected to have sufficient sensitivity to allow the first positive detection using this technique.

Key issues include correction for ionospheric dispersion, beamforming, efficient triggering, and the exclusion of spurious events from radio-frequency interference. We review the progress in each of these areas, and consider the further progress expected for future application with the SKA.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

472

Poster 1 DM and NU - Board: 263 / 538

The electron spectrum from annihilation of Kaluza-Klein dark matter in the Galactic halo

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The Kaluza-Klein (KK) particles, which are the feasible candidate for the dark matter, produce electrons and positrons when they annihilate in the Galactic halo. When the electrons and positrons propagate in the Universe, their direction is randomized by the Galactic magnetic field, and energy is reduced by some energy loss mechanisms. We calculate the electron and positron spectrum expected from KK particle annihilation to be observed at Earth, taking account of propagation effects in the Galaxy.

We assume the lightest KK particle (LKP) in the mass range from 500 GeV to 1000 GeV is the dark matter consisting of the Galactic halo, and we treat the particle spectra from LKP annihilation which include electron-positron component from two-body decays and “continuum” emission. We calculate the effects of diffusion and energy loss in the Galaxy, and analyze the resulting spectra. These spectra strongly depend on the LKP mass and will be compared with recent observational data taking account of energy resolution of detectors. We can set some constraints for the boost factor of dark matter concentration in the Galactic halo. In addition, we will discuss the recent result on positron fraction based on our calculation.

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480

Poster 1 CR - Board: 159 / 1327

Development of a High Altitude LAGO Site in Peru

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The Latin American Giant Observatory (LAGO) Project is an extended Cosmic Ray Observatory mainly oriented to perform basic research in three branches: high energy phenomena, space weather and atmospheric radiation at ground level. To observe the high energy component (over 10 GeV) of Gamma Ray Bursts (GRBs), the LAGO Collaboration is installing Water Cherenkov Detectors (WCDs) in high altitude sites.

Extensive Air Showers (EAS) produced in the atmosphere by GRBs high energy photons could be detected by WCD arrays given their good sensitivity to secondary photons and other particles in the cascades, by looking for excesses over the secondary particle flux. In this work the current developments to build and characterize a high altitude (> 4600 m a.s.l.) LAGO site in the central highlands of Peru are described.

Collaboration:

LAGO

Registration number following “ICRC2015-I”:

396

Poster 1 GA - Board: 82 / 982

Study of the VHE diffuse emission in the central 200 pc of our Galaxy with H.E.S.S.

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The Very High Energy Galactic Center Ridge was revealed by H.E.S.S. in 2006, after subtraction of the point sources HESS J1745-290 possibly associated with Sgr A* and HESS J1747-281 associated with the composite supernova remnant G0.09+0.1. The hard spectrum of the Ridge emission and its spatial correlation with the local gas density suggest that the emission is due to collisions of multi-TeV cosmic rays with the dense clouds of interstellar gas present in this region.

The much larger H.E.S.S. dataset (250 hrs) that is now available from this region and the improved analysis method dedicated to faint emission allow us to reconsider the characterization of this gamma-ray emission in the central 200 pc of our Galaxy through a detailed morphology study and the

extraction of the total energy spectrum with much better accuracy.

To test the various contributions to the total gamma-ray emission, we use a 2D maximum likelihood approach that allows to constrain a phenomenological model of the signal. We discuss the nature of the various components, and their implication on the cosmic-ray distribution in the central 200 pc of our Galaxy. Finally, we will reveal an additional source in this region and will discuss its potential nature.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

828

Poster 1 CR - Board: 246 / 1328

Inelastic and diffractive cross section measurements with the CMS experiment

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The inelastic cross section has been measured in proton-proton and proton-lead collisions at centre-of-mass energies per nucleon up to 8 TeV at the LHC. Nuclear scaling effects play an important role in the simulation of cosmic ray interactions and are studied in collisions with lead nuclei. Furthermore, the probability of diffractive interactions influences the efficiency of the energy transport in extensive air showers and, thus, for example the depth of the shower maximum. We present an overview of the related results published by the CMS Collaboration.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

345

Poster 1 DM and NU - Board: 290 / 488

Moon shadow observation with the ANTARES neutrino telescope

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The ANTARES detector is the largest neutrino telescope currently in operation in the North Hemisphere.

One of the main goals of the ANTARES telescope is the search for point-like neutrino sources. For this reason both the pointing accuracy and the angular resolution of the detector are important and a reliable way to evaluate these performances is needed.

One possibility to measure the angular resolution and the pointing accuracy is to analyse the shadow of the Moon, i.e. the deficit in the atmospheric muon flux in the direction of the Moon induced by absorption of cosmic rays.

Analysing the data taken between 2007 and 2012, the Moon shadow is detected with about 3σ significance in the ANTARES data.

The first measurement of the ANTARES angular resolution and absolute pointing for atmospheric muons using a celestial calibration source is obtained. The presented results confirm the good pointing performance of the detector as well as the predicted angular resolution.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

0442

Poster 1 GA - Board: 117 / 1001

Long term stability analysis on the MD-A under TIBET III array

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The underground muon detector with water Cherenkov technique is constructed as the upgrad of the Tibet air shower array, aiming at a higher sensitivity for gamma-ray observation. In one of the modules (MD-A), the full-sealing large Tyvek bag is used as a closed? container. As the MD-A has been operated for more than one year, the long term stability of the performance of such detector is reported.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

858

Poster 1 SH - Board: 22 / 1253

High Energy Solar Particle Events foRecastIng and Analysis: The HESPERIA Project**Author:** Olga Malandraki¹**Co-authors:** Allan J. Tylka ²; Bernd Heber ³; Christos Sarlanis ⁴; Galina Bazilevskaya ⁵; Gerry Share ¹; Karl-Ludwig Klein ⁶; Marlon Nuñez ⁷; Neus Agueda ⁸; Norma Crosby ⁹; Rami Vainio ¹⁰; Rolf Buetikofer ¹¹; Ronald Murphy ¹²; Veronica Bindi ¹³¹ IAASARS, National Observatory of Athens, Athens, Greece² NASA Goddard Space Flight Center, Washington, DC, USA³ Christian-Albrechts-Universitaet zu Kiel, Germany⁴ ISNet Co, Athens, Greece⁵ Lebedev Physical Institute of Russian Academy of Sciences, Moscow, Russia⁶ Observatoire de Paris, Meudon, France⁷ University of Malaga, Spain⁸ University of Barcelona, Spain⁹ Belgian Institute for Space Aeronomy, Brussels, Belgium¹⁰ University of Turku, Finland¹¹ University of Bern, Switzerland¹² Naval Research Laboratory, Washington DC, USA¹³ University of Hawaii at Manoa, Honolulu, USA**Corresponding Author:** omaland@astro.noa.gr

Solar energetic particles are of prime astrophysical interest, but are also a space weather hazard motivating the development of predictive capabilities. The HORIZON 2020 project 'HESPERIA' will produce two novel Solar Energetic Particle (SEP) operational forecasting tools based upon proven concepts (UMASEP, REleASE). At the same time it will advance our understanding of the physical mechanisms that result into high-energy SEP events through the systematic exploitation of the high-energy gamma-ray observations of the FERMI mission and other novel datasets (PAMELA; AMS), together with in situ SEP measurements near 1 AU. Furthermore, HESPERIA will explore the possibility to incorporate the derived results into future innovative space weather services. Publicly available software to invert neutron monitor observations of relativistic SEPs to physical parameters that can be compared with the space-borne measurements at lower energies will be provided for the first time. In order to achieve these goals HESPERIA will exploit already available large datasets stored into databases such as the neutron monitor database (NMDB) and SEPServer that have been developed under FP7 projects from 2008 to 2013. The structure of the HESPERIA project, its main objectives, as well as the added value to the SEP research will be presented and discussed.

Registration number following "ICRC2015-I":

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Poster 1 SH - Board: 38 / 914

Possibilities for selected space weather and atmospheric studies in JEM-EUSO project?

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The main scientific task of JEM-EUSO is to observe the ultra high energy cosmic rays by looking the atmosphere from space. On one hand the detailed description and study of various sources of the background is important (e.g. Bertaina et al., 2014). On the other hand, the study of selected magnetospheric and ionospheric processes leading to temporal and spatial variability of UV on the orbit where JEM-EUSO is supposed to be situated, could be a useful by-product of the main task of the project. We summarize selected processes connected with atmospheric electricity and with energetic particles which can cause the events as TLE, TGE and TGFs (recently observed on mountains too). Our groups (in CBK Warsaw, in IEP Kosice) have long track of experience with measurements of waves and particles for magnetospheric/ionospheric research. The JEM-EUSO, if the experiment is added by very minor monitoring-type of suprathreshold/energetic particle device, and coordinated with other satellite measurements and with the ground based observations, may be of relevance for space weather studies related to the effects in the chain magnetosphere/ionosphere/atmosphere. We discuss such possibilities.

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0173

Poster 1 GA - Board: 118 / 427

GRAINE project: An overview and status of the 2015 balloon-borne experiment with emulsion gamma-ray telescope

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The observation of high-energy cosmic gamma-rays provides us with direct information of high-energy phenomena in the universe. Currently, AGILE and Fermi-LAT are observing gamma-ray sky and many understandings are being brought to us. However, past and current observations have significant limitations. The improvement of angular resolution and polarization sensitivity is one of keys for a breakthrough of the limitations.

We are pushing forward GRAINE project, 10MeV-100GeV cosmic gamma-ray observation with a precise (0.08deg@1-2GeV) and polarization sensitive large aperture area ($\sim 10\text{m}^2$) emulsion telescope by repeated long duration balloon flights.

We demonstrated the feasibility and performance of the emulsion gamma-ray telescope using accelerator beams with gamma-rays/electrons/muons and atmospheric gamma-rays at mountain height.

In 2011, the first balloon-borne, emulsion gamma-ray telescope experiment was successfully performed with a 125cm^2 aperture area and 4.3 hour flight duration. We demonstrated the working and performance of the emulsion gamma-ray telescope at a balloon flight for the first time. And the first understanding of the background was obtained with the emulsion gamma-ray telescope at a balloon flight.

Based on the experience and achievements of the 2011 balloon experiment, we are planning a next balloon experiment on Japan-Australia scientific ballooning at Alice Springs with a 3600cm^2 aperture area and ~ 1 day flight duration in May 2015. In the next balloon experiment, we aim to detect the Vela pulsar, a well-known bright gamma-ray source, with more than 5σ significance and to demonstrate the overall performance of the emulsion gamma-ray telescope. Then, we will start the observation with the highest imaging resolution and polarization sensitivity. And phase resolving of the pulse emission from the Vela pulsar will be also challenged.

An overview and status of the 2015 balloon experiment are presented.

Collaboration:

– not specified –

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Poster 1 DM and NU - Board: 264 / 539

The observability of gamma-ray spectral features from Kaluza-Klein dark matter annihilation

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The lightest Kaluza-Klein particle (LKP), which appears in the theory of universal extra dimensions, is one of the good candidates for cold dark matter. We assume the LKP mass ranges from 500 GeV to 1000 GeV. We focus on the LKP annihilation modes which contain gamma-rays as final products. The gamma-ray spectrum from LKP annihilation has a characteristic peak structure near the LKP mass ("lines") from two-body decays and continuum emission. Gamma rays do not lose energy during propagation after production near the galactic center where dark matter concentration is expected, so we can treat it easier than electron.

We investigate the detectability of this peak structure by considering energy resolution of near-future detector, and calculate the expected count spectrum of the gamma-ray signal. The observed gamma-ray spectrum will show the peak clearly, if the LKP mass is heavier. In contrast, if the LKP mass is light, constraint for the boost factor becomes strictly. Detecting such peak structure would be conclusive evidence that dark matter is made of LKP.

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480

Poster 1 SH - Board: 47 / 1323

Time variations of proton flux in Earth inner radiation belt for 2006-2015 years based on the PAMELA and the ARINA data

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The PAMELA and the ARINA experiments onboard satellite RESURS-DK1 are carried out since 2006 up to now. PAMELA instrument in the first place is intended to measure of high energy antiparticles in cosmic rays while main purpose of the ARINA instrument is study of high-energy charged particle bursts in the magnetosphere. Both these experiments have possibility to study protons in the inner radiation belt. Complex of these two instruments covers proton energy range from 30 MeV up to trapping limit ($E \sim 2$ GeV). Measurements with PAMELA and ARINA include both last minimum and maximum of solar cycle. It is important because existing empirical radiation belt models do not able to calculate trapped particle fluxes taking into account solar activity changing, e.g. widely used AP-8 model allows to evaluate proton fluxes just in two cases: for minimum or maximum of a solar activity. In this report we present temporal profiles of proton flux in the inner zone of the radiation belt ($1.11 < L < 1.50$, $0.18 < B < 0.22$ G for 2006 - 2015 year) based on PAMELA and ARINA measurements. Dependence of proton fluxes on degree of solar activity were studied for various phases of 23/24 solar cycle. At that it was shown that proton fluxes of energies >30 MeV at the solar minimum several times greater than at the solar maximum.

Registration number following "ICRC2015-I":

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Poster 1 GA - Board: 120 / 954

The first GCT camera for the Cherenkov Telescope Array.

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The Gamma-ray Cherenkov Telescope (GCT) is proposed to be part of the Small Size Telescope (SST) array of CTA (the Cherenkov Telescope Array). Its dual mirror optical design allows the use of a compact camera of diameter roughly 0.4m, the curved focal plane of which is equipped with 2048 pixels of $\sim 0.2^\circ$ angular size, resulting in a field of view of $\sim 9^\circ$. The GCT camera is designed to record the flashes of Cherenkov light from gamma-ray initiated electromagnetic cascades, which last only a few tens of nanoseconds. Modules based on "TARGET" ASICs provide the required fast electronics, allowing sampling at 1 GSample/s and digitization, as well as first level of triggering using the analogue outputs of the photosensors. The GCT camera is the first fully assembled prototype for a dual mirror Cherenkov telescope ever built and is currently being commissioned in the UK. On-telescope testing of its performance is expected to take place in France in September 2015. In this paper we give a detailed description of the mechanics and electronics of the camera and discuss recent progress with testing and commissioning.

Collaboration:

CTA

Registration number following "ICRC2015-I":

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Poster 1 DM and NU - Board: 291 / 1127

Performances and main results of the KM3NeT prototypes

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The KM3NeT collaboration aims to build a km³-scale neutrino telescope in the Mediterranean Sea. The first phase of construction comprises the deep-sea and onshore infrastructures at the KM3NeT-It (100 km offshore Capo Passero, Italy) and KM3NeT-Fr (40 km offshore Toulon, France) sites and the installation of 31+7 detection units. For the next step (KM3NeT 2.0) completion of two detectors are planned as extension of the detectors realized during the first phase of construction: ARCA for high energies ($E > \text{TeV}$) in Italy and ORCA for low energies (GeV range) in France.

A prototype digital optical module made of 31" PMTs was deployed in April 2013 inside the ANTARES neutrino telescope. This prototype, attached to an ANTARES string, is operating since its installation. It validated the multi-PMT technology and demonstrated the capability to identify muons with a single optical module searching for local time coincidences between PMTs inside the optical module.

A prototype detection unit made of three optical modules was installed at the KM3NeT-It site. It was deployed in May 2014; it is active and taking data. More than 700 hours of data have been recorded and analyzed. The experience achieved with this prototype detection unit validates the submarine deployment procedures, the mechanics and the electronic of the apparatus, the data taking and analysis procedures. Through the study of ⁴⁰K decay in sea water and dedicated data taking periods with flashing LED beacons, it is possible to calibrate in time the detector with nanosecond stability. A dedicated algorithm has been developed to select atmospheric muons and reconstruct their zenith

angle with a resolution of about 8 degrees. An excellent agreement is found when comparing the detected signal from muons with Monte Carlo simulations.

The performance and results of the two prototypes will be presented.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

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Poster 1 GA - Board: 121 / 1192

FACT - Charged Cosmic Ray Particles as a Tool for Atmospheric Monitoring

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FACT is the first Imaging Air Cherenkov Telescope to use solid-state photosensors (G-APD/SiPM) in order to measure the light flashes induced by air-showers. A vital part of the telescope system is the atmosphere.

Typically, external devices such as LIDARs are used to quantify the quality of the atmospheric condition.

Due to the exceptional stability of G-APD sensors, a different approach to monitor the quality of the atmosphere can be implemented. Due to this stability variations of the measured charged cosmic ray flux are an effect of changes of the atmosphere. Trigger rates of FACT are already used to identify strong disturbances for example clouds or Calima.

In a new study, we use the data taken during the past years to investigate more subtle effects like the difference between summer and winter atmosphere predicted by Monte Carlo simulations.

Collaboration:

FACT

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Poster 1 CR - Board: 141 / 145

New electronics for the surface detectors of the Pierre Auger Observatory

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The surface detector array of the Pierre Auger Observatory consists of 1660 water Cherenkov detectors that sample the charged particles and photons of air showers initiated by energetic cosmic rays at the ground. Each detector records data locally with timing obtained from GPS units and power from solar panels and batteries. In the framework of the planned upgrade of the Auger Observatory, new electronics has been designed for the surface detectors. The electronics upgrade includes better timing with up-to-date GPS receivers, higher sampling frequency, increased dynamic range, increased processing capability, and better calibration and monitoring systems. It will also process the data of the additional scintillator detectors planned for the upgrade. In this paper, the design of the new electronics will be presented and its performance will be discussed.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

29

Poster 1 CR - Board: 193 / 750

Parallelization schemes for AIRES's Monte Carlo

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In this work we introduce different parallelization schemes implemented in the AIRES (AIR-shower Extended Simulations) software, in order to perform simulations, without thinning algorithm, in HPC clusters.

The AIRES's particle stack was modified to define a new structure allowing its parallelization using MPI library.

Adopting this new structure, three different parallelization tactics were implemented according to how particles are transferred between the working nodes: 1) Transfer based on the amount of particles stored in the stacks, 2) Transfer based on the energy of particles stored in the stacks 3) Transfer based on the energy of particles stored in the stacks, with decisions according the characteristics of the particle's nucleus type.

As part of this paper will be present a comparison of the obtained results between the most performant parallelized version of AIRES and original version of AIRES, considering longitudinal and lateral profiles of vertical showers induced by Fe primaries of $10^{16.75} eV$.

Towards the end of this work we will include an analysis of performance results of each parallelization tactic evaluated by different simulations of vertical showers whose energies are between $10^{15.75} eV$ and $10^{18.75} eV$.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 1 CR - Board: 194 / 758

Diffusion and Anisotropy of Cosmic Rays in the Galaxy: Beyond the Dipole

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The transport of Galactic cosmic rays in both turbulent and regular magnetic fields can be described in terms of diffusion and drift motions. These produce gradients of cosmic-ray densities. The anisotropy resulting from these gradients for an observer located anywhere in the Galaxy is commonly described in terms of a pure dipole moment, the amplitude of which is proportional to the gradient at the observer point normalised by the density at the same observer point. By calculating the angular distribution on the sphere of the observer in the specific case of cosmic rays propagating diffusively from a single source, we show that this recipe to estimate the dipole moment is only an approximation, and that higher order moments are actually also expected. Since a dipole moment is by essence a vector, it is conceivable to build configurations of sources where the global vector cancels even with a non-vanishing gradient of cosmic-ray density. In this case, the non-vanishing gradient would show up at higher order moments that do not add linearly, such as the moment describing a symmetric quadrupole. Although the dipole moment is expected to remain dominant for an observer located on Earth and for sources distributed in the Galactic disk, the description given in this paper of the anisotropy expected within a pure diffusion model could contribute to some extent to explain the observed anisotropies of low-energy cosmic rays beyond the dipole.

Collaboration:

– not specified –

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607

Poster 1 GA - Board: 122 / 565

Photon Reconstruction for H.E.S.S. Using a Semi-Analytical Model

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The High Energy Stereoscopic System (H.E.S.S.) is an array of five Imaging Atmospheric Cherenkov Telescopes (IACTs) designed to detect and image cosmogenic gamma-rays with very high energies. Originally consisting of just four identical IACTs (CT1-4) with an effective mirror diameter of 12 m each, it was expanded with a fifth IACT (CT5) with a mirror diameter of 28 m in 2012. Being the largest IACT worldwide, CT5 allows to lower the energy threshold of H.E.S.S., enabling to close the energy gap between space-based detectors and IACTs. Events can be analysed either monoscopically (i.e. using only information of CT5) or stereoscopically (requiring at least two triggered

telescopes per event). To achieve a good performance, a sophisticated event reconstruction and analysis framework is indispensable. This is particularly important for H.E.S.S. since it is now the first IACT array that consists of different telescope types. An advanced reconstruction method is based on a semi-analytical model of electromagnetic particle showers in the atmosphere ("model analysis"). The properties of the primary particle are reconstructed by comparing the image recorded by each triggered telescope with the Cherenkov emission from the shower model using a log-likelihood maximisation. Due to its performance, this method has become one of the standard analysis techniques applied to CT1-4 data. Now it has been modified for use with the five-telescope array. We present the adapted model analysis and its performance in both monoscopic and stereoscopic analysis mode.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

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Poster 1 CR - Board: 187 / 227

Transition radiation at radio frequencies from ultra-high energy neutrino-induced showers.

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Detection of transition radiation from neutrino-induced showers escaping a dense medium is a promising technique which might be employed in future generations of ultra-high energy neutrino detectors. Using the well-known ZAS-Halzen-Stanev (ZHS) Monte Carlo simulation, we have computed the electric field created by showers crossing a dense medium-air interface. Our calculations show that transition radiation is sizeable in a wide solid angle range with full coherence up to ~ 1 GHz. These properties could make possible the design of large aperture detectors with low signal threshold. The work reported here represents a stepping stone for future dedicated investigations of particular experimental setups.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

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Poster 1 CR - Board: 138 / 503

AugerNext: R&D studies at the Pierre Auger Observatory for a next generation ground-based ultra-high energy cosmic ray experiment

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The findings so far of the Pierre Auger Observatory and those of the Telescope Array define some requirements for a possible next generation global cosmic ray observatory: it needs to be considerably increased in size, it needs good sensitivity to composition, and it has to cover the full sky. At the Pierre Auger Observatory, AugerNext aims to conduct some innovative initial research studies on a design of a sophisticated hybrid detector fulfilling these demands. Within a European supported ASPERA/APPEC (Astroparticle Physics European Consortium) project for the years 2011-2014, such R&D studies primarily focused on the following areas: i) consolidation of the detection of cosmic rays using MHz radio antennas; ii) proof-of-principle of cosmic ray microwave detection; iii) test of the large-scale application of new generation photo-sensors; iv) generalization of data communication techniques; and v) development of new schemes for muon detection with surface arrays. This contribution summarizes the achievements of these R&D studies within the AugerNext project.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

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Poster 1 SH - Board: 12 / 568

Suprathermal ions at 1 AU in solar wind fluxes from near equatorial coronal holes in 2006-09

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Ion energy spectra and abundance ratios were studied in 0.04-2 MeV/nucleon ion fluxes using ACE/ULEIS data during the solar minimum between solar cycles 23 and 24. The unique prolonged minimum of 2006-2009 permitted to select 35 quiet time periods when suprathermal ion fluxes from near equatorial coronal holes (CH) were observed at 1 AU. The values of relative ion abundances indicate the presence of a particle population accelerated in different processes on the Sun or in the interplanetary space and forming suprathermal particle fluxes. Suprathermal C/O and Fe/O ratios from coronal holes were found to correlate with their bulk solar wind values from CH (ACE/SWICS data) whereas suprathermal 4He/O values were about ten times higher than their bulk wind values. 3He, 4He, Fe, C and O ion energy spectra showed that ion intensities depended on solar wind speed and the fluxes were higher inside fast wind streams. The results obtained suggest that the bulk solar wind described by Maxwellian distribution appears to be the source of ions further accelerated to suprathermal energies forming the high energy solar wind tail. The ion spectra obtained here were fitted by power law functions or combined power law-exponential which suggests different mechanisms of acceleration.

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Poster 1 SH - Board: 40 / 1160

STUDY ON CORONAL MASS EJECTION, MAGNETIC CLOUD AND THEIR GEOEFFECTIVENESS

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A detailed investigation on geoeffectiveness of Coronal Mass Ejections [CMEs] associated with Magnetic Clouds [MCs] observed during 1996-2009 have been studied. The collected sample events are divided into two groups based on their association with CMEs related to geomagnetic storms, Dst \leq -50 nT eg. 1. geoeffective events & 2. For nongeoeffective events, Dst \geq -50 nT. Other field parameters and their various derivatives & variance [BZV, BZV2, (BZ)2V] have been analysed in an attempt to study mechanism and the cause of geoeffectiveness. Furthermore, Halo and partial halo CMEs are likely to be the major cause for Geomagnetic storms [GMSs] of high intensity. From our investigations, we have observed that the intense and long duration, southward magnetic field component [BZ] and fast solar wind speed are responsible for geomagnetic storms. There exists a weak anti-correlation (R = -0.36) for geoeffective events between CME speed [VCME] and Dst index and relatively better correlation 1. between VCME and solar wind speed [VSW] (R=0.54) and 2. Dst index and solar wind speed (R=0.64) whereas the correlation (R=0.16) between Dst index and southward magnetic field component [BZ] is very poor.

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Poster 1 CR - Board: 171 / 501

CALET perspectives for calorimetric measurements of high energy electrons based on beam test results

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CALET is a space mission currently in the final phase of preparation for a launch to the International Space Station (ISS), where it will be installed on the Exposure Facility of the Japanese Experiment Module (JEM-EF). One of the main science goals of the experiment is the measurement of the inclusive electron (+positron) spectrum.

By integrating a sufficient exposure on the ISS, CALET will be able to explore the energy region above 1 TeV, where the presence of nearby sources of acceleration is expected to shape the high end of the electron spectrum and leave faint, but detectable, footprints in the anisotropy. In order to meet this experimental goal, CALET has been designed to achieve a large proton rejection capability ($>10^5$) thanks to a full containment of electromagnetic showers in a $27 X_0$ thick calorimeter (TASC) preceded by a $3 X_0$ fine-grained pre-shower calorimeter (IMC) with imaging capabilities. In this paper the expected performance of the instrument with electrons will be discussed on the basis of the results of measurements performed during beam calibration tests at CERN-SPS at beam energies up to 290 GeV.

Collaboration:

CALET

Registration number following "ICRC2015-I/":

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Poster 1 GA - Board: 108 / 729**A major electronics upgrade for the H.E.S.S. Cherenkov telescopes 1-4****Author:** Gianluca Giavitto¹

Co-authors: Arnim Balzer²; Axel Kretzschmann¹; Christian Stegmann¹; David Berge³; David Salek³; Duncan Ross⁴; Emmanuel Moulin⁵; Francois Brun⁶; François Toussenel⁷; Hartmut Lüdecke¹; Holger Leich¹; Jean-Francois Glicenstein⁵; Jim Hinton⁸; Julian Thornhill⁴; Marandon Vincent⁹; Marek Penno¹⁰; Marko Kossatz¹; Markus Schade¹; Mathieu de Naurois¹¹; Matthias Fülling¹; Patrick Nayman⁷; Rachel Christiane Simoni¹²; Stefan Klepser¹³; Terry Ashton⁴; Thomas Chaminade¹⁴; Thomas Schwab⁹; Valentin lefranc⁵; eric delagnes⁵

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Poster 1 GA - Board: 135 / 607**Time-dependent injection as a model for rapid blazar flares****Author:** Michael Zacharias^{None}**Corresponding Author:** m.zacharias@lsw.uni-heidelberg.de

The detection of very rapid flares on the order of minutes in blazars has spawned a lot of theoretical activity. Even though many models take time-dependent effects (such as varying magnetic fields, etc) into account, a time-dependent nature of the injection process is usually omitted. In this presentation

it is shown using the standard one-zone model that time-dependent injection has strong effects on the resulting spectra of blazars. Due to the time-dependency of the injection the particles cannot reach an equilibrium state and the kinetic equation for the electron distribution function becomes non-linear. This leads to (i) much faster electron cooling and (ii) a change in the cooling process after some time depending on the injection parameters. This change in the cooling process has direct and very significant effects for the spectrum of a flaring blazar.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 1 GA - Board: 109 / 603

ROI: A Prototype Data Model for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) will be a ground-based gamma-ray observatory with full-sky coverage in the very-high energy (VHE) regime. It is proposed to consist of more than 100 telescopes and should produce large amounts of data, possibly exceeding the volume of current VHE Imaging Atmospheric Cherenkov Telescopes by ~two orders of magnitude. This volume of data represents a new challenge to the VHE community, which is looking for new data formats to transfer and store the CTA data. One of the prototypes currently under study is the ROI (Regions Of Interest) file format for camera images. It stores only those pixels of a camera image that are close to the shower, thus removing the major part of the night sky background while keeping all pixels that might belong to the shower. Simple, on-the-fly compression is used to reduce the file size even further.

Here, we explain the ROI prototype in detail and present preliminary results applied to real data and simulations.

Collaboration:

CTA

Registration number following "ICRC2015-I":

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Poster 1 GA - Board: 91 / 1202

A new time-dependent likelihood technique for detection of gamma-ray bursts with IACT arrays

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In imaging atmospheric Cherenkov telescope arrays (IACTs), the standard method of statistically inferring the existence of a source is based on the maximum likelihood method of Li&Ma (1983). We will present a new statistical approach, also based on maximum likelihood theory, which takes into account a priori knowledge of the source light curve. This approach is especially useful for observations of rapidly decaying gamma-ray bursts (GRBs). Using Monte Carlo simulations, the new maximum likelihood test statistic is evaluated under realistic conditions for GRBs observed by current generation IACT arrays, and a moderate improvement in sensitivity is projected. To calculate the improvement, we conservatively assume that the Li&Ma integration time has been optimally chosen, which isn't possible in reality without prior knowledge of the burst fluence. The sensitivity improvement depends on the decay index of the burst and the observing delay, but is projected to be approximately 30% for a typical observation near the threshold of detection (typical is defined as a burst observed with a 2min delay and that decays as a power law of index -1). An even larger improvement is projected for quickly observed, rapidly decaying GRBs. The method is shown to be relatively resilient to uncertainties in the light curve, as long as it still captures the decaying nature of the GRB flux. We will also discuss results established by using this technique to analyze VERITAS GRB observations.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

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Poster 1 CR - Board: 185 / 152

LARGE-SCALE ANISOTROPY OF TeV-BAND COSMIC RAYS

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The expected anisotropy in the 1 to 104 TeV energy range is calculated for Galactic cosmic rays with both anisotropy in the diffusion tensor and source discreteness taken into account. We find that if the sources are distributed radially (but with azimuthal symmetry) in proportion to Galactic pulsars, the expected anisotropy almost always exceeds the observational limits by one order of magnitude in the case of isotropic diffusion. If the radial diffusion is more than an order of magnitude smaller than the azimuthal diffusion rate, the radial gradient of the sources can be accommodated about 5% of the time. If the sources are concentrated in the spiral arms, then the anisotropy depends on our location between them, but in some spatial window, roughly equidistant from adjacent spiral arms, the observational constraints on anisotropy are obeyed roughly 20%–30% of the time for extremely anisotropic diffusion. The solar system is in that window less than 10% of the time, but it may be there now. Under the assumption of isotropic diffusion, nearby supernovae are found to produce a discreteness anisotropy that is nearly two orders of magnitude in excess of the observational limit if all supernovae are assumed to contribute equally with a source rate 1 in every 100 years

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 1 SH - Board: 41 / 1161**Solar-cycle dependence of selected turbulence quantities at Earth****Author:** Renier Burger¹**Co-authors:** Amore Nel¹; Nicholas Eugene Engelbrecht²¹ North-West University² SANSA**Corresponding Author:** adri.burger@nwu.ac.za

Ab initio modulation models require a number of turbulence quantities as input for any reasonable diffusion tensor. While turbulence transport models describe the radial evolution of such quantities, they in turn require observations in the inner heliosphere as input values. To study long-term modulation requires turbulence data over at least a solar magnetic cycle. As a start we analyze 1-minute resolution data for the N-component of the magnetic field, from 1974 to 2012 (initially using IMP and then ACE data), covering about two solar magnetic cycles. We assume a very simple three-stage power-law frequency spectrum to construct a second-order structure function that is fitted to the data. Apart from an inertial- and an energy range (with the transition between the two denoted by the bendover scale), we assume a cutoff range at small frequencies in order to ensure a finite energy density. The spectrum is forced to be either flat or to decrease with decreasing frequency in the latter range. Given that cosmic rays sample magnetic fluctuations over long periods in their transport through the heliosphere, we average the spectra over at least 27 days. We find that the variance of the N-component has a clear solar-cycle dependence, with smaller values ($\sim 6 \text{ nT}^2$) during solar minimum and larger during solar maximum periods ($\sim 17 \text{ nT}^2$), well correlated with the magnetic field magnitude, in agreement with previous studies. The inertial range index almost identical to the Kolomogorov value $-5/3$. Our results suggest that the dominant change in the spectrum of fluctuations of the N-component of the magnetic field, over a solar magnetic cycle, is its level. To a good approximation the spectrum retains its shape for scales up to ~ 100 times the bendover scale, while its level is well correlated with the magnitude of the magnetic field.

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Poster 1 CR - Board: 151 / 1294**NuMoon: Status of ultra high energy particle searches with LO-FAR****Author:** Sander ter Veen¹**Co-authors:** Anna Nelles²; Arthur Corstanje²; Emilio Enriquez²; Gia Trinh³; Heino Falcke⁴; Jörg Hörandel²; Jörg Rachen²; Laura Rosetto²; Maaijke Mevius¹; Olaf Scholten⁵; Pim Schellart²; Satyendra Thoudam⁶; Stijn Buitink⁷; Tijs Karskens²

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The lunar askaryan technique is one of the few ways to obtain a large enough collecting area to detect ultra high energy cosmic rays and neutrinos at the highest end of the spectrum, above 10^{21} eV. The flux of these particles is unknown, but if they are found they either point back to the best cosmic accelerators or may be the products of the decay of exotic particles and a step towards dark matter identification. The large collecting area is especially true for frequencies between 100-200 MHz, where the radiation is spread out over a wider angle and thus more of the lunar surface can be used for a possible detection. The NuMoon project therefore observes the Moon at these frequencies to search for nanosecond pulses. A first project with the Westerbork Synthesis Radio Telescope has placed the most stringent upper limits on the flux of ultra high energy cosmic rays and neutrinos. The next step is to observe with LOFAR, currently the most sensitive low frequency telescope. In this contribution I will present the status and plans of the project.

Collaboration:

– not specified –

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0977

Poster 1 GA - Board: 92 / 1118

Optical Polarimetry Campaign on Markarian 421 During the 2012 Large Flaring Episodes

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In 2012, Fermi/LAT gamma-ray and radio observations have registered the largest ever recorded flaring episodes from the blazar Markarian 421.

The unprecedented activity state of the source has remained high, and much above the normal behaviour seen from the source also for the year 2013, characterising a dramatic and long-lasting change of behaviour in the emission of the object. This unique event has been followed, and showed extreme signatures in all bands in which it was observed, from radio to VHE gamma-rays. Polarisation monitoring of the source has nevertheless been somewhat more scarce, and direct observation of the peak activity in 2012 was prevented by the source's proximity with the Sun at the time.

As part of our continuous monitoring programme of TeV emitting blazars in optical polarimetry at the Liverpool Telescope, whose first phase used the RINGO2 fast polarimeter and lasted from late 2010 to early 2013, we have observed Mkn 421 with regular coverage and a sub-weekly cadence for over two years. This continued monitoring allowed us to follow the polarisation behaviour of

the source for over two years and up to the days preceding the dramatic flare event in 2012. In the weeks before the multi-wavelength and high-energy outbursts, Mrk 421 presented an unprecedented increase in its degree of polarisation, which rose by a factor of 5, not witnessed in decades from this object. The source also showed a never-seen large rotation of its polarisation angle, by over 180 degrees. In this talk we will present our entire dataset on Mkn 421, concentrating in discussing the unprecedented events in optical polarisation that preceded the HE outburst. The main question we put ourselves is if what we have seen is a polarimetric precursor of the high activity that followed. If yes, what connections can we establish between them, and what remains mysterious to us about it?

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0543

Poster 1 DM and NU - Board: 294 / 474

A dual-PMT optical module (D-Egg) for IceCube-Gen2

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The next upgrade of IceCube Neutrino observatory (IceCube-Gen2) enhances the detection capability of neutrinos with a few hundred TeV energies or greater by the increased instrumented volume in the glacier ice. Enhancement of the optical sensor performance in detecting ultra-violet photons can be a key factor for IceCube-Gen2 to achieve a higher sensitivity as more Cherenkov lights are expected in the short wavelengths. We have developed an optical module housing two 8" photo-multiplier tubes (PMTs) in an UV transparent oval shaped glass. The two high-QE PMTs are installed in a way facing both up and down so that the resultant angular acceptance is more uniform. This uniformity of optical acceptance further improves the downward-going event detection and background veto efficiency compared to the current IceCube optical sensors. In addition, the improvements on UV transmittance of the housing glass and the inner gel lead to an improvement of the photon detection efficiency by a factor of four at wavelengths shorter than 340 nm.

Here, the initial performance of the first prototype module of D-EGG is reported. We also present simulation studies of the IceCube-Gen2 performance with the new dual-PMT modules.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

342

Poster 1 CR - Board: 243 / 1206

Measuring cosmic ray ions fluxes with AMS-02

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One of the key characteristic of Alpha Magnetic Spectrometer (AMS-02) is its capability to measure the relative abundances and absolute fluxes of the nuclear components of the galactic cosmic rays (CRs), from hydrogen up to iron ($Z=26$), in a kinetic energy range from GeV/n to TeV/n. In this contribution we discuss the methodology for the precise identification ions with AMS-02, which is relevant for the estimation of the flux ratio of secondary-to-primary CRs species, such as boro-to-carbon ratio. This is important because a precise measurement is needed to test the different propagation models and to constrain their free parameters.

The raw data are first processed to extract the relevant information for the ions study, for a more efficient handling of the entire data sample. The charge identification is a combination of Z measurements from the upper and lower time of flight scintillator layers and the inner and outer silicon tracker layers (2 located at the edges and 7 layers in the inner part of the detector). The resolution and efficiency of the charge selection process is estimated by creating independent "pure" data samples for each detection layer, exploiting the available redundancy of the charge measurement. The method for the calculation of the detector acceptance for each ion species is also described.

For the correct estimation of the ion fluxes we had to properly understand the fragmentation properties in case of interaction inside the detector (if the primary particle undergoes a charge change it might be wrongly identified). To tackle this problem, we developed dedicated analysis tools to study the interaction properties on Monte Carlo simulated events, that allow us to estimate the location, survival probability and fragmentation branches for each species.

Collaboration:

AMS

Registration number following "ICRC2015-I":

498

Poster 1 SH - Board: 48 / 1355

Geo effectiveness of halo CMEs and their association with cosmic ray intensity variations

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The Coronal Mass Ejections generally occur in large numbers during the period of high solar activity carry large amount of 1025 J and 1013 kg of plasma into interplanetary medium]. The fast CMEs coming from the Sun into interplanetary space are the solar coronal features that contain high magnetic field having the capability to produce interplanetary disturbances. CMEs travelling at different speeds tend to merge into what are known as complex ejecta, which are seen in interplanetary medium during times of high solar activity. In our studies, it is observed that halo CMEs

produce large enhancement in geomagnetic activity particularly during the high solar activity periods. We studied the relationship between Coronal Mass Ejections and cosmic ray intensity variation for the period of 1996 to 2011, covering the solar cycle 23 and ascending phase of recent solar cycle 24. To carry out the study; we have taken the entire halo CMEs data of LASCO. The cosmic ray data used in this analysis are taken from Kiel neutron monitors. We observed a negative and high correlation between occurrence rates of low latitude CMEs with cosmic rays. $A > 0$ and $A < 0$ epochs of solar magnetic cycle also show negative and good correlation between occurrence rates of CMEs and cosmic rays. However, correlation is found higher for $A < 0$ epochs in comparison to $A > 0$ epochs. We have also done three analysis to derive the effect of Halo CMEs on cosmic ray intensity. Halo CMEs produce large transient decreases in cosmic ray intensity on short-term basis.

Registration number following "ICRC2015-I/":

361

Poster 1 DM and NU - Board: 257 / 481

Simulation studies of the expected proton rejection capabilities of CALET

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The CALorimetric Electron Telescope (CALET) is a Japanese led international space mission by JAXA (Japanese AeroSpace Agency) in collaboration with the Italian Space Agency (ASI) and NASA. The instrument will be launched to the International Space Station in 2015. The major scientific goals for CALET are to measure the flux of cosmic-ray electrons (including positrons) from 1 GeV to 20 TeV, gamma rays to 10 TeV and nuclei with $Z=1$ to 40 up to 1,000 TeV. These measurements are essential to search for dark matter signatures, investigate the mechanism of cosmic-ray acceleration and propagation in the Galaxy and discover possible astrophysical sources of high-energy electrons nearby the Earth.

The instrument consists of two layers of segmented plastic scintillators for the cosmic-ray charge identification, a 3 radiation length thick tungsten-scintillating fiber imaging calorimeter and a 27 radiation length thick lead-tungstate calorimeter. Protons are the largest source of background for the high-energy electron observation. As the ratio of protons to electrons increases at higher energies, a proton rejection power better than 10^5 is necessary to measure the electron spectrum with a proton contamination below a few percent in the TeV energy region.

In this work, a Monte Carlo based study of the proton rejection capability CALET can achieve from GeV to TeV energies is presented. Both standard analysis based on consecutive selection criteria and multivariate analysis are applied to simulated samples of signal and background events.

Finally, the resulting accuracy and signal-to-background ratio expected in the electron spectrum measurement are assessed.

Collaboration:

CALET

Registration number following "ICRC2015-I/":

208

Poster 1 GA - Board: 93 / 732

Blazar Alerts with the HAWC Online Flare Monitor

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The High Altitude Water Cherenkov (HAWC) Gamma Ray Observatory monitors the gamma-ray sky in the 100 GeV to 100 TeV energy range with >95% uptime and unprecedented sensitivity for a survey instrument. The HAWC Collaboration has implemented an online flare monitor that detects episodes of rapid flaring activity from extragalactic TeV sources in the declination band from -26 to 64 degrees. This allows timely alerts to be sent to multiwavelength instruments without human intervention. The preliminary configuration of the online flare monitor achieves sensitivity to flares of at least 1 hour duration that attain an average flux of 10 times that of the Crab Nebula. While flares of this magnitude are not common, several flares reaching the level of 10 Crab have been observed in the TeV band in the past decade. With its survey capabilities and high duty cycle, HAWC will expand the observational data set on these particularly extreme flares. We will discuss results from the first alerts issued by the online flare monitor and the prospects for multiwavelength studies of blazar dynamics, the extragalactic background light, and the intergalactic magnetic field using extreme blazar flares detected by HAWC. We will also highlight upcoming improvements to the flare monitor that will extend its sensitivity to weaker flares.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

645

High-Light Talks / 875

The Voyager Journey to Interstellar Space: Overview and Update

Author: Edward Stone¹

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After a thirty-five year journey, Voyager 1 began observing the properties on the very local interstellar medium on August 25, 2012, at a radial distance of 121.6 AU. Now at 132 AU, Voyager 1 has been exploring the region where the interstellar wind and magnetic field are perturbed by the flow of interstellar ions around the heliosphere and the formation of a wall of H atoms. The plasma density is ~100 times that observed in the outer heliosphere, and the intensity of galactic cosmic rays is at the highest level observed, with transient variations caused by the arrival of Merged Interaction Regions originating at the sun. Although the interstellar magnetic field is distorted as it wraps around the heliosphere, the turbulence in the field is <1% of the average field. This very weak turbulence leads to extremely low cosmic ray scattering rates and pitch angle anisotropies that persist for months. Now at 108 AU, Voyager 2 continues to explore the outer regions of the heliosheath where the solar wind flow has turned 75 degrees from radial as it flows toward the heliotail. Even though solar maximum conditions persist, the galactic cosmic ray intensity at Voyager 2 has been increasing and is now ~80% of that observed by Voyager 1, suggesting Voyager 2 may reach interstellar space in several years.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

609

High-Light Talks / 314

The Very High Energy Sky from ~ 20 GeV to Hundreds of TeV

Author: Mathieu de Naurois¹

¹ CNRS

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After nearly a decade of operation, the three major arrays of atmospheric Cherenkov telescopes have revolutionized our view of the Very High Energy Universe, unveiling more than 100 sources of various types. MAGIC, consisting of two 17m diameter telescopes on the Canary island of La Palma, and VERITAS, with four 12m telescopes installed in southern Arizona, USA, largely explored the extragalactic sky, where the majority of the sources are active galactic nuclei (AGN), with gamma-ray emission originating in their relativistic jets. In July 2014 MAGIC discovered the most distant gamma-ray source at very high energies, the gravitationally lensed blazar S3 0218 residing at the redshift of 0.944. The FSRQ PKS 1441+25 ($z=0.939$), observed by MAGIC & VERITAS in 2015, showed a strong flaring activity over a time span of several weeks. Rapid variability from various BL Lacertae objects, down to minute timescales, has been observed by the three experiments, and measurement of their high-energy spectra allows the level of extragalactic background light to be constrained.

Since the commissioning of the fifth, large telescope in December 2012, H.E.S.S. II is the only hybrid array of Imaging Atmospheric Cherenkov Telescopes operating in the energy range ~ 20 GeV to 100 TeV. With its broad energy range, H.E.S.S. explored the Galactic Plane with unprecedented sensitivity. The legacy release of the H.E.S.S. Galactic Plane Survey, consisting of 2800 hours of observations of the Galactic disk, reveals major new results. This is the first high-resolution (~0.1 deg) and sensitive (~2% Crab Nebula point-source sensitivity) survey of the Milky Way in TeV gamma rays.

The Milky Way harbors a large variety of high energy sources of various types. In recent years, deep observations of several key Galactic regions of utmost importance for this field have been conducted by the three experiments. Among them are the Galactic Center region and its halo (particularly relevant for dark matter searches), the Cygnus region and its mysterious Milagro sources, the Crab Nebula and pulsar (surprisingly showing pulsed emission till above 1 TeV), the iconic gamma-ray supernova remnant RX J1713.7-3946 and other SNRs (Tycho, ...), the Vela pulsar and several binary systems such as LS 5039, PSR B1259-63, HESS J0632+057 and LSI 61 +303. Joint observations on several of these objects proved to be the most efficient way to understand their nature. A deep observation of the Large Magellanic Cloud revealed, for the first time, spectacular and powerful accelerators of stellar origin outside our own galaxy.

Highlights of these observations with H.E.S.S. , MAGIC and VERITAS will be presented and discussed at the conference.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

323

High-Light Talks / 527**Mapping dark matter in the Milky Way****Author:** Miguel Pato¹**Co-author:** fabio iocco²¹ *OKC Stockholm*² *Instituto de Fisica Teorica***Corresponding Author:** migpato@gmail.com

The presence of dark matter in spiral galaxies was inferred long ago by measuring the rotational speed of the gas across each galaxy. Applying the same technique to the Milky Way, a spiral itself, is much more challenging due to our peculiar position and thus the Galactic distribution of dark matter remains poorly constrained to this day. In this talk, I shall introduce two important developments for dynamical studies of the Milky Way. First, a new compilation of kinematic measurements is presented and used to pinpoint with unprecedented precision the rotation curve of our Galaxy. Second, an exhaustive array of observation-based baryonic models is constructed to set the contribution of stellar bulge, stellar disc and gas to the total gravitational potential. I will then quantify the discrepancy between these two components and derive the latest constraints on the dark matter distribution. The implications for modified Newtonian dynamics are also briefly examined. I shall end with a discussion of future directions to improve our mapping of the dark matter distribution in the Milky Way.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

461

High-Light Talks / 1376**Latest results from the Alpha Magnetic Spectrometer on the International Space Station****Author:** Samuel Ting¹¹ *Massachusetts Inst. of Technology (US)***Corresponding Author:** samuel.ting@cern.ch

In four years on the International Space Station, the AMS experiment has collected more than 65 billion cosmic rays up to TeV energies. The latest results will be summarized.

Collaboration:

AMS

Registration number following "ICRC2015-I":

0000

Invited Review Talks / 1380**Cosmic particle acceleration after a decade of VHE gamma-ray observations****Author:** Felix Aharonian¹¹ *DIAS Ireland and MPI Heidelberg***Corresponding Author:** felix.aharonian@mpi-hd.mpg.de

Gamma-rays observations are believed to play a crucial role in the solution to the long standing problem of origin of cosmic rays (CRs). The results obtained over the last decade with the space and ground based detectors have demonstrated the great potential of gamma-ray astronomy, in particular in the context of the search and identification of major contributors to the flux of galactic and extragalactic CRs.

Presently, more than 150 objects are reported as VHE gamma-ray emitters. These may be categorised into ten (or so) source populations, including Supernova Remnants (SNRs) and Active Galactic Nuclei (AGN) which have been predicted, within the frameworks of different astrophysical scenarios and conceptual/theoretical schemes, as the most likely factories of production of galactic and extragalactic CRs, respectively. However, the attempts of interpretation of these results generally reveal quite large uncertainties in estimates of the principal model parameters. This prevents us from clear-cut statements, e.g. regarding the contribution of SNRs to the bulk of galactic cosmic rays, in particular at PeV energies (the domain of the “knee” in the CR spectrum). I will briefly discuss the progress regarding the recent “hunt” for the PeVatrons, and highlight some regions in our Galaxy, including the Galactic Center, which may accommodate proton PeVatrons. If confirmed, this would be a major milestone towards the understanding the origin of galactic CRs.

At the same time, the recent gamma-ray observations demonstrate that particle acceleration is a widely spread phenomenon taking place with remarkable diversity, with regards the acceleration mechanisms, type of sources, scales of available energy, etc. In specific environments, e.g. in Pulsar Wind Nebulae (PWN) and in blazars, the particle acceleration can proceed with unusually high efficiency in the sense of both the total energy released in an ensemble of nonthermal particles and the maximum energy achieved by individual particles. In some cases these machines seem to operate at an acceleration rate close to the theoretical limit set by the classical electrodynamics.

Thus, there are many reasons to believe that the spectral, spatial and temporal studies of these extreme accelerators with the next generation gamma-ray instruments like CTA, will result in discoveries the significance of which could go beyond the traditional topics related to the origin of CRs.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

1076

Invited Review Talks / 1384**Relations between high-energy particle and cosmic-ray physics****Author:** Ralph Engel¹¹ *KIT*

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to be filled

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

975

Parallel SH 02 Outer Helio / 154

The Effect of a Dynamic Inner Heliosheath Thickness on Cosmic Ray Modulation

Author: Stefan Ferreira¹

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The time-dependent modulation of galactic cosmic rays in the heliosphere is studied over different polarity cycles by computing 2.5 GV proton intensities using a two-dimensional, time-dependent modulation model. By incorporating recent theoretical advances in the relevant transport parameters in the model we showed in previous work that this approach gave realistic computed intensities over a solar cycle. New in this work is that a time-dependence of the solar wind termination shock (TS) position is implemented in our model to study the effect of a dynamic inner heliosheath thickness (the region between the TS and heliopause) on the solar modulation of galactic cosmic rays. The study reveals that changes in the inner heliosheath thickness, arising from a time-dependent shock position, does affect cosmic ray intensities everywhere in the heliosphere.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

172

Parallel CR05 TH/aniso / 1326

The Galactic Magnetic Field and UHECR Optics

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Co-authors: Deepak Khurana¹; Michael Sutherland ; Nafian Awal¹

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Our understanding of the Galactic magnetic field (GMF) has improved tremendously in recent years. The Jansson-Farrar (2012) (JF12) GMF model is currently the most realistic and comprehensive model available. It was constrained by fitting all-sky Faraday Rotation Measures of $\sim 40k$ extragalactic sources, simultaneously with WMAP polarized (Q,U) and total synchrotron emission maps, which together provide more than 10,000 independent datapoints, each with measured astrophysical variance. The talk will give a concise review of the JF12 model and its derivation, with emphasis on which features of the GMF are well and poorly established.

The data unambiguously demand a large scale coherent component to the halo field which is a diverging-spiral centered on the Galactic center, with field lines running from South to North. In addition to the coherent component, the JF12 model describes the spatial variation of the random field strength and additionally has a “striated” random component, in both disk and halo. The puzzles posed by the large scale coherent halo and disk magnetic fields, and their possible origins, will be discussed and comparison to external galaxies will be made. The state-of-knowledge about the coherence length of the random field and the local environment of the solar system will be summarized.

A good model of the Galactic magnetic field is crucial for determining the sources of UHECRs, for modeling the transport of Galactic CRs (the halo field provides a heretofore-overlooked escape route for by diffusion along its field lines), and for calculating the background to dark matter and CMB-cosmology studies. I will present new results on the lensing effect of the GMF on UHECRs, which produces multiple images and dramatic magnification and demagnification that varies with source direction and CR rigidity, and show movies of VHECR propagation from a transient source at the Galactic Center and from the solar neighborhood.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

388

Parallel GA05 GeV excess GalCen / 431

Interacting Cosmic Rays with Molecular Clouds in the Galactic Center

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The High-Energy Stereoscopic System (HESS) has detected diffuse TeV emission correlated with the distribution of molecular gas along the Ridge at the Galactic Center. Diffuse, nonthermal emission is also seen by the Fermi large area telescope (Fermi-LAT) in the GeV range and by radio telescopes in the GHz range. Additionally, there is a distinct, spherically symmetric excess of gamma rays seen by Fermi-LAT in the GeV range. A cosmic ray flare, occurring in the Galactic Center, 10 000 years ago has been proposed to explain the TeV Ridge (Aharonian et al. 2006). An alternative, steady-state model explaining all three data sets (TeV, GeV, and radio) invokes purely leptonic processes (Yusef-Zadeh et al. 2013). We show that the flare model from the Galactic Center also provides an acceptable fit to the GeV and radio data, provided the diffusion coefficient is energy independent. However, if Kolmogorov-type turbulence is assumed for the diffusion coefficient, we find that two flares are needed, one for the TeV data (occurring approximately 10 000 years ago) and an older one for the GeV data (approximately a hundred thousand years old). We find that the flare models we investigate do not fit the spherically symmetric GeV excess

as well as the usual generalized Navarro-Frenk-White spatial profile, but are better suited to explaining the Ridge. We also show that a range of single-zone, steady-state models are able to explain all three spectral data sets. A low gas density is needed for the steady-state model to be wind driven. Higher gas densities can be accommodated by an energy independent diffusion or streaming based steady-state model. Additionally, we investigate how the flare and steady-state models may be distinguished with future gamma-ray data looking for a spatial dependence of the gamma-ray spectral index.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

404

Parallel GA06 TH / 1304

A Radiation Transfer Model for the UV-submm Radiation Fields in the Milky Way: Application to High Energy Astrophysics

Author: Richard Tuffs¹

Co-authors: Cristina Popescu²; Felix Aharonian¹; Giovanni Natale²; Ruizhi Yang¹

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We present a solution for the interstellar radiation fields (ISRF) in the Milky Way from UV to submm wavelengths based on axisymmetric radiation transfer modelling of the panchromatic SED of the galaxy in direct and dust-reradiated starlight as constrained by all-sky imaging by the IRAS, COBE and Planck satellites. This is the first self-consistent model of the spatial and spectral distribution of radiation fields that predicts all available observations, including the submm imaging from Planck. For canonical electron energy spectra we predict the relative levels and hardness of inverse compton (IC) emission from the ISRF and cosmic microwave background as a function of position in the galaxy. The ISRF component is found to become important within the solar circle not only for high energy IC emission from the diffuse interstellar medium, but also for very high energy IC emission from sources of cosmic ray electrons, notwithstanding the diminution of the ISRF component through the Klein-Nishina effect. We also predict the variation over the sky in visibility of very high energy gamma-ray sources within and external to the galaxy due to pair production in the mid-IR component of the ISRF.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

973

Parallel CR04 e+ e- / 207

SECONDARY POSITRONS AND ELECTRONS OBSERVED BY THE PAMELA SPECTROMETER

Author: Vladimir Mikhailov¹

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Precise measurements of electron and positron fluxes in energy range from 80 MeV to several GeV below the geomagnetic cutoff rigidity were carried out using the PAMELA magnetic spectrometer. The instrument was launched on June 15th 2006 onboard the Resurs-DK satellite on an orbit with the inclination 70 degrees and the altitude 350-600 km. It is continue to collect data so far. The procedure of trajectories calculations in the geomagnetic filed gives a way to separate stably trapped and albedo components produced in interactions of cosmic ray protons with the residual atmosphere. The work presents spatial distributions of secondary electrons and positrons in the near Earth space including the South Atlantic Anomaly. Altitudinal, latitudinal, longitudinal and temporal dependences of the fluxes are discussed. These results are particularly interesting for accurate definition of radiation models on the low Earth orbits.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

223

Parallel SH 02 Outer Helio / 377

Pick-up Ion Scattering in the Outer Heliosheath - implications for IBEX and Voyager 1 observations.

Author: Jacek Niemiec¹

Co-authors: Jacob Heerikhuisen²; Ken-Ichi Nishikawa²; Vladimir Florinski²

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The nearly circular band of energetic neutral atom (ENA) emission dominating the field of view of the Interplanetary Boundary EXplorer satellite (IBEX), is most commonly attributed to the effect of charge exchange of secondary pickup ions (PUIs) gyrating about the magnetic field in the outer heliosheath and the interstellar space beyond.

The main difficulty with this model is the problem with stability of ring distributions that tend to generate waves and scatter onto a shell on time scales too short for charge exchange to occur. We performed a careful study of the ring instability using theoretical dispersion relations, hybrid plasma simulations, and fully kinetic PIC simulations that included electron dynamics.

In addition to several prescribed distributions, we used primary ENA fluxes from the global kinetic-neutral model of the heliosphere to obtain a smooth empirical representation of

the PUI ring produced from solar-wind and heliosheath ENAs. Simulations reveal that the ring distribution generates both left- and right-hand polarized waves traveling parallel to the background magnetic field. Narrow rings generate abundant magnetic fluctuations at the resonant frequencies, whereas simulations with broadened rings show very low levels of turbulence. Nonetheless, particle scattering occurs for every type of rings we studied. Results are discussed in the context of IBEX observations of the ribbon and the recent Voyager 1 in situ measurements of magnetic field fluctuations in the outer heliosheath.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

357

Parallel CR04 e+ e- / 994

Time Dependence of the Cosmic Rays Positron Fraction

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The PAMELA magnetic spectrometer is continuously gathering data about cosmic ray positrons and electrons on board the Resurs DK satellite since July 2006. Below about 10 GeV cosmic rays are strongly modified by charge-sign dependent solar modulation effects.

In this work the time variation of the positron fraction as observed by the PAMELA experiment is presented. The large data set, about nine years from 2006 till 2015, covers most of the solar cycle 24.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

223

Parallel CR05 TH/aniso / 1305

Investigation of the galactic magnetic field with ultra-high energy cosmic rays

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We propose to perform an independent test of recent galactic magnetic field parameterizations, and to obtain information on the origin of cosmic rays. Based on 3D simulations of cosmic nuclei from their sources

to observation, we determine the average expected arrival direction for protons. As energy decreases, the average direction is expected to move away from the source line of sight to several 10th of degrees. When comparing the angular distance between these expected average arrival directions and simulated protons we find angular distances at the level of a few degrees only. The analysis includes typical energy and angular resolutions of modern observatories, and their ability to separate protons from nuclei through shower shape measurements. We quantify the expected sensitivity for evaluating galactic and extragalactic magnetic fields, and for discovering point sources of cosmic rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

986

Parallel GA05 GeV excess GalCen / 801

Observations of High-Energy Gamma-Ray Emission Toward the Galactic Centre

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The inner region of the Milky Way is one of the most interesting and complex regions of the gamma-ray sky. The intense interstellar emission and resolved point sources, as well as potential contributions by other sources such as unresolved source populations and dark matter, complicate the interpretation of the data. In this talk, we report on the Fermi-LAT team analysis of a 15x15 degree region around the direction of the Galactic centre. We describe our methodology for point-source detection and treatment of the interstellar emission. In general, the gamma-ray emission is well described by a combination of these two contributions. However, low-intensity residual emission remains and we will discuss its characterisation.

Collaboration:

FERMI

Registration number following "ICRC2015-I/":

697

Parallel GA06 TH / 752

Using GBM As Alert For A Galactic Type Ia Supernova

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A Galactic type Ia supernova(SN Ia) event would go entirely unnoticed to us due to the large optical extinction in the Milky Way plane, the weak neutrinos signal from a SN Ia, as well as the dim soft X-rays signal. But the recent SN2014J confirms that SN Ia emit gamma-ray lines, which lasts for weeks, from the $56\text{Ni} \rightarrow 56\text{Co} \rightarrow 56\text{Fe}$ decay. The lines span from 158 keV to 2.6 MeV, which occur just within the Fermi GBM energy range. The Milky Way is optically thin to gamma-rays and GBM has continuous and nearly all-sky coverage, therefore GBM can act as an ideal Galactic SN Ia monitor and alarm. We will build analytical models of SNIa gamma line emission to yield the supernova gamma-ray light curves and spectra and use SN2014J data to constrain and calibrate, predicting the timescale when the supernova signal emerges as distinct from the GBM background within the first days after the explosion. Thus finding how soon we are able to confirm a Galactic SN Ia signal from GBM data after explosion and get alarmed, and use GBM to get localization (Earth occultation technique) meanwhile.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

672

Parallel SH 02 Outer Helio / 595

Cosmic ray anisotropies near the heliopause

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When the Voyager 1 spacecraft crossed the heliopause, energetic particle observations showed unexpectedly large anisotropies in the local interstellar medium. For high energy galactic cosmic rays, the anisotropy is such that a deficiency of particles near pitch-angles of 90 degrees was recorded. For low energy anomalous cosmic rays, the anisotropy is completely different; an enhancement near 90 degrees was observed. We put forward a simple explanation for these seemingly incongruous anisotropies based on (perpendicular) diffusion across the heliopause that is more efficient at certain pitch-angles. We motivate our choice of transport parameters and present results that are in qualitative agreement with Voyager measurements, vindicating to a certain extent our modeling efforts.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1100

Parallel GA05 GeV excess GalCen / 1140

Unveiling the nature of the “Fermi GeV excess”: robust characterisation and possible interpretations

Author: Francesca Calore¹

Co-authors: Carmelo Evoli²; Christoph Weniger¹; Daniel Hooper; Ilias Cholis³; Tim Linden⁴

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Recently, a spatially extended excess of gamma rays collected by the *Fermi*-LAT from the inner region of the Milky Way has been claimed by different and independent groups. I will present a robust characterisation of the morphology and spectral properties of such an extended diffuse emission, including systematic uncertainties that are related to the high density of cosmic rays, gas, magnetic fields and abundance of point sources [1]. I will show that this re-assessment of the excess properties in light of background model systematics is significantly different from what claimed before and that it allows more freedom for models fitting the excess. In particular, I will scrutinise one of the most promising non-dark-matter astrophysical interpretations, namely the gamma-ray emission from leptonic cosmic rays interacting with gas and ambient photons and injected during burst-like events. I will show how well burst events during an active past of the Galactic center might account for the *Fermi* GeV excess and how we can disentangle this process from other viable interpretations.

[1] F. Calore, I. Cholis, and C. Weniger, *Background model systematics for the Fermi GeV excess*, Accepted for publication in JCAP, arXiv:1409.0042

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

878

Parallel GA06 TH / 1144

Are gamma rays produced in the core region of microquasars and AGNs?

Author: Behrouz Khiali¹

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Cosmic Ray (CR) acceleration is still challenging in high energy astrophysics. A first-order Fermi mechanism within magnetic reconnection layers has been demonstrated to be a powerful CR accelerator in recent studies. In this work we have investigated this acceleration process in the nuclear region of radio-galaxies and microquasars and found that the very high energy (VHE) emission from these astrophysical sources may be originated in the nuclear region around the central black hole. We employed both leptonic and hadronic models to interpret the observed gamma emission resulting from interactions of accelerated particles by magnetic reconnection with the ambient radiation, magnetic and matter fields. We compared the acceleration rate with the proper cooling rates obtaining the maximum particle energy and then reconstructed the spectral energy distribution (SED) for a few galactic and extragalactic sources and found that they are consistent with the observations. Also this model naturally explains the fast time variability of the emission of these sources.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

829

Parallel CR04 e+ e- / 385

Precision Measurement of the (e⁺+e⁻) Flux in Primary Cosmic Rays from 0.5 GeV to 1 TeV with the Alpha Magnetic Spectrometer on the International Space Station

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We present a measurement of the cosmic ray (e⁺+e⁻) flux in the range 0.5 GeV to 1 TeV based on the analysis of 10.6 million (e⁺+e⁻) events collected by AMS. The statistics and the resolution of AMS provide a precision measurement of the flux. The flux is smooth and reveals new and distinct information. AMS measurements of individual e⁺ and e⁻ fluxes show neither e⁺ nor e⁻ can be described by a single power law above 27.2 and 52.3 GeV, respectively. Surprisingly, above 30.2 GeV, the combined (e⁺+e⁻) flux can be described accurately by a single power law with a spectral index $\gamma = -3.170 \pm 0.008(\text{stat+syst}) \pm 0.008(\text{energy scale})$.

Collaboration:

AMS

Registration number following "ICRC2015-I":

370

Parallel CR05 TH/aniso / 1325

A Uniformly Selected, All-Sky Optical AGN Catalog for UHECR Correlation

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Studies discerning whether there is a significant correlation between UHECR arrival directions and optical AGN are hampered by the lack of a uniformly selected and complete all-sky AGN catalog. To remedy this, we are preparing such a catalog based on the 2MASS Redshift Survey (2MRS), a spectroscopic sample of ~45,000 galaxies complete to a K magnitude of 11.75 over 91% of the sky. We have analyzed the available optical spectra of these 2MRS galaxies (~80%), in order to identify the AGN amongst them with uniform criteria. A first-stage release of the AGN catalog for the Southern hemisphere using the 6dF Galaxy Survey spectra (100% complete outside the Galactic plane), will be available before the ICRC. Providing a comparably uniform and complete catalog for the Northern sky is more challenging because the spectra for the Northern galaxies were taken with different instruments; its timescale and expected completeness will be reported.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

993

Parallel SH 02 Outer Helio / 777

Galactic Cosmic Rays Modulation near Heliopause from Numerical Simulations

Author: Xiaocheng Guo¹

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² University of Alabama in Huntsville

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We investigate the possibility of the modulation of galactic cosmic ray (GCR) in the outer heliosheath (OHS) by means of the numerical simulations. The transport of GCR in the heliosphere is simulated by solving the Parker transport equation through a stochastic method, and the plasma background of the heliosphere is obtained from a global MHD-neutral simulation. The results confirm that no modulation effects are observed in the OHS due to the weak scattering of GCR particles by the fluctuation in the local interstellar magnetic field (LIMF). It is reasonable to assume that the heliopause is a free escape boundary for GCR. Moreover, we carry out the simulations to approximate the recent observed sudden step-like increase of GCR flux during the heliopause crossing of Voyager 1. The results indicate that the extremely small cross-field GCR transport in the OHS may hinder most of the GCR particles outside of the heliosphere. Drifts along heliopause and heliospheric current sheet enhance the inward GCR transport from the OHS, leading to the increase of GCR intensity inside heliosphere. The formed sharp step-like increase in GCR flux near the heliopause agrees with the recent Voyager 1 observations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

682

Parallel GA05 GeV excess GalCen / 943

Interpreting the GeV gamma-ray excess in terms of non-standard cosmic-ray diffusion models.

Author: Alfredo Urbano¹

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A GeV gamma-ray excess has possibly been individuated in Fermi-LAT data from the Galactic Center, and interpreted in terms of Dark Matter annihilations, either in hadronic or leptonic channels. However, the identification of such an excess strongly relies on the capability of carefully assessing the background over which the excess is supposed to emerge. For this reason, it is crucial to critically scrutinise the role of the diffuse gamma-ray background as well as the presence of additional astrophysical emissions.

Here, making use of advanced numerical tools, we conduct such analysis focusing our attention on two crucial astrophysical ingredients that may significantly alter the diffuse gamma-ray background from the innermost region of the Milky Way galaxy.

On the one hand, motivated by simple arguments related to the motion of electrons along ordered magnetic field lines, we allow for anisotropic cosmic-ray diffusion.

On the other one, motivated by the possibility to have a population of supernovae in the region of the Galactic bulge, we explore non-standard cosmic-ray source terms.

We critically discuss how the inclusion of these two ingredients strongly affects the interpretation of the GeV gamma-ray excess in terms of Dark Matter annihilation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

515

Parallel CR04 e+ e- / 575

Latest Alpha Magnetic Spectrometer results : positron fraction and pbar/p ratio.

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A precision measurement by AMS of the positron fraction in primary cosmic rays in the energy range from 0.5 to 500 GeV based on 10.9 million positron and electron events is presented. The measured positron fraction shows a rapid decrease from 1 to ~8 GeV followed by a steady increase and reaching a maximum value at 275+32 GeV. The new results show, for the first time, that above ~275 GeV the positron fraction no longer exhibits an increase with energy and is compatible with the minimal flux model with the exponential cutoff of ~550 GeV. The progress report on the results for the pbar/p ratio from 1 to 450 GV are presented for the first time.

Collaboration:

AMS

Registration number following "ICRC2015-I":

516

Parallel CR05 TH/aniso / 169

The ultra-high energy cosmic rays image of Virgo A

Author: Radomir Smida¹**Co-authors:** Daniel Bub¹; Engel Ralph¹¹ *Karlsruhe Institute of Technology***Corresponding Author:** radomir.smida@kit.edu

Arrival directions of ultra-high energy cosmic rays from the direction to one of the brightest radio source Virgo A were studied with recent models of the Galactic magnetic field. The obtained image of this radiogalaxy is similar for all studied models and it is unique in the comparison with images of other possible point source candidates. We present a method suitable for identifying cosmic rays arriving from this close-by radiogalaxy.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0180

Parallel GA06 TH / 1215

The Role of Fast Magnetic Reconnection on the Radio and Gamma-Ray Emission from the Nuclear Regions of Microquasars and Low Luminosity AGNs

Author: Luís H. S. Kadowaki¹**Co-authors:** Chandra B. Singh¹; Elisabete de Gouveia Dal Pino¹¹ *University of Sao Paulo (IAG-USP)***Corresponding Author:** luis.kadowaki@iag.usp.br

Fast magnetic reconnection events can be a very powerful mechanism operating in the core region of microquasars and active galactic nuclei (AGNs). In earlier work, it has been suggested that the power released by fast reconnection events between the magnetic field lines lifting from the inner accretion disk region and the lines anchored into the central black hole (BH) could accelerate relativistic particles and produce the observed radio emission from microquasars and low luminosity AGNs (LLAGNs). Moreover, it has been proposed that the observed correlation between the radio emission and the mass of these sources, spanning 10^4 orders of magnitude in mass, might be related to this process. In the present work, since gamma-ray emission is correlated with the accelerated relativistic particles that produce the radio emission, we have compared the magnetic power released by fast reconnection with the observed very high energy emission (from MeV/GeV to TeV bands) of

microquasars, LLAGNs, blazars, and gamma-ray bursts (GRBs). Considering magnetic reconnection driven by turbulence, we found that in the case of LLAGNs and microquasars, not only their radio but also the gamma-ray emission can be due to magnetic power released by fast reconnection. We have found also that the gamma-ray emission has a correlation with mass analogous to the radio, indicating that both are connected with reconnection events in the core region. On the other hand, the emission from blazars and GRBs does not follow the same trend, suggesting that their emission is produced outside the core, as expected. Complementary to these studies, we will also present results of numerical MHD simulations of a shearing-box reproducing fast magnetic reconnection events in the turbulent corona above a BH accretion disk.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

683

Parallel SH 02 Outer Helio / 1247

Cosmic rays beyond the boundary of the heliosphere

Author: Vladimir Florinski^{None}

Co-authors: Alan Cummings¹; Edward Stone¹; Jakobus le Roux²

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In August of 2012 the Voyager 1 space probe has left the solar-wind bubble of ionized gas we call the heliosphere and entered the denser and colder environment of the interstellar cloud surrounding the solar system. Energetic charged particles underwent dramatic changes past the heliopause: the heliospheric ions disappeared completely, while the galactic cosmic rays were for the first time measured in their unmodulated state. The interstellar medium is almost entirely devoid of turbulent magnetic fluctuations, and the transport of cosmic rays is governed by a large-scale geometry of the magnetic field. We discuss observations of heliospheric ions, including anomalous cosmic rays, near the heliopause transition, and propose interpretations of the measured intensities and pitch-angle distributions based on gradient drift in a weakly nonuniform magnetic field. The heliopause transition appears to be permeated by magnetic flux tubes connected to the interstellar space and facilitating particle escape. The two Flux tube crossings by the spacecraft allowed an indirect measurement of the plasma radial velocity near the heliopause. We also discuss galactic cosmic ray transport properties and their anisotropies in the outer heliosheath.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

948

Parallel GA05 GeV excess GalCen / 1234

Testing the interpretation of the Fermi Galactic center excess in terms of unresolved point sources

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We present a new, powerful and background-independent technique to constrain the luminosity function of point source populations that might contribute to the observed GeV excess emission around the Galactic center. Using this technique, we search for indications of such a population in the latest Fermi LAT data and discuss, for the case of milli-second pulsars, the implications for multi-wavelength searches in the next future. Finally, we show that our technique is particularly promising for a study of the Galactic center excess with upcoming high-resolution gamma-ray space telescopes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

952

Parallel GA06 TH / 24

Non-thermal radiation from interaction of compact objects with a jet in Cen A

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The central engines in active galaxies are immersed in huge central stellar clusters and also surrounded by spherical halos with radii of a few tens of kpc containing from a few hundred up to several thousand globular clusters. We investigate the acceleration of particles on the shocks formed in collisions of different compact objects at the kpc distances with jet plasma. We show that electrons can be accelerated on the shocks up to energies of the order of hundreds TeV. They emit synchrotron radiation up to the X-ray energies and also inverse Compton up-scatter background radiation to GeV-TeV energies. We calculate the non-thermal radiation produced by electrons in the jet of nearby radio galaxy Cen A.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

14

Parallel CR05 TH/aniso / 880

Northern sky Galactic Cosmic Ray anisotropy between 10-1000 TeV with the Tibet Air Shower Array

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We report on the observation of the large-scale sidereal anisotropy of Galactic Cosmic Rays (GCRs) between 10 TeV and 1 PeV, with the data collected by the Tibet Air Shower experiment between October 1995 and February 2010. The energy resolution is improved and the data with zenith angle up to 60 degrees is used. The two-dimensional intensity map with declination from -30 degree to 90 degree at 300 TeV is well connected with IceCube's observation at 400 TeV in 2012. A new structure on the energy dependence of the first harmonic coefficients of the large scale anisotropy is revealed above 100 TeV, which may give a new picture about the origin of GCRs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

755

Parallel CR04 e+ e- / 1154

Limits on the Multi-TeV Cosmic Ray Electron Flux from CREST (Cosmic Ray Electron Synchrotron Telescope)

Author: JIm Musser¹

Co-authors: Charles Bower¹; Gregory Tarle²; Joseph Gennaro³; Mathew Geske⁴; Michael Schubnell³; Muller Dietrich⁵; Scott Nutter⁶; Scott Wakely⁵; Stephane Coutu⁷; nahee park⁸

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Electrons at energies greater than 1 TeV must originate in the local Galactic neighborhood, within a kpc or so, owing to their rapid energy loss rates during propagation. Only a few candidate acceleration sites exist within this horizon, such as the Vela, Monogem or Cygnus Loop supernova remnants, and thus a measurement of the multi-TeV cosmic-ray electron flux would be a very useful probe of the nearby high-energy universe. The CREST instrument was designed to detect multi-TeV cosmic electrons through their synchrotron x-ray emission in the Earth's magnetic field. It consists of an array of 1024 BaF2 crystal detectors designed to detect the linear pattern of photons characteristic of synchrotron emission at these energies, surrounded by veto plastic scintillators to guard against chance alignments of charged particles in air showers. This instrument was successfully flown on a high-altitude balloon for 10 days in Antarctica during the 2011/2012 Long Duration Balloon campaign. In this paper we present the first experimental limits, derived from this flight's data, on the multi-TeV cosmic electron flux.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

912

Parallel CR04 e+ e- / 1132

A Cosmic-ray Electron Spectrum with VERITAS

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¹ *McGill University*

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Cosmic-ray electrons and positrons (CREs) at GeV-TeV energies are a unique probe of our local Galactic neighborhood. CREs lose energy rapidly via inverse Compton scattering and synchrotron processes while propagating in the Galaxy, effectively placing a maximal propagation distance for TeV electrons of order ~ 1 kpc. Within this window, production of CREs can come from a handful of known, nearby astrophysical sources capable of exciting CREs to that energy or from more exotic production mechanisms, like particle dark matter. HESS, and later MAGIC, have shown that ground-based imaging atmospheric Cherenkov telescopes have the capability to measure CREs into the TeV band. In this presentation we'll discuss the status of a VERITAS measurement of the electron plus positron cosmic ray spectrum.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

907

Parallel CR05 TH/aniso / 657

A simple model of the cosmic ray spectrum and composition across the Galactic to extragalactic transition

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Co-authors: Denis Allard²; Etienne Parizot²

¹ *Tel-Aviv University*

² *APC Laboratory*

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We present a simple theoretical and phenomenological model accounting for the evolution of the cosmic-ray spectrum and composition with energy, based on the available data over the entire spectrum. We show that there is no need to postulate any additional component, other than one single Galactic component depending on rigidity alone, and one extragalactic component, whose characteristics are similar to those derived from a study of particle acceleration at mildly relativistic shocks in a GRB environment (Globus et al., 2015). In particular, we show that the resulting cosmic ray

spectrum and composition satisfy the various constraints derived from the current data in the Galactic/extragalactic transition region, notably from the measurements of KASCADE Grande and Auger. Finally, we derive some generic features that a working phenomenological scenario may exhibit to give a global account of the cosmic ray data with a minimum number of free parameters.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

573

Parallel GA05 GeV excess GalCen / 1361

Search for gamma-ray line signatures with H.E.S.S.

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Co-authors: Agnieszka Jacholkowski²; Christian Farnier³; Jan Conrad⁴; Knut Mora⁵

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Most of results from astrophysical observations point to a 27% contribution of non-baryonic dark matter to the mass-energy budget of the universe. Although still undetermined, strongly motivated candidates in form of weakly interactive massive particles could explain its nature and their annihilations or decays would give rise to detectable signatures in gamma rays. In 2012, the H.E.S.S. collaboration started data taking with the largest imaging atmospheric Cherenkov telescope in the world, significantly lowering the energy threshold of the experiment. In particular, due to its location and enhanced performances at low energies, the H.E.S.S. experiment is now in a position to extend the search for line dark matter signals down to a 100 GeV mass range. The sensitivity to line searches with a new full likelihood approach will be discussed and preliminary results from observations with the second phase of H.E.S.S. will be presented.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

1011

Parallel SH 02 Outer Helio / 1119

Propagation Times of Jovian Electrons

Author: Adrian Vogt¹

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Although the main processes are well known, the transport of charged particles in the inner heliosphere is still under investigation. Because of a GPU-accelerated algorithm to solve Parker's transport equation by means of stochastic differential equations (SDEs), our newly developed code offers the possibility to perform extensive parameter studies. In this study we use counting rates of low-MeV electrons originating from the Jovian magnetosphere, measured by various spacecraft, to compare our simulation results with. We present the propagation times and also compare energy spectra and counting rates with spacecraft data in the ecliptic.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

906

Parallel GA06 TH / 269

Very High Energy Emission from Gamma-Ray Bursts

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Gamma-ray bursts (GRBs), the most powerful sources of gamma rays in the universe, have been detected at energies up to 95 GeV. This energy is at the verge of what is known as the Very High Energy (VHE, above 100 GeV) emission regime. VHE sources are targets for currently running and upcoming ground-based Cherenkov telescopes. It is therefore very important to understand the VHE emission mechanism(s) of GRBs. Synchrotron radiation by electrons accelerated in the external shocks of a GRB blast wave, widely accepted as the mechanism for X-ray to radio afterglow emission, has difficulty to explain >10 GeV emission hours after the GRB trigger. We model VHE emission from interactions of cosmic-rays which are shock-accelerated in the GRB blast wave. We compare this hadronic flux model with leptonic inverse Compton flux model and discuss characteristics which can distinguish them and which could be tested by Cherenkov telescopes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

281

Parallel DM 02 / 950

Results from the annual modulation analysis of the XMASS-I dark matter data

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XMASS-I, the first phase of the XMASS project, is a direct detection dark matter experiment using 832 kg of liquid xenon at Kamioka in Japan. One of the signatures of dark matter in direct detection experiments is the annual modulation of the event rate due to the relative motion of the Earth around the Sun. We have continuously collected data with a low trigger threshold of 0.3 keVee for more than one year since November 2013. In this talk, we will present the physics results from the annual modulation analysis using the full 832kg liquid xenon volume of the XMASS-I detector.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0805

Parallel CR06 Dir p He / 1278

BESS-Polar Measurements of the Cosmic-ray Proton and Helium Spectra

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The energy spectra of cosmic-ray protons and helium near solar minimum were precisely measured with BESS-Polar II (Balloon-borne Experiment with a Superconducting Spectrometer) during a long-duration flight over Antarctica in December 2007 and January 2008. The absolute fluxes and spectral shapes of primary protons and helium probe the origin and the propagation history of cosmic rays in the Galaxy. The spectra are also essential as inputs to calculate the spectrum of cosmic-ray antiprotons, which are secondary products of cosmic-ray interactions with the interstellar gas. To optimize the measurement of the magnetic rigidity of incident particles, obtained from the curvature of their trajectories in a solenoidal magnetic field of 0.8 Tesla, an improved calibration of the central JET-type drift chamber and two inner drift chambers was developed. We report absolute spectra of primary cosmic-ray protons to ~ 160 GeV and helium to ~ 80 GeV/nucleon, and compare these to other current measurements. We also show the antiproton spectrum in the range 0.17 to 3.5 GeV and report the antiproton/proton ratio. The temporal variation of the antiproton/proton ratio, measured by BESS since 1993, covering solar minimum, solar maximum, and solar magnetic field reversal, provides a crucial test of charge-sign dependence of solar modulation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

967

Parallel CR07 EAS mass / 618

Report of the Working Group on the Composition of Ultra-High Energy Cosmic Rays

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The atmospheric depth X_{\max} at which the particle number of an air shower reaches its maximum is a good indicator for the mass of the primary particle. We present a comparison of the energy evolution of the mean of X_{\max} as measured by the Telescope Array and Pierre Auger Collaborations. After accounting for the different resolutions, acceptances and analysis strategies of the two experiments, the two results are found to be in good agreement within systematic uncertainties.

Collaboration:

Pierre Auger & Telescope Array

Registration number following "ICRC2015-I/":

259

Parallel GA07 MAGIC / 1336

Highlights of MAGIC

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Abstract

MAGIC is a ground-based astrophysics instrument for measuring gamma rays in the energy range ~ 35 GeV – 50 TeV. It is the first instrument, which paved the road into the sub-100 GeV gamma-ray sky. MAGIC consists of two 17m diameter, F/1.03 imaging atmospheric Cherenkov telescopes, which are separated by 85m distance and are located at 2200m a.s.l. in the Roque de los Muchachos European North Observatory on the Canary island of La Palma. Since 2004 the MAGIC-I telescope is performing observations of celestial gamma sources. In 2009 we installed the almost identical MAGIC-II telescope and since then we are operating them in the coincidence (stereo) mode. The MAGIC telescopes went through an upgrade program and since fall 2012 they are taking data with an unprecedented sensitivity. In this report we are going to present the recent observational highlights of MAGIC and their astrophysical implications. I will be showing, for example, recently discovered most distant gamma-ray source at very high energies, the gravitationally lensed blazar S3 0218 residing at the red-shift of 0.944, strong flares of several extragalactic sources from relatively large red-shifts, detection of a new FSRQ from the red shift of 0.37, extraordinary short flare of IC-310, the spectrum of pulsed gamma-rays from the Crab pulsar extending till ~ 2 TeV, precision measurement of the spectrum and of the peak of the Inverse Compton emission of Crab Nebula, and many other exciting results.

Collaboration:

MAGIC

Registration number following "ICRC2015-I/":

1336

Parallel NU 02 / 1379

Status of the PINGU detector

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Scientists have created the world's largest neutrino telescope, the IceCube Neutrino Observatory, in one of the planet's most extreme environments at South Pole Station Antarctica. Completed in 2010, and instrumenting more than a cubic-kilometre of ice, IceCube also includes a low-energy detector array, called DeepCore, that has performed world-leading indirect dark matter searches and very high statistic studies of atmospheric neutrinos down to approximately 10 GeV. Building on the success of DeepCore, a new infill array called PINGU (the Precision IceCube Next Generation Upgrade) is now being proposed that would further reduce the in-ice energy threshold to a few GeV. Such a detector would be capable of significantly expanding the current low-energy program, including the potential to make a first determination of the neutrino mass ordering. In this talk we will discuss the design and sensitivity of the PINGU detector.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

1176

Parallel CR06 Dir p He / 1205

Measurements of Galactic Cosmic-Ray Hydrogen and Helium Isotopes with the BESS-Polar II Instrument

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The Balloon-Borne Experiment with a Superconducting Spectrometer (BESS-Polar II) flew successfully over Antarctica for 24.5 days in December 2007 through January 2008 during a period of minimum Solar activity. BESS-Polar II is configured with a solenoidal superconducting magnet and a suite of various particle detectors. It allows to accurately identify hydrogen and helium isotopes among the incoming cosmic-ray nuclei with energies from 0.2 up to about 1.5 GeV/n. The long duration of the flight, and the good stability of the detectors increased the number of cosmic-ray events previously recorded with BESS-Polar I by a factor of 5, reaching about 4.7 billion collected particles. This allows to study and measure hydrogen and helium isotope fluxes with unprecedented precision. In this paper, the isotope flux and ratio measurements with BESS-Polar II will be presented and compared to previous measurements and theoretical predictions. They provide essential information to constrain cosmic-ray propagation models.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

934

Parallel CR07 EAS mass / 796

Composition at the "ankle" measured by the Pierre Auger Observatory: pure or mixed?

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We report for the first time on the measurement of the correlation between the depth of shower maximum and the signal in water-Cherenkov stations for events reconstructed by both the fluorescence and surface detectors of the Pierre Auger Observatory. Such a correlated measurement is a unique feature of a hybrid air shower observatory and allows us to determine the purity of the cosmic-ray composition. The observed correlation in the energy range around the "ankle" $\lg(E/\text{eV}) = 18.5 - 19.0$ differs significantly from the expectations for pure beams for all current hadronic models, indicating that the primary composition in this range is not pure but mixed.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I/":

696

Parallel DM 02 / 371

Search for dark matter in the hidden-photon sector with a large spherical mirror

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In case dark matter consists of hidden-sector photons which kinetically mix with regular photons, a tiny oscillating electric-field component is present wherever we have dark matter. In the surface of conducting materials this induces a small amount of radiation being emitted almost perpendicular to the surface, with the corresponding photon frequency approximately matching the mass of the hidden photons. We report on a construction of an experimental setup with a large 15 m² spherical metallic mirror that will allow for searches of hidden-photon dark matter in the eV and sub-eV range by application of different electromagnetic radiation detectors. We discuss sensitivity and accessible regions in the dark matter parameter space.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

284

Parallel GA07 MAGIC / 772

Study of the extreme flaring activity of Mrk501 during multi-wavelength observations in 2012

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Co-authors: David Paneque Camarero ²; Fabrizio Tavecchio ³; Francesco Borracci ⁴; Reyes Luis ⁵

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Markarian 501 is a nearby ($z=0.034$) Very High Energy ($>100\text{GeV}$, VHE) emitting high-synchrotron-peaked BL Lac object. It is the third source discovered at VHE, by the Whipple Telescope in 1996, and it has been regularly observed since then. From 2008 onward, these observations have taken the form of organized multi-wavelength (MWL) campaigns where the source has been monitored for several months every year with excellent contemporaneous coverage from radio to TeV energies provided by more than 25 instruments.

During the 2012 MWL campaign, we detected an exceptional gamma-ray flare that reached ~ 10 times the Crab nebula flux at energies above 1 TeV, together with a particularly hard VHE spectrum (spectral index ~ 2), which remained hard during the days following the high activity. This represents the largest outburst seen from Mrk501 since the historical 1997 flare, which was reported by the previous generation of Cherenkov Telescopes, namely HEGRA, Whipple and CAT. During the highest VHE activity in June 2012, the peak position of the high-energy bump was measured to be at ~ 2 TeV, which is twice larger than the peak position of the high-energy bump determined during the historical Mrk501 flare from 1997, and one of the highest ever measured peak position for any VHE source. The VHE observations from MAGIC/VERITAS were complimented by the large temporal coverage provided by the First G-APD Cherenkov Telescope (FACT), enabling for the first time a comparison of the data taken simultaneously by the FACT and MAGIC telescopes. This MWL campaign provided a unique dataset to probe the intrinsic properties of Mrk501. We will show the variability and correlations at different energies, and report on the evolution of the broadband SEDs with simultaneous multi-band observations. We will also show the difficulty to explain this outstanding flaring activity within the commonly used leptonic models.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

639

Parallel NU 02 / 1014**All-flavour high-energy neutrino astronomy with KM3NeT/ARCA****Author:** Paolo Piattelli¹¹ INFN**Corresponding Author:** piattelli@lns.infn.it

The recent discovery by the IceCube collaboration of a high-energy neutrino flux of extra-terrestrial origin has opened a new observational window on the Universe. However, unambiguous identification of the emitting neutrino sources will require next generation neutrino telescopes with full sky coverage.

The KM3NeT Collaboration aims at building a research infrastructure in the depths of the Mediterranean Sea hosting a several cubic kilometre neutrino telescope. The technology for the detector construction and operation is defined and under final test with prototypes at a depth of 2500m and 3500m. The detector array with optical modules will be subdivided into sizeable building blocks of string-type detection units. This intrinsically modular nature of the detector allows for a staged implementation with increasing size from about 0.1 km³ for high-energy astronomy (phase-1) to be completed by 2016 to a volume of several km³ in the final phase.

Following phase-1, KM3NeT 2.0 will comprise two detectors with different granularity of the arrays of optical modules: KM3NeT/ARCA at the KM3NeT-It site as the extension of the phase-1 detector to two building blocks dedicated to high-energy neutrino astronomy and KM3NeT/ORCA, a single building block located at the KM3NeT-Fr site offshore Toulon (France) dedicated to the study of neutrino mass hierarchy (covered by another presentation).

The latitude of KM3NeT/ARCA will allow for a wide coverage of the observable sky including the region of the galactic centre. Thanks to the favourable characteristics of sea water the direction of neutrinos will be measured with excellent angular resolution also for cascade events. The expected KM3NeT/ARCA sensitivity will allow for the detection of the reported IceCube flux within about one year of observation, providing new data on its origin, energy spectrum and flavour composition; within five years of observation KM3NeT/ARCA could give indications at 3-sigma level on various galactic point-like sources.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

549

Parallel CR07 EAS mass / 863**Summary of UHECR composition measurements by the Telescope Array Experiment****Author:** John Belz¹

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We study the chemical composition of ultrahigh energy cosmic rays primarily using the Xmax technique. The reconstruction techniques use events either seen by two of the TA fluorescence detectors (stereo mode), or by one fluorescence detector, and one fluorescence detector and the TA surface detector (hybrid mode). Each technique has its own acceptance imprinted on the data. We compare the resulting Xmax distributions to those of shower Monte Carlo simulations, by generating events and analyzing them with exactly the same programs as the data. For energies greater than 10^{18} eV, the results in all cases appear to be an unchanging light composition. In this talk, a summary of all TA Xmax data will be presented.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

742

Parallel CR06 Dir p He / 311

Precision Measurement of the Proton Flux in Primary Cosmic Rays from 1 GV to 1.8 TV with the Alpha Magnetic Spectrometer on the International Space Station.

Author: Vitaly Choutko¹

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A precision measurement of the proton flux in primary cosmic rays with rigidity 1 GV to 1.8 TV is presented based on 300 million events. The results show that proton flux is smooth and exhibits no sharp structures with rigidity. The detailed variation with rigidity of the flux spectral index is presented for the first time. The spectral index is progressively hardening at high rigidities.

Collaboration:

AMS

Registration number following "ICRC2015-I":

80

Parallel GA07 MAGIC / 360

Tera-electron-Volt pulsed emission from the Crab detected by MAGIC

Author: Emma de Ona Wilhelmi¹

Co-authors: Daniel Galindo ²; Daniel Garrido-Terrats ³; David Fidalgo ; Diego Torres ⁴; Markus Gaug ⁵; Roberta Zanin ⁶; Takayuki Saito ⁷; Thomas Schweizer ⁸; Wlodek Bednarek ⁹; Wojciech Idec ⁸; marcos lopez ¹⁰

¹ CSIC-IEEC² UB³ UAB⁴ IEEC-CSIC⁵ Universitat Autònoma de Barcelona⁶ Universitat de Barcelona⁷ Kyoto University⁸ Max Planck Institute for Physics⁹ University of Lodz¹⁰ University Complutense of Madrid**Corresponding Author:** wilhelmi@ieec.uab.es

The last six years have witnessed major revisions of our knowledge about the Crab Pulsar, the central engine of the remnant of the supernova explosion that occurred in 1054 AD. The pulsed high-energy emission is believed to be due to synchrotron-curvature radiation in the pulsar magnetosphere, reaching a maximum energy of a few hundreds of GeV. However, new measurements obtained with the MAGIC telescopes have challenged the current plausible scenarios with the discovery of pulsed gamma-ray emission extending to the TeV regime. The pulse profile derived is consistent with those at lower energies, although a careful spectroscopic investigation of the peaks observed shows clear different spectral behaviour of those. This new spectral component requires gamma-ray production via inverse Compton radiation close to or beyond the light cylinder radius by an underlying particle population with Lorentz factors greater than 5×10^6 . We will present the new results and discuss the strong implications in the acceleration and radiation of particles in the surrounding of the Crab pulsar.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

352

Parallel DM 02 / 438

CALET's Sensitivity to Dark Matter and Astrophysical Sources

Author: Holger Motz¹¹ Waseda University**Corresponding Author:** motz@aoni.waseda.jp

The Calorimetric Electron Telescope (CALET) will be launched to the ISS within this year and measure the energy and direction distribution of electron+positron cosmic rays well into the TeV range during a 5 year mission. With a $1:10^5$ proton rejection rate and an energy resolution of 2%, it is capable of detecting even small features in the spectrum. Combining the measurement of the total electron and positron flux by CALET with the positron fraction data from the AMS-02 experiment, it will be possible to significantly constrain models of Dark Matter annihilating in the galactic halo. Assuming the positron excess is caused by a single power law source, the expected Dark Matter limits for the year 2021 will be presented, based on simulated data for the 5 year CALET mission together with positron fraction data for by then 10 years of AMS-02 measurement, extrapolated from their latest published results. These predictions are compared to limits derived with the same procedure using current experimental data from AMS-02 and Fermi-LAT.

While emission from a single nearby pulsar wind nebula is a possible explanation for the positron excess, the large number of pulsars discovered by radio and X-ray telescopes makes an overlapping

spectrum from several strongly contributing sources likely. Based on a numerical cosmic ray propagation simulation, the cosmic-ray spectra from nearby pulsar wind nebulae have been calculated and the expected capability of CALET to discern the multiple overlapping spectra, with parameters chosen to explain the observed cosmic ray excess, from the single power law spectrum of one pulsar is shown.

Collaboration:

CALET

Registration number following "ICRC2015-I":

406

Parallel NU 02 / 532

KM3NeT - ORCA: Measuring neutrino oscillations and the mass hierarchy in the Mediterranean

Author: Juergen Brunner¹¹ *CPPM***Corresponding Author:** juergen.brunner@cern.ch

The atmospheric flux of neutrinos has traditionally been seen as a background to the detection of an astrophysical neutrino signal. In recent years however, it has been realised that in the few-GeV range, this flux holds the key to resolving a fundamental question of particle physics: that of the neutrino mass hierarchy, i.e. whether the mass eigenstate ν_3 is heavier (normal hierarchy) or lighter (inverted hierarchy) than the ν_2 and ν_1 states.

The influence of the mass hierarchy on neutrino oscillations in matter leaves its imprint on the atmospheric neutrino flux via the characteristic appearance/disappearance patterns of different neutrino types as a function of energy and path through the Earth. ORCA - Oscillations Research with Cosmics in the Abyss - will be a dense configuration of KM3NeT detection units, optimised for studying the interactions of neutrinos in seawater at low energies. To be deployed at the French KM3NeT site, ORCA's multi-PMT optical modules will take advantage of the excellent optical properties of deep seawater to accurately reconstruct both cascade and track events with a few GeV of energy. This contribution reviews these methods and technology, and compares ORCA's power for not only determining the neutrino mass hierarchy, but placing new constraints on other key parameters such as θ_{23} , with other current and near-future experiments.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

1217

Parallel DM 02 / 981

The test results of the Silicon Tungsten Tracker of DAMPE

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The DAMPE (DARk Matter Particle Explorer) is one of the five satellite missions in the framework of the Strategic Pioneer Research Program in Space Science of the Chinese Academy of Science (CAS). DAMPE is a powerful space telescope for high energy gamma-rays, electrons and cosmic rays detection.

The detector consists of a double layer of plastic scintillator strips detector (PSD) that serves as anti-coincidence, followed by silicon-tungsten tracker-converter (STK).

The STK is followed by an imaging calorimeter of about 31 radiation lengths thickness, made up of 14 layers of BGO (Bismuth Germanium Oxide) bars. Finally, a layer of neutron detectors is added to the bottom of the calorimeter.

The total thickness of the BGO calorimeter and the STK correspond to about 33 radiation lengths, making it the deepest calorimeter ever used in space.

In this document we will present a detailed study of the performance of the EQM (Engineering Qualification Model) STK during a test beam performed at CERN in October - November 2014.

The STK is being developed by an international collaboration composed of groups from University of Geneva, INFN Perugia, INFN Bari, INFN Lecce and Institute of High Energy Physics, Beijing.

The STK is composed of a total of 7 tracker planes, forming 6 tracking layers. Three tungsten layers of 1 mm each, used for photon conversion, are integrated into the support trays of the second, third and fourth tracker planes.

The EQM STK is equipped with 26 ladders made of four single sided silicon strip detectors that are glued on 7 tracker planes, forming 6 tracking layers. The performances in term resolution and signal to noise ratio for different beam configurations will be described.

Moreover, the performances of the 192 ladders used for the construction of the Flight Model STK will be also presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

823

Parallel CR07 EAS mass / 1176

Measurements of the first two moments of the depth of shower maximum over nearly three decades of energy, combining data from the standard Pierre Auger fluorescence detector and the High Elevation Fluorescence Telescopes

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For the first time the Pierre Auger Collaboration presents $\langle X_{\max} \rangle$ and $\sigma(X_{\max})$ measurements covering nearly three decades of energy. In this analysis we include new X_{\max} data obtained with the Pierre Auger High Elevation Fluorescence Telescopes (HEAT) enhancement. The HEAT telescopes cover a field of view ranging from 30° to 60° of elevation and are located next to one of the standard fluorescence detector sites (Coihueco). The combination of the HEAT and Coihueco telescopes covers a field of view from ~2° up to ~60° of elevation. Thus, they can sample the atmospheric longitudinal profile of nearby lower energy showers allowing us to extend the energy range down to 10¹⁷ eV.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

631

Parallel GA07 MAGIC / 289

Discovery of TeV gamma-ray emission from the pulsar wind nebula 3C 58 by MAGIC**Author:** Ruben Lopez-Coto¹**Co-authors:** Diego Torres²; Emiliano Carmona³; Emma de Ona Wilhelmi⁴; Jonatan Martin⁵; Juan Cortina⁶; Miguel-Ángel Pérez-Torres⁷; Oscar Blanch Bigas⁸; Wlodek Bednarek⁹¹ *Institut de Fisica d'Altes Energies - IFAE*² *CSIC-IEEC*³ *CIEMAT*⁴ *APC*⁵ *IEEC*⁶ *IFAE*⁷ *IAA*⁸ *Instituto de Fisica de Altas Energias (IFAE)*⁹ *University of Lodz***Corresponding Author:** rlopez@ifae.es

The pulsar wind nebula (PWN) 3C 58 has been proposed as a good candidate for detection at VHE (VHE; $E > 100$ GeV) for many years. It is powered by one of the highest spin-down power pulsars known (5% of Crab pulsar) and it has been compared to the Crab Nebula due to its morphology. This object was previously observed by imaging atmospheric Cherenkov telescopes (Whipple, VERITAS and MAGIC), and upper limit of 2.4% Crab Unit (C.U.) at VHE. It was detected by Fermi-LAT with a spectrum extending beyond 100 GeV. We analyzed 81 hours of 3C 58 data taken with the MAGIC telescopes and we detected VHE gamma-ray emission with a significance of 5.7 sigma and an integral flux of 0.65% C.U. above 1 TeV.

We report the first significant detection of PWN 3C 58 at TeV energies. According to our results 3C 58 is the least luminous VHE gamma-ray PWN ever detected at VHE and the one with the lowest flux at VHE to date. We compare our results with the expectations of time-dependent models in which electrons up-scatter photon fields. The best representation favors a distance to the PWN of 2 kpc and Far Infrared (FIR) comparable to CMB photon fields. If we consider an unexpectedly high FIR density according to GALPROP, the data can also be reproduced by models assuming a 3.2 kpc distance. A low magnetic field, far from equipartition, is required to explain the VHE data. Hadronic contribution from the hosting supernova remnant (SNR) requires an unrealistic energy budget given the density of the medium, disfavoring cosmic ray acceleration in the SNR as origin of the VHE gamma-ray emission.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

297

Parallel CR06 Dir p He / 51

Precision Measurement of the Helium Flux in Primary Cosmic Rays from 2 GV to 3 TV with the Alpha Magnetic Spectrometer on the International Space Station

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A precision measurement of the Helium flux in primary cosmic rays with rigidity 2 GV to 3 TV is presented based on 50 million events. The detailed variation with rigidity of the spectral index is presented for the first time. The helium spectral index is progressively hardening at high rigidities. The precise ratio of the proton to Helium flux is also presented. Surprisingly, above ~ 25 GV the ratio can be accurately described with a single power law.

Collaboration:

AMS

Registration number following "ICRC2015-I/":

64

Parallel NU 02 / 741

The IceCube-Gen2 High Energy Array

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Co-authors: Christian Haack²; Claudio Kopper³

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² *RWTH Aachen University*

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Given recent observations of an astrophysical flux of neutrinos by the IceCube neutrino observatory, the design of the next generation Antarctic neutrino observatory is well underway. The IceCube Gen2 high-energy array will instrument a $\sim 10 \text{ km}^3$ volume of clear glacial ice at the South Pole to deliver substantial increases in the observed astrophysical neutrino sample for all neutrino flavors. This detector will support a rich physics program, including a search for point sources, a more detailed spectral and flavor characterization of the astrophysical neutrinos, searches for cosmogenic neutrinos, studies of cosmic rays, and searches for signatures of beyond-the-standard-model neutrino physics. This contribution highlights the detector sensitivity and geometry optimization studies performed during the design process. Additionally, astrophysical neutrino sensitivity is increased by the addition of an extensive surface detector to identify and reject atmospheric backgrounds originating from the southern hemisphere. This large detector, in combination with the existing IceCube neutrino observatory and the rest of the IceCube Gen2 facility will be the flagship experiment of the new field of neutrino astronomy.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

650

Parallel CR07 EAS mass / 781

Telescope Array search for photons and neutrinos with the surface detector data

Authors: Benjamin Stokes¹; Dmitri Ivanov^{None}; Gordon Thomson¹; Grigory Rubtsov²; Masaki Fukushima³; Sergey Troitsky⁴

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We report on a search for ultra-high-energy photons with a multivariate analysis technique based on the properties of shower fronts of events observed by the Telescope Array surface detector. We present the point source photon flux upper limits for all directions in the Northern hemisphere. The revised constraints on the diffuse flux of the primary photons with energies greater than 10^{19} eV are also presented. We also report on results of a down-going neutrino search.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

685

Parallel DM 02 / 381

The Silicon-Tungsten Tracker of the DAMPE Mission

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DAMPE (DARK Matter Particle Explore) is a satellite mission of the Chinese Academy of Science dedicated to high energy particle detections in space. The main scientific objective of DAMPE is to detect electrons and photons in the range of 5 GeV-10 TeV with unprecedented energy resolution in order to identify possible Dark Matter signatures. It will also measure the flux of nuclei up to 100 TeV with excellent energy resolution, which will bring new insights to the origin and propagation high energy cosmic rays. With its excellent photon detection capability, the DAMPE mission is also well placed for new discoveries in high energy gamma astronomy.

The DAMPE detector consists of a plastic scintillator strips detector (PSD) that serves as anti-coincidence detector, a silicon-tungsten (STK), a BGO imaging calorimeter of about 31 radiation lengths, and a neutron detector.

The STK is being developed by an international collaboration formed with groups from University of Geneva, INFN Perugia, INFN Bari, INFN Lecce and Institute of High Energy Physics, Beijing. The

STK consists of 6 tracking double-layers; each consists of two layers of single-sided silicon strip detectors measuring the two orthogonal views perpendicular to the pointing direction of the apparatus. Three layers of Tungsten plates with thickness of 1mm are inserted in front of tracking layer 2, 3 and 4 for photon conversion. The STK uses single-sided AC-coupled silicon micro-strip detectors. The sensor is 9.5 cm by 9.5 mm in size, 320 μ m thick, and segmented into 768 strips with a 121 μ m pitch. Only every other strip will be readout but since analogue readout is used the position resolution is better than 80 μ m for most incident angles, thanks to the charge division of floating strips. Because of the analog readout STK can also measure the charge of the incident cosmic rays.

In this contribution, the key features of the STK will be describes. An overview on the development, qualification and beam tests of an Engineering and Qualification Model, as well as the status of the construction of the Flight Model will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

362

Parallel GA07 MAGIC / 288

Black Hole Lightning from the Peculiar Gamma-Ray AGN IC 310

Author: Dorit Glawion^{None}

Co-authors: Eduardo Ros¹; Felicia Krauß²; Julian Sitarek³; Jörn Wilms⁴; Karl Mannheim⁵; Matthias Kadler⁵; Pierre Colin⁶; Robert Schulz⁷; Uwe Bach⁸

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The nearby active galaxy IC 310, located in the outskirts of the Perseus cluster of galaxies is a bright and variable multi-wavelength emitter from the radio regime up to very high gamma-ray energies above 100 GeV. Originally, the nucleus of IC 310 has been classified as a radio galaxy. However, studies of the multi-wavelength emission showed several properties similar to those of blazars as well as radio galaxies.

In late 2012, we have organized the first contemporaneous multi-wavelength campaign including radio, optical, X-ray and gamma-ray instruments. During this campaign an exceptionally bright flare of IC 310 was detected with the MAGIC telescopes in November 2012 reaching an averaged flux level in the night of up to one Crab above 1 TeV with a hard spectrum over two decades in energy. The intra-night light curve showed a series of strong outbursts with flux-doubling time scales as fast as a few minutes. The fast variability constrains the size of the gamma-ray emission regime to be

smaller than 20% of the gravitational radius of its central black hole. This challenges the shock acceleration models, commonly used in explanation of gamma-ray radiation from active galaxies. Here, we will present more details on the MAGIC data and discuss several possible alternative emission models.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

221

Parallel CR06 Dir p He / 1321

Fermi-LAT Measurement of Cosmic-ray Proton Spectrum

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Co-author: Elizabeth Hays²

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The Pass 8 gamma-ray simulation and reconstruction package for the Large Area Telescope (LAT) on the Fermi Gamma-ray Space Telescope has dramatically enhanced the ability of the LAT to perform gamma-ray science. The Pass 8 improvements have also allowed for the development of a new cosmic-ray proton analysis. Using the new Pass 8 direction and energy reconstruction, we create a new proton event selection.

This event selection has an acceptance of $1 \text{ m}^2 \text{ sr}$ over the incident proton energy range from 20 GeV to over 1 TeV. This event selection applied to over 6 years of LAT observations provides high statistics for a spectral measurement. The systematic errors in the acceptance and energy reconstruction require careful study. The event selection and spectral measurement of the Pass 8 proton analysis opens the door to additional proton analyses with the LAT, such as the evaluation of proton anisotropy. We present a detailed study of the measurement of the cosmic-ray proton spectrum with Pass 8 data for the Fermi-LAT.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

989

Parallel NU 02 / 1170

Neutrino Telescope Array (NTA): Prospect towards Survey of Astronomical ν_τ Sources

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By separating $\nu_\tau \rightarrow \tau$ conversion from τ -shower generation, the Earth-skimming ν_τ method allows for huge target mass and detection volume simultaneously. In part motivated by recent IceCube astrophysical PeV neutrino events, the planned NTA observatory will have three site stations watching the air mass surrounded by Mauna Loa, Mauna Kea, and Hualalai on Hawaii Big Island, plus a site station at the center watching the lower night sky. Sensitivities equivalent to $> 100 \text{ km}^3$ water and pointing accuracy of $< 0.2^\circ$ can be achieved with Cherenkov-fluorescence stereoscopic observation for PeV-EeV neutrinos that is almost background-free. With design based on experience from the operating Ashra-1 detector, and the goal of clear discovery and identification of astronomical ν_τ sources, a new International Collaboration is being formed to probe for cosmic proton accelerators.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

922

Parallel GA07 MAGIC / 199

Constraints on the cosmic ray cluster physics from a very deep observation of the Perseus cluster with MAGIC

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Co-authors: Camilla Maggio³; Joaquim Palacio⁴; Monica Vazquez Acosta⁵

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Galaxy clusters are the largest and most massive gravitationally bound structures known in the Universe. Cosmic-ray hadrons (CR) accelerated at structure formation shocks and injected by galaxies, are confined in galaxy clusters where they accumulate for cosmological times. The presence of diffuse synchrotron radio emission in several clusters proves the existence of high-energy electrons, and magnetic fields, but a direct proof of CR acceleration is missing. However CRs must interact with the intra-cluster medium (ICM) inducing a diffuse gamma-ray emission. The Perseus cluster, a nearby cool-core cluster, has been identified among the best candidates to detect such emission. We present here the results of a very deep observation of the Perseus cluster with the MAGIC telescopes, accumulating about 300 hours of data from 2009 to 2015. No evidence of large-scale VHE gamma-ray emission from CR-ICM interactions has been detected. The flux upper limit above 1 TeV allows us to put stringent constraints on the cluster CR physics, in particular on the CR-to-thermal pressure, on the CR acceleration efficiency at formation shocks, and on the magnetic field of the central cluster region.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

206

Parallel CR06 Dir p He / 793**Measurement of trapped and quasitrapped deuterons in PAMELA experiment****Author:** Sergey Koldobskiy¹¹ *NRNU MEPhI***Corresponding Author:** koldobskiy@gmail.com

The results of measurements of trapped and albedo cosmic ray deuteron fluxes obtained in the PAMELA experiment are presented in this work. The PAMELA is an international experiment aimed to measurements of cosmic ray particle fluxes in wide energy range. In particular, Analysis of PAMELA data gives possibility to identify deuterons and then to reconstruct deuteron spectra of different origin (galactic, albedo and radiation belt particles). The first results of reconstruction of trapped and albedo deuterons generation zones are presented in this work. This investigation was done by means backtracing methodics.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

123

Parallel DM 02 / 1271**Extensive studies of CaMoO₄ crystals for dark matter experiments****Author:** Bayarto Lubsandorzhiev¹¹ *Institute for Nuclear Research of RAS***Corresponding Author:** lubsand@rambler.ru

We present results of extensive studies of CaMoO₄ crystals for dark matter experiments. Light emission kinetics and absolute light yield of the crystals were measured thoroughly at room temperature. The temperature dependence of the crystals parameters were measured in the wide range of 1-300K. It is shown that CaMoO₄ crystals are very interesting for dark matter experiments and for neutrinoless double-beta experiments too.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

951

Parallel CR07 EAS mass / 920

Measuring the cosmic ray mass composition with LOFAR

Author: Stijn Buitink¹

Co-authors: Anna Nelles²; Arthur Corstanje²; Gia Trinh³; Heino Falcke²; J.E. Enriquez²; J.P. Rachen²; Jörg Hörandel⁴; L. Rossetto²; Olaf Scholten⁵; Pim Schellart⁶; S ter Veen⁷; Satyendra Thoudam⁸; T Karskens²; Tim Huege⁹

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The LOFAR radio telescope measures the radio emission from air showers with unprecedented precision. In the dense core individual air showers are detected by hundreds of dipole antennas. The complicated radio pattern on the ground is accurately reproduced by modern radio simulation codes and contains information about the longitudinal shower development. With a hybrid reconstruction technique, we measure the depth of the shower maximum with an accuracy of $<20 \text{ g/cm}^2$.

We will present the latest LOFAR results of cosmic-ray mass analysis in the energy regime of 10^{17} eV to 10^{18} eV. This range is of particular interest as it may harbor the transition from a Galactic to an extragalactic origin of cosmic rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

780

High-Light Talks / 1377

Nine Years of Cosmic Ray Investigation by the PAMELA Experiment

Author: Mirko Boezio¹

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The nine years of data taking in space of the experiment PAMELA are providing interesting information concerning the origin and

propagation of both galactic and solar cosmic rays. The measured antiparticle component of the cosmic radiation shows features that can be interpreted in terms of dark matter annihilation or pulsar contribution. The precise measurements of the energy spectra of protons, helium and light nuclei and their isotopes, electrons, as well as of their arrival distribution challenges our basic vision of the mechanisms of production, acceleration and propagation of cosmic rays in the galaxy. The study of the time dependence of the various components of the cosmic radiations clearly shows solar modulation effects as well as charge sign dependence of these effects. PAMELA measurement of the energy spectra during solar energetic particle events fills the existing energy gap between the highest energy particles measured in space and the ground-based domain. Furthermore, providing pitch angle measurements, it allows the study of the effects of particle transport within interplanetary space over a broad range in energy. Furthermore, by sampling the particle radiation in different regions of the magnetosphere, PAMELA data provide a detailed study of the Earth's magnetosphere. This talk illustrates the most recent scientific results obtained by the PAMELA experiment.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0000

High-Light Talks / 891**Progress in the Development of Radio-Cherenkov Neutrino Detectors**

Author: Steven Barwick¹

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Evidence is growing for the existence of a diffuse flux of astrophysical neutrinos with energies up to a few $\times 10^{15}$ eV. This has spurred considerable interest in developing new techniques that can extend the search to even higher neutrino energies. Promising new efforts over the past half-decade focus on the radio-Cherenkov technique in polar regions with cold, highly transparent ice. I will describe the broad, complementary physics goals of these telescopes with design sensitivities as least a factor 10 better than current limits for energies $>10^{17.5}$ eV. One important goal centers on a measurement of the cosmological neutrino flux, whose existence is relatively secure but also expected to be quite small even under the best of circumstances. The inherent cost efficiencies of radio-Cherenkov techniques suggest far greater boosts in sensitivity are possible. After briefly reviewing the progress by ANITA, ARA, and GNO collaborations, I will report on the first results from the ARIANNA Hexagonal Radio Array, completed in December 2014 and located on surface of the Ross Ice Shelf at a site about 110 km from McMurdo Station, Antarctica.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0664

High-Light Talks / 128**2FHL: The second Catalog of Hard Fermi-LAT Sources****Author:** Marco Ajello¹**Co-authors:** Alberto Dominguez¹; Cutini Sara²; Gasparrini Dario²; Jamie Cohen³¹ *Clemson University*² *Agenzia Spaziale Italiana (ASI) Science Data Center*³ *University of Maryland***Corresponding Author:** majello@clemson.edu

The Fermi Large Area Telescope (LAT) has been routinely gathering science data since August 2008, surveying the full sky every three hours. The first Fermi-LAT catalog of sources detected above 10 GeV (1FHL) relied on three years of data to characterize the >10 GeV sky. The improved acceptance and point-spread function of the new Pass 8 event reconstruction and classification together with six years of observations now available allow the detection and characterization of sources directly above 50 GeV. This closes the gap between ground-based Cherenkov telescopes, which have excellent sensitivity but small fields of view and duty cycles, and all-sky observations at GeV energies from space. In this contribution we will present the second catalog of hard Fermi-LAT sources detected at >50 GeV. We will discuss the properties of the extragalactic and Galactic source populations with an emphasis on the detection of spatially extended sources in the plane of our Galaxy.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

1158

High-Light Talks / 1378**Elemental Abundances of Ultra-Heavy GCRs measured by SuperTIGER and ACE-CRIS and the Origin of Galactic Cosmic Rays****Author:** Thomas Hams^{None}**Corresponding Author:** thomas.hams@nasa.gov

The Super Trans-Iron Galactic Element Recorder (SuperTIGER) long-duration balloon instrument and the Cosmic Ray Isotope Spectrometer (CRIS) on the NASA Advanced Composition Explorer (ACE) satellite have measured the abundances of galactic cosmic-ray elements from 10Ne to 40Zr with high statistics and single-element resolution. SuperTIGER launched from Williams Field, McMurdo Station, Antarctica, on December 8, 2012, flying for a record 55 days. During that flight we detected $\sim 3,000$ nuclei with atomic number $Z \geq 30$. The resolution in charge (Z) of SuperTIGER is excellent, with $\sigma_Z \approx 0.16e$ at 26Fe. SuperTIGER is sensitive to nuclei with energy at the top of the atmosphere of $E > 0.8$ GeV/nucleon. The instrument has now been recovered and preparations are underway for its next flight. ACE-CRIS has been taking data in space for more than 17 years since launch in 1997, has collected ~ 625 nuclei with atomic number $Z \geq 30$, and shows excellent resolution with clear separation between the charges for $30 \leq Z \leq 40$. ACE-CRIS is sensitive to nuclei in the energy range $150 \leq E \leq 600$ MeV/nucleon. Preliminary results from the balloon-borne SuperTIGER

show good agreement with ACE measurements in space, validating our corrections to SuperTIGER abundances for nuclear interactions in the atmosphere. The results from these experiments will be discussed in the context of the OB association model for the origin of galactic cosmic rays. Future missions to measure elemental abundances to higher Z , the SuperTIGER-II LDB instrument and the orbiting Heavy Nuclei eXplorer (HNX) mission, will also be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

961

ApPIC/IUPAP / 1404

Report from ApPIC/IUPAP (Astroparticle Physics International Committee) to ICRC 2015

Corresponding Author: michel.spiro@cnrs-dir.fr

Invited Review Talks / 1382

Dark Matter Candidates: Status and Perspectives

Author: Tim M.P. Tait¹¹ *University of California, Irvine***Corresponding Author:** ttait@uci.edu

The identity of the dark matter is perhaps the most pressing question confronting particle physics, and is likely to transform our understanding of fundamental particles. A wide array of theoretical ideas exist, though there is currently little experimental guidance as to which are correct. I will review the current status of the leading candidates to play the role of the dark matter, particularly in light of experimental searches, and offer some perspective as to their prospects in the future.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

988

Invited Review Talks / 721

Recent Results in Neutrino Astronomy

Author: Claudio Kopper¹¹ *University of Alberta*

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With the recent discovery of high-energy neutrinos of extra-terrestrial origin by the IceCube neutrino observatory, neutrino-astronomy is entering a new era. The highest energy neutrinos observed to date exceed 1 PeV in energy, a regime of particular interest because the neutrinos should point back to the still elusive accelerators of the highest energy Galactic and extragalactic cosmic rays. This review talk will cover currently operating neutrino telescopes in water and ice, the latest results from searches for a flux of extra-terrestrial neutrinos and current efforts in the search for steady and transient neutrino point sources. In addition the talk will discuss future detectors such as KM3NeT in the Mediterranean Sea, plans for IceCube high-energy detector upgrades and the status of radio experiments with sensitivity to cosmogenic neutrinos.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

234

Parallel GA08 EGAL / 927

Detection of very-high-energy gamma rays from the most distant and gravitationally lensed blazar S3 0218+35 using the MAGIC telescope system

Author: Julian Sitarek¹

Co-authors: Antonio Stamerra²; Daniel Mazin³; Dijana Dominis Prester⁴; Elina Lindfors⁵; Ievgen Vovk⁶; Josefa Becerra Gonzalez⁷; Marina Manganaro; Miguel Nievas Rosillo⁸; Sara Buson⁹

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S3 0218+35 is a blazar located at a cosmological redshift of $z=0.944$. It is gravitationally lensed by a spiral galaxy at a redshift of $z=0.68$. The blazar and its lens are well studied in the radio through X-ray bands, and several blazar outbursts were detected by Fermi-LAT at energies above 100 MeV.

Strong gravitational lensing was invoked to explain the two components apparent in the radio and GeV light curves, separated by 10-12 days.

In July 2014 another outburst was observed by Fermi-LAT, triggering follow-up observations with the MAGIC telescopes at energies above 100 GeV. The observations were scheduled at the expected time of arrival of the component delayed by the strong gravitational field of the lens, resulting in a firm detection of S3 0218+35.

Using the combined Fermi-LAT and MAGIC data sets, we report on the spectrum and variability of this unique blazar, the most distant among all currently known VHE sources.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

500

Parallel CR09 EAS knee / 340

The energy spectrum of cosmic rays in the range from 10^{14} to 10^{18} eV

Author: Sven Schoo¹

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The KASCADE experiment and its extension KASCADE-Grande have significantly contributed to the current knowledge about the energy spectrum and composition of cosmic rays (CRs) with energies between the knee and the ankle. However, the data of both experiments were analysed separately, although Grande used the muon information of the KASCADE-array.

A coherent analysis based on the combined data of both arrays is expected to profit from reconstructed shower observables with even higher accuracy compared to the stand-alone analyses. In addition, a significantly larger fiducial area is available.

By this analysis we obtain the spectrum and composition of CRs in the range from 10^{14} to 10^{18} eV with a larger number of events and further reduced uncertainties using one unique reconstruction procedure for the entire energy range. This contribution will provide an outline of the reconstruction procedure used and the energy spectrum and composition obtained will be presented.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I/":

306

Parallel GA09 Binaries / 1197

H.E.S.S. observations of PSR B1259-63 during its 2014 periastron passage

Authors: Brian van Soelen¹; Carlo Romoli²; Christian Mariaud³; Felix Aharonian⁴; Gerd Pühlhofer⁵; Iurii Sushch⁶; Mathieu de Naurois³; Pol Bordas⁷; Thomas Murach⁸; Ullrich Schwanke⁸; Victor Zabalza⁹

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An extended observation campaign of the gamma-ray binary system PSR B1259-63 has been conducted with the H.E.S.S.II 5-telescope system during the source's periastron passage in 2014. Here we report on the outcome of this campaign, which consists of more than 85 h of observations covering both pre/post-periastron orbital phases and, for the first time, very-high-energy (VHE, $E > 100$ GeV) observations right at the periastron passage. The new data set overlaps with and extends in phase previous H.E.S.S. campaigns on this source in 2004, 2007 and 2011, allowing for a detailed long-term characterisation at VHEs. The results obtained with H.E.S.S.II will be shown and discussed in a multi-wavelength context, including a comprehensive X-ray monitoring campaign and contemporaneous observations of high-energy gamma-rays with the Fermi-LAT.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

927

Parallel CR08 Dir light / 376

LITHIUM AND BERYLLIUM ISOTOPES IN THE PAMELA-EXPERIMENT

Author: Wolfgang Menn¹¹ University of Siegen**Corresponding Author:** menn@pamela.physik.uni-siegen.de

On the 15th of June 2006, the PAMELA satellite-borne experiment was launched from the Baikonur cosmodrome and it has been collecting data since that time. The apparatus comprises a time-of-flight system, a magnetic spectrometer (permanent magnet) with an silicon-microstrip tracking system, an imaging calorimeter built from layers of silicon -microstrip detectors interleaved with plates of tungsten, an anti-coincidence system, a shower tail scintillator-counter and a neutron detector. The scientific objectives addressed by the mission are the measurement of the antiprotons and positrons spectra in cosmic rays, the hunt for antinuclei as well as the determination of light nuclei fluxes from hydrogen to oxygen in a wide energy range and with high statistics. The instrument in its detector-combination is also capable to identify isotopes. In this paper the identification capability using multiple dE/dx measurements in the calorimeter will be shown and new results of the isotopic ratios of lithium and beryllium with increased statistics will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

365

Parallel SH 03 SEP II / 477

Influence of region behind the shock front on acceleration of solar energetic particles

Author: Ivan Petukhov¹

Co-authors: Anastasia Petukhova²; Stanislav Petukhov¹

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Acceleration of solar energetic particles by the shock accompanying a coronal mass ejection is considered. Influence of the region behind the shock front on particle acceleration process is investigated. The external boundary of coronal mass ejection and the shock front are specified as the segments of spherical surfaces with the different radii moving in coordination. Nonstationarity of process, spherical symmetry and adiabatic losses of particle energy in the extending environment are considered in the calculation. The propagation velocity of solar wind is determined by the conservation of matter stream taking into account the known distribution of matter density. Scatterings of solar energetic particles are carried out by Alfvén waves moving radially from and to the Sun. The parameters determining the coefficient of particle diffusion are chosen taking into account the available results of theoretical calculations and indirect measurements. Influence of the accelerated particles on dynamics of the system and the turbulence level of the magnetic field isn't considered. The performed numerical calculations show that the influence extent of the region behind the shock front on acceleration process is determined by a ratio between coefficients of particle diffusion in regions behind and before the front. In that case when these coefficients are comparable: 1) rate of acceleration significantly decreases; 2) the considerable part of the accelerated particles is behind the shock front; 3) at the same time few of the accelerated particles with the maximum energies reaches the ejection surface.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

167

Parallel CR08 Dir light / 990

Measurement of Lithium and Beryllium cosmic-ray abundances by the PAMELA experiment

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The PAMELA experiment is collecting particles along a low Earth semi-polar orbit on board of Resurs-DK 1 satellite since June 2006. The combined information of a silicon tracking system and a scintillator hodoscope provides redundant light-element identification capabilities, via multiple ionization energy-loss measurements. Results on the abundances of galactic secondary elements Li and Be will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

95

Parallel GA08 EGAL / 879

The extreme environment in the center of Mrk 876 and the switch on of its AGN activity

Author: Eugenio Bottacini¹

Co-author: Elena Orlando¹

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Results from surveys show that most galaxies underwent one or more eras of Active Galactic Nucleus (AGN) activity throughout their existence. During the AGN era the central region of the galaxy becomes very bright up to soft gamma-ray energies due to inverse-Comptonization by relativistic electrons. However, survey studies can not draw definite conclusions on what switches on the AGN activity in the first place. Instead case studies on single sources have the advantage of providing a complete picture of a source that allows for precise conclusions.

In this talk we present the results of a case study on Mrk 876. The detection of a transient and extreme gravitationally redshifted Fe-line allows us to find its emission mechanism, thereby constraining the rotation of the super-massive black hole in the center of Mrk 876. This finding together with a morphological study of the source allow for conclusions on the mechanism that switched on the AGN activity in Mrk 876.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

751

Parallel SH 03 SEP II / 853

Solar Energetic Particles measured by AMS-02

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Co-authors: Claudio Corti¹; Cristina Consolandi¹; Kathryn Whitman¹

¹ *University of Hawai'i at Manoa (US)*

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The Alpha Magnetic Spectrometer (AMS-02) with its acceptance of about $0.45 \text{ m}^2 \text{ sr}$, is the largest Solar Energetic Particle (SEP) detector in space. It was installed on the International Space Station (ISS) on May 19, 2011, where it will take data for the duration of the station (≈ 2024). In the first 3 years of operations, AMS-02 detected and measured the highest energy SEPs produced during M- and X-class flares and fast coronal mass ejections magnetically connected with the Earth. AMS-02

is able to perform precise measurements in a short period of time which is typical of these transient phenomena and to collect enough statistics to measure fine structures and time evolution of the spectrum. The method to identify the SEPs over the galactic cosmic rays background will be described. The events observed by AMS-02 since the beginning of its mission will be presented and some SEP preliminary results will be shown. AMS-02 observations, with their unprecedented resolution and high statistics, can therefore help to understand the behavior of SEPs at high energies and to constrain models of SEP production.

Collaboration:

AMS

Registration number following "ICRC2015-I":

733

Parallel GA09 Binaries / 1280

H.E.S.S. observations of LS 5039

Authors: Carlo Romoli¹; Christian Mariaud²; Felix Aharonian³; Guillaume Dubus⁴; Markus Boettcher⁵; Mathieu de Naurois⁶; Pol Bordas⁷; Victor Zabalza⁸

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LS 5039 is a gamma-ray binary system observed in a broad energy range, from radio to TeV energies, which exhibits both flux and spectral modulation folded on its orbital period of ~ 3.9 d. The X-ray and very-high-energy (VHE, $E > 100$ GeV) gamma-ray fluxes display a maximum/minimum at inferior/superior conjunction, with spectra becoming respectively harder/softer, a behavior which is completely reversed in the high-energy domain (HE, $0.1 < E < 100$ GeV). The GeV spectrum cuts off at a few GeVs, with a new hard component emerging at $E > 10$ GeV that is compatible with the low-energy tail of the TeV emission. The low 10–100 GeV flux, however, makes the GeV and TeV components difficult to reconcile within a single particle population emitting scenario. Here we report on new observations of LS 5039 conducted with the H.E.S.S. telescopes from 2009 to 2015. This new data set allows for an unprecedentedly-deep phase-folded coverage of the source at TeV energies, as well as an extension of the VHE spectral range down to ~ 100 GeV. Our results will be discussed in the context of VHE emission/absorption processes operating in the system and its connection with the emission observed at X-ray and GeV energies.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

909

Parallel CR09 EAS knee / 45

Energy spectrum of the primary cosmic rays in the range 10\,GV–10\,TV

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The GRAPES-3 experiment measures directional flux 1 GeV muons with very high precision. For a precise simulation of the measured flux of 1GeV muons in GRAPES-3, the energy spectrum of primary cosmic rays should be accurately known. We have used the data from several balloon and satellite based experiments to determine the proton and helium spectrum in the energy range from 10GV to 10TV. Since these experiments utilize different measurement techniques the results on energy spectrum were represented in different units. A detailed study has been performed to evaluate the spectral indices of proton and helium primaries in the corresponding energy ranges of 10GeV-10TeV and 20GeV-20TeV, respectively. The results of this study will be presented in the conference.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

54

Parallel CR08 Dir light / 589

Precision Measurement of Lithium Flux in Cosmic Rays with the Alpha Magnetic Spectrometer on the International Space Station

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Lithium nuclei in cosmic rays are produced by the spallation of heavier cosmic rays on the interstellar medium. Thus, the abundance of Lithium constitutes a very sensitive observable for the modeling of cosmic rays propagation in the Galaxy. A precision measurement of the Lithium flux with rigidities from 2 GV to 3 TV by AMS, based on 1.6 million events, is presented for the first time. The variation of the flux spectral index with rigidity is also presented.

Collaboration:

AMS

Registration number following "ICRC2015-I":

178

Parallel GA09 Binaries / 295

VHE gamma-ray observations of transient and variable stellar objects with the MAGIC telescopes

Author: Alba Fernandez-Barral¹

Co-authors: Alicia Lopez Oramas²; Christian Fruck³; Daniela Hadasch⁴; Emma de Ona Wilhelmi⁵; Oscar Blanch Bigas⁶; Pere Munar Adrover⁷; Roberta Zanin⁸

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Transient and variable stellar objects provide a proper environment for particle acceleration and radiation of GeV-TeV gamma-rays. MAGIC Collaboration has carried out deep observations of different transient and variable stellar objects. Here we highlight 5 of them: LS I +61 303, MWC 656, SS 433, Cygnus X-1 and SN 2014J. We present the results of those observations, including long-term monitoring of Cygnus X-1 and LS I +61 303 (7 and 8 years, respectively). Cygnus X-1 is one of the brightest X-ray sources and best studied microquasars along a broad range of wavelengths whose steady and variable signal was searched by MAGIC within a multiwavelength scenario. The latest results of two peculiar objects, MWC 656 and SS 433, are also shown in this presentation. The former is the first detected high-mass X-ray binary system that is composed of a black hole and a Be star and the latter is the only super-critical accretion system known in our galaxy. Finally, we report the observations of SN 2014J, the nearest Type Ia SN of the last 40 years. Its proximity and early observation gave a remarkable opportunity to study important features of these powerful events.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

300

Parallel SH 03 SEP II / 857

Study of the Solar Modulation of Local Interstellar Protons with AMS-02, PAMELA, Neutron Monitors and Voyager 1

Author: Claudio Corti¹

Co-authors: Cristina Consolandi¹; Kathryn Whitman¹; Veronica Bindi¹

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Galactic Cosmic Rays (GCRs) entering the heliosphere are disturbed by the magnetic field of the Sun, which varies with a period of 11 years. The solar modulation affects the GCR fluxes up to few tens of GeV, modifying the shape and the intensity of the local interstellar spectrum (LIS). The time variation of the galactic cosmic protons at Earth can be studied indirectly on ground with the Neutron Monitors (NMs) and directly from space with AMS-02 (2011-now) and PAMELA (2006-2010).

A new parametrization of the LIS will be presented, based on the latest data from AMS-02 and Voyager 1. Using the framework of the force-field approximation, the solar modulation parameter will be extracted from the time-dependent proton fluxes measured by PAMELA. The results will be compared with the modulation parameter inferred by NMs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

737

Parallel CR09 EAS knee / 1181

Observation of primary cosmic rays with the new Tibet hybrid experiment(YAC-II + Tibet-III + MD))

Author: Jing Huang¹

Co-author: for the Tibet ASgamma Collaboration for the Tibet ASgamma Collaboration ¹

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We have started a new hybrid air shower experiment in Yangbajing (4300m a.s.l.) in Tibet since February 2014. This new hybrid experiment consists of the YAC-II comprising of 124 core-detectors placed on a grid of about 500 m², the Tibet-III AS array with the total area of about 50000 m² and the underground MD array comprising of 5 clusters with 800 m² each below underground 2.5m. This hybrid-array system is used to observe air showers of high energy celestial gamma-ray origin and those of nuclear-component origin. These measurements are essential to investigate the acceleration mechanism and propagation of primary cosmic rays in the Galaxy. Thanks to extremely low background level, it is expected to be capable of detecting a dozen new point-like gamma-ray sources and also diffuse gamma rays from the Galactic plane in the northern sky. In this talk, we will report the present status and main scientific goals of this new experiment, including the instrument configuration and performance.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

920

Parallel GA08 EGAL / 762

VERITAS detection of gamma-ray flaring activity from the BL Lac object 1ES1727+502 during bright moonlight observations

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During May 2013, a gamma-ray flare from the BL Lac object 1ES 1727+502 ($z=0.055$) has been detected with the VERITAS Cherenkov telescopes. This detection represents the first evidence of very-high-energy ($E>100$ GeV) variability from this blazar and has been achieved using a reduced-high-voltage configuration which allows observations under bright moonlight. The integral flux is about five times higher than the archival VHE flux measured by MAGIC. The detection triggered additional VERITAS observations during standard dark-time and multiwavelength observations from infrared to X-rays with the FLWO 48" telescope and the Swift satellite. The results from this campaign are presented and used to produce the first spectral energy distribution of this object during gamma-ray flaring activity. The spectral-energy-distribution is then fit with a standard synchrotron-self-Compton model, placing constraints on the properties of the emitting region in the blazar.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

486

Parallel GA08 EGAL / 742

Discovery of VHE gamma-rays from the radio galaxy PKS 0625-354 with H.E.S.S.

Author: Michal Dyrda¹

Co-authors: Lukasz Stawarz ²; Mateusz Janiak ³; Michal Ostrowski ⁴; Olivier Hervet ⁵; Rafal Moderski ⁶; Wiercholska Alicja ¹

¹ *Institute of Nuclear Physics PAS*

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Most of the extragalactic objects detected so far in the very high energy (VHE) regime are blazars, but detected nearby radio galaxies: M87, Cen A and NGC 1275 of type FRI seem to constitute a new class of VHE emitters. The radio galaxy PKS 0625-354 was observed with the H.E.S.S. phase I telescopes in 2012, above the energy threshold of 250 GeV. The time-averaged TeV energy spectrum is well characterized by a power law model. The broad-band spectral energy distribution (SED), including the available multiwavelength data, as well as the VHE data gathered with H.E.S.S. will be presented.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

598

Parallel GA09 Binaries / 620

DETECTION OF PERSISTENT SUB-GEV GAMMA-RAY EMISSION TOWARDS SS433/W50

Author: Pol Bordas¹

Co-authors: Ervin Kafexhiu²; Felix Aharonian³; Ruizhi Yang²

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SS433 features the most energetic jets known in our Galaxy. A large fraction of the jet kinetic power is delivered to the surrounding W50 nebula at the jet termination shock, from which high-energy emission and cosmic-ray production have been anticipated. Here we report on the possible detection of a persistent gamma-ray signal from a source located within the 99.9 % confidence level contours around SS433/W50 obtained with the Fermi Large Area Telescope. The spectral energy distribution displays a maximum at ~ 250 MeV and a sharp cutoff thereafter, strongly resembling the gamma-ray spectrum of solar flares, and suggesting that gamma-rays are rendered through proton-proton interactions. If the observed gamma-ray emission is produced in the SS433/W50 interaction regions and the same mechanism is operating in other baryon-loaded microquasar jets, their collective contribution could represent a significant fraction of the total galactic cosmic-ray flux at GeV energies.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

540

Parallel CR09 EAS knee / 315

Observation of a knee in the p+He energy spectrum below 1 PeV by using an hybrid measurement with ARGO-YBJ and a LHAASO Cherenkov Telescope

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Co-authors: Cao Zhen¹; LHAASO Collaboration ARGO-YBJ Collaboration²

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The measurement of cosmic ray energy spectra, in particular for individual species, is an essential approach in finding their origin. Locating the “knees” of the spectra is an important part of the

approach and has yet to be achieved. Here we report a measurement of the mixed Hydrogen and Helium spectrum using the combination of the ARGO-YBJ experiment and of a prototype Cherenkov telescope for the LHAASO experiment. A knee feature at 640 ± 87 TeV, with a clear steepening of the spectrum, is observed. This is in agreement with other two independent analyses of ARGO-YBJ data, and provides new important inputs to acceleration/propagation models for galactic cosmic rays.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

39

Parallel CR08 Dir light / 355

Precision Measurement of Boron to Carbon Flux Ratio in Cosmic Rays with energies from 0.5 GeV/n to 1 TeV/n with the Alpha Magnetic Spectrometer on the International Space Station.

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A precision measurement by the Alpha Magnetic Spectrometer of the Boron to Carbon fluxes ratio with energies from 0.5 GeV/nucleon to 1 TeV/nucleon based on 10 million events is presented. Precision measurement of the Boron flux, based on 2 million events, together with the variation of the flux spectral index with rigidity is also presented.

Collaboration:

AMS

Registration number following "ICRC2015-I":

177

Parallel SH 03 SEP II / 566

Transport of Solar Energetic Particles across the Parker field due to field line meandering

Author: Timo Laitinen¹**Co-authors:** Andreas Kopp²; Frederic Effenberger³; Michael S. Marsh⁴; Silvia Dalla⁵¹ *Jeremiah Horrocks Institute, University of Central Lancashire, Preston, UK*² *Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, Kiel, Germany*³ *Department of Mathematics, University of Waikato, Hamilton, New Zealand*⁴ *Met Office, Exeter, UK*⁵ *Jeremiah Horrocks Institute, University of Central Lancashire, Preston, UK*

Corresponding Author: tmlaitinen@uclan.ac.uk

Multi-spacecraft observations of Solar Energetic Particles (SEPs) show that SEPs related to a single solar eruption can be observed over a wide range of heliolongitudes. The SEP anisotropy observations suggest that interplanetary transport significantly contributes to this spreading of SEPs across the mean Parker Spiral field. However, the current transport models that describe the cross-field propagation as diffusion using the Fokker-Planck (FP) equation with a simple cross-field diffusion term, cannot reproduce the extent of SEP events without unrealistically large cross-field diffusion coefficients. Laitinen et al (2013) noted that the initial, non-diffusive propagation of charged particles along turbulently meandering field-lines provides a key to explaining the wide SEP events. Particles that initially propagate along meandering field-lines spread fast across the mean field. Thus, the resulting SEP event extent can be expected to be wider than predicted by the FP description. In this work, we implement field-line meandering into a FP modelling framework for Parker Spiral geometry. We use an SDE approach to propagate particles along field-lines that meander across the Parker Spiral field, and compare our new model with the traditional FP approach. The particle and field-line diffusion coefficients are calculated using a turbulence model that is consistent with a parallel mean free path of 0.3 AU for 10 MeV protons at 1 AU. We find that our new model results in a wide longitudinal extent of SEP events, with $\sigma = 33^\circ$ for the longitudinal peak intensity distribution, consistent with SEP observations, while for the same turbulence parameters the traditional modelling only gives $\sigma = 10^\circ$. Our results show that field-line meandering must be taken into account when modelling SEP propagation in interplanetary space. We discuss the effect of turbulence strength on the extent of SEP events.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

510

Parallel CR09 EAS knee / 917

Observation of a knee in the p+He energy spectrum below 1 PeV by measuring particle densities very close to the EAS core with the ARGO-YBJ experiment

Authors: Antonio D'Amone¹; Antonio Surdo²; Ivan De Mitri³; Lorenzo Perrone¹

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The CR spectrum has been studied by the ARGO-YBJ experiment in a wide energy range (TeV \rightarrow PeVs). This study is particularly interesting because not only it allows a better understanding of the so called 'knee' of the energy spectrum and of its origin, but also provides a powerful cross-check among very different experimental techniques.

The unique detector features (full coverage, time resolution, large dynamic range) and location (4300 m above sea level) allowed both lowering the energy threshold down to the region covered by direct measurements and reaching the knee of the all-particle spectrum where data from many ground based experiment are available since long time. Moreover, the possibility of a detailed study of the particle distribution at ground in the first few meters from the shower axis, provided a new and efficient way of selecting events initiated from light mass primaries (i.e. protons and alpha particles), without relying on the muon signal, thus avoiding systematic dependencies on the adopted hadronic interaction model.

The resulting all-particle spectrum (measured in the energy range 100 TeV - 10 PeV) is in good agreement with both theoretical parametrizations and previous measurements, thus validating the selection and reconstruction procedures. The light-component (i.e. p + He) spectrum has been measured

from 30 TeV up to about 5 PeV. The result, while being consistent with highest energy direct measurements, shows a clear indication of a bending below 1 PeV. This is in agreement with other two independent analysis of ARGO-YBJ data (one of them also using the Cherenkov signal as measured by a LHAASO telescope prototype), and provides new important inputs to acceleration/propagation models for galactic cosmic rays.

Registration number following "ICRC2015-I":

778

Collaboration:

ARGO-YBJ

Parallel CR08 Dir light / 520

Precision Measurement of the Carbon to Helium Flux Ratio in Cosmic Rays from 2 GV to 2 TV with the Alpha Magnetic Spectrometer on the International Space Station

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A precision measurement of the flux ratio of Carbon to Helium in primary cosmic rays with rigidities from 2 GV to 2 TV is presented. Precision measurement of the Carbon flux, based on 8 million events, together with the variation of the flux spectral index with rigidity is also presented.

Registration number following "ICRC2015-I":

302

Collaboration:

AMS

Parallel GA08 EGAL / 668

The Detection of Fermi AGN above 100 GeV using Clustering Analysis

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The 6-year *Fermi* data set contains some 8000 extragalactic events with $E > 100\text{GeV}$. To search for the sources of these events, we applied a clustering algorithm (DBSCAN), using a search radius based on the *Fermi*-LAT point spread function, to events from > 10 degrees above and below the Galactic plane. This analysis revealed 49 significant clusters. Of these, 21 correspond to known Very High Energy (VHE) emitting Active Galactic Nuclei (AGN) in the TeVCat catalogue and 9 represent new

VHE sources –6 BL-Lacs, one blazar of unknown type and two unidentified sources. These objects are compared with the known VHE AGN population and the prospects for follow-up observations with ground based γ -ray observatories are considered.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

202

Parallel GA09 Binaries / 1243

Linking gamma-ray observations with models of eta Carinae

Author: Olaf Reimer¹

Co-authors: Anita Reimer²; Klaus Reitberger¹; Ralf Kissmann¹

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Eta Carinae, the so-far only colliding wind binary detected at high-energy gamma-rays, has been observed over its first complete orbit since launch of the Fermi Gamma-ray Space Telescope. Different emission scenarios are proposed to explain the temporal and spectro-temporal features, by either postulating strong dominance of hadronic particle populations, a single emitting particle population in combination with significant absorption by γ - γ pair production, or mixed emission scenarios. The interplay between different particle populations as function of energy, orbital phase, inclination etc. is best studied by numerical hydrodynamics in conjunction with particle transport models. We demonstrate that transitions between hadron-dominated to lepton-dominated high-energy emission are predicted in colliding wind binary scenarios depending on orbital parameters. The complex picture emerging from such simulations will be discussed and linked to proposed models for eta Car.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

599

Parallel SH 03 SEP II / 1021

On the origin of relativistic solar particle events: interplanetary transport modelling and radio emission

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The highest energies of solar energetic nucleons detected in space or through gamma-ray emission in the solar atmosphere are in the GeV range. Where and how these particles are accelerated is still controversial. The candidate processes are related to magnetic reconnection in a flare or a coronal mass ejection (CME), and to the shock wave driven by a fast CME. We search for observational indications on the acceleration site, via comparative analyses of the timing of relativistic solar protons, observed by neutron monitors on the Earth, and electromagnetic emissions of the associated eruptive solar activity. The microwave emission, at frequencies above 10 GHz, emphasises the impulsive flare phase, while emissions at lower frequencies (hundreds of MHz to a few GHz) reveal both the impulsive flare and post-impulsive particle acceleration. We use different time profiles of the radio emission to describe the solar injection function and model the interplanetary particle transport taking into account the effects of focusing by an average Archimedean magnetic field, and scattering by its fluctuations. The predicted time profiles of the relativistic protons at 1 AU are confronted with neutron monitor observations of events from solar cycle 23. We use the results to discuss the nature of the prompt and delayed relativistic proton releases that have been identified in neutron monitor recordings of relativistic solar particle events.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

629

Parallel SH 03 SEP II / 926

Search for solar neutrons during the maximum activity of solar cycle 24

Author: Diego Lopez¹

Co-authors: Takashi Sako ¹; Yasushi Muraki ¹; Yutaka Matsubara ¹

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During the second period of maximum solar activity (October 2013 through October 2014) of the current solar cycle we have searched for solar neutron events.

When a solar flare occurs, ions are sometimes accelerated. Those ions interact with the solar atmosphere and produce solar neutrons. We examined recent data from five stations of the International Network of Solar Neutron Telescopes (Gornergrat, Switzerland; Mauna Kea, USA; Mt. Chacaltaya, Bolivia; Mt. Norikura, Japan; Mt. Sierra Negra, Mexico). Our result did not produce any statistically significant event. Therefore, we calculated the upper limit of the neutron fluxes at the Sun based on a statistical analysis and considering impulsive emission. We report that our upper limits are consistent with the solar neutron flux calculated for the 2005 September 7th solar neutron event associated with an X17 class solar flare.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1090

Parallel GA08 EGAL / 591

A Bright Gamma-ray flare from the Blazar B2 1215+30 Detected by VERITAS and Fermi-LAT

Authors: Floriana Zefi¹; Reshmi Mukherjee²

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We report on evidence of correlated gamma-ray variability from the BL Lac source B2 1215+30, detected by VERITAS ($E > 100$ GeV) and the Fermi Large Area Telescope ($100 \text{ MeV} < E < 100$ GeV). The source was observed by VERITAS during an exceptional flaring state in February 2014. Further investigations of flux variability in the energy range covered by Fermi-LAT, quasi-simultaneous with VERITAS observations, showed evidence of correlated variability. Using these results we constrain the size of the emission region and derive a limit on the Doppler factor of the relativistic jet of B2 1215+30.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

517

Parallel CR08 Dir light / 702

Voyager 1 Observations of Galactic Cosmic Rays in the Local Interstellar Medium: Energy Density and Ionization Rates

Author: Alan Cummings¹

Co-authors: Bryant Heikkila²; Edward Stone¹; Nand Lal²; William Webber³

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³ New Mexico State University

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Voyager 1 (V1) has been in the local interstellar medium (LISM) since August, 2012. We present the galactic cosmic-ray (GCR) energy spectra of most elements from H through Ni, and also of electrons, for a period exceeding two years. The V1 energy spectra define the newly-revealed, low-energy part of the interstellar spectra of nuclei down to ~ 1 MeV/nuc and of electrons down to ~ 8 MeV. We use these observations, along with estimates of the higher-energy portion of the interstellar nuclei spectra and estimates of the interstellar electron spectra at both higher and lower energies, to estimate the energy density of cosmic rays in the LISM and the cosmic ray ionization rate of atomic H. We find that the total energy density of cosmic rays is $\sim 1.0 \text{ eV cm}^{-3}$, which includes a contribution of 0.02 eV cm^{-3} from electrons. This energy density is somewhat larger than the energy density of the local interstellar magnetic field ($\sim 0.6 \text{ eV cm}^{-3}$).

We find the cosmic ray ionization rate of atomic H to be $1.7 \times 10^{-17} \text{ s}^{-1}$, which is a factor of ~ 10 below the ionization rates in diffuse interstellar clouds based on astrochemistry methods. The cross section for ionization of H atoms peaks at lower energies than our observations, so a significant contribution to the total ionization rate of the LISM could be occurring below our detection threshold.

In order to match the higher ionization rate, the new V1 observations would require that one or both of the interstellar spectra of nucleons and electrons turn up at energies below ~ 1 MeV/nuc for nuclei and ~ 8 MeV for electrons.

This work was supported by NASA under contract NNN12AA012.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

613

Parallel GA09 Binaries / 1020

Time-dependent modelling of particle acceleration and non-thermal emission in Eta Carina

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² *University of Leicester*

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Eta Carina is the only colliding-wind binary for which non-thermal emission is detected from hard X-rays to high-energy gamma rays. Although the physical conditions in the shock region change on timescales of hours to days, the variability seen at GeV energies is quite weak and on significantly longer timescales. The gamma-ray spectrum exhibits two spectral features that can be interpreted as emission originating from the shock and post-shock regions of the two distinct stellar winds. Here we report on the first time-dependent modelling of the non-thermal emission in Eta Carina in this scenario, which aims to explain the level of gamma-ray emission as well as the variability with orbital phase. We used a time-dependent acceleration scheme to derive the spectrum of relativistic particles in the adiabatic shock of the companion star, including the effects of cosmic ray pressure modification. We find that emission from primary electrons is unlikely to be responsible for the gamma-ray emission, and that gamma-ray emission from accelerated protons interacting with the dense shocked wind material can explain the observations. The significant pair production absorption in the stellar radiation fields leads to a drop in the predicted gamma-ray emission above several hundred GeV - consistent with the upper limits as reported by H.E.S.S.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

571

Parallel CR09 EAS knee / 961

Observation of a knee in the p+He energy spectrum below 1 PeV by using a bayesian technique for the data analysis of the ARGO-YBJ experiment.

Authors: Paolo Montini¹; Stefano Maria Mari²

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The measurement of the cosmic ray (CR) spectrum plays a fundamental role in the understanding of the production and acceleration mechanisms of high energy CR. Moreover the determination of the CR composition at energies > 100 TeV could provide a better understanding of the origin of the knee in the all-particle CR spectrum.

The ARGO-YBJ experiment is a full coverage air shower detector operated at the Yangbajing international cosmic ray observatory (Tibet, P.R. China, 4300 m a.s.l.) and has been in stable data taking in its full configuration since November 2007 to February 2013. The detector has been designed in order to detect showers produced by primaries of energies down to few TeV up to the PeV region. The high segmentation of the detector allow a detailed measurement of the lateral particle distribution, that can be exploited in order to discriminate showers produced by light primaries. In this work the measurement of the CR p+He energy spectrum is presented in the energy range 10-3000 TeV. In particular, a bayesian technique has been used for the statistical measurement of the energy spectrum. A deviation from a single power law is clearly evident at energies below 1 PeV. This is in agreement with other two independent analysis of ARGO-YBJ data (one of them also using the Cherenkov signal as measured by a LHAASO telescope prototype), and provides new important inputs to acceleration/propagation models for galactic cosmic rays.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I/":

602

Parallel CR11 Radio / 841

SLAC T-510: A beam-line experiment of radio emission from particle cascades in the presence of a magnetic field

Author: Konstantin Belov¹

Co-authors: Abigail Vieregge²; Adrew Romero-Wolf¹; Anne Zilles³; Benjamin Rotter⁴; Benjamin Strutt⁵; Brian Flint Rauch⁶; Carsten Hast⁷; Charles Naudet¹; Chin-Hao Chen⁸; Christopher Williams; David Besson⁹; David Saltzberg¹⁰; David Seckel¹¹; David Urdaneta¹²; Harm Schoorlemmer¹³; Jessica Stockham⁹; Jiwoo Nam⁸; Joe Lam¹²; John Clem¹⁴; Katharine Murley¹¹; Keith Bechtol²; Keith Jobe⁷; Kyle Borch¹²; Kyle Kuwatani¹²; Mark Stockham⁹; Martin Israel¹⁴; Peter Gorham¹³; Pisin Chen⁸; Rachel Hyneman¹⁵; Robert Binns¹⁴; Ryan Nichol⁵; Stefan Funk¹⁶; Stephanie Wissel¹²; Tim Huege³; TsungChe Liu⁸; Viatcheslav Bugaev¹⁴

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Radio detection is a technique of great interest for detecting ultra-high energy cosmic rays. Models of radio emission from extensive air showers, based solely on principles of classical electrodynamics, were developed in recent years. The SLAC T-510 experiment was conducted in January-February of 2014 using an electron beam to validate these models in a laboratory environment. Secondary cascades were induced by a 4.35 GeV electron beam in a polyethylene target in presence of a controlled magnetic field of up to 1000 G to mimic the geomagnetic field. The radio emission was measured in both vertical and horizontal linear polarizations by UHF and VHF antennas at different locations relative to the cascade. The experimental results, are in very good agreement with the models. The results and the models are described in details in separate contributions to this conference. The emission associated with the Askaryan component as well as the emission associated with the magnetic field were observed. A brief description of the experiment as well as the main results will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

722

Parallel NU 03 / 959

Motivations and Techniques of a Surface Detector to Veto Air Showers for Neutrino Astronomy with IceCube at the Southern Sky

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IceCube is the world's largest high-energy neutrino observatory, built at the geographic South Pole. For neutrino astronomy, a large background-free sample of well-reconstructed astrophysical neutrinos is essential. The main backgrounds for this signal are muons and neutrinos, which are produced in cosmic-ray air showers in the Earth's atmosphere. The coincident detection of these air showers by the surface detector IceTop is already used in IceCube analyses to veto atmospheric neutrinos and muons in the field of view of the southern sky. The success and limitations of the IceTop array as a cosmic ray veto motivate properties of future surface veto detectors. Dependent on different scenarios for the astrophysical neutrino flux a surface air shower detector has the potential to significantly improve IceCube Gen2.

Here, we summarize different physics cases for a surface veto and the motivation for different detection technologies based on first simulations and measurements.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

505

Parallel CR10 Dir heavy / 394

Observation of ^{60}Fe in the Galactic Cosmic Rays

Author: Martin Israel¹**Co-authors:** Alan Cummings ²; Edward Stone ²; Eric Christian ³; Georgia de Nolfo ³; Kelly Lave ⁴; Mark Wiedenbeck ⁵; Richard Leske ²; Richard Mewaldt ²; Tycho von Rosenvinge ³; Walter Binns ⁴¹ *Washington University in St Louis*² *California Institute of Technology*³ *NASA/GSFC*⁴ *Washington University in St. Louis*⁵ *Jet Propulsion Laboratory***Corresponding Author:** mhi@wustl.edu

The Cosmic Ray Isotope Spectrometer (CRIS) on the ACE spacecraft has been measuring the isotopic composition of Galactic Cosmic Rays (GCRs) since October 1997. Using selected data from the past seventeen years, we have a set of 3.55×10^5 Fe nuclei in the energy interval ~ 240 to ~ 470 MeV/nucleon with excellent mass resolution characterized by $\sigma = 0.24$ amu. In this data set we have detected fifteen well resolved iron-60 nuclei. Iron-60 is beta- unstable with a half-life 2.6 million years. The detection of these radioactive nuclei permits us to set an upper limit of a few million years on the time between nucleosynthesis of these nuclei and their acceleration to cosmic-ray energy. A lower limit of $\sim 10^5$ years was established by the CRIS observation that the electron-capture isotope nickel-59 is essentially absent in the GCRs. These two limits bracket the nucleosynthesis-to-acceleration time to a range that is consistent with the emerging evidence that the bulk of GCRs are accelerated in associations of massive stars (OB associations).

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

68

Parallel DM03 / 1164

Determining the Local Dark Matter Density

Author: Hamish Silverwood¹**Co-authors:** Gianfranco Bertone ; Justin Read ²; Pascal Steger ³; Sofia Sivertsson ⁴¹ *University of Amsterdam*² *University of Surrey*³ *E*⁴ *Stockholm University and University of Amsterdam*

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Determination of the Dark Matter density at the solar position is critical to direct dark matter searches. Additionally, it is important to make this determination with as few assumptions as possible, as results from direct detection searches are used to explore a wide variety of theoretical models, and hidden astrophysical assumptions could bias theoretical searches. Here we present a Jeans analysis based method for the determination of the local dark matter density which allows us to limit the number of assumptions we need to make. We fit baryon and Dark Matter density models to tracer density and velocity dispersion data via integrated Jeans equations, and from these derive the local dark matter density.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

917

Parallel GA10 VERITAS / 1156

Science Highlights from VERITAS

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VERITAS is a ground-based array of four 12-meter telescopes near Tucson, Arizona and is one of the world's most sensitive detectors of very high energy (VHE: >100 GeV) gamma rays. VERITAS has a wide scientific reach that includes the study of extragalactic and Galactic objects as well as the search for astrophysical signatures of dark matter and the measurement of cosmic rays. In this presentation, we will summarize the current status of the VERITAS observatory and present some of the scientific highlights since 2013.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

907

Parallel NU 03 / 1142

The first construction phase of the Baikal-GVD neutrino telescope

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Baikal-GVD is a future cubic-kilometer neutrino telescope in Lake Baikal which will be formed by multimegaton subarrays –clusters of strings. Construction of the first GVD-cluster has been started

in 2012 by deployment of the first string. The five string array has been deployed in 2014. We review a present activity towards the first cluster implementation and describe some results obtained with five string array.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

893

Parallel CR10 Dir heavy / 1264

SuperTIGER and the Origin of Galactic Cosmic-Rays

Author: Thomas Hams¹

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820

Parallel CR11 Radio / 693

New results of the digital radio interferometer LOPES

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LOPES was a digital, phased antenna array located at the site of KASCADE-Grande in Karlsruhe, Germany. Triggered by the particle-detector array of KASCADE, LOPES measured the radio signal of air showers. By an interferometric, offline combination of the signals measured by different antennas, LOPES was able to enhance the signal-to-noise ratio. This lowered the detection threshold significantly close to 0.1 EeV, despite the high human-made radio background at the experimental site. While LOPES already is dismantled, data analysis is still continued. Recent progress concerns the amplitude calibration of the existing data, and the incorporation of detector effects in air-shower

simulations. This enables a better comparison of measurements with theoretical predictions. Moreover, we will present and compare the latest results on the reconstruction of the energy and the shower maximum based on two different methods: the reconstruction of the hyperbolic radio wavefront relying on time measurements, and the reconstruction of the lateral distribution relying on amplitude measurements.

Collaboration:

LOPES

Registration number following "ICRC2015-I/":

191

Parallel DM03 / 283

Dark matter annihilation and decay factors in the Milky Way's dwarf spheroidal galaxies

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Self-annihilation or decay of dark matter (DM) particles could produce high-energy gamma-rays. Owing to their proximity, high DM content, and lack of astrophysical background, dwarf spheroidal galaxies (dSphs) of the Milky Way are among the best targets for current and future gamma-ray instruments. Putting constraints on the DM particle properties requires a precise knowledge of their "astrophysical" factors, hence on their DM content. Here, the latter is reconstructed using their stellar kinematic data through the Jeans analysis.

Using large sets of mock data, we have identified several biases in the Jeans analysis and proposed an optimal setup in order to mitigate them. Using this optimal setup, we present a new estimation of the astrophysical factors for twenty-one dSphs. Our robust analysis gives the most realistic estimation of the uncertainties on these factors to date. We discuss the ranking of the dSphs according to the potential they present for annihilating and decaying DM indirect detection. We also show that Segue 1, often considered as one of the best target for DM indirect detection, has a highly uncertain astrophysical factor due to probable Milky Way foreground contamination.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

294

Parallel GA10 VERITAS / 868

Highlights from the VERITAS AGN Observation Program

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The VERITAS array of four 12-m imaging atmospheric-Cherenkov telescopes began full-scale operations in 2007, and is one of the world's most sensitive detectors of astrophysical VHE ($E > 100$ GeV) gamma rays. Observations of active galactic nuclei (AGN) are a major focus of the VERITAS Collaboration, and more than 50 active galactic nuclei (AGN), primarily blazars, are known to emit VHE photons. Approximately 3000 hours have been devoted to the VERITAS AGN observation program and roughly 150 AGN are already observed with the array, in most cases with the deepest VHE exposure to date. These observations have resulted in 32 detections, most of which are accompanied by contemporaneous, broadband observations, enabling a more detailed study of the underlying jet-powered processes. Recent highlights of the VERITAS AGN observation program, and the collaboration's long-term AGN observation strategy, will be presented.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

583

Parallel CR11 Radio / 1260

Telescope Array Radar (TARA): First Measurement of EAS Radar Cross-section Upper Limit

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TARA (Telescope Array Radar) is a cosmic ray radar detection experiment co-located with the Telescope Array conventional surface scintillation detector (SD) and fluorescence telescope detector (FD) near Delta, UT. The TARA detector combines a 40 kW transmitter and high gain transmitting antenna which broadcasts the radar carrier over the SD array and in the FD field of view to a 250 MS/s DAQ receiver. Data collection began in August, 2013. We have created a novel signal search technique in which the expected (simulated) radar echo of a particular air shower is used as a matched filter template and compared to radio waveforms obtained by triggering the radar DAQ by the fluorescence detector. This technique is used to calculate radar cross section upper limits on triggers that correspond to TA FD events. I discuss the search algorithm and results, and comment on the future of CR radar with TARA.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

966

Parallel CR10 Dir heavy / 1314

Abundances of Ultra-Heavy Galactic Cosmic Rays from the SuperTIGER Instrument

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The SuperTIGER (Trans-Iron Galactic Element Recorder) experiment was launched on a long-duration balloon flight from Williams Field, Antarctica, on December 8, 2012. SuperTIGER flew for a total of 55 days at a mean atmospheric depth of 4.4 g/cm². The instrument measured the abundances of galactic cosmic rays in the charge (Z) range $Z \geq 10$ with excellent charge resolution, displaying well resolved individual element peaks for $10 \leq Z \leq 40$. SuperTIGER collected $\sim 3.95 \times 10^6$ Iron nuclei, ~ 7.1 times as many as detected by TIGER. We will present details of the data analysis techniques and the elemental abundances in the range $30 \leq Z \leq 40$. The data presented contain more than 600 events in this charge range, with charge resolution at iron of < 0.18 cu. Our measured abundances are generally consistent with those measured by TIGER and ACE. Our results confirm the earlier results from TIGER, supporting a model of cosmic-ray origin in OB associations, with preferential acceleration of refractory elements over volatile elements.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

983

Parallel NU 03 / 468

Experimental calibration of the ARA radio neutrino telescope with an electron beam in ice

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Askaryan Radio Array (ARA) is being built at the South Pole aiming for observing high energy cosmogenic neutrinos above 10 PeV. The ARA detector identifies the radio emissions from the excess charge in a particle shower induced by a neutrino interaction. Such a radio emission was first predicted by Askaryan in 1962 and experimentally confirmed by Saltzberg et al. using the SLAC accelerator in 2000. In the ARAcAlTA experiment, we irradiated an ice target with 40 MeV electron beams using the Telescope Array Electron Light Source located in an radio quiet open-air environment to verify our understanding of the Askaryan emission and the detector responses used in the ARA experiment. Observed signals include two kind of backgrounds: transition radiations from the boundary between air and ice, and radio emissions from the sudden beam appearance. We measure coherences, polarizations and angular distributions of the radio signals to quantify each components in the observed signals. The recorded waveforms are then compared with simulation which includes all the calibration information obtained in a laboratory to verify the detector responses. The first observational results from ARAcAlTA will be presented in the conference

Collaboration:

ARA

Registration number following "ICRC2015-I":

422

Parallel DM03 / 356

Astrophysical explanation of AMS-02 electron and positron data and constraints on dark matter contribution

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Electron and positron cosmic rays are one of the most powerful tool for astroparticle physics. The AMS-02 Collaboration has recently released the electron, positron inclusive and positron fraction spectra measured with an incredible precision. We performed a combined analysis of the recent AMS-02 data in a self-consistent framework where we theoretically model all the astrophysical components that can contribute to the observed fluxes in the whole energy range. The primary electron flux has been modeled using the near Supernova Remnants in the Green catalog and a far and smooth component of distant sources. Electron and positron flux has been derived for all the Pulsar Wind Nebulae of the ATNF catalog with the hypothesis that all the sources shine with the same efficiency and energy spectrum slope. Finally, we derive the secondary electron and positron fluxes originating from interactions on the interstellar medium of primary cosmic rays, for which we derive a novel determination by using preliminary AMS-02 proton and helium data. We obtain a remarkable agreement between our various modeling and the AMS-02 data for all types of analysis, demonstrating that the whole AMS-02 leptonic data admit a self-consistent interpretation in terms of astrophysical sources and secondary production.

An exotic contribution to electron and positron cosmic ray spectra could be associated to annihilating dark matter WIMP particles.

We have studied at which extent this extra component could substitute or add to the Pulsar Wind Nebulae contribution and we derive severe constraints on the dark matter particle annihilation cross section.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

349

Parallel GA10 VERITAS / 1214

The TeV Morphology of the Interacting Supernova Remnant IC 443

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The middle-aged supernova remnant IC 443 is interacting with molecular gas in its surroundings. Fermi-LAT has established that its gamma-ray emission at low energies shows the "pion bump" that is characteristic of hadronic emission. TeV emission was previously established by MAGIC and VERITAS at a site of interaction between the shock front and a molecular cloud. VERITAS has continued to observe IC 443 and can now resolve the emission on few-arcmin scales. We will present results on the emission morphology and discuss possible sources of the emission, including the shell of the remnant and other gaseous structures in the vicinity.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

1167

Parallel DM03 / 834

A dark matter origin of the extragalactic radio background

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Observations by ARCADE-2 and other telescopes have reported an excess in the isotropic radio background. This excess has a hard spectral index and is found to significantly exceed the expected contribution from known astrophysical sources. Specifically, previous works have suggested that the ARCADE-2 signal is unusually smooth, compared to emission which traces large scale structure. In

this talk, we will discuss scenarios in which the ARCADE-2 data can be explained via the annihilation of dark matter particles. We compute flux and anisotropy of the annihilation signals from dark matter halos and find that with assumptions of strong magnetic fields and extended substructure in massive clusters, dark matter models can produce small anisotropies that remain consistent with observational constraints. We also show that the above assumptions can be significantly relaxed in an alternative scenario where electrons can be efficiently reaccelerated by Alfvén waves in the intra-Cluster medium. Our analysis suggests that any source capable of explain the extragalactic radio excess must be more extended than typical for baryons in galaxies, hinting at a novel physics interpretation.

Collaboration:

– not specified –

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725

Parallel CR10 Dir heavy / 817

Galactic Cosmic-Ray Composition and Spectra for Ne through Ni from 0.8 to 10 GeV/nuc with the SuperTIGER Instrument

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SuperTIGER (Trans-Iron Galactic Element Recorder) is a large-area balloon-borne instrument built to measure the galactic cosmic-ray abundances of elements from $Z=10$ (Ne) through $Z=56$ (Ba) at energies from 0.8 to ~ 10 GeV/nuc. SuperTIGER successfully flew around Antarctica for a record-breaking 55 days, from December 8, 2012 to February 1, 2013. In this paper, we present results of an analysis of the data taken during the flight for elements from $Z=10$ (Ne) to $Z=28$ (Ni). We report excellent charge separation throughout this range, with an Fe charge resolution of 0.16. We will compare our galactic element abundance measurements, secondary to primary ratios (e.g. (Si+Ti+V)/Fe), and energy spectra with those from other instruments operating at different energy ranges.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

377

Parallel CR11 Radio / 645

High-precision measurements of extensive air showers with the SKA

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As of 2020, the Square Kilometre Array will constitute the world's largest radio telescope, offering unprecedented capabilities for a diverse science programme in radio astronomy. At the same time, the SKA will be ideally suited to detect extensive air showers initiated by cosmic rays in the Earth's atmosphere via their pulsed radio emission. With its very dense and uniform antenna spacing on an area of several km² and its large instantaneous bandwidth of 50-350 MHz, the low-frequency part of the SKA will provide very precise measurements of individual cosmic ray air showers. These precision measurements will allow detailed studies of the mass composition of cosmic rays in the region of transition from Galactic to extragalactic cosmic rays. Also, the SKA will facilitate three-dimensional "tomography" of the electromagnetic cascades of air showers, allowing us to study particle interactions at energies beyond the reach of the LHC with very high precision. Finally, studies of possible connections between air showers and lightning initiation can be taken to a new level with the SKA. We will report on the technical requirements for air shower detection with the SKA and discuss the science potential and project status.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

326

Parallel NU 03 / 843

The ExaVolt Antenna Mission Concept and Technology Developments

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Co-authors: Amy Connolly²; Brian Dailey³; Brian Hill⁴; Carl Gilbert Pfendner⁵; Christian Miki⁴; Frank Baginski⁶; Gary Varner⁴; James Beatty⁷; Kenneth Brakke⁸; Patrick Allison⁷

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In the past decade, searches for the cosmogenic neutrino flux produced by the interactions of ultra-high energy cosmic rays with the cosmic microwave background have not yet resulted in detection. Radio detection of ultra-high energy neutrinos provides a cost-effective means probing large amounts of effective volume. The Antarctic Impulsive Transient Antenna (ANITA) balloon-borne experiment, with sensitivity to neutrinos with energies $> 10^{19}$ eV, has provided some of the most stringent limits on cosmogenic neutrino production models by searching for coherent radio Cherenkov signals produced by the Askaryan effect in Antarctic ice. The ExaVolt Antenna (EVA) is a mission concept to extend the sensitivity of balloon-borne radio neutrino detection to energies 10^{17} eV. EVA uses a novel antenna design that exploits the surface area of the balloon to provide a reflector antenna with 30 dBi gain (compared to 10 dBi on ANITA). We will present an overview of the mission concept and recent technology developments.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

710

Parallel GA10 VERITAS / 662

VERITAS observations of exceptionally bright TeV flares from LS I +61 303

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The very-high-energy (VHE; $E > 100$ GeV) gamma-ray observatory, VERITAS, detected exceptionally bright flares from the high mass X-ray binary LS I +61 303 during the period October - December 2014. LS I +61 303 is a known VHE gamma-ray source, the flux from which varies strongly with the orbital period of ~ 26.5 days. The maximum VHE flux is found around apastron (orbital phase ~ 0.6) at a level typically corresponding to 10-15% of the Crab Nebula flux (> 350 GeV). During these most recent observations, relatively short (day scale), bright TeV flares were observed from the source around apastron in two orbital cycles (October and November). Both cases exhibited peak fluxes above 25% of the Crab Nebula flux (> 350 GeV), making these the brightest VHE flares ever detected from this source. In the last orbital cycle observed (December), the source had returned to its historical level of activity. The results of these VERITAS observations from 2014 will be presented.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

316

Parallel NU 03 / 1180

On the feasibility of the radar detection of high-energy cosmic neutrinos

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We discuss the feasibility of the radar detection technique as a method for detecting high-energy cosmic neutrinos. When a high-energy neutrino interacts in a dens medium such as ice or rock, a particle cascade will be induced. While traversing through, the cascade will ionize the medium. We discuss the radar detection technique as a probe for the detection of the induced ionization plasma. The feasibility of the method depends on several crucial parameters of the plasma, such as its density and lifetime which will be discussed in detail. Taking into account for these plasma parameters an energy threshold of several PeV for the primary cascade-inducing neutrino is obtained. This allows the method, if shown successful, to cover the currently existing energy gap between several PeV where IceCube runs out of statistics, and several EeV where the Askaryan radio detectors start to become sensitive.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

189

Parallel CR10 Dir heavy / 718

Energy spectra of nuclei from protons to iron in sources, according to the ATIC experiment

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One of the main results of the ATIC experiment is a collection of energy spectra of abundant cosmic ray nuclei –protons, He, C, O, Ne, Mg, Si, Fe measured in terms of the energy per particle in energy range from 50 GeV to tenths of TeV. In this report the ATIC energy spectra of abundant nuclei are back propagated to the spectra in sources in terms of magnetic rigidity using a number of GALPROP-based models of cosmic rays propagation. It is shown that the results of comparison of the slopes of the spectra are relatively weakly model-dependent within a set of studied models. It is shown that the helium spectrum in sources is flatter than the proton spectrum with high statistical significance. A regular growth of steepness of the spectra is found for a charge range from helium to iron, and this conclusion is also statistical significant. The results are discussed and compared with data of other modern experiments.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0635

Parallel DM03 / 1173

Stellar evolution constrains primordial black holes as dark matter candidates

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Dark matter could be captured by stars at any stage of their evolution.

By considering adiabatic contraction of the dark matter (DM) during star formation, we estimate the amount of DM trapped in stars at their birth.

We simulate the adiabatic contraction of a DM distribution during the process of the star formation, paying particular attention to the phase space distribution of the DM particles after the contraction. Assuming the initial uniform density and Maxwellian distribution of DM velocities, we find that the majority of particles contributing at any given moment into the density $\rho(r)$ at small r have very elongated orbits and spend most of their time at distances larger than r . That greatly increases amount of DM that could be captured during star lifetime

As a concrete example we consider the case of primordial black holes (PBHs). If the DM consists partly of PBHs, they will be trapped together with the rest of the DM and will be finally inherited by a star compact remnant—a white dwarf (WD) or a neutron star (NS), which they will destroy in a short time. Observations of WDs and NSs thus impose constraints on the abundance of PBH.

We show that the best constraints come from WDs and NSs in dwarf spheroidals which could exclude the DM consisting entirely of PBH in the mass range $10^{16} - 10^{24}$ g, with the strongest constraint on the fraction $\Omega_{PBH}/\Omega_{DM} \leq 10^{-2}$ being in the range of PBH masses $10^{20} - 10^{21}$ g. If the primordial origin of some old globular clusters would be confirmed these constraints would be considerably strengthened and total mass range $10^{16} - 10^{26}$ g would be excluded.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

798

Parallel CR11 Radio / 531

The lunar Askaryan technique with the Square Kilometre Array

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Co-authors: Heino Falcke ²; Jaime Alvarez-Muniz ³; Justin Bray ⁴; Ken Gayley ⁵; Maaijke Mevius ⁶; Olaf Scholten ⁷; Ralph Spencer ⁸; Ray Protheroe ⁹; Robert Mutel ⁵; Ron Ekers ¹⁰; Rustam Dagkesamanskii ¹¹; Sander ter Veen ⁶; Stijn Buitink ¹²; Tim Huege ¹³

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The lunar Askaryan technique is a method to study the highest-energy cosmic rays, and their predicted counterparts, the ultra-high-energy neutrinos. By observing the Moon with a radio telescope, and searching for the characteristic nanosecond-scale Askaryan pulses emitted when a high-energy particle interacts in the outer layers of the Moon, the visible lunar surface can be used as a detection area. Several previous experiments, at Parkes, Goldstone, Kalyazin, Westerbork, the ATCA, Lovell, LOFAR, and the VLA, have developed the necessary techniques to search for these pulses, but existing instruments have lacked the necessary sensitivity to detect the known flux of cosmic rays from such a distance. This will change with the advent of the SKA.

The Square Kilometre Array (SKA) will be the world's most powerful radio telescope. To be built in southern Africa, Australia and New Zealand during the next decade, it will have an unsurpassed sensitivity over the key 100 MHz to few-GHz band. We introduce a planned experiment to use the SKA to observe the highest-energy cosmic rays and, potentially, neutrinos. The estimated event rate will be presented, along with the predicted energy and directional resolution. Prospects for directional studies with Phase 1 of the SKA will be discussed, as will the major technical challenges to be overcome to make full use of this powerful instrument. Finally, we show how Phase 2 of the SKA could provide a vast increase in the number of detected cosmic rays at the highest energies, and thus to provide new insight into their spectrum and origin.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

476

Parallel GA10 VERITAS / 686

VERITAS Observations of The Galactic Center Ridge

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The Galactic Center Ridge is perhaps the most local, busy environment for high energy particle acceleration; home to many relativistic particle accelerators such as pulsar wind nebulae, supernova remnants, and the central supermassive black hole SgrA*. Observations with VHE (>100 GeV) gamma-ray telescopes of the region have revealed multiple point sources associated with well known objects, as well as regions of extended emission not directly associated with targets at other wavelengths. More importantly, the detection of a large, diffuse component of >300 GeV gamma-ray emission by the HESS collaboration is strongly believed to be the result of accelerated cosmic rays interacting with molecular cloud regions, thus providing a window into high energy cosmic ray acceleration. Here we present the VERITAS observations of the Galactic Center Ridge taken from 2008-2014 above 2 TeV. These observations have revealed a distinct emission component extending along the Galactic Plane which may be due to either diffuse or unresolved point sources. We investigate possible correlations with both the lower energy (>300 GeV) H.E.S.S. maps, as well as other wavebands (radio, X-ray).

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

1062

Parallel DM03 / 942

A new look at the cosmic ray positron fraction

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Registration number following "ICRC2015-I/":

802

Parallel CR11 Radio / 357

Radio emission from ultra-high energy cosmic-ray showers after reflecting on the Earth.

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We present the calculation of coherent radio pulses emitted by extensive air showers induced by ultra-high energy cosmic rays accounting for reflection on the Earth's surface.

Our work is motivated by the detection of pulsed events in the ANITA experiment compatible with cosmic-ray origin after reflection on the ice cap at the South Pole.

The properties of the radiation are discussed in detail emphasizing the effects of reflection on the intensity, frequency and angular distribution of the signal.

Our results are obtained with a new version of the ZHAireS simulation code, accounting for reflection on a surface.

These calculations are of relevance in studies of existing and future radio detection experiments looking at the Earth from mountain tops, balloons and satellites.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

138

Parallel NU 03 / 1297

Phased Radio Arrays for Ultra-high Energy Neutrino Detectors

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The detection of ultra-high energy neutrinos is an important step towards understanding the most energetic cosmic accelerators and would enable tests of fundamental physics at energy scales that cannot be easily achieved on the Earth. Radio detector arrays such as ANITA, ARA, and ARIANNA exploit the Askaryan effect and the radio-transparency of glacial ice, which together enable hundred-cubic-kilometer volumes of ice to be monitored with sparse instrumentation. Thus far, the global trigger thresholds of these experiments have been governed by the rate of coincidences occurring between single-antenna triggers due to thermal noise. One possibility to enhance the sensitivity of in-situ radio detector stations is to correlate the analog signals from individual antennas in hardware prior to the trigger decision. We have simulated the response of such phased arrays in a variety of configurations and find that the reduced trigger threshold would (1) increase event rates of cosmogenic neutrinos and (2) could lower the energy threshold to the PeV scale to provide meaningful overlap with optical-Cherenkov neutrino detectors. A prototype phased array will be deployed in summer 2015 to test the practical implementation of this concept as part of the Greenland Neutrino Observatory (GNO).

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

982

Parallel CR10 Dir heavy / 561

The NUCLEON Space Experiment status and the first results

Authors: Aleksandr Panov¹; Alexander Voronin¹; Andrey Turundaevskiy¹; Artur Tkachenko²; Danila Polkov³; Dmitry Karmanov¹; Dmitry Podorozhny¹; Eduard Atkin⁴; Igor Kovalev¹; Ilya Kudryashov¹; Leonid Tkachev⁵; Lubov Svshnikova¹; Mikhail Merkin¹; Mikhail Torochkov¹; Nikolay Gorbunov⁵; Oleg Vasiliev¹; Sergey Filippov³; Sergey Porokhovoy⁵; Vadim Bulatov³; Viktor Grebenyuk⁵; Vitaly Shumikhin⁴; Vyacheslav Dorokhov³

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The "knee" energy range 1015 - 1016 eV is a crucial region for the understanding of the Cosmic Rays (CR) origin, acceleration and propagation in our Galaxy. The NUCLEON satellite experiment is designed to investigate directly a cosmic ray nuclei energy spectrum and the chemical composition from 100 GeV to 1000 TeV and the atomic charge range up to $Z \sim 40$ as well as a cosmic ray electron spectrum from 50 GeV to 3 TeV. The effective geometric factor is more than 0.2 m²sr for nuclei and 0.06 m²sr for electrons. The satellite was launched in 26 December 2014. The spacecraft orbit is a Sun-synchronous one with inclination 97.276 and a middle altitude of 475 km. The total weight of the NUCLEON apparatus is 375 kg, and planned exposition time of 5 years. The flight tests of the NUCLEON detector were done and the preliminary NUCLEON experiment results are presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

483

Parallel GA10 VERITAS / 542

A detailed study of gamma-ray emission from Cassiopeia A using VERITAS

Author: Sajjan Kumar¹

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Supernova remnants (SNRs) have long been considered the leading candidate sites for the acceleration of cosmic rays within the Galaxy through the process of diffusive shock acceleration. The connection between SNRs and cosmic rays is supported by the detection of high energy (HE; 100 MeV to 100 GeV) and very high energy (VHE; 100 GeV to 100 TeV) gamma rays from young and middle-aged SNRs. However, the interpretation of the gamma-ray observations is not unique. This is due to the fact that gamma rays can be produced by electrons through non-thermal Bremsstrahlung and inverse Compton scattering, and by protons through proton-proton collisions and subsequent neutral pion decay. To disentangle and quantify the contributions of electrons and protons to the gamma-ray flux, it is necessary to measure precisely the spectra and morphology of SNRs over a broad range of gamma-ray energies. Cassiopeia A (Cas A) is one such young SNR (~350 years) which is bright in radio and X-rays. It has been detected as a bright point source in HE gamma rays by Fermi-LAT and in VHE gamma rays by HEGRA, MAGIC and VERITAS. Cas A has been observed with VERITAS for more than 60 hours - three times the published exposure. The observations were taken between 2007 to 2013 over a wide range of zenith angles. In particular, half of the total data was taken under large zenith angle to boost the effective area above few TeV. Here, we will present the detailed spectral and morphological results from the complete dataset.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

492

Poster 2 CR - Board: 144 / 444**Aerosol in spring-summer-autumn-winter cycles by observation at Yakutsk EAS array in 2004-2013.****Author:** Stanislav Knurenko¹**Co-author:** Igor Petrov¹¹ *Yu. G. Shafer Institute of Cosmophysical Research and Aeronomy***Corresponding Author:** igor.petrov@ikfia.sbras.ru

Long-term set of data of aerosol composition and transparency of the atmosphere in the region of Yakutsk analyzed. Season variation of the characteristics are found in the annual cycle. Season variation taken into account in air shower analysis.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

273

Poster 2 SH - Board: 24 / 1023**Estimation of the cosmic ray ionization in the Earth's atmosphere during GLE71****Author:** Lev Dorman¹

Co-authors: C. Plainaki ²; Helen Mavromichalaki ³; P. Paschalis ³

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DYASTIMA is an application, based on Geant4, which simulates the cascades of particles that are generated due to the interactions of cosmic ray particles with the atmospheres of the planets. The first version of DYASTIMA has been successfully applied to the Earth's atmosphere, providing results that are in accordance with the publications of other models (Paschalis et al., *New Astronomy*, 2014). Since then, important improvements and extensions have been made to this application, including a graphical user interface environment that allows the more effective management of the configuration parameters. Also, the actual modeling of the atmosphere has been changed allowing the definition of more complex cases and at the same time providing, in a more efficient way (with respect to the program's previous version) enhanced outputs. In this work, we combine the new version of DYASTIMA with the NMBANGLE PPOLA model (Plainaki et al., *Solar Phys.*, 2010), that estimates the spectrum of SEPs during relativistic proton events using ground level neutron monitor data from the worldwide network. Such a joint model has as a primary scope the simulation of a SEP event and of its secondary products at different altitudes in the Earth's atmosphere, providing at the same time an estimation of the respective ionization rates and of their spatial and temporal dependence. We apply this joint model to GLE 71, on 17 May 2012, and we discuss the results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0754

Poster 2 CR - Board: 228 / 651

Revised absolute amplitude calibration of the LOPES experiment

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One of the main aims of the LOPES experiment was the evaluation of the absolute amplitude of the radio signal of air showers. This is of special interest since the radio technique offers the possibility for an independent and highly precise determination of the energy scale of cosmic rays on the basis of signal predictions from first principles. For the calibration of the amplitude measured by LOPES we used an external source. Previous comparisons of LOPES measurements

and simulations of the radio signal predicted by CoREAS revealed a discrepancy in the order of a factor of two. A re-measurement of the reference calibration source, now performed for the free field, was recently done by the manufacturer. These updated calibration values lead to a lowering of the reconstructed electric field measured by LOPES and therefore a significantly better agreement with the simulations. We will discuss the updated calibration and its impact on the LOPES analysis results.

Collaboration:

LOPES

Registration number following "ICRC2015-I":

326

Poster 2 CR - Board: 193 / 838

ARGO-YBJ absolute energy scale calibration for light primaries in the multi TeV region by using the Moon shadow

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On the base of its high altitude and nearly full coverage, the ARGO-YBJ experiment could play an important role in understanding the energy scale. In this work the light component (proton + helium like) of cosmic rays can be selected from the shower lateral information. By combining the westward displacement of moon shadow position due to the effect of the geomagnetic field, we carefully checked the relationship and its systematic error in determining shower primary energy from the shower size. The construction of an energy scale for the measurement of spectrum of the cosmic ray light component below few tens TeV is then discussed.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

420

Poster 2 SH - Board: 25 / 1039

Mini neutron monitor measurements at the Neumayer III station and on the German research vessel Polarstern

Author: Dennis Galsdorf¹

Co-authors: A. Stoessl²; Bernd Heber³; G. Benade⁴; Harm Moraal⁵; Helena Kruger⁶; Jan Gieseler⁷; Konstantin Herbst⁸; Michael Walter²

¹ CAU² DESY Zeuthen³ CAU-Kiel, Germany⁴ NWU Potchefstroom, ZA⁵ North-West University⁶ North-West University, Potchefstroom⁷ University of Kiel⁸ Christian-Albrechts-Universität zu Kiel**Corresponding Author:** herbst@physik.uni-kiel.de

Neutron monitors (NMs) are ground-based devices to measure the variation of cosmic ray intensities. They are reliable devices but difficult to install because of their size and weight. Therefore a portable mini NM (MNM) that can be installed as an autonomous station at any location that provides suitable conditions has been developed recently. The first continuous measuring MNMs are installed at Neumayer III and the German vessel Polarstern. They are providing scientific data since October 2012 and January 2014, respectively. NM measurements are influenced by the (variable) Earth magnetic field and the atmospheric conditions. Thus in order to interpret the data a detailed knowledge of the instrument sensitivity with geomagnetic latitude (rigidity) and atmospheric pressure is essential. The rigidity dependence is determined experimentally by utilizing several latitude scans. The Polarstern was specially designed for working in the polar seas and sails usually twice a year in areas with rigidity ranges below 1 GV and above 10 GV. The results of different latitude scans from October 2012 to January 2015 will be presented and discussed in the framework of a yield function.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

857

Poster 2 GA - Board: 98 / 372

Performance of Silicon Photomultipliers for the Dual-Mirror Medium-Sized Telescopes of the Cherenkov Telescope Array

Author: Jonathan Biteau¹**Co-authors:** A. Nepomuk Otte²; Caitlin Johnson³; David A. Williams³; David Chinn³; Kevin Doyle³; Kevin Meagher²; Thanh Nguyen¹ UC Santa Cruz² Georgia Tech³ UCSC**Corresponding Author:** jbiteau@ucsc.edu

Gamma-ray observations in the very-high-energy domain ($E > 30$ GeV) can exploit the imaging of Cherenkov flashes lasting a few nanoseconds from atmospheric particle showers. Photomultipliers have been used as the primary photosensors to detect gamma-ray induced Cherenkov light for the past 25 years, but they are increasingly challenged by the swift progress of silicon photomultipliers (SiPMs). We are working to identify the optimal photosensors of medium-sized Schwarzschild-Couder telescopes (SCT), which are proposed to contribute a significant fraction of the sensitivity of the Cherenkov Telescope Array in its core energy range. We present the capabilities of the latest SiPMs from the Hamamatsu, SensL, and Excelitas companies that we have characterized in our

laboratories, and compare them to the SiPMs equipping the prototype SCT camera that is under construction.

Collaboration:

CTA

Registration number following "ICRC2015-I":

363

Poster 2 GA - Board: 92 / 112

Energy Determination and Gamma/Hadron Separation using the Lateral Distribution of EAS for the 100 TeV Gamma-Ray Astronomy

Author: Kazumasa Kawata¹

Co-authors: Masato Takita²; Munehiro Ohnishi²; Takashi SAKO³

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More than 100 gamma-ray sources have been detected by the Cherenkov telescopes in the energies from sub-TeV to multi-TeV. On the other hand, the extensive air shower (EAS) arrays, such as the Tibet air shower array, the ARGO-YBJ and the Milagro, have observed several gamma-ray sources with the wide field of view and higher energy threshold than the Cherenkov telescopes.

Aiming at 100 TeV gamma-ray astronomy, the Tibet water-Cherenkov-type muon detector (MD) array ($\sim 4000\text{m}^2$) was constructed under the Tibet air shower (AS) array ($\sim 37000\text{m}^2$), and the data taking was started in 2014. This AS+MD array will significantly improve gamma-ray sensitivity in 10-1000 TeV region by means of gamma/hadron separation based on counting the number of muons accompanying an air shower.

In this work, performance of the Tibet AS+MD array will be investigated by the detailed MC simulations. We will mainly study the energy determination of gamma-ray-induced air showers in the 10-1000 TeV energy region using the lateral distribution of EAS assuming the Tibet AS+MD array. We will also show possibility of selecting gamma-ray showers from the hadron backgrounds by the age parameter of the lateral distribution.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0107

Poster 2 SH - Board: 12 / 297

Cosmic ray intensity variations in the 24th solar cycle observed by LAAS experiments

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Co-authors: Atsushi Iyono ²; Hiroki Matsumoto ; Isao YAMAMOTO ²; Kazuhide OKEI ³; Nobuaki OCHI ⁴; Nobusuke TAKAHASHI ⁵; Saya YAMAMOTO ¹; Shuhei TSUJI ³; Soji OHARA ⁶; Takao NAKATSUKA ⁷

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In Large Area Air Shower experiments, one of EAS arrays is deployed on the second floor of four stories building in the campus of Okayama University of Science to limit the zenith angle acceptance of muon detection. This system provide EAS muon intensities from zenith solid angles. To compare these intensities with solar activities such as flares, CME and magnetic-storms, LAAS data have been analyzed. Faster data acquisition with Ha/CaK solar telescope have also been carried out. In this presentation, cosmic ray variations for four years since 2011 are going to be reported as well as fast image data.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

299

Poster 2 GA - Board: 60 / 298

FACT – Calibration of Imaging Atmospheric Cerenkov Telescopes with Muon Rings

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The First G-APD Cherenkov Telescope (FACT) is an Imaging Air Cherenkov Telescope (IACT) located on the Canary Island of La Palma.

Its target is to provide long term monitoring of stellar objects like Active Galactic Nuclei.

FACT is the first IACT to use Silicon Photomultipliers instead of conventional PMTs.

Therefore studying the detector properties is especially important.

An event class that can offer valuable insight in the detector are Muon rings.

These images are created by single muons that hit the mirror of the telescope.

Because their unique shape one can use shape recognition techniques like the hough transform to identify these events.

The well-known properties of muon rings and their small photon arrival time distribution allow to estimate the time resolution, photon detection efficiency and point spread functions of the telescope.

In this contribution the methods used to extract the muons will be presented. Also the first results including the time resolution of FACT and the calibration of the Monte-Carlo simulations are shown.

Collaboration:

FACT

Registration number following "ICRC2015-I":

190

Poster 2 CR - Board: 149 / 554

Tragaldabas: a high performance detector for the regular study of cosmic ray properties

Author: Juan A. Garzon¹

Co-authors: Alberto Blanco²; Alexandra Pais³; Andres Gomez Tato⁴; Angeles Lopez Agüera⁵; Anna Morozova³; Georgy Kornakov⁶; Hector Alvarez Pol⁷; Jose Collazo¹; Juan J. Blanco⁸; Juan Taboada⁹; Luis Lopes¹⁰; Marcos Seco⁷; Marek Palka¹¹; Miguel Morales¹; Pablo Rey⁴; Paulo Fonte²; Vicente Perez Muñuzuri¹²

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Cosmic rays, coming either from the Sun, our galaxy or other galaxies, are permanently arriving to the Earth after having been affected by the intergalactic magnetic fields, the solar activity and the terrestrial atmosphere, being a very valuable source of information of our surrounding Universe.

Since the last year, a new RPC-based tracking detector, TRAGALDABAS (acronym of "TRAsGo for the AnaLysis of the nuclear matter Decay, the Atmosphere, the earth's B-field And the Solar activity"), has been installed at the Univ. of Santiago de Compostela, Spain (N:42°52'34", W:8°33'37") and is taking cosmic ray data at a rate of about 7 million of events per day. The detector has three active planes inside a volume of $\sim 1.2 \times 1.5 \times 1.8 \text{ m}^3$ and offers a granularity of 120 cells per plane, an arrival time resolution of about $\sim 300 \text{ ps}$, a tracking angular resolution below 3° and a detection efficiency close to one. A team of about 20 researchers from 11 laboratories of 5 European countries is collaborating in the maintenance and calibration of the detector and in the analysis of the data.

In this talk, the main design features of the facility will be presented together with their measured performances and a summary of the preliminary results obtained related with the main fields of research that are covered by the collaboration: analysis of the microstructure of cosmic ray showers, solar physics, space weather, geomagnetism and stratosphere dynamics, among others.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

479

Poster 2 CR - Board: 243 / 1036

Variations of low energy gamma-rays in the atmosphere: seasonal and occurrence

Author: Yury Balabin¹

Co-authors: Alexey Germanenko¹; Boris Gvozdevsky¹

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Low energy gamma-rays background in the polar atmosphere (Apatity (67° N) and Barenzburg (78° N)) is studied. Continuous measurements of gamma-ray differential spectrum in Apatity and integral one in Barenzburg are conducted since 2009. There is a seasonal variation of gamma-ray flux falling down from upper hemisphere. The same variations in thermal neutron and low energy charged particle fluxes are observed. Variations, which connected with atmospheric precipitations are also observed. They occur around year and go after rain, snowfall or fog. Energy range of these variation is up to ~3 MeV. We suggest the variations to be caused by interaction between secondary cosmic rays and clouds in the low atmosphere.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

861

Poster 2 DM and NU - Board: 284 / 855

Spectrometry of the Earth using Neutrino Oscillations

Author: Akimichi Taketa¹

Co-author: Carsten Rott²

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Neutrinos have favorable properties for measuring the elemental composition deep inside the earth's interior. First, they propagate a long distance almost undisturbed through the earth due to their weak interactions with matter. Secondly, neutrino oscillations in matter are sensitive to the electron density of the medium traversed by them. Therefore, neutrinos can be used for a probe to determine the average atomic mass ratio Z/A of the earth's core by comparing with the earth's nucleus density distribution that is inferred from seismic observations. There is little uncertainty in densities of the earth's core, but our knowledge of its main light element is very limited. With the advent of the new-generation megaton neutrino detectors, neutrino oscillation mass spectrometry will allow us

to constrain directly the light elements in the earth's outer core. We report the detail of this novel technic and the sensitivity study.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

738

Poster 2 SH - Board: 18 / 489

Relation of the equatorial component of the cosmic ray anisotropy to the parameters of interplanetary medium

Author: Olga Kryakunova¹

Co-authors: Anatoliy Belov²; Artem Abunin²; Evgeniya Eroshenko²; Mariya Abunina²; Viktor Yanke²; Viktoriya Oleneva²

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Variations of the cosmic ray vector anisotropy observed on Earth are closely related on the condition of near the Earth interplanetary medium. The hourly characteristics of vector anisotropy obtained by the global survey method from the data of world wide neutron monitor network during 1957-2013 allow us to investigate connection of the cosmic ray anisotropy with the solar wind parameters. In the offered work relation of the equatorial component A_{xy} of the cosmic ray anisotropy (rigidity 10 GV) to the solar wind velocity and density, to intensity of the interplanetary magnetic field and to the changes of cosmic ray density in which the spatial gradient of CR is revealed in interplanetary space, is studied. Characteristics of CR anisotropy for various combinations of the interplanetary parameters corresponding to various conditions of the interplanetary medium are compared. Opportunity to judge on condition of a solar wind by cosmic ray anisotropy data is discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

432

Poster 2 CR - Board: 171 / 1204

URAGAN & TRAGALDABAS: two complementary approaches for the regular survey of cosmic rays

Authors: Igor Yashin¹; Juan A. Garzon²

Co-authors: Alberto Blanco Castro³; Alexandra Pais⁴; Anatoly Petrukhin¹; Andres Gomez ; Angeles López Agüera⁵; Anna Dmitrieva¹; Anna Morozova⁴; Hector Alvarez Pol⁶; Ivan Astapov¹; José Collazo⁷; Juan J. Blanco⁸; Juan Taboada⁹; Kornakov Georgy¹⁰; Luis Lopes¹¹; Marcos Seco Miguelez¹²; Marek Palka¹³; Miguel Morales⁷; Natalia Barbashina¹; Pablo Rey¹⁴; Paulo Fonte¹⁵; Teresa Kurtukian¹⁶; Vicente Perez Muñuzuri⁹; Viktor Shutenko¹

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Cosmic Rays research is of great interest both because it improves our knowledge of how Cosmic Rays are produced and accelerated and because it provides a great deal of information about the interstellar and interplanetary media, the solar activity and the Earth's surroundings.

In order to deepen our understanding of several phenomena related with the cosmic rays, two complementary facilities have been developed in Europe based on the local measurement of cosmic ray bundles with unusual performances. On the one hand the large area tracking hodoscope URAGAN, located at the MEPhI of Moscow (55.7° N, 37.7° E, 173 m a.s.l.), is targeted to detect in a real-time mode the muon flux at the Earth's surface in a wide range of zenith angles (0-80°) with a high angular resolution (~1°). The main objective of URAGAN is study variations of the angular distribution of the muon flux caused by different atmospheric and extra-atmospheric processes.

On the other hand, TRAGALDABAS is a small area (~1.8m²) tracking detector, located at the Univ. of Santiago de Compostela (42.9°, 8.6° W, 240 m a.s.l.), offering as its main strengths outstanding resolutions on both position (~100 cm²) and time (~300 ps) and good angular resolution (<2.5°). These features will allow it to explore the front structure of the cosmic ray showers and to make some guess about the energy and the arrival direction of primary cosmic rays.

The distance between both facilities is ~3557 km, allowing to scan a significant area of the celestial sphere looking for common and simultaneous effects in the arrival of cosmic rays. In this poster, we summarize the main aspects of our initiative for a joint analysis of the data taken by both facilities, the combined performances and the main research topics we want to undertake.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

479

Poster 2 DM and NU - Board: 283 / 899

Sensitivity of the JEM-EUSO detector to UHE tau neutrino

Author: Galina Vankova-Kirilova¹

Co-authors: Andrea Santangelo²; Mario Bertaina³; Maryan Bogomilov⁴; Rosen Matev⁴; Roumen Tsenov¹; Stefan Mladenov¹

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The ultra high energy cosmic neutrinos are source of knowledge for both astrophysical mechanisms of particle acceleration and fundamental interactions. They open a window into the very distant and high-energy Universe that is difficult to access by any human means and devices. The possibility of detecting them in large exposure space-based apparatus, like JEM-EUSO, is an experimental challenge.

The Extreme Universe Space Observatory on-board the Japanese Experiment Module (JEM-EUSO) on the International Space Station (ISS) is an innovative space mission designed to detect ultra-high energy cosmic rays (UHECRs). When high energy cosmic particles interact with the atomic nuclei of air molecules they initiate extensive air showers (EAS). Orbiting the Earth with period of 90 minutes, at an altitude of about 400 km, JEM-EUSO will detect the light from isotropic nitrogen fluorescence excited by the extensive air showers and Cherenkov radiation reflected from the earth surface or dense clouds.

In this paper we present an estimation of the feasibility of detection of UHE tau neutrino by the JEM-EUSO telescope. The interactions of tau-neutrino in sea water and earth crust has been investigated. The estimation of the propagation length and energy of the outgoing tau-lepton shows that if the decay of tau occurs in the atmosphere close enough to the earth surface, e.g. below $\sim 5\text{ km}$ altitude, the cascade is intensive enough and the generated light can be detected from space.

The geometrical aperture of the JEM-EUSO detector for Earth-skimming tau neutrino events has been estimated for clear sky condition, nadir mode and an average background. The results indicate that the trigger probability of the JEM-EUSO telescope increases up to $\sim 100\%$ at energies $E\nu_\tau \geq 8 \times 10^{19}$ eV.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

762

Poster 2 CR - Board: 238 / 845

What number of cosmic ray events do we need to measure source catalogue correlations?

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Recent comparison studies of cosmic ray arrival directions and active galactic nuclei have resulted in evidence for correlation with weak significance against an isotropic source distribution. In this paper we address the question of what sample size is needed to measure a highly statistical significant correlation to a parent source catalog. We compare several scenarios for the directional scattering of ultra-high energy cosmic rays given our current knowledge of the galactic and intergalactic magnetic fields. We find significant correlations between an assumed source catalog if the cosmic rays are primarily composed of protons and there are greater than 1000 events, and that inclusion of galactic magnetic field scattering weakens that significance.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

710

Poster 2 CR - Board: 169 / 1168**The coordinate-tracking detector based on the drift chambers****Author:** Anatoly Petrukhin¹**Co-authors:** Alexandr Ovechkin¹; Alexei Bogdanov¹; Anatoly Borisov²; Anatoly Kozhin²; Dmitry Chernov¹; Egor Zadeba¹; Igor Yashin¹; Konstantin Kompaniets¹; Lev Dushkin¹; Natalia Barbashina¹; Nikolay Ampilogov¹; Nikolay Volkov¹; Rinat Fakhрутdinov²; Rostislav Kokoulin¹; Victor Shutenko¹; Vyacheslav Ovchinnikov¹; Vyacheslav Selyakov¹¹ *National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)*² *Institute of High Energy Physics***Corresponding Author:** aapetrukhin@mephi.ru

The large-scale coordinate-tracking detector TREK for registration of near-horizontal muon flux generated by ultrahigh energy primary particles is being developed in MEPhI. Detector is based on the multiwire drift chambers from the neutrino experiment at the IHEP U-70 accelerator, their key advantages are a large effective area (1.85 m²), good coordinate and angular resolution with a small number of measuring channels. Detector will be operated as a part of the experimental complex NEVOD, in particular, jointly with Cherenkov water detector (CWD) with volume of 2000 cubic meters and coordinate detector DECOR.

The first part of the detector representing two coordinate planes of 8 drift chambers in each (CTUDC) has been developed and has been mounted on the opposite sides of CWD. It has the same principle of joint operation with NEVOD-DECOR triggering system and the same drift chambers alignment, so main features of the detector TREK will be examined. Results of a cross-calibration of the CTUDC and coordinate-tracking detector DECOR and a joint work with NEVOD-DECOR complex are presented. Propositions concerning construction of the full-scale tracking detector TREK are discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

50

Poster 2 GA - Board: 124 / 999**Probing cluster environments of blazars through gamma-gamma absorption****Author:** Iurii Sushch¹**Co-author:** Markus Böttcher¹¹ *North-West University*

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Blazars, a class of radio-loud active galactic nuclei with their jets pointed close to the line of sight to Earth, are the most abundant extragalactic gamma-ray sources detected both by the Fermi Gamma-Ray Space Telescope and by groundbased atmospheric Cherenkov Telescope facilities. Most blazars are known to be hosted in giant Elliptical galaxies, but their cluster environments are poorly characterized. Very-high-energy (VHE; above ~ 10 GeV) gamma-rays emitted in the jet may be absorbed by low-energy (IR, optical) radiation through gamma-gamma pair production, leaving a characteristic imprint of the surrounding radiation field in the high-energy and VHE gamma-ray spectrum of the blazar. We study the possibility of the efficient absorption of the VHE gamma-rays in the cluster environments of gamma-ray bright blazars due to the intracluster light and/or close companion galaxies. We show that such absorption is negligible and should not affect the gamma-ray emission.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

826

Poster 2 GA - Board: 83 / 130

Construction of a Schwarzschild-Couder telescope as a candidate for the Cherenkov Telescope Array: Implementation of the optical system

Author: Julien Rousselle¹

Co-authors: Akira Okumura²; Andriy Petrashyk³; Brian Humensky³; Daniel Nieto³; Manel Errando⁴; Reshmi Mukherjee⁴; Valerie Connaughton⁵; Vladimir Vassiliev¹

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We present the final optical system design of the prototype Schwarzschild-Couder telescope (pSCT), for which construction is scheduled to begin in early fall at the Fred Lawrence Whipple Observatory in southern Arizona, USA. The Schwarzschild-Couder telescope is a candidate for a future extension of the Cherenkov Telescope Array. This novel aplanatic optical system design is made of two aspheric mirrors. The primary mirror has 48 large (~ 1 m²) mirror panels for an aperture of 9.6 m, while the secondary, made of 24 panels, has an aperture of 5.4 m. The resulting PSF is expected to be around 5 arcmin, which corresponds to a physical size of 8 mm on the focal plane. This represents a challenge for the fabrication of inexpensive aspheric mirror panels and for the precise alignment of the optical system as well as for the stability of the optical support structure. In this submission we introduce the design of the Schwarzschild-Couder optical system and describe the solutions adopted for the manufacturing of the mirror panels and their assembly on the optical support structure.

Collaboration:

CTA

Registration number following "ICRC2015-I":

1260

Poster 2 CR - Board: 217 / 256

Effects of thunderstorms electric field on the energy of cosmic ray electron

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Studies on energy changes of cosmic ray electron in thunderstorms electric field are very important to understand the acceleration mechanism of secondary charged particles caused by electric field. In this paper, Monte Carlo simulations were performed by CORSIKA to study the energy of cosmic ray electron in two typical electric fields. One is upper than the threshold field strength resulting in a runaway breakdown process (such as the order of 1kV/cm), the other is lower than that (such as the order of 0.1 kV/cm). The electron energy spectra and equilibrium energies are obtained at different fields and different altitudes, especially above YBJ (4300 m a.s.l., Tibet, China). The decrease of the ground cosmic ray intensity during thunderstorms observed in ARGO-YBJ is discussed by using our simulation results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

110

Poster 2 SH - Board: 35 / 895

Interplanetary shock manifestation in cosmic rays and geomagnetic field

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The analysis of groundbased measurements of cosmic ray intensity and geomagnetic field during the 96 interplanetary shocks passing by Earth was fulfilled. It was shown that most part of the shocks (49 of 96) were accompanied by simultaneous effects –decreases in the cosmic ray intensity and geomagnetic field. But there was no amplitude accordance: more part of the strong and moderate geomagnetic storms with amplitude more than 60 nT (44 from 60) did not observed together with the cosmic ray intensity decreases or these effects were very weak. Nearly a half of the shocks (40 of 96) had effects only in cosmic ray or in geomagnetic field, and 7 shocks had no any ground effects. The difference of our approach consists that our purpose is to clarify the role of the geometrical

factor of moving solar wind structure intersections respect to the Earth by the ratio of their geo-effective manifestations in the geomagnetic field and in the cosmic rays. Thus were obtained new data confirming our preliminary conclusions that the region responsible for the generation of geomagnetic storms and cosmic ray Forbush decreases of are spatially separated in the interplanetary disturbances.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

167

Poster 2 SH - Board: 37 / 307

Design of the high voltage supply module of a prototype energy spectrometer for solar wind plasma measurement

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A prototype energy spectrometer is being developed for space missions aiming at observing solar wind plasma activity. This detector mainly consists of three sections: entrance section, particle detection section and readout electronics. The entrance section is implemented by a symmetrical quadrispherical Electrostatic analyzer (ESA) with top hat, which selects incident particles with their incoming direction and by their energy-per-charge (E/Q) value. And the detection section is composed of two microchannel plate (MCP) electron multipliers and position encoding discrete anodes. A fast sweeping high voltage with 32 steps in 62.5 ms and sweep range from -2300 V to -5V for ESA, and a fixed high voltage at -2500 V to -2300V for MCP, is needed by this detector. In order to meet the requirement of high voltage supply of ESA and MCP, a high voltage supply module is designed in this paper. Firstly a high voltage block is employed to generate a -3000 V fixed output, which is divided by a resistor network to get a fixed high voltage. Meanwhile, it is sent to a fast high voltage photoelectric coupler to generate sweeping high voltage.

Test results showed that less than 0.8% relative precision for fixed high voltage, 0.08% non-linearity with fast enough slew rate for sweep high voltage, were attained, which indicated that the high voltage supply module meets the design requirements. The module has been successfully assembled with the prototype detector for ground-based vacuum test.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

286

Poster 2 GA - Board: 51 / 217

Searches for Gamma-Ray Emission from TeV Binary Candidates with HAWC

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The High-Altitude Water Cherenkov (HAWC) Observatory is a large field-of-view, high-uptime detector which measures TeV cosmic rays and gamma rays from 2/3 of the sky each day. The large uptime and field of view make the detector well-suited to observe time-dependent emission from objects such as pulsars and TeV binaries. Very high energy gamma rays have been observed from only a small number of binary systems in the Galaxy, and the emission mechanisms are poorly understood. HAWC is beginning to carry out a simultaneous survey of many TeV binary candidates. We describe the sensitivity of HAWC to periodic emission from Galactic sources of gamma rays and present data from the first year of observations with the partially constructed observatory.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

151

Poster 2 GA - Board: 117 / 470

Expectation on Observation of Gamma-ray Astronomy with the LHAASO Project

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The Large High Altitude Air Shower Observatory (LHAASO) project is a new generation instrument, which will be built at 4400m above sea level in Daocheng, Sichuan province, China. With a sensitivity of 10 milli-Crab, LHAASO will survey the northern sky in the declination band from -10° to 70° with a 100% duty cycle. With the wide field-of-view, LHAASO can observe not only the γ -ray point sources, but also extended sources, diffuse sources and transient phenomena. From the simulation result on observation of SNRs, Cygnus region, diffuse galactic γ -rays and transient sources, we can see that LHAASO has a strong ability to provide the accurate spectrum from 300GeV to 1 PeV and give a final judgment on different cosmic ray acceleration mechanism models.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

1185

Poster 2 CR - Board: 213 / 142

Experimental cosmic ray studies by the sub-array of the Alborz-I array

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The first phase of the Alborz Observatory Array (Alborz-I) is designed to have 20 scintillation detectors to study the cosmic ray spectrum in the energy range of 10^{12} eV to 10^{16} eV. In order to collect data under stable environmental conditions, a sub-array consists of 5 plastic scintillation detectors on a pentagon with side of 5 m similar to the central cluster of the Alborz-I have been operational since February 2014. This paper studies angular distribution of detected showers and the angular resolution of the sub-array with comparing to the simulated results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

158

Poster 2 CR - Board: 218 / 257

Mass Composition of Cosmic Rays of the energy region 10^{16} – 10^{18} eV by data the Small Cherenkov Array at Yakutsk. Comparison with results of other installations

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In the paper are present the new results for the mass composition of cosmic rays, obtained of the energy region 10^{16} – 10^{18} eV. The data were obtained at Small Cherenkov array over a 20 - year period of continuous observation. The our experimental data are indicate at changed in the mass composition in the energy range 10^{16} - 10^{18} eV and it's confirmed by independent results obtained by other EAS arrays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

273

Poster 2 CR - Board: 212 / 139

Temporal signatures of the Cherenkov light induced by extensive air showers of cosmic rays detected with the Yakutsk array

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We are analysing temporal characteristics of signals from the wide field-of-view (WFOV) Cherenkov telescope detecting extensive air showers (EAS) of cosmic rays (CR) in coincidence with surface detectors of the Yakutsk array. Our aim is to reveal causal relationships between measured characteristics and physical properties of EAS.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

61

Poster 2 CR - Board: 214 / 212

Universality of the lateral and angular distributions of electrons in large extensive air showers

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Based on shower simulations we show that the electron distribution $f(\theta, r, E; s)$, describing fully the fraction of electrons with energy E , at shower age s , at the distance from the axis r and having angle θ is the same for any shower, independently of the primary energy or mass and shower fluctuations. We find an analytic description of this function fitting it best in most populated regions of the variable space.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

229

Poster 2 CR - Board: 138 / 244

Development of a Front-End Electronics for YAC-III detectors of TibetASgamma experiment

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To measure the cosmic-ray composition at the knee energy region, Yangbajing Air shower Core (YAC) -III

experiment is planned in Tibet, China.

We developed a front-end electronics to read out charge signal from YAC detectors.

The readout system consists of a charge-to-time converter circuit and a time-to-digital converter circuit.

The system has a linearity from less than 1 pC to more than 1000 pC to achieve

a wide readout range which is required to measure the burst size of air shower core

from 1 MIP to 10⁶ MIPs (Minimum Ionization Particle) with two photomultipliers of a YAC detector.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1082

Poster 2 GA - Board: 110 / 274

Cooling Tests of the NectarCAM camera for the Cherenkov Telescope Array

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The NectarCAM is a camera proposed for the Medium-Size-Telescopes (MSTs) in the framework of the Cherenkov Telescope Array (CTA), the next-generation

observatory for high-energy gamma-ray astronomy. The cameras are designed to operate in an open environment and their mechanics must provide protection for all their components under the conditions defined for the CTA observatory. In order to operate in a stable environment and ensure the best physics performance, each NectarCAM will be enclosed in a slightly over-pressurized, nearly air-tight, camera body, to prevent dust and water from entering. The total power dissipation will be ~7.7 kW for a 1855-pixel camera. The largest fraction is dissipated by the readout electronics in the modules. We present the design and implementation of the cooling system together with the test bench results obtained on the NectarCAM thermal demonstrator.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

285

Poster 2 CR - Board: 200 / 993

A general estimator of the primary cosmic ray energy with the ARGO-YBJ experiment

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The determination of the primary cosmic ray all-particle spectrum with ground-based air shower experiments usually depends on the assumed elemental composition and hadronic interaction model. Here we show that an energy estimator independent of the primary mass composition can be defined by means of shower parameters measured in the core region, as carried out in the ARGO-YBJ experiment. An energy resolution better than 20% is obtained. Being insensitive to the number of muons, this energy determination has only a weak dependence on the hadronic interaction model. The features of this energy estimator have been validated by extensive MC simulations and used in the analysis of the ARGO-YBJ data.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

817

Poster 2 DM and NU - Board: 277 / 1186

Reconstruction of cascade-type neutrino events in KM3NeT/ARCA

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KM3NeT is a future research infrastructure hosting the next-generation underwater neutrino observatory in the Mediterranean Sea. Within KM3NeT, the ARCA detector will be devoted to the observation of high-energy cosmic neutrinos both in diffuse and point source mode. The discovery of cosmic high energy neutrinos by the IceCube collaboration with a large fraction of shower-like events has led to the recognition of the particular importance of this channel at high(est) energies. While the neutrinos detected by IceCube are compatible with a diffuse distribution, good angular resolution is crucial for the identification of possible sources. Using Monte Carlo simulations, dedicated cascade reconstruction algorithms have been developed for KM3NeT/ARCA allowing for both

an efficient discrimination of showers from the main background of high energy atmospheric muon bundles and a high precision in the determination of the kinematic variables of the cascades. The optical properties of water and the new technology of KM3NeT (multi-PMT digital optical module) make it possible to reach an energy resolution of roughly 10% and a median angular resolution of less than 2 degrees for high energy cascades taking place within the instrumented volume. The reconstruction methods and the results obtained will be presented.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

1021

Poster 2 DM and NU - Board: 253 / 748

Shower reconstruction with the KM3NeT/ORCA detector

Author: Jannik Hofestädt¹**Co-authors:** Clancy James²; Thomas Eberl³¹ *ECAP*² *University of Erlangen-Nuernberg*³ *Erlangen University***Corresponding Author:** jannik.hofestaedt@physik.uni-erlangen.de

The determination of the neutrino mass hierarchy is a central goal of upcoming neutrino physics experiments. In a detailed investigation we have evaluated the potential of the multi-megaton underwater KM3NeT/ORCA detector (Oscillation Research with Cosmics in the Abyss) to perform this measurement using atmospheric neutrinos in the multi-GeV energy range. The detector will be a dense array of optical modules located in the Mediterranean Sea, using technology developed for KM3NeT.

The reconstruction of electron neutrinos in charged-current events is a key task and substantially affects the mass hierarchy sensitivity. Due to the small light scattering in water, it is possible to distinguish the signatures of electromagnetic and hadronic showers with the ORCA detector. This allows for determining the inelasticity (Bjorken y) of neutrino interactions, and thus a separation of neutrino and anti-neutrino charged-current and of neutral-current events on a statistical basis. In addition, the Bjorken y sensitivity helps to improve the neutrino energy resolution. In this talk the method developed to reconstruct shower events will be presented and the performance in terms of neutrino energy and direction resolution, event classification and Bjorken y sensitivity will be discussed.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

424

Poster 2 CR - Board: 244 / 1041

Cosmic ray measurements in the atmosphere at several latitudes in October, 2014

Author: Vladimir Makhmutov¹

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We summarize the results of analysis of cosmic ray (CR) measurements in the Earth's atmosphere at several latitudes on October 20 and 24, 2014. The cosmic ray fluxes in the atmosphere were recorded during balloon flight in Zaragoza (Spain; 41°39'N, 0°54'W) by two detectors constructed at the Reading University, UK and at the Lebedev Physical Institute, Russia. We compare these data with simultaneous cosmic ray measurements by standard radiosondes in northern Murmansk region, Apatity (Russia; 67°33'N, 33°24'E), in Antarctica (observatory Mirny; 66°33'S, 93°00'E) and in Moscow (Russia; 55°45'N, 37°37'E). The measurements in Reading (UK; 51° 27'N, 0° 58' W) and in Mitzpe-Ramon (Israel; 30°36'N, 34°48' E) are also used in the analysis. We focus on the estimation of the cosmic ray latitudinal effect in the atmosphere. The new results will be discussed and compared with the previous results obtained.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

243

Poster 2 CR - Board: 203 / 1072

Reconstruction of the parameters of cosmic ray induced extensive air showers using radio detection and simulation

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Cosmic rays have a wide energy spectrum and their flux decreases quickly with the energy. For the most energetic events (above 10^{17} eV), the mass composition is not well known, due to shower to shower fluctuations. The knowledge of the mass composition would allow us to constrain theoretical models which predict different types of source and acceleration mechanism according to the mass of the particle. The only way to study such rare events is to observe the extensive air shower (EAS), composed of the secondary particles produced in the atmosphere after the interaction between the primary cosmic ray and the atmosphere's constituents. The EAS is mainly composed of electrons,

positrons and photons. Different ways of detection exist to determine the EAS parameters. The fluorescence detectors receive the light emitted by the atmosphere constituents after being excited by the EAS charged particles. Cerenkov tanks and plastic scintillators sample the particles on the ground. Radio antennas record the electric field emitted by the electrons and positrons of the shower. These detection methods are able to reconstruct some of the EAS parameters such as the energy of the primary particle, its arrival direction, the EAS core position on the ground and the atmospheric depth at which the number of particles is maximum (X_{\max}). The radio signal is now quite well understood and its description via the simulation is successful. In this context, the reconstruction method described in this contribution is based on a detailed comparison between the simulated radio footprint and the one sampled by an array of antennas. The method is sensitive to the X_{\max} value which is strongly correlated to the primary mass. We finally show how the radio detection is able to reconstruct all the EAS parameters on its own.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

810

Poster 2 GA - Board: 87 / 58

The Optical system for the Large Size Telescope of the Cherenkov Telescope Array

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Co-authors: Achim Vollhardt²; Akira Okumura³; Arno Gadola⁴; Christopher Jablonski⁵; Dieter Horns⁶; Hideaki Katagiri⁷; Holger Wetteskind⁸; Koji Noda⁹; Masahiro Teshima¹⁰; Michi Chikawa¹¹; Miki Kagaya¹²; Momoko Ogino¹³; Norihito CHO⁷; Robert Stadler⁵; Satoshi Fukami¹³; Stefan Steiner²; Takayuki Saito¹⁴; Tatsuo Yoshida⁷; Ulisses Barres de Almeida¹⁵; Ulrich Straumann²; Yoshitaka Hanabata¹³; tokonatsu yamamoto¹⁶

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The Large Size Telescope (LST) of the Cherenkov Telescope Array (CTA) is designed to achieve a threshold energy of 20 GeV. The LST optics is composed of one parabolic primary mirror 23 m in diameter and 28 m focal length. The reflector dish is segmented in 198 hexagonal, 1.51 m flat to flat mirrors. The total effective reflective area, taking into account the shadow of the mechanical

structure, is about 368 m². The mirrors have a sandwich structure consisting of a glass sheet of 2.7 mm thickness, aluminum honeycomb of 60mm thickness, and another glass sheet on the rear, and have a total weight about 47 kg. The mirror surface is produced using a sputtering deposition technique to apply a 5-layer coating, and the mirrors reach a reflectivity of ~94% on average at 370 nm. The mirror facets are actively aligned during operations by an Active Mirror Control system, using actuators, CMOS cameras and a reference laser. Each mirror facet carries a CMOS camera, which measures the position of the light spot of the optical axis reference laser on the target of the telescope camera. The two actuators and the universal joint of each mirror facet are respectively fixed to three neighboring joints of the dish space frame, via specially designed Interface Plate. In this contribution, we will overview the design and validation of each component in the optical system for the LST prototype.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

81

Poster 2 DM and NU - Board: 251 / 341

Searches for neutrinos from Gamma-ray burst with 4 years of the ANTARES data

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Gamma-ray bursts (GRB) are the most energetic transient sources observed in the Universe. They are supposed to be produced by the emission of an inhomogeneous relativistic jet in which energy dissipation occurs via internal shocks. In these shocks, particles as electrons and protons could be accelerated at very high energies via Fermi acceleration processes. Thus, GRB are promising candidates to be cosmic accelerators of the very high energy cosmic rays. However, since cosmic-rays are deviated by magnetic fields and interact with matter and also because GRBs are mostly located at high redshift, it is impossible to directly observe an association between a GRB and a cosmic ray signal. High-energy neutrinos are proxies commonly used to directly probe such association because they are created by photohadronic interactions in the GRB jets up to very high energies and then propagate straight towards the observer. ANTARES is the largest neutrino telescope in the Northern Hemisphere. In this presentation, the GRB analysis done with four years of ANTARES data to search for a GRB neutrino signal will be presented. An individual study of GRB130427A, one of the most energetic and nearby burst, will also be shown. At last, thanks to the ANTARES results constraints on the physics of GRB jets have been derived for few bursts.

Collaboration:

ANTARES

Registration number following "ICRC2015-I/":

681

Poster 2 GA - Board: 105 / 181

The Camera Calibration Strategy of the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) will be the next generation ground based observatory in very high energy gamma ray astronomy. The facility will achieve a wide energy coverage, starting from a threshold of a few tens of GeV up to hundreds of TeV by utilising several classes of telescopes, each optimised for different regions of the gamma-ray spectrum. The required energy resolution of better

than 10-15% over most of the energy range and a goal of 5%

systematic uncertainty on the measurement of the Cherenkov light intensity at the position of each telescope means that a very precise evaluation of the entire system will need to be made. The composite nature of the array means multiple camera technologies will be employed so multiple calibration systems and procedures will be necessary to meet the performance requirements. Additional constraints will come from the need to minimise observing time losses and that the observatory is foreseen to operate for tens of years, so both short and long term systematic changes in performance will need to be investigated and monitored. This contribution summarises the recommended camera calibration strategy of CTA based on the experience with current IACTs.

Collaboration:

CTA

Registration number following "ICRC2015-I":

200

Poster 2 DM and NU - Board: 273 / 848

Online and Near Realtime Searches for Neutrinos from GRBs with IceCube

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Gamma Ray Bursts (GRBs) have long been suspected as the sources for the ultra high energy cosmic rays. For this to be true, a mechanism must exist within the GRB to produce hadrons, a consequence of which is the production of neutrinos. So far, no significant observation has been made that suggests GRBs produce neutrinos. The IceCube neutrino Observatory, a cubic kilometer ice Cherenkov detector at the south pole has put stringent limits on the theoretical models predicting GRB neutrino and cosmic ray production. Although no significant observation has yet been made, even a single high energy neutrino event coincident in time and direction to a known GRB could constitute a discovery. As such, we have implemented a rapid data processing and analysis scheme that allows

for the detection of possible GRB coincident neutrino events, as well as the ability to send alerts of such events to other observatories for followup observations. This poster will describe the data processing and analysis scheme, the sensitivity of current searches, and the mechanism in place to send alerts for future IceCube observations.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

251

Poster 2 CR - Board: 232 / 771

AMON: transition to real-time operations

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The Astrophysical Multimessenger Observatory Network (AMON) will link the world's leading high-energy neutrino, cosmic-ray, gamma-ray and gravitational wave observatories by performing real-time coincidence searches for multimessenger sources from observatory subthreshold data streams. The resulting coincidences will be distributed to interested parties in the form of electronic alerts for real-time follow-up observation. We will present the science case, design elements, current and projected partner observatories, and status of the AMON project. Observatories that already signed the AMON Memorandum of Understanding (MoU) include the IceCube and ANTARES Neutrino Observatories, the HAWC and VERITAS gamma-ray observatories, the Pierre Auger Cosmic Ray Observatory and the Swift satellite experiment. AMON is an open network seeking new triggering and follow-up observatories, as well as collaborators interested in the scientific goals of AMON. The prototype of the AMON server has been online since August 2014 and processing archival data. Currently, we are deploying new high-uptime servers and will be ready to start issuing alerts as early as summer 2015.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

372

Poster 2 DM and NU - Board: 285 / 567

Acoustic properties of glacial ice for neutrino detection and the Enceladus Explorer

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Ultra high energy neutrinos may be observed in ice by the emission of acoustic signals. The SPATS detector has successfully shown that GZK-neutrinos can be observed in the clear ice at the South Pole at the IceCube detector site. To explore other potential detection sites glacial ice in the Alps and in Antarctica has been surveyed for its acoustical properties. The purpose of the Enceladus Explorer (EnEx) on the other hand is the search for extraterrestrial life on the Saturn moon Enceladus. Here acoustics is used to maneuver subsurface inside the ice by trilateration of signals. A system of acoustic pingers has been developed to study both applications.

In the south polar region of the moon Enceladus secluded crevasses are situated, filled with liquid water probably heated by tidal forces due to the short distance to Saturn. We intend to take a sample from these crevasses by using a combination of a melt down and steering probe called IceMole (IM). Maneuvering IM requires a good understanding of ice properties like the speed of sound, the attenuation of acoustic signals in ice, their directional dependencies and their dependence on different frequencies. Information about this can not only be used for a positioning system but could also contribute to the design of a future large scale acoustic neutrino detector.

We present our analysis methods and the findings on attenuation, sound speed and frequency response obtained at several sites in the Alps and Antarctica.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

513

Poster 2 CR - Board: 196 / 923

Xmax reconstruction based on radio detection of air showers

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The radio emission from air showers is used to accurately reconstruct the depth of the shower maximum (Xmax). We present a method based on using the full two-dimensional radiation profile as observed on the ground. While the density of shower particles reaching the ground is usually described with a 1D lateral distribution function, the intensity of the radio pulse is a complex function of observer position with respect to the shower axis. The CoREAS code simulates these complicated patterns to very high precision. When the antenna density is sufficiently high, like for example in the LOFAR core, the 2D approach leads to a resolution on Xmax of 17 g/cm². This is the same level of accuracy that is achieved with fluorescence detection.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

780

Poster 2 CR - Board: 195 / 910

Test for the Radio Detection of the Extensive Air Shower using the Electron Beam in Telescope Array

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We are carrying out an R&D project to search for radar echoes from cosmic ray induced extensive air showers. For the verification of the radar echo technique, we have used the electron beam as a pseudo air shower generated by the Electron Light Source (ELS). The radio receivers consist of two wide-band log-periodic antennas and digital receivers, and the transmitter consists of a Yagi antenna. We have observed a radio signal synchronized with the electron beam. The design of the experiments, detail of the observed signal and a result of the field test will be presented.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

773

Poster 2 CR - Board: 198 / 989

Probing the pseudorapidity region $\eta > 7$ with the ARGO - YBJ detector

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By means of the analog readout, the ARGO-YBJ experiment is able to image the very hot region of the shower core up to particle density of many $10^4/\text{m}^2$. Exploiting this feature the number of particles within 10 m from the core and the local age have been carefully studied. This cascade region is mainly developed from particles produced in the first interactions with pseudorapidity $\eta > 7$, an angular region still out of the reach of the accelerator experiments. We find a systematic shift of the measured local age by ~ 0.15 - 0.20 with respect to the MC expectation, by assuming primary fluxes and composition as given by the Hoerandel model and hadronic interactions as described by QGSJET2. This effect cannot be taken into account by any instrumental effect neither by reconstruction biases. Possible explanations of this result involve

both the features of the hadronic interaction as well as the elemental composition of the primary cosmic rays in the energy range between 50 TeV and 5 PeV.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

817

Poster 2 CR - Board: 141 / 353

The instrumentation of the data acquisition system for the MonRAt telescope

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MonRAt is a compact telescope designed to detect photons generated by ultra-high energy cosmic ray particles in the atmosphere. The telescope is composed of a 64-pixel multianode photomultiplier tube in the focus of a parabolic mirror. Ultraviolet-passing filters are positioned in front of the photocathode to select photons within the wavelength range of nitrogen fluorescence. The data acquisition system consists of a front-end, a set of preamplifiers and FPGA-based boards able to record trigger times and waveforms from each channel. MonRAt is being designed to detect air fluorescence and Cherenkov radiations under different atmospheric and geomagnetic conditions.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

59

Poster 2 GA - Board: 82 / 509

MAGIC discovery and observation of the candidate extreme BL Lac object RBS 0723

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The BL Lac object RBS 0723 is an extreme BL Lac object (EHBL) candidate. These sources are known to show an extreme frequency of their synchrotron and inverse Compton peaks in the spectral energy distribution (in the hard X-ray and TeV bands respectively). Furthermore, they are characterized by the extreme hardness of the UV-X-ray and intrinsic TeV continua. These characteristics are usually explained in a leptonic synchrotron+SSC emission model under the assumption that the energy distribution of the emitting relativistic electrons has a large value of the minimum Lorentz factor ($\approx 10^5$) and a rather low magnetic field intensity (10^{-2} G). This aspect points out a significant difference with respect to the parameters usually used in “classical” TeV BL Lac modelling. Thus, EHBLs are important and very interesting targets as their observation allows to investigate the properties of blazars belonging to a poorly known category of sources described by peculiar values of the relevant physical quantities of the jets.

MAGIC performed an observational campaign on RBS 0723 between December 2013 and April 2014. The source was detected for the first time in the GeV-TeV regime on January 2014 with a statistical significance of more than 5 standard deviations. The non-detection in the earlier data taken in December points to a possible VHE flux variability, at variance with common wisdom on similar sources such as 1ES 0229+200, where variability is considered quite limited. In this contribution, we will report about MAGIC observation results including the light curve and the spectral energy distribution modelling.

Collaboration:

MAGIC

Registration number following “ICRC2015-I”:

444

Poster 2 DM and NU - Board: 287 / 96

Structure of Massive Protoneutron neutron star PSR J1614-2230 with Trapped Neutrinos

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Cosmic ray particle acceleration in supernovae is expected to occur. A protoneutron star is formed in the aftermath of the supernova explosion of a massive star. Therefore, the study of properties and structure of protoenutron stars has great implications for investigating the origin and acceleration of cosmic rays. Considering the baryon octet which comprises of the least massive baryons and includes the Λ , Σ and Ξ , focusing on the influence of trapped neutrinos, we study the composition and structure of massive protoneutron star PSR J1614-2230 in the framework of relativistic mean field theory (RMFT). In this paper we show the calculation results about constitution, temperature, equation of states, mass and radius of the protoneutron star for different cases of trapped neutrinos. It is found that trapped neutrinos have significant impact on the natures of massive protoneutron star.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

110

Poster 2 CR - Board: 191 / 262

Depth of Maximum Development of Extensive Air Showers by Radio Emission Data at Yakutsk EAS Array

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Radio emission at Yakutsk Array registers at frequency 32 MHz and radio antennas co-located with scintillation and Cherenkov detectors of Yakutsk Array. The co-location with particle detectors brings as a profit the reconstruction of fundamental air shower parameters, such as shower axis, energy and arrival direction (azimuthal and zenith angles).

The paper presents data obtained in the new series of measurements of Yakutsk Radio Array in the period 2009-2013 years. We analyze individual showers and reconstruct Xmax by slope of radio LDF. Obtained results of Xmax are compared with results of other arrays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

273

Poster 2 GA - Board: 84 / 138

Study on the Sensitivity of high-energy GRB detection using the single-particle technique at an altitude 5200 m a.s.l

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Owing to the advantages in the wide field of view, high duty cycle and large effective area, ground based high altitude EAS experiments play an important role in studying the high energy gamma ray bursts (GRBs). While shower mode technique provides the most sensitive way in searching for GRBs above 100GeV energy, the single-particle technique can extend the GRBs search energy down to GeV level. In this paper, by assuming a prototype setup composing three Water Cherenkov Detector

(WCD) units locating at 5200m a.s.l. , in PuMa JiangTang, Tibet, China, we study the sensitivity of GRB detection using single-particle technique.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

154

Poster 2 GA - Board: 68 / 346

Data processing activities at the MAGIC site

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MAGIC is a system of two imaging atmospheric Cherenkov telescopes located on the Canary Island of La Palma. The fast processing of the data at the observation site plays an essential part in the operation of the telescopes and has continuously improved since the beginning of the experiment. The on-site computing can be divided into three major contributions: the MAGIC online analysis (MOLA), providing preliminary real time analysis results; the on-site analysis (OSA), providing final data products at the end of each observation night; and the Data Check (DC), an everyday check on the telescope's subsystems performance and the quality control of the data observed previous night. We present the status of the system, including the latest upgrades and details on its performance.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

1269

Poster 2 SH - Board: 30 / 1257

Neutron- γ discrimination on the Solar Neutron Telescope at Sierra Negra, Mexico using pulse shape analysis

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Solar neutron telescopes (SNTs) were designed to observe neutrons emitted during solar flares. All SNTs consist of a number of central scintillator plates, surrounded by proportional counters or thin scintillator detectors. Incoming neutrons interact with nuclei within the scintillator and produce recoil protons. The energy of a neutron may be estimated from the light emitted by the recoil proton. Proportional counters and scintillator plates around the detector work as anti-counters to distinguish neutrons from charged particles. Considering the SNT installed at Sierra Negra, Mexico, is shielded with a 5 mm lead layer on top and 10 mm iron plates at the sides to reject background photons.

In this paper we present a method to discriminate between neutrons and γ -rays analysing the shape of the output signal from SNT's scintillators.

We also present the results of the experiment performed to validate this technique, taking advantage of the SNT's capacity to reject low energy γ -rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

693

Poster 2 GA - Board: 53 / 347

Investigating the X-ray emission from the Galactic TeV Gamma-ray Source MGRO J1908+06

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MGRO J1908+06 is a bright, extended TeV gamma-ray source located near the Galactic plane. The TeV emission has previously been attributed to the pulsar wind nebula (PWN) of the nearby Fermi-LAT pulsar PSR J1907+0602. However, studies of the TeV morphology with VERITAS have shown that MGRO J1908+06 is somewhat larger than other PWNe of a similar age and that the TeV spectrum does not soften with distance from the pulsar as is observed for other PWNe. Although MGRO

J1908+06 is very bright in gamma rays, having a flux corresponding to ~80% of the Crab Nebula flux at 20 TeV, no extended emission at other wavelengths has so far been detected. We report on our analysis of X-ray data obtained with XMM-Newton of the region near MGRO J1908+06. We searched the X-ray data for point-like X-ray sources that may be associated with the TeV emission, carried out an extended source analysis to constrain the diffuse X-ray emission from MGRO J1908+06, and modeled the multi-wavelengths spectrum of the source.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1112

Poster 2 GA - Board: 54 / 343

Application of Maximum Entropy Deconvolution to γ -ray skymaps

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Skymaps measured with Imaging Atmospheric Cherenkov Telescopes (IACT) represent the real source distribution convolved with the point spread function of the observing instrument. Current IACTs have an angular resolution in the order of 0.1 degree which is rather large for the study of morphological structures and for comparing the morphology in γ -rays to measurements in other wavelengths where the instruments have better angular resolutions.

Serendipitously it is possible to approximate the underlying true source distribution by applying a deconvolution algorithm to the observed skymap, thus effectively improving the instruments angular resolution. From the multitude of existing deconvolution algorithm several are already used in astronomy, but in the special case of γ -ray astronomy most of these algorithms are challenged due to the high noise level within the measured data.

One promising algorithm for the application to γ -ray data is the Maximum Entropy Algorithm. The advantage of this algorithm is the possibility to take a priori knowledge into account and that it is an independent approach to previous work, e.g., Heinz et al. (2012) who applied the Richardson Lucy Algorithm to γ -ray skymaps.

An implementation of the Maximum Entropy Algorithm is provided in the MemSys5 software package by Gull and Skilling (1999). As this algorithm is very sensitive to various input parameters it is essential to understand their influences. We present a study of these parameter influences in order to investigate the applicability of the Maximum Entropy Algorithm for the deconvolution of skymaps in γ -ray astronomy.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

227

Poster 2 CR - Board: 158 / 813

Estimated pulse height spectrum with pulse pile-up correction for Neutron Monitor of Mexico City

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The operating principles of Neutron Monitors are nuclear reactions within the proportional counters. The output signal of these is an electric pulse for every secondary cosmic ray particle that interacts with the detector. Then, the amplitude of the pulse signal reflects the amount of charge generated on each individual interaction. The estimated pulse height distribution provides an energy resolution index and useful parameter to determine the proper operation of the detector. As a result, random nature of cosmic radiation, in addition to the operating characteristics of the detector and the electronic system, lead to a phenomenon called pulse *pile-up*. The effect of the pulse *pile-up* on the recorded pulse height spectra, can be seen on the added wings in the energy peaks of the distribution. This reduces the energy resolution of the instrument.

In the present work, we describe an algorithm that takes advantage of mathematical techniques of digital signal processing with the purpose of calculating the pulse amplitude distribution lessening the distortion caused by pulse *pile-up*. The algorithm was written in *python*, using *numpy* and *scipy* libraries. Finally, we present the results of applying the algorithm to signals from the neutron monitor operating at Mexico City.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

378

Poster 2 CR - Board: 219 / 291

The primary energy spectrum derived from Linsley method with simulations of heavy compositions in the LAAS mini array observation

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Observation experiments of Cosmic rays have been carried out since 1996 in Okayama University of Science, the primary energy spectrum in energy range of 10^{16} eV to $10^{19.5}$ eV has been obtained by using a mini array consist of 8 plastic scintillation counters and an extensive air shower (EAS) time structure since 2006. And, in order to improve the energy resolution of the mini array observation, data of zenith angle of EASs have been collected since 2010.

In this presentation, we report on results of simulations and data analysis for the primary energy estimate by taking account into primary proton and iron nuclei, because primary particles had been assumed to be proton nuclei in simulations and data analysis until 2013.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

299

Poster 2 SH - Board: 39 / 716

THE SUN SHADOW OBSERVED BY HAWC

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We present preliminary images of the sun shadow from data collected by the High Altitude Water Cherenkov Observatory (HAWC) during 2013 and 2014. HAWC is an air shower array located in the central region of Mexico that observes TeV cosmic rays at a rate of about 10 kHz. The magnetic field of the solar corona is very difficult to measure directly. However indirect observations of the solar corona are possible using the deficit in the flux of cosmic rays coming from the direction of the Sun. The inner magnetic field of the Sun as well as the interplanetary magnetic field frozen in the solar wind deviate low energy cosmic rays. In contrast, high energy cosmic rays (TeV) are expected to be absorbed in the Sun's photosphere and to produce a shadow in the Sun's nominal position viewed from Earth. Several ground-based instruments have observed during the last decades effects of the heliospheric magnetic field on the size of the sun shadow and its position. In this work, we compare our maps to those obtained by similar ground-based measurements obtained during earlier solar cycles and discuss long-term monitoring of the solar magnetic field with HAWC.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

1347

Poster 2 CR - Board: 155 / 715

TRACKING COSMIC RAYS BY CRAYFIS GLOBAL DETECTOR

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ABSTRACT:

The purpose of this research paper is to develop efficient sites array of using CRAYFIS(Cosmic Rays Found in smart phone)which gives real time radiation weather map on temporal and spatial scales. It is suggested how a map can be prepared in terms of exact azimuth zenith and altitude angles so that the direction of the cosmic rays sources could be estimated.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

605

Poster 2 CR - Board: 246 / 660

Modelling of radio emission in the SLAC T-510 Experiment using microscopic Geant4 simulations

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Co-authors: Abigail Vieregge²; Andrew Romero-Wolf³; Benjamin Rotter⁴; Brian Rauch⁵; Carsten Hast⁶; Charles Naudet⁷; Chin-Hao Chen⁸; Christopher Williams⁹; Dave Besson⁹; David Saltzberg¹⁰; David Seckel¹¹; David Urdaneta²; Harm Schoorlemmer¹²; Jessica Stockham¹³; Jiwoo Nam⁸; Joe Lam²; John Clem¹¹; Katie Mulrey¹¹; Keith Bechtol¹⁴; Keith Jobe¹⁵; Konstantin Belov⁷; Kyle Borch²; Kyle Kuwantani²; Mark Stockham¹³; Martin Israel⁵; Peter Gorham¹²; Pisin Chen¹⁶; Rachel Hyneman¹⁷; Ryan Nichol¹⁸; Stefan Funk¹⁹; Stephanie Wissel²; Tim Huege¹; Tsung-Che Liu⁸; Viatcheslav Bugaev⁵; Walter Binns²⁰

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The SLAC T-510 experiment was designed to verify established microscopic models for simulation of radio emission from air showers by reproducing the physics under controlled lab conditions. For this verification, the simulation toolkit Geant4 was expanded by the calculation of the emitted radio signal with the “end-point” and the “ZHS” formalisms in parallel. We present and compare the results of the two simulation approaches, taking into account the details of the experimental set-up such as the beam energy, target geometry and material, and the magnetic field configuration. We put special emphasis on the discussion of the effects due to refraction and transition radiation and show an initial comparison of the simulation results with the measured data of the SLAC T-510 Experiment.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

327

Poster 2 CR - Board: 166 / 1061

Measuring system of the NEVOD-EAS array

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The NEVOD-EAS detector designed for the registration of extensive air showers in the primary particle energy range of $10^{15} - 10^{17}$ eV is currently being created on the basis of the experimental complex NEVOD-DECOR. The measuring system of the NEVOD-EAS detector has a cluster organization and is located in the MEPhI campus (Moscow, Russia). In total, the detector includes 12 clusters of scintillation counters. The characteristic dimensions of the cluster are 20×20 m². The distance between the clusters is about 50 m. The detector area is 2×10^4 m².

The main detecting elements of the NEVOD-EAS are scintillation counters of the extensive air shower electron-photon component. These counters were previously used in the EAS-Top and KASCADE-Grande setups. Each counter consists of the NE102A plastic scintillator with the dimensions of $800 \times 800 \times 40$ mm³ and the Philips XP3462 photomultiplier enclosed inside the light-isolated pyramidal stainless steel housing. Four counters are combined into a detector station. Four detector stations form one NEVOD-EAS cluster.

Analog signals from the counters of the cluster come to the cluster local post (LP). Local post provides selection of events according to the intra-cluster trigger conditions, digitizes the amplitude information and transmits data to the central DAQ post.

The main functions of the central DAQ post are: synchronization of all NEVOD-EAS clusters, control of LP of all clusters, reception and storage of the experimental and monitoring data from the cluster LP.

The features of the NEVOD-EAS measuring system, which provides EAS detection, collection and primary processing of data, time synchronization of clusters and selection of events according to the

data of individual clusters, are discussed. The results of testing of the counter elements, the readout electronics and the first detector cluster are presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 2 CR - Board: 182 / 1060

Spectrum and anisotropy of cosmic rays in the model of relativistic nonlocal diffusion

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Blasi and Amato [1] studied diffusive propagation of cosmic rays (CR) in the Galaxy, taking into account spatial and temporal distribution of supernova remnants, diffusion in halo and spallation of nuclei. In frames of this model based on classic diffusion equation, they calculated the energy spectrum, chemical composition and anisotropy of galactic cosmic rays observed at Earth. They carried out calculations for different choices of the diffusion coefficient $D(E)$. The large scale distribution of supernova remnants is modeled as the distribution of pulsars, with and without accounting for the spiral structure of the Galaxy.

In this work, we carried out similar calculations, but in the framework of the relativistic nonlocal diffusion approach [2] taking turbulent character of interstellar medium, the time dependence of the particle energy and long-acting sources into account. Introduction of non-local operators is justified by turbulent nature of the interstellar magnetic field, accelerating diffusion. We use the formalism of propagators expressed via fractional stable laws [2] being fundamental solutions of the anomalous diffusion equation with integro-differential operators of fractional orders. Calculations are compared with the results of Monte Carlo simulation and the data presented in [1]. The influence of turbulent heterogeneity on the characteristics under consideration is revealed and discussed.

This work is supported by Russian Foundation for Basic Research (grant 13-01-00585).

1. Blasi P., Amato E. (2012) *Journal of Cosmology and Astroparticle Physics*, 2012, 010; 011.
2. Uchaikin, VV (2013) *Physics Uspekhi*, 56 (11) 1074.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1134

Poster 2 GA - Board: 99 / 296

Simulation of electron trajectories in nuclear emulsion and its application

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To examine the nuclear emulsion chemical uniformity or Poisson distribution of grains, simulations of electron trajectory have been carried out on the basis of the single elastic scattering Monte Carlo method considering energy straggling processes and their fluctuations. To compare these simulated results, image processing method of charged particle tracks in nuclear emulsion have also been developed. In this paper, simulation results and track analysis are going to be present.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

299

Poster 2 GA - Board: 89 / 294

INFN Camera demonstrator for the Cherenkov Telescope Array

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The Cherenkov Telescope Array is a world wide project with the aim of exploring the highest energy region of the electromagnetic spectrum. With two arrays, one for each hemisphere, it will guarantee the full sky coverage in the energy range from few tens of GeV to hundreds of TeV, with improved angular resolution and a sensitivity in the TeV energy region better by one order of magnitude than the currently operating arrays. In order to cover this wide energy range, three different telescope types have been envisaged, with different mirror sizes and focal plane features. In particular, for the highest energies a possible design is a dual mirror Schwarzschild-Couder optical scheme, with a small focal plane. A silicon photomultiplier (SiPM) based camera is being proposed as a solution to match the pixel angular size of ~ 0.17 degrees.

INFN is developing a camera demonstrator made by 9 Photo Sensor Modules (PSMs, 64 pixels each, total coverage $\sim 1/4$ of the full focal plane) equipped with FBK (Fondazione Bruno Kessler, Italy) Near UltraViolet High Fill factor SiPMs and a Front-End Electronics (FEE) based on Target 7 ASIC, a 16 channels fast sampler (up to 2GS/s) with deep buffer, self-trigger and on-demand digitization capabilities specifically developed for this purpose. The pixel dimension of 6x6 mm² leads to a very compact design with challenging problems of thermal dissipation.

A modular structure, made by copper frames hosting one PSM and the corresponding FEE inserted in an aluminum structure, has been conceived, with a water cooling system to keep the required working temperature. The actual design, the adopted technical solutions and the achieved results for this demonstrator are presented and discussed.

Collaboration:

CTA

Registration number following "ICRC2015-I":

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Poster 2 GA - Board: 57 / 292

Very high energy gamma-ray follow-up observations of novae and dwarf novae with the MAGIC telescopes

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In the last few years the Fermi-LAT instrument has detected GeV gamma-ray emission from several novae. Such GeV emission can be interpreted in terms of inverse Compton emission from electrons accelerated in the shock or in terms of emission from hadrons accelerated in the same conditions. The latter might reach much higher energies and could produce a second component in the gamma-ray spectrum at TeV energies. We perform follow-up observations of selected novae and dwarf novae in search of the second component in TeV energy gamma rays. This can shed light on the acceleration process of leptons and hadrons in nova explosions. We have performed observations with the MAGIC telescopes of 3 sources, a symbiotic nova YY Her, a dwarf nova ASASSN-13ax and a classical nova V339 Del, shortly after their outbursts. We did not detect TeV gamma-ray emission from any of the objects observed. The TeV upper limits from MAGIC observations and the GeV detection by Fermi constrain the acceleration parameters for electrons and hadrons.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

297

Poster 2 CR - Board: 225 / 597

High energy astroparticle physics for high school students

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The questions about the origin and type of cosmic particles are not only fascinating for scientists in astrophysics, but also for young enthusiastic high school students. To make them familiar with research in astroparticle physics, the Pierre Auger Collaboration agreed to make 1% of its data public available. The Pierre Auger Observatory investigates the cosmic rays at the highest energies and consists of more than 1600 water Cherenkov detectors, located near Malargüe, Argentina. With the available public data, students can perform their own hands-on analysis of data from this experiment. In the framework of an Auger Masterclass organised within the context of the German outreach network "Netzwerk Teilchenwelt" they do get an insight into cosmic ray physics and scientific research concepts. We present the project and experiences with students.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

490

Poster 2 DM and NU - Board: 252 / 193

A search for neutrinos from Gamma Ray Bursts with the IceCube Neutrino Detector

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Abstract: The origin of the Ultra-High Energy Cosmic Rays (UHECRs) is still unknown. Gamma-Ray Bursts (GRBs) are generally presented as possible candidates to host progenitors producing such UHECRs. However, the exact physical processes underlying GRBs are yet not fully understood. If GRBs are (partly) responsible for the observed UHECRs, they have to contain a hadronic component, and consequently high-energy neutrinos must also be produced. In this case, large scale neutrino observatories on Earth, such as the cubic kilometer IceCube Neutrino Observatory located at the South Pole, should be able to detect them.

We will present a search method based on two separate datasets: the long ($T_{90} > 2$ sec) and short ($T_{90} < 2$ sec) GRBs. They will be treated separately in order to obtain the best possible sensitivity as the commonly accepted picture is that long GRBs and short GRBs have a different inner engine. Our studies will be based on different event selections and specific statistical methods. The latter include a newly developed spatial and a time spectral analysis of which the details will be discussed.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

233

Poster 2 GA - Board: 58 / 271

Observations of hard spectrum Unassociated Fermi Objects with MAGIC

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More than one-third of the sources reported in the 1st and 2nd Fermi catalogs (1FGL and 2FGL) lack a clear association with a known astrophysical source, and are known as Unassociated Fermi Objects (UFOs).

We report MAGIC observations of three UFOs selected basing on their high energy spectral properties (e.g. hardness of the spectrum), as well as on additional multiwavelength information, strongly suggesting a blazar origin of their emission.

No significant signal was detected from any of them. In this contribution we present the MAGIC upper limits combined with the collected multiwavelength spectral energy distributions of those sources.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

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Poster 2 GA - Board: 59 / 278

Simultaneous H.E.S.S. and RXTE observations of the microquasars GRS 1915+105, Circinus X-1 and V4641 Sgr

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Microquasars, Galactic binary systems showing extended and variable radio emission, are potential gamma-ray emitters. Indications of gamma-ray transient episodes have been reported in at least two systems, Cyg X-1 and Cyg X-3. The identification of additional gamma-ray emitting microquasars is key for a better understanding of these systems.

Very-high energy gamma-ray emission from microquasars has been predicted to happen during periods of transient outbursts potentially connected with the formation of a jet-like outflow. Observations of the microquasars GRS 1915+105, Circinus X-1 and V4641 Sgr were undertaken with the H.E.S.S. telescope array and the RXTE satellite with the aim of detecting a broadband flaring event in the very-high energy gamma-ray and X-ray bands. Contemporaneous observations using the H.E.S.S. telescope array and the RXTE satellite were obtained on three microquasars - GRS 1915+105, Circinus X-1, V4641 Sgr. We report here on the analysis of these data for each system, including a

detailed X-ray analysis assessing the location of the sources in a hardness-intensity diagram during observations, and we discuss the derived upper limits on their very-high energy gamma-ray flux.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

288

Poster 2 CR - Board: 223 / 464

A study of the capability of the LHAASO experiment to separate primary mass groups samples

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The LHAASO experiment will operate in the Sichuan province (China) at high altitude (4410 *m a.s.l.*) sampling the electromagnetic and muonic EAS components in a 1 km^2 surface with an unprecedented high ratio between the active and the effective area. The EAS electromagnetic component will be measured by 5635 m^2 plastic scintillator detectors and the muonic one by 1211 water cherenkov detectors, 3.6 *m* radius and 1.2 *m* high each, buried 2.5 *m* underneath the ground surface.

In this contribution we present the experiment capabilities of separating, by mean of the ratio between the muon and electron numbers at observation level, at least two mass groups in the $10^{14} - 10^{17} \text{ eV}$ energy range. The study has been performed by mean of a complete EAS simulation for fixed primary energy and fixed zenith angle, using the CORSIKA code and the QSGJetII-04 hadronic interaction model. Therefore current results represent only the first step toward a complete discussion. We will show that an experiment operating at high altitude (i.e. near to shower maximum) will separate, in this energy range, at least two mass groups (i.e. the light and the heavy ones) with high efficiency, the percentage of events wrongly classified will be discussed.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

0412

Poster 2 SH - Board: 38 / 525

The background conditions of cosmic ray ion charge measurements in MONICA experiment

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The present contribution is dedicated to the investigation of background conditions for cosmic ray ion ionization state measurements in MONICA experiment. The future experiment MONICA is aimed to study the cosmic ray ion fluxes from H till Ni in energy range 10-300 MeV/n. The experiment main scientific objective is the measurement of ion ionization state, as well as elemental, isotope composition and energy spectra of Solar Energetic Particle (SEP), Anomalous (ACR) and Galactic (GCR) cosmic ray fluxes. The observation of ion fluxes will be carried out with high acceptance multilayer semiconductor telescope-spectrometer MONICA installed onboard satellite. The satellite orbit parameters (circular, altitude is about 600 km, polar) were chosen for the realization of unique method for the measurement of charge state of ions at energies >10 MeV/n based on the usage of Earth magnetic field as a separator of ion charge. To realize the method of geomagnetic separator it is necessary to detect ions in Earth magnetosphere in the interval of geomagnetic L-shells from 1.5 to 6. In this interval of L-shells the MONICA detectors will be loaded by the trapped energetic particles in the Earth's outer and inner radiation belts. In present work we have carried out the analysis of background particle fluxes with taking into account the recent data of satellite experiments and known AE-8, AP-8 models and formulated the recommendations to improve the background conditions for the MONICA experiment.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0341

Poster 2 CR - Board: 209 / 1017

Longitudinal development of EAS muon component - comparison of data from the Muon Tracking Detector in KASCADE-Grande with model predictions

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The KASCADE-Grande Muon Tracking Detector allowed measurements with high accuracy for the directions of EAS muons having energy above 0.8 GeV. Combining information about the direction of the extensive air shower, obtained with the KASCADE-Grande particle detector array, and the directions of reconstructed muon tracks we have investigated the muon production heights by means of the triangulation method. The obtained results gave us direct insight into the longitudinal development of the muonic component of EAS for showers with the primary energy above 10^{16} eV.

Distributions of measured muon production heights are compared to the distributions obtained for showers simulated with CORSIKA for proton and iron primaries. In the simulations the following four models: QGSJet-II-02, QGSJet-II-04, EPOS1.99 and EPOS-LHC, in combination with FLUKA, were used and their ability to reproduce the experimental results is discussed.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

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Poster 2 SH - Board: 43 / 1230

SEP Protons in GEO with the ESA MultiFunctional Spectrometer

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The Multi-Functional Spectrometer (MFS) is a radiation monitor that together with CTTB (Component Technology Test Bed) make the AEEF-TDP8 (ESA Alphasat Environment and Effects Facility - Technology Demonstration Payload 8). The two units are installed on the X panel of the Alphasat satellite as a hosted payload. MFS is an instrument specifically designed to characterise the Space Radiation environment while CTTB was built to monitor the effect of radiation on electrical components (GaN transistors, Memories and Optical Transceivers) in geostationary orbit. The mission lifetime of AEEF/TDP8 is 3 years with possible extension to 5 years and TDP8 is expected to be acquiring

scientific data during the whole period. On ground, correlation between radiation environment and radiation effects can be established.

Before launch, MFS was submitted to proton and electron beam tests at Paul Scherrer Institute in Switzerland in 2010. The main purpose was the validation and calibration of the MFS proto-flight model together with the estimation of particle energy resolution and identification capability. A full Geant4 simulation with the MFS in-flight configuration was built and used to validate the results from ground tests.

The full detector simulation has proved to be a valuable tool for the unfolding of MFS channel counts into particle spectra based on a Single Value Decomposition (SVD) method. Results for Proton and Electron spectra measured with the MFS in GEO will be presented, in particular for the case of SEP events registered in 2014 during periods of maximum solar activity of solar cycle 24.

Alphasat is a large telecommunications satellite primarily designed to expand Inmarsat's existing global mobile telecommunication network, launched in July 2013. It was built by Airbus DS through a public-private partnership (PPP) between the European Space Agency (ESA) and Inmarsat. Alphasat is based on Alphabus, the large European telecom platform developed by Airbus DS and Thales Alenia Space under a joint contract with ESA and France's CNES space agency.

Keywords: Space Radiation Monitor, cosmic rays, SVD method, SEP

Collaboration:

– not specified –

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864

Poster 2 SH - Board: 17 / 441

Measurement and simulation of neutron monitors count rate dependence on surrounding structure

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Neutron monitors are the premier instruments for precise measurements of time variations (e.g., of solar origin) in the Galactic cosmic ray (GCR) flux in the range of ~1-100 GeV. However, it has proven challenging to accurately determine the yield function (efficiency) vs. rigidity in order to relate a neutron monitor's count rate with those of other monitors in the worldwide network and the underlying GCR spectrum. Monte Carlo simulations of the yield function have been developed but there have been few opportunities to validate these models observationally, especially with regard to the particular environment surrounding each monitor. Here we have precisely measured the count rate of a calibration neutron monitor ("calmon") near the Princess Sirindhorn Neutron Monitor (PSNM) at Doi Inthanon, Thailand, which provides a basis for comparison with count rates of other neutron monitors worldwide that are similarly calibrated. We directly measured the effect of the surrounding structure by operating the calmon both outside and inside the building. Using Monte Carlo simulations, we can clarify differences in response of the calmon and PSNM, as well as the calmon outside and inside the building. The dependence of the calmon count rate on surrounding structure can be attributed to its sensitivity to neutrons of 0.5-10 MeV and a shift of sensitivity to nucleons of higher energy when placed inside the building. Simulation results for the calmon to PSNM count rate ratio are in agreement to within a few percent, providing a useful validation and improving confidence in our ability to model the yield function for a neutron monitor station. Partially supported by the Thailand Research Fund, a Mahidol University postdoctoral fellowship, the South African National Antarctic Programme of the National Research Foundation, and the United States National Science Foundation (PLR-1341562, PLR-1245939, and their predecessors).

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

399

Poster 2 SH - Board: 29 / 1239

Development of new front end electronics for the SciCRT detector at Sierra Negra, Mexico

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The SciCRT (SciBar Cosmic Ray Telescope) is a new cosmic-ray experiment, an improved solar neutron telescope and muon detector, composed of 14 848 scintillator bars arranged to track and record energy of incident particles. The detector was installed at the top of Sierra Negra volcano in Mexico (4600 m above sea level) and 5/8 of the full SciCRT has been in operation since March 2014. To optimize the detector for operation at the mountain, a new fast readout electronics was developed (described in a separate paper by Y. Sasai et al.) and is planned to be installed soon.

However, current design of front end electronics (inherited from K2K experiment) prevents the completion of the experiment. Existing front end boards (FEB) employ ASIC technology to reduce board size, making construction of new boards expensive. Even operating at 5/8 of the detector's full capacity, there are not enough FEBs to consider a long term observation. Therefore, If we want to complete the installation of the full SciCRT and ensure its function over an extended period of time, front end electronics must be upgraded.

For the development of new FEBs we plan to implement a time over threshold (ToT) processor using a Field programmable gate array. The purpose of this method is to measure deposited energy using simpler electronics than conventional pulse-height processing circuits. Since the relationship between ToT and deposited charge is non-linear, we also need to adapt the basic ToT method to achieve better linearity and resolution. In this paper we will present the details of the proposed system and some tests of ToT method applied to the SciCRT detector.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

693

Poster 2 GA - Board: 78 / 47

Stress testing Ethernet Switches for NectarCAM in the Cherenkov Telescope Array with a synchronous UDP frame generator

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The Cherenkov Telescope Array (CTA) will be the next generation ground-based gamma-ray instrument. It will be made up of approximately 100 telescopes of at least three different sizes, from 4 to 23 meters in diameter.

The previously presented prototype of a high speed data acquisition (DAQ) system for CTA has become concrete within the NectarCAM project, one of the most challenging camera projects due to its 40-Gbps average output rate on 265 Ethernet 1000baseT links, bundled to 40Gbps on four optical links and reduced to 10Gbps after event-building. Design constraints include procurement of a maximum of components as commercial off-the-shelf products for an operation period of at least 30 years. Hence the results of the generic hardware characterisation are supposed to serve as a reference for similar setups.

Tests of single components and the whole data acquisition chain have been carried out with standard network analysing tools as well as a purpose-built Single-Board-PC cluster providing 320 physical gigabit Ethernet ports. In order to mimic the total synchronicity (some nanoseconds) of the 265 camera front-end modules, we implemented a light-weight version of the IP standard Precision Time Protocol, which can synchronise the outputs of all boards to an average of $O(10^2)$ ns. A multi-purpose system with FPGA boards delivering Ethernet packets on 48 ports with the same characteristics as the real front-end has completed specific aspects of our test. We will present the results of all tests that could be performed ahead of the delivery of the first complete real camera hardware foreseen for 2015.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

1287

Poster 2 SH - Board: 7 / 101

A mini neutron monitor in Central Antarctica (Dome Concordia)

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A new cosmic ray detector has been installed in the inner Antarctic Plateau, at Concordia station (75°06'S 123°23'E, 3233 meters a.s.l.). The detector consists of two fully independent measuring units: FIN1 - a standard mini neutron monitor, and FIN2 - a bare (lead-free) neutron monitor. The detector was built by the North-West University (Potchefstroom, South Africa), are owned and operated by the University of Oulu (Finland), and hosted by the French-Italian Concordia station. The detector is placed in a thermo-stabilized "Physics" shelter, fully maintained all year-round. The Concordia station is an optimal for the detection of solar energetic particles and low energy galactic cosmic rays. The detector's asymptotic acceptance cone is nearly perpendicular to the equatorial plane, pointing to the geographical southern latitudes $>80^\circ$ for cosmic rays with energies above a few GeV, which is much more in the polar direction than that for the South Pole cosmic ray station.

The measurements started in mid-January 2015, and the instruments work properly. The average count rate is about 15 counts/sec and 4 counts/sec for FIN1 and FIN2 units, respectively. Every single hit is recorded by a DAS with a time stamp allowing for an off-line analysis. The reference atmospheric pressure level is set to 650 mb. The very preliminary barometric correction coefficients are -0.7 ± 0.02 and -0.73 ± 0.02 %/mb, for FIN1 and FIN2 units, respectively, but they will be defined more precisely by the Conference time, when more statistics are collected. We are fully prepared for a solar energetic particle event once it appears. Meanwhile, time variability of cosmic rays is recorded on the routine basis.

The data are still preliminary but will be publicly available, after verification, at the databases cosm-rays.oulu.fi and www.nmdb.eu.

Technical development and assistance from Gert Benadé, Renier Fuchs and Hendrik Krüger (all from the North-West University, Potchefstroom, South Africa) is acknowledged.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

113

Poster 2 GA - Board: 123 / 107

Flasher and muon-based calibration of the GCT telescopes proposed for the Cherenkov Telescope Array

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The GCT is a dual-mirror Small-Sized-Telescope (SST-2M) prototype proposed for the Cherenkov Telescope Array (CTA). Calibration of the GCT's camera is primarily achieved with LED-based flasher units capable of producing ~ 4 ns (FWHM) pulses of 400 nm light across a large dynamic range, from 0.1 up to 1000 pe. The flasher units are housed in the four corners of the camera's focal plane and illuminate it via reflection from the secondary mirror. These flasher units are adaptable to allow several calibration scenarios to be accomplished: camera flat-fielding, linearity measurements (up to and past saturation), and gain estimates from both single pe measurements and from the photon statistics at various high illumination levels. In these proceedings, the performance of

the GCT flashers is described, together with ongoing simulation work to quantify the efficiency of using muon rings as an end-to-end calibration for the optical throughput of the GCT.

Collaboration:

CTA

Registration number following "ICRC2015-I":

121

Poster 2 GA - Board: 97 / 104

Real-time atmospheric monitoring for the Cherenkov Telescope Array using a wide-field optical telescope

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The Cherenkov Telescope Array (CTA) is the next generation of ground-based very high energy gamma-ray instruments and will be built on two sites (one in each hemisphere) in the coming years, with full array operation foreseen to begin 2020. The goal of performing a high precision gamma-ray energy measurement while maximizing the use of observation time demands detailed and fast information about atmospheric conditions. Besides LIDARs designed to monitor clouds and aerosol content of the atmosphere in the pointing direction of the CTA telescopes, we propose to use the "FRAM" (F/(Ph)otometric Robotic Atmospheric Monitor) device, which is a small robotic astronomical telescope with a large field of view and a sensitive CCD camera that together ensure precise atmospheric characterization over the complete field-of-view of the CTA.

FRAM will use stellar photometry to measure atmospheric extinction across the field of view of the CTA without interfering with the observation (unlike laser-based methods). This allows FRAM to operate with high temporal resolution and provide both real-time data for on-the-fly scheduling decisions and an offline database for calibration and selection of scientific data. The fast robotic mount of the telescope supports quick observation of multiple fields when the array is split and even a check of the conditions in the directions of the upcoming observations is possible. The FRAM concept is built upon experience gained with a similar device operated at the Pierre Auger Observatory. A working prototype of FRAM proposed for CTA is being built in Prague for extensive testing before deployment on site; first results and experiences with this prototype are presented.

Collaboration:

CTA

Registration number following "ICRC2015-I":

115

Poster 2 SH - Board: 8 / 105

Database of Ground Level Enhancements (GLE) of High Energy Solar Proton Events

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Solar proton events (SPE) occur as a result of massive acceleration of charged particles in the solar corona and/or interplanetary space. Usually such events provide quite a soft spectrum of energetic particles, but sometimes the spectrum can appear hard with energy of solar protons being sufficient to be detected on ground. Such exceptional events are called GLE (ground-level enhancements) and are numbered consecutively from the first event that was detected in 1942.

Here we present an international GLE database hosted by the University of Oulu, that is an inheritance of previous similar databases developed in USA and Australia. We acknowledge work of Louise Gentile, Mark Duldig and Harm Moraal. The database is located at <http://gle.oulu.fi>

The interface and data organization are discussed as well as a possibility for accessing and mirroring the database.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

113

Poster 2 DM and NU - Board: 265 / 644

Fermi-LAT studies of IceCube's track-like HESE events.

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A small subset of IceCube's extraterrestrial neutrino candidates are detected as track events. The track-like nature of these events within the IceCube detector affords us a ~1 degree angular resolution for the neutrino's origin. This neutrino angular resolution is comparable to the angular resolution of the Fermi Large Area Telescope (LAT) for ~1 GeV photons. Utilising a deep LAT exposure and taking advantage of these angular resolutions, we have searched for faint and flaring GeV gamma-ray sources spatially coincident with IceCube's track-like events. No faint gamma-ray sources or gamma-ray flares were found to be spatially or temporally coincident with the neutrino candidates considered. The deep exposure did however reveal several new gamma-ray point sources which were found to be spatially coincident with Active Galactic Nuclei. The non-detection of the gamma-ray counterparts of the neutrino candidates is briefly discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

121

Poster 2 SH - Board: 16 / 434

Relationship between the Neutron Time Delay Distribution and the Rigidity Spectrum of Primary Cosmic Rays up to 16.8GV

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Neutron monitors are the premier instruments for precisely tracking time variations in the Galactic cosmic ray flux at GeV-range energies above the geomagnetic cutoff at the location of measurement. In addition to the count rate, recording and analysing the time delays between successive counts allows us to infer variations in the cosmic ray spectrum as well. In particular, we can determine the leader fraction L , defined as the fraction of neutrons that did not follow a previous neutron detection in the same tube from the same nuclear interaction, from time delay histograms. By analyzing data taken during 2001-2007 by a ship-borne neutron monitor latitude survey we confirm a strong dependence of L on the geomagnetic cutoff up to 16 GV. The data of the Princess Sirindhorn Neutron Monitor (PSNM) located in Thailand at a higher vertical cutoff of 16.8 GV have also been analysed for the period 2007-2014. We have developed Monte Carlo simulations of cosmic ray interactions in the atmosphere and in both neutron monitors. Both data and simulations show that the absolute value of L depends significantly of the configuration of the detector and that experimental conditions such as the electronic dead time must be well monitored. The simulation results show a change in L with the geomagnetic cutoff as observed by the latitude survey, confirming that this change in L can reasonably be attributed to changes in the cosmic ray spectrum. Supported in part by a postdoctoral fellowship from Mahidol University, the Thailand Research Fund, the United States National Science Foundation (OPP-0838839, PLR-1245939, and their predecessors) and the Australian Antarctic Division.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

399

Poster 2 CR - Board: 248 / 433

Top and Bottom Counting Detectors for the ISS-CREAM experiment

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It is important to measure the cosmic ray spectrum to understand the origin, acceleration and propagation mechanisms of high-energy cosmic rays. The Cosmic Ray Energetics And Mass (CREAM) experiment will be launched in 2015 to the International Space Station (ISS) to measure cosmic ray elemental spectra up to energies beyond the reach of balloon instruments. The Top Counting Detector (TCD) and Bottom Counting Detector (BCD) are designed for separating electrons from protons using the difference between electromagnetic and hadronic shower shapes in the energy range of 300 GeV ~ 800 GeV. The T/BCD each consists of a plastic scintillator read out by 20 by 20 photodiodes. The active detection areas in the T/BCD are $500 \times 500 \text{ mm}^2$ and $600 \times 600 \text{ mm}^2$, respectively. Before integration with the payload, the T/BCD was assembled and qualified with environment tests such as vibration and thermal vacuum tests to confirm the safety of the T/BCD in a space environment. The T/BCD has now been integrated with the payload. The TCD is located between the ISS-CREAM carbon target and its calorimeter, and the BCD is located below the calorimeter. Noise and calibration of the T/BCD have been tested with Ground Support Electronics (GSE) boards, and the capability of the T/BCD to separate electrons from protons has been studied with GEANT3 simulation. We present the design, construction, performance and simulation results of the T/BCD.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1087

Poster 2 CR - Board: 205 / 338

The KASCADE Cosmic Ray Data Centre (KCDC)

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KCDC is a web-platform for distributing air-shower events measured by the KASCADE and KASCADE-Grande experiments.

In addition to the data, an extensive documentation on the experiments and the published observables is provided to ease the use of the data in analyses performed by the cosmic ray community. Since the experiments have been funded by tax-payers, access is not restricted to physicists. Therefore, additional information and example analyses are needed and provided to enable students and/or pupils to get in touch with astroparticle physics.

In its current installment, KCDC provides access to 160 million events measured by the KASCADE array and central detector. The data set consists of 18 observables including both, reconstructed shower properties, like the number of charged particles at ground, and meta data, like when the event has been recorded.

In the first year of operation nearly 100 users from more than 30 countries distributed over 5 continents logged on to the KCDC web-platform.

This contribution will cover the current state of the project and the future plans for extending the published data set and the software implementation of KCDC.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

306

Poster 2 CR - Board: 187 / 559

THE RELATIONSHIP BETWEEN GALACTIC COSMIC RAYS AND SOLAR WIND

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The relationship between galactic cosmic rays and solar wind is investigated using an extended time- dependent and anisotropic force field model, where galactic cosmic rays flux is found to be related to the solar wind speed through the local interstellar spectrum and a modulation parameter. Galactic cosmic ray flux calculated at 1au within the energy range (0.2 –88)GeV using the model is also presented, the flux variation with time calculated at 1au at a fixed energy range using the model is also presented and the solution is used to predict the flux variation at earth. The mechanism of cosmic rays transport considered here are only the diffusion and convection, other processes such as particle drifts, energy losses and magnetic irregularities among others are not considered in this work.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

481

Poster 2 CR - Board: 239 / 858

Search for EeV Protons of Galactic Origin

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From about 1-3 EeV, results from the HiRes, Telescope Array, and Pierre Auger experiments all indicate that cosmic ray composition is light, probably protonic. Since this energy range is above the critical energy of the galactic magnetic field, if these cosmic rays are of galactic origin there should be an anisotropy in their arrival directions at the earth. We will present a calculation of how this anisotropy should appear, search the data of the Telescope Array surface detector for this effect, and if absent calculate an upper limit on the fraction of cosmic rays of energy 1-3 EeV that are of galactic origin.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

732

Poster 2 DM and NU - Board: 278 / 95**GADZOOKS!: status and physics potential****Author:** Pablo Fernández¹¹ UAM**Corresponding Author:** pablo.fernandezm@uam.es

The GADZOOKS! project is the proposed upgrade of the Super-Kamiokande (SK) detector in order to enable it to efficiently detect thermal neutrons. Inverse beta decay reactions, as well as charged current quasi-elastic (CCQE) scattering of low energy anti-neutrinos (up to a few hundreds of MeV) in SK, produce one positron and one neutron in the final state. The neutron thermalizes and is captured by gadolinium (Gd). The capture is followed by a ~ 8 MeV gamma cascade. The observation of this cascade would mean that SK could identify these reactions as genuine with very high coincidence and efficiency (>80%).

GADZOOKS! will enable Super-Kamiokande - and water Cherenkov detectors in general - to pursue a wealth of physics which is currently inaccessible due to backgrounds. The most important will be the first observation of the diffuse supernova neutrino background: Super-Kamiokande enriched with Gd can discover it after few years of running. In addition, Gd-loading has benefits for other physics currently shadowed by backgrounds, such as subtle features of supernova bursts, pre-supernovae and reactor antineutrinos. Gd would also provide improvements for atmospheric and accelerator neutrino analysis and proton decay searches.

The main R&D program towards GADZOOKS! is EGADS: a 200 ton, fully instrumented tank built in a new cavern in the Kamioka mine. EGADS incorporates all the necessary subsystems to make GADZOOKS! a reality.

This contribution will describe all the main physics topics and the description and status of the EGADS R&D, which is being carried out for the realization of GADZOOKS!

Collaboration:

- not specified -

Registration number following "ICRC2015-I":

104

Poster 2 CR - Board: 234 / 814**Analysis of GCR Spectra and Composition Using Penetrating Particle Data from the CRIS Instrument on ACE****Author:** M. Wiedenbeck¹

Co-authors: A. Cummings²; A. Davis²; A. Labrador²; E. Christian³; E. Stone²; G. de Nolfo³; M. Israel⁴; R. Leske²; R. Mewaldt²; T. von Rosenvinge³; W. Binns⁴

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The Cosmic Ray Isotope Spectrometer (CRIS) on NASA's Advanced Composition Explorer (ACE) spacecraft has been making precise measurements of cosmic-ray elemental and isotopic composition and energy spectra for nearly 18 years. This instrument uses the dE/dx versus total energy technique to identify nuclei that stop in thick stacks of silicon solid-state detectors and to measure their energy. The energy range covered for these stopping particles extends up to ~ 280 MeV/nuc for O and ~ 570 MeV/nuc for Fe. We have developed a new technique for identifying particles that penetrate the entire detector stack that relies on a combination of the total energy deposited in the stack and the change of dE/dx from the front to the back of the stack. This technique allows us to extend energy spectra for cosmic-ray elements to higher energies and can be used for bridging the energy gap between the CRIS stopping-particle spectra and measurements made in low-Earth orbit by instruments such as HEAO-C2, PAMELA, and AMS-02. We will describe the technique, show some applications to extending the energy limit of the CRIS spectra, and discuss the limitations on the energy coverage that can be achieved.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

703

Poster 2 DM and NU - Board: 290 / 709

Diffuse CR, neutrino and gamma-ray fluxes from starburst and star-forming galaxies within the 'escape model'

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We have shown that the cosmic ray (CR) knee can be entirely explained by energy-dependent CR leakage from the Milky Way, with an excellent fit to all existing data ("escape model"), see Contribution 122, CR-TH, from D. SEMIKOZ.

In the present work, we have applied our escape model to other normal galaxies. We have also calculated the CR flux expected to leak from starburst galaxies. From this, we have inferred the diffuse CR intensity from normal and starburst galaxies, and compared the resulting nuclear composition at Earth with observational constraints.

We have then computed the diffuse neutrino and gamma-ray fluxes (produced by CR interactions with gas in their host galaxies), and compared our results to the recent IceCube observations of

high-energy neutrinos and to the Fermi-LAT determination of the diffuse extragalactic gamma-ray background.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

623

Poster 2 GA - Board: 76 / 556

The On-Site Analysis of the Cherenkov Telescope Array

Author: Andrea Bulgarelli¹

Co-authors: Adriano De Rosa ²; Alessandro Carosi ³; Alessandro Tacchini ²; Alessio Aboudan ²; Amanda Weinstein ⁴; Andrea Zoli ¹; Brian Humensky ⁵; Catherine Boisson ⁶; Denis Bastieri ⁷; Domenico Beneventano ⁸; Eleonora Torresi ²; Etienne Lyard ⁹; Fabian Schüssler ¹⁰; Fulvio Gianotti ¹; Gernot Maier ¹¹; Gino Tosti ¹²; Giovanni De Cesare ²; Giovanni Lamanna ¹³; Giuseppe Malaguti ²; Igor Oya ¹⁴; Jean Jacquemier ¹⁵; Jerzy Borkowski ¹⁶; Jim Hinton ¹⁷; Jon Dumm ¹⁸; Juan José Rodríguez-Vázquez ¹⁹; Julian Osborne ²⁰; Jurgen Knodlseder ²¹; Karl Kosack ²²; Luciano Nicastrò ²; Lucio Angelo Antonelli ¹; Lucy Fortson ²³; Marc Ribo ²⁴; Martino Marisaldi ²; Matthias Fuessling ²⁵; Nadine Neyroud ²⁶; Paola Grandi ²⁷; Pep Colomé ²⁸; Peter Wegner ²⁹; Phil Evans ²⁰; Raquel De los Reyes ³⁰; Ricardo Graciani Diaz ³¹; Rico Lindemann ³²; Sara Buson ³³; Saverio Lombardi ¹; Sera Markoff ³⁴; Simon Rosen ²⁰; Sonia Bergamaschi ⁸; Stefan Ohm ²⁹; Susumu Inoue ³⁵; Thierry Le Flour ³⁶; Valentina Fioretti ²; Vincenzo Testa ³⁷; Vito Conforti ³⁸

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The Cherenkov Telescope Array (CTA) observatory will be one of the largest ground-based very-high-energy gamma-ray observatories.

The on-site analysis will perform a first CTA scientific analysis of data acquired from the array of telescopes, in both northern and southern sites. The On-Site Analysis has two pipelines: the Level-A pipeline (also known as Real-Time Analysis, RTA) and the level-B one. The RTA performs a data quality monitoring and must be able of issuing automated alerts on variable and transient astrophysical sources within 30 seconds from the last acquired Cherenkov event that contributes to the alert, with a sensitivity not worst than the final one by more than a factor of 3. The Level-B Analysis has a better sensitivity (not be worse by a factor of 2) and should start within 10 hours from the acquisition of the data: for this reason this analysis could be performed at the end of an observation or next morning.

The latency (in particular for the RTA) and the sensitivity requirements are challenging because of the large data rate, a few GByte/s. The remote connection to the CTA candidate site with a rather limited network bandwidth makes the issue of the exported data size extremely critical and prevents any kind of processing in real-time of the data outside the site of the telescopes. For these reasons the analysis will be performed on-site with infrastructures co-located with the telescopes, with limited electrical power availability and with a reduced possibility of human intervention. This means that the on-site hardware infrastructure should have low-power consumption. A substantial effort toward the optimization of high-throughput computing service is envisioned to provide hardware and software solutions with high-throughput, low-power consumption and at low-cost.

This contribution provides a summary of the design of the on-site analysis and reports some prototyping activities.

Collaboration:

CTA

Registration number following "ICRC2015-I":

288

Poster 2 GA - Board: 114 / 550

A concept of long buffer readout system for large-area gamma-ray facilities

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One of the constraints for the instruments with large number of readout channels is the cost of a complex data acquisition (DAQ) system. We suggest here the novel approach - the Long Buffer ReadOut System (LiBROS).

The LiBROS comprises the trigger, based on Field-Programmable-Gate-Array (FPGA) and the readout system based on Flash Analog-To-Digital Converters (FADCs). The readout channel analog signal is split in two branches: the trigger branch and the data branch. The trigger branch is fed to discriminators which produce time-over-threshold (TOT) logic signals. We suggest to digitize these signals with only 1-bit resolution but high rate of 1 GHz, directly inside the FPGA, exploiting the Serializer/Deserializer (SerDes) feature. In this manner, the start and the stop time of the TOT signal is tagged that estimates the arrival time of the initial signal with precision better than 1 ns. Having the time reconstructed by the trigger system the data branch can have a limited bandwidth and, therefore, reduced FADC sampling rate. This suppressed FADC datastream is piped directly to the FPGA memory in serial mode, using only one datastream per FPGA input pin. This allows one FPGA chip to serve large number of readout channels that simplifies the design and reduces costs by the factor of at least 4, compared to the current DAQ approaches used in Imaging Atmospheric Cherenkov Telescopes.

Moreover, due to the large FPGA memory and suppressed data volumes, the suggested DAQ approach will possess the extremely long data buffer of $>50 \mu\text{s}$. This allows to design the simple central trigger system for arrays covering more than a several km^2 . The high integrity, low cost and simplicity of the concept offers it for any air-Cherenkov facility with a large number of readout channels

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

485

Poster 2 GA - Board: 77 / 553

Long term lightcurve of the BL Lac object 1ES 0229+200 at TeV energies

Author: Gabriele Cologna¹

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The high-frequency peaked BL Lac object 1ES 0229+200 ($z = 0.14$) was first detected in very high energy (VHE, $E > 100 \text{ GeV}$) γ -rays by the H.E.S.S. (High Energy Stereoscopic System) collaboration in 2006. No variability was reported in the source in the initial study and its spectral characteristics have been used to derive constraints on the extragalactic background light (EBL, Aharonian et al. 2007) and on the intergalactic magnetic field (IGMF, e.g. Tavecchio et al. 2010, Dermer et al. 2011, Vovk et al. 2012). 1ES 0229+200 has been observed with H.E.S.S. for ~ 130 hours from 2004 to 2013:

we present here the full dataset analyzed with a more sensitive method. The results indicate that the source is not constant and displays flux variability on yearly and monthly timescales. No spectral change is detected. The existence of flux variability affects the derivation of constraints on both EBL and IGMF. The H.E.S.S. observations cover several simultaneous multi-frequency campaigns and we compare VHE variations with those reported in different bands.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

488

Poster 2 GA - Board: 112 / 238

A high-level analysis framework for HAWC

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The High Altitude Water Cherenkov (HAWC) Observatory continuously observes an instantaneous field of view of about 2 steradians above the array for gamma-rays between 100 GeV to 100 TeV. The large amount of raw data, the importance of small number statistics, the large dynamic range of gamma-ray signals in time ($1 - 10^8$ sec) and angular extent (0.1 – 100 degrees), and the growing need to directly compare results from different observatories pose some special challenges for the analysis of HAWC data. To address these needs, we have designed and implemented a modular analysis framework based on the method of maximum likelihood. The framework facilitates the calculation of a binned Poisson Log-likelihood value for a given source model, data set, and detector response. The parameters of the source model (sky position, spectrum, angular extent, etc.) can be optimized to obtain a best match to the data. In a similar way, the parameters of the detector response (absolute pointing, angular resolution, etc.) can be optimized using a well-known source such as the Crab Nebula.

Our software for defining a source model was designed concurrently with the Multi-Mission Maximum Likelihood (3ML) architecture, and allows for the definition of a general collection of sources with individually varying spectral and spatial morphologies. Compatibility with the 3ML architecture allows to easily perform powerful joint fits with other observatories. In this contribution, we describe the design and capabilities of the HAWC analysis framework and the applicability of the framework design to other VHE observatories. We present verification of the HAWC detector response using the point-like Crab Nebula as a reference. As a demonstration, we show the first fit of the Crab spectrum using low-level data from two observatories: HAWC and Fermi-LAT.

Collaboration:

HAWC

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257

Poster 2 GA - Board: 115 / 236

Cherenkov Telescope Array Data Management

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Very High Energy gamma-ray astronomy with the Cherenkov Telescope Array (CTA) is evolving towards the model of a public observatory. Handling, processing and archiving the large amount of data generated by the CTA instruments and delivering scientific products are some of the challenges in designing the CTA Data Management. The participation of scientists from within CTA Consortium and from the greater worldwide scientific community necessitates a sophisticated scientific analysis system capable of providing unified and efficient user access to data, software and computing resources. Data Management is designed to respond to three main issues: (i) the treatment and flow of data from remote telescopes; (ii) "big-data" archiving and processing; (iii) and open data access. The design is inspired by the lessons learned from current and past Atmospheric Cherenkov Telescopes, from CTA precursors, from existing astronomical observatories, and finally from the technical know-how of major computing, data centres and e-infrastructures that serve large international projects and world-wide communities. In this communication the current major developments, prototypes and the view on the technical design of the CTA Data Management are presented

aiming at guaranteeing reliable processing, ensuring quality of services for access, transmission and dissemination of data.

Collaboration:

CTA

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250

Poster 2 CR - Board: 245 / 1055

FEATURES OF LONG PERIOD VARIATIONS OF GALACTIC COSMIC RAY INTENSITY IN RELATIONS WITH THE TURBULENCE OF THE INTERPLANETARY MAGNETIC FIELD in 1968-2014

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Data of super neutron monitors, Bx, By, Bz components of the Interplanetary Magnetic Field (IMF) have been used to study relations of the long-period variations of the Galactic Cosmic Rays (GCRs) intensity with IMF turbulence for the period of 1968-2014. We find that the changes of the rigidity spectrum exponent γ of the GCR intensity variations and the exponents v_y , v_z , v_x of the Power Spectral Density (PSD) of the By, Bz, Bx components show a radical alternation of the large-scale structure of the IMF turbulence in considered period. We have studied the properties of the Probability Distribution Function (PDF) of the Bx, By, Bz components and their differences $\delta B_i = B_i(t+\tau) - B_i(t)$ ($i=x, y, z$) of the IMF, over the varying time scales $\tau = 1, 2, 3, 4, 5$ days.

We find that for the time scales $\tau > 4$ days the skewness and kurtosis of the IMF turbulence almost equal zero. So, at first approximation, one can state that the PDFs are almost Gaussian and anisotropy and inhomogeneous of the IMF turbulence can be ignored in large vicinity of space ($> 10^{13}$ cm). However, for smaller vicinity of space ($< 10^{13}$ cm) the turbulence of the solar wind plasma can be an anisotropic. As a result, for large part of space one can state that IMF turbulence could be fully described by the parameters of PSD (P-power and v -exponent) and employ for the calculation of transport coefficients of GCR in heliosphere.

We suppose that the changes of the turbulence in the range of frequencies $[10^{(-6)} - 10^{(-5)}]$ Hz (responsible for the scattering of the GCR particles of the energies 5-50 GeV) and the module B of the IMF versus solar activity can be considered as the general reasons of the long period variations of the GCR intensity.

Collaboration:

– not specified –

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Poster 2 SH - Board: 27 / 1193

Comparison of muon hodoscope URAGAN and neutron monitors' data for 2008 –2014

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Study of temporal variations of the flux of cosmic rays on the Earth's surface provides important information about the processes in the heliosphere that cause these variations. These processes have the strong influence on the low-energy cosmic particles, so these studies are mainly carried out in a flux of neutrons detected by ground-based neutron monitors (NM). Studies of variations of cosmic ray muon flux with URAGAN muon hodoscope are not less interesting, since muons are sensitive to higher (than neutrons) energies of the primary cosmic rays.

The results of measurements of cosmic ray variations with muon hodoscope URAGAN, and Moscow (MNM) and Apatity (ANM) neutron monitors during 2008 –2014 are compared. URAGAN and MNM are located at the same latitude and have the same threshold rigidity (2.45 GV). URAGAN and ANM (0.65 GV) have different threshold rigidities, but similar asymptotic directions for primary particles. Hourly data of neutron monitors corrected for barometric effect and URAGAN data corrected for barometric and temperature effects have been analyzed. Correlation dependences between the parameters of the counting rates of the neutron monitors and the muon hodoscope during different heliospheric disturbances are obtained. Periods of coincidence and anticoincidence of data in muon and neutron components of cosmic rays are analyzed. The connection between these results and various processes of solar activity is discussed.

Collaboration:

– not specified –

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Poster 2 DM and NU - Board: 288 / 1272

Testing magnetars as sources of VHE and UHE cosmic rays with IceCube

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The electromagnetic wind of a fast-spinning magnetars has been proposed as a site for cosmic rays acceleration from very high energies (VHE) to ultrahigh energies (UHE). We show how high-energy neutrinos would be produced in these scenarios, when the accelerated particles interact with the baryons of the expanding supernova ejecta and the radiation fields in the pulsar wind nebula. In this talk, we make use of the current IceCube sensitivity in diffusive neutrino background, in order to constrain the parameter space of the most extreme neutron stars as sources of VHE and UHE cosmic rays. We demonstrate that the current non-observation of EeV neutrinos put stringent constraint on

the birthrates, ejecta mass and acceleration efficiency of the magnetar sources. Assuming a proton cosmic ray composition, we find that the IceCube sensitivities almost exclude any contribution from these sources. Furthermore, we consider scenarios where a fraction of cosmic rays can escape from the jets without significant interactions. We show that even in these scenarios, the IceCube upper limits still partially constrain magnetars as sources as UHECRs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 2 CR - Board: 227 / 615

"First results from Run1 of the Extreme Energy Events experiment

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The Extreme Energy Events (EEE) Project is an experiment for the detection of Extensive Atmospheric Showers of energy greater than 10^{11} eV. It consists of an array of telescopes hosted in High Schools spread on the Italian territory, each made of three Multigap Resistive Plate Chambers very similar to the ones built for the Time Of Flight system of the ALICE experiment at CERN.

The telescopes are managed and constructed at CERN by teams of students and teachers: this peculiarity enhances the scientific relevance of its goals with an effective outreach action.

The experiment took a first coordinated data taking ("Pilot-Run") in fall 2014 and another ("Run1") from February to April 2015. About thirty telescopes took data at the same time and more than 5 billions of cosmic ray events have been collected. Data were transmitted to the CNAF –the biggest Italian storage and computing center managed by INFN –to be reconstructed and analyzed.

In this presentation an overall description of the experiment will be given and the most recent results will be shown. In particular we have a first set of measurements of the coincidences in pairs of telescopes even more than 1 km apart, and a study of variations with time of the muon cosmic flux, related on astrophysical phenomena like Forbush decreases.

Collaboration:

– not specified –

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Poster 2 CR - Board: 164 / 1007

On the optimisation of the construction of a ground-based neutron monitor for galactic cosmic ray monitoring and space weather applications

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The neutron monitor (NM) remains the best available instrument for monitoring the secondary nucleonic component of the galactic cosmic rays for more than 80 years. Today, NMs have been given another role related to satellite-based technologies for monitoring and forecasting of space weather events. At many sites around the world, the old neutron monitors were refurbished and synchronised into a network known as the neutron monitor data base (NMDB). During the years, little has been changed in the construction of the actual neutron monitor. In this work we carried out a detailed study of the role of the various components (reflector, producer and moderator) on the output signal of a NM64 neutron monitor. The study was performed using the fully integrated particle physics Monte Carlo simulation package FLUKA utilising several different types of incident particles - from monoenergetic neutrons and protons to a complex galactic cosmic rays source tailored for the location of the neutron monitor in Dourbes (50.1°N, 4.6°E). The influence of the size and shape of the different parts on the energy spectrum of the neutrons in the detector tube was analysed in order to optimise the construction and to investigate if it would be possible to extract more information about the incident radiation. The results obtained here have been applied to the design of the second neutron monitor which is under construction in Dourbes.

Collaboration:

– not specified –

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851

Poster 2 SH - Board: 31 / 1285

Frequency analysis of the Mexico City neutron monitor time series using fractal and wavelet

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We studied cosmic ray intensity variations in the daily data of the database of the Mexico City neutron monitor station during the period 1990 to 2014 using wavelet transforms to determine the power density function and its time evolution, with which we have identified the mid- and long-term variations present in the registers. We give the corresponding confidence levels for the periodicities found and their relative contribution to the total power of such variations. We also performed a fractal analysis of the time series to identify its intrinsic variations and long term persistency. Consistent results were found with both kinds of analysis. As a reference, we compare these results with those of classical Fourier analysis based on the discrete Fourier transform.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1974

Poster 2 CR - Board: 161 / 947

New concept of very high energy cosmic ray observation by wide field-of-view telescope

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The chemical composition of the very high energy cosmic rays (VHECRs) is an important piece of information to investigate their origin and acceleration mechanism. Possible change of chemical composition at the knee energy range has been reported by air shower experiments based on sampling of muons or Cherenkov photons. So far low flux of VHECRs along with uncertainties due to indirect detection, has limited the precision of chemical composition measurement. It is thus essential to improve primary mass estimation via measurement of additional parameters of the air showers. In the present work, we propose a new concept of VHECR observation using ultra-wide field-of-view (FOV) refractive imaging atmospheric Cherenkov telescope (IACT). The wide-FOV optics have been designed in the framework of JEM-EUSO mission for ultra-high energy cosmic ray (UHECR) observation from the International Space Station. The pathfinder experiments testing such optics have been successfully operated on the balloon and on the ground. The technique of imaging of the Cherenkov light has been used in GeV–TeV energies by IACT arrays using $\gg 10$ -m-scale reflective telescopes. Above $\sim 10^{15}$ eV, the Cherenkov light from cosmic rays initiated air showers spreads over a few km that can be detected even by meter-scale telescopes. At these energies, Cherenkov images of distant air showers span $\sim 15^\circ$ and thus wide FOV optics is necessary for their detection and characterization. To evaluate potential performances of this concept, a large number of air showers were generated using CORSIKA packages. In the presentation, we introduce the basic concept of wide-FOV IACT technique for VHECR observation and characterize the performance of the sets for the chemical composition study. In addition, we discuss prospective advantages of EUSO-type wide-FOV telescopes for VHECR and UHECR physics.

Collaboration:

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Poster 2 SH - Board: 23 / 689

NMDB: the database for real-time and historical Neutron Monitor measurements

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The Neutron Monitor database NMDB, which has been funded by the FP7 program of European Commission, has been providing both real-time as well as historical data since its inception in 2008. In the beginning only the participants from a few European and Asian countries were providing

their data to the database. However, the number of stations participating in NMDB is still increasing so that currently most American and Australian stations are also contributing to NMDB.

Additionally, data from other historical stations (from Ahmedabad to Zugspitze) is being added to NMDB as a further step for one of our goals: making all Neutron Monitor data available in one format from one place for everybody. The data can be selected, viewed, and downloaded through the web interface at nest.nmdb.eu.

To facilitate the addition of new stations, a set of python scripts has been developed which can be used by all stations to easily transfer their data to NMDB in a tested way. By using a common software the data quality and the accessibility of the database is improved.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

603

Poster 2 CR - Board: 229 / 685

Is radar detection of extensive air showers feasible?

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We investigate the feasibility of the radar technique for extensive air shower detection. A set of simulations of radio wave reflection off the short-lived plasma produced by the high-energy showers in the air is performed, considering various radar setups and shower geometries. We show that the plasma produced by air showers should be treated always as underdense. Thus, we use the Thomson cross-section for scattering of radio waves with correction for molecular quenching. We sum coherently the radio waves reflected off the individual electrons over the volume of the disk-like ionization trail to obtain the time evolution of the signal arriving at the receiver antenna. The movement of the wave-scattering region behind the relativistically moving shower front is taken into account. The received power and the spectral power density of the radar echo are analysed. Based on the obtained results, we conclude that the scattered signal is too weak for the radar method to provide an efficient and inexpensive method of air shower detection. We discuss possible uncertainties of this result.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

193

Poster 2 CR - Board: 153 / 681

The in-flight calibration of the TUS orbital detector

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A Function to Describe Attenuation of Cosmic Ray Air Shower Particles in Snow

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Snow overburden is a part of the IceTop detector at the South Pole, and becoming more significant over time as snowdrift buries the array. Snow attenuates the electromagnetic component of cosmic ray air showers before they reach the detectors, reducing the measured signals S , raising the threshold of the array in general, and introducing a potential source of systematic error in measuring shower energy. Understanding this attenuation is vital for shower reconstruction and energy resolution. A simulation of cosmic ray air shower particles has been used to map the attenuation response due to snow, and parameterize attenuation behavior as a function of zenith angle and shower evolution stage.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

386

Poster 2 CR - Board: 180 / 134

The radial gradient of cosmic ray intensity in the Galaxy

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The dependence of the cosmic ray intensity on Galactocentric distance is known to be much less rapid than that of the thought-to-be sources: supernova remnants. This is an old problem ('the radial gradient problem') which has led to a number of possible 'scenarios'. Here, we use recent data on the supernova remnant's radial distribution and correlate it with measured HII electron temperature (T). We examined three models of the cosmic ray injection and acceleration and in all of them the injection efficiency increases with increasing ambient temperature T. The increase is expected to vary as a high power of T in view of the strong temperature dependence of the tail of the Maxwell-Boltzmann distribution of particle energies. Writing the efficiency as proportional to T^n we find $n \sim 8.4$. There is thus, yet another explanation of the radial gradient problem.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1215

Poster 2 DM and NU - Board: 254 / 491

Self-veto approaches to reject atmospheric neutrinos in KM3NeT/ARCA

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A main objective of the future neutrino telescope KM3NeT/ARCA is the detection and measurement of extraterrestrial neutrinos. Atmospheric neutrinos, which are produced in particle showers in the Earth's upper atmosphere, represent the main background to this signal. Muon bundles which accompany downgoing atmospheric neutrinos can be used to differentiate the latter from their extraterrestrial counterparts and thus to identify cosmic neutrino signals from the upper hemisphere.

The program package CORSIKA has been used for simulating extensive air showers. These particle showers contain many particle types, but beside neutrinos the only particles surviving up to the ~3000m depth of the detector are muons. A veto strategy has been developed which uses the detector signals induced by these muons. In particular these muons modify the observed topology on neutrino-induced events, with a significant effect on different reconstruction parameters. Making use of these effects, most of the downward-going atmospheric neutrinos can be rejected. The analysis methods and results will be reported in this poster.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

446

Poster 2 DM and NU - Board: 255 / 493

Search for GRB neutrino emission according to the photospheric model with the ANTARES telescope

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The ANTARES detector is the largest neutrino telescope currently in operation in the North Hemisphere.

One of the main goals of the ANTARES detector is the search for point-like neutrino sources including transient sources like GRBs.

In the so-called photospheric model for the emission from GRBs the interaction of the radiation field with the leptonic component of the outflow could lower down the expected energy spectrum of the associated neutrino emission from GRBs.

In coincidence with a GRB alert from a satellite, ANTARES stores a window of few minutes of unfiltered data.

A dedicated directional filtering and reconstruction is applied offline to enhance the sensitivity in the lower energy range of ANTARES detector (50 GeV - 1 TeV).

The result of Monte Carlo simulations of this analysis will be presented.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

0442

Poster 2 CR - Board: 201 / 1029

EAS age and energy determinations through the study of the LDF in the first few meters from the core with the ARGO-YBJ experiment

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The ARGO-YBJ experiment, a full coverage extensive air shower (EAS) detector located at high altitude (4300 m a.s.l.) in Tibet-China, has been operated with very high stability from the fall 2007 to

the beginning of 2013. The array consisted of a carpet of about 7000 m² Resistive Plate Chambers (RPCs) operated in streamer mode and equipped with both digital and analog readout, providing the measurement of particle densities up to few particles per cm², with single hit space and time resolutions better than 20cm and 2ns, respectively. The unique detector features (full coverage, wide dynamic range, ...) and location (very high altitude) allowed a detailed study of the lateral distribution function (LDF) of particles at ground very close to the shower axis, in a wide interval of primary energies from few TeV up to the knee of the all-particle spectrum.

The information collected in the first 10 meters from the shower has been shown to provide very effective tools for the determination of both energy and shower age. The shower age was shown to be correlated with the reconstructed LDF slope near the core, independently of the primary mass. This shower universality was then used to correct the detected truncated size at ground in order to have a mass independent energy estimator with a lognormal resolution at the level of 0.15, getting better with energy. The details of the adopted procedure together with the evaluation of its uncertainties will be fully discussed.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

778

Poster 2 GA - Board: 65 / 28

The very high energy characteristics of shell-type SNRs at different ages

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The investigation of VHE gamma-ray sources by any methods, including mirror Cherenkov telescopes, touches on the problem of the cosmic ray origin and, accordingly, the role of the Galaxy in their generation. The SHALON observations have yielded the results on Galactic supernova remnants (SNR) of different ages. Among them are: the shell-type SNRs Tycho's SNR (1572y), Cas A (1680y), IC 443 (age $\sim (3 - 30) \times 10^3$ y), γ Cygni SNR (age $\sim (5 - 7) \times 10^3$ y) and classical nova GK Per (Nova 1901). For each of SNRs the observation results are presented with spectral energy distribution by SHALON in comparison with other experiment data and images by SHALON in together with data from X-ray by Chandra and radio-data by CGPS. The collected experimental data have confirmed the prediction of the theory about the hadronic generation mechanism of very high energy 800 GeV - 100 TeV gamma-rays in Tycho's SNR, Cas A and IC443. Recently, unique data on GK Per TeV gamma-ray emission were obtained with SHALON experiment. The X-ray data shows that, the nova remnant of GK Per could be a younger remnant that will resemble older SNRs (like IC 443) which interact with molecular clouds. GK Per is supposed to be a candidate for TeV gamma-ray emission due to the accelerated particles in the reverse shock region. The analysis of SHALON observation data revealed the main TeV-emission region coinciding with the position of central source of GK Per and the weak emission of shell, that is also observed in X-ray by Chandra.

Collaboration:

– not specified –

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34

Poster 2 DM and NU - Board: 289 / 1370

Neutrinos from galactic compact binaries

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The recent observation of an astrophysical flux of neutrinos at the IceCube telescope represents the “first light” in the burgeoning field of neutrino astronomy. Motivated by this long-awaited discovery, we re-examine the potential high energy neutrino emission from compact binaries on the basis of state-of-the-art proton acceleration models, and interaction of those protons with plasma from accreting matter. We show that under reasonable assumptions compact binary sources could produce neutrinos up to the maximum observed energies. We also use the spatial distribution of these sources (as collected from various surveys) to bound the Galactic contribution to the diffuse flux of neutrinos. We conclude that Galactic sources could provide a dominant contribution to the IceCube flux.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

1031

Poster 2 CR - Board: 241 / 930

Effect of electric fields of thunderstorm atmosphere on detection of the neutron component of cosmic rays

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Results of the study of data of the detection of high-energy and thermal neutrons on Tien-Shan experimental complex at different stages of thunderstorm activity are presented. We found that the standard deviation of minute values of the neutron monitor data during thunderstorms always exceeds values under fair weather conditions. We selected events during the passage of thunderstorm clouds over the high altitude station without lightning discharges or with a small number with them. It was found that atmospheric electric field (E_z -component ≥ 10 -15 kV/m) of positive polarity decreases the count rate of the neutron monitor, and negative polarity increases. The sensitivity of the detected particles to change in E_z decreases with increasing their energy. The upper energy threshold is ~ 10 GeV. The physical mechanism of effect is based on lead nucleus capture of soft negative muons with the subsequent generation of neutrons. Absence of this effect in thermal neutrons data confirms the conclusion since the main difference of the thermal neutrons detector from the neutron monitor is the absence of the lead.

In the active phase of a thunderstorm in the formed thundercloud the picture of distribution of charges is complex and multilayered. The field on the ground can essentially differ from the field that caused the acceleration or deceleration of charged particles. It is possible that the occurrence of the nuclear processes is caused by lightning. Recorded at the Tine Shan bursts of both slow and fast neutrons during lightning discharges are discussed.

Collaboration:

– not specified –

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Poster 2 SH - Board: 13 / 409

The event of ground level enhancement of solar cosmic rays on October 28, 2003: the spectrum in a wide energy range.

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We present the results of spectrum analysis of the event of ground level enhancement of solar cosmic rays on October 28, 2003 (GLE65) in the widest range of energies. The energy spectrum of cosmic rays is studied on the basis of direct measurements of solar particle fluxes aboard the ACE, GOES and WIND spacecraft, as well as by data recorded by the worldwide neutron monitor network. In the relativistic energy range the estimations of spectrum have been obtained using the effective energy method proposed by the authors. It has been established that in this event the energy spectrum of solar cosmic rays extends from ~ 40 keV to ~ 5 GeV and it is described by a power function with an exponential cut-off in the field of relativistic energies. To find out the nature of solar cosmic rays the quasi-linear theory of regular acceleration of charged particles by shock waves in the low solar corona developed at ShiCRA of SB RAS is used. It has been concluded that the process of acceleration of solar cosmic rays was over at a distance of 4 solar radii.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0264

Poster 2 CR - Board: 145 / 454

Characteristic features of NM counts in relation to CMEs and Magnetic fields

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Characteristic features of NM counts in relation to CMEs and Magnetic fields
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Abstract

CMEs are magnetized structures, which can affect the heliospheric conditions, producing large fluctuations in the heliospheric magnetic field. CMEs traveling at different speeds tend to merge into what are known as complex ejecta, which are seen often in the interplanetary medium during times of high solar activity (Burlaga et al. 2001). The increase of the magnetic field during the passage of an ejecta at 1 AU is related to the GCR intensity decrease (Cliver et al. 2003). Traditionally, GCR intensity has been compared with sunspot number (SSN) and other solar activity indices, such as solar flares, 10.7 cm radio flux, and so on (see Belov 2000 and references therein). CMEs are large-scale phenomena that change the configuration of the interplanetary magnetic field (IMF) and clearly modulate the cosmic-ray intensity on short-term (few day) timescales. Therefore, it is natural to think that CMEs may also contribute to longer term modulation, in particular by contributing to the propagating barriers (GMIRs) that are believed to be the cause of the long-term modulation. The global network of neutron monitors (NMs) have provided data to the heliophysics community for over sixty years to study the time variations of the galactic cosmic ray (GCR) intensity. Simpson recommended a standard NM for worldwide use during the International Geophysical Year (IGY, 1957-58). NM data have been used extensively for the time variation studies ranging from minutes to decades. Coronal Mass Ejections are vast structures of plasma and magnetic fields that are expelled from the sun into the heliosphere, which is detected by remote sensing and in-situ spacecraft observations. The present study is related with four different types of CMEs namely Asymmetric 'Full' Halo CMEs, Partial Halo CMEs, Asymmetric and Complex 'Full' Halo CMEs and 'Full' Halo CMEs on cosmic ray neutron monitor intensity. The data of three different ground based neutron monitors having different cutoff rigidity threshold and CME events observed with instruments on-board and Wind spacecraft have been used. The superposed epoch (Chree) analysis has been applied to the arrival times of these CMEs. The occurrence frequency of three different types of CMEs used in the present analysis depicts very complex behavior. Significant fluctuations in cosmic ray intensity is observed few days after the onset of asymmetric full halo and few days after the onset of full halo CMEs. The fluctuations in cosmic ray intensity are more prior to the onset of both types of the CMEs. However, during Partial Halo CMEs the cosmic ray intensity peaks, few days prior to the onset of CMEs and depressed few days prior to the onset of CMEs, whereas in case of asymmetric and complex full CMEs, the intensity depressed 2 days prior to the onset of CMEs and enhanced 2 days after the onset of CMEs. The deviations in cosmic ray intensity are more pronounced in case for asymmetric and complex full halo CMEs compared to other CMEs. The cosmic ray intensity shows nearly good anti-correlation with interplanetary magnetic field strength (B) during asymmetric full halo CMEs and partial halo CMEs, whereas it shows poor correlation with B during other CMEs. The interplanetary magnetic field strength B shows significant correlation before and after the onset of these CMEs.

Keywords: cosmic ray, coronal mass ejections, interplanetary magnetic field.

Collaboration:

– not specified –

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0001

Poster 2 CR - Board: 221 / 455

Neutron Monitors and cosmic-ray data for solar modulation studies: 2. Modulation time series.

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Galactic cosmic-ray fluxes (GCR) and neutron monitor (NM) count rates depend on Solar activity. The modulation levels estimated in previous studies strongly depend on the datasets used (from different NM stations or GCR data) and on the different assumptions made (unknown interstellar flux, NM yield functions, ...). We discuss an improved method to estimate the modulation parameter ϕ for any GCR data and NM times series. To do so, we used recent satellite and balloon GCR data to constrain the interstellar fluxes and to calibrate NM stations. These fluxes are then folded with the NM yield functions and compared to their count rates to extract ϕ times-series. Reference values are calculated from a set of neutron monitor stations from 1960 to 2015 and cross-checked with those obtained from GCR data. We also provide (i) a web interface to evaluate ϕ at any period from NM data, and (ii) homogeneous sets of modulation levels for all GCR data in CRDB.

Keywords: Solar modulation, Cosmic rays, Neutron monitor

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

417

Poster 2 GA - Board: 126 / 829

Gamma Hadron Separation using Pairwise Compactness Method with HAWC

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The High-Altitude Water Cherenkov (HAWC) Observatory is a ground based air shower array deployed on the slopes of Volcan Sierra Negra in the state of Puebla, Mexico. While HAWC is optimized for the detection of gamma-ray induced air showers, the background flux of hadronic cosmic-rays is 4 orders of magnitude greater, making background rejection paramount for gamma-ray observations. On average, gamma-ray and cosmic-ray showers are characterized by different spatial distributions of charge at ground level. We will present a method to identify the primary particle type in an air shower that uses the spatial relationship of triggered PMTS (or "hits") in the detector. For a given event hit-pattern on the HAWC array, we calculate the mean separation distance of the hits for a subset of hit pairs weighted by their charges. By comparing the mean charge and mean separation distance for the selected hits, we infer the identity of the primary particle. We will report on the efficiency for identifying gamma-rays and the performance of the technique with data, specifically the resulting observed signal of the Crab Nebula.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

721

Poster 2 CR - Board: 235 / 826

Measurements, system response, and calibration of the SLAC T-510 Experiment

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The SLAC T-510 experiment provides the first beam-test of radio-frequency radiation from a charged particle cascade in the presence of a magnetic field (up to 1kG), a model system for radio-frequency emission from a cosmic ray air shower. The primary purpose of this experiment is to provide a suite of controlled laboratory tests to compare to models based on particle-level models of RF emission, making the calibrations of critical importance. We present here system calibrations and analysis of the experiment from end to end. Measurements of the beam charge and two-dimensional magnetic field map are fed directly into the simulations using the ZHS and Endpoint formalisms. Simulated electric fields are forward-folded with the system response, allowing for direct comparisons of spectra and waveforms with the simulations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 2 DM and NU - Board: 279 / 820

Performance of the Completed ARIANNA Hexagonal Radio Array

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The ARIANNA collaboration has recently completed the installation of a seven-station hexagonal array of radio detectors. These detectors seek to measure radio pulses generated by extremely high energy cosmic neutrino interactions. The detectors are deployed on the Ross Ice Shelf of Antarctica and collect data during the austral summer months. Data is delivered off continent in near real-time. The performance of the telescope will be summarized. Methods for separating radio backgrounds from neutrino-induced radio pulses will be presented. A search for cosmogenic neutrinos will be described and used to place an upper limit on the cosmogenic neutrino flux.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

664

Poster 2 GA - Board: 111 / 605

MESS: A Prototype for the Cherenkov Telescope Array Pipelines Framework

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The Cherenkov Telescope Array (CTA) will be a ground-based gamma-ray observatory with full-sky coverage in the very-high energy (VHE) regime. It is proposed to consist of more than 100 telescopes and should produce large amounts of data. Apart from the impact on the storage system, this also imposes tight requirements on the software framework to ensure efficient and robust data processing and trouble-free coding.

This contribution will present MESS (Modular Efficient Simple System), a pipeline framework design prototype for CTA that

- uses well-known tools like C, FITS and Unix pipes, allowing the algorithm developers to focus on physics problems without learning complicated software paradigms,
- combines unified interfaces with flat data structures for direct data access in order to facilitate the development of modules for this framework
- can construct complex pipelines with arbitrary event selection on the command line and run them as fast as dedicated compiled programs.

In the presentation, these and other features of MESS will be explained in detail, accompanied by example pipelines for real-world use cases.

Collaboration:

CTA

Registration number following "ICRC2015-I":

536

Poster 2 CR - Board: 154 / 705

Photon Counting with a Fully Digital FDIRC (Focused Differential Internal Reflection Cherenkov)

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A prototype of an Internal Reflection Cherenkov, with a SiO₂ (Fused Silica) radiator bar optically connected to a cylindrical mirror, was tested at CERN SPS in March 2015 with a beam of relativistic ions obtained from fragmentation of primary argon nuclei at energies 13 and 30 GeV/n. The detector, designed to identify cosmic nuclei, features an imaging focal plane of dimensions ~4 cm x 3 cm equipped with 16 arrays of NUV-SiPM (near-ultraviolet sensitive silicon photon avalanche detector) for a total of 1024 sensitive elements. The outstanding performance of the photodetectors (with negligible background between adjacent photopeaks), allowed to apply a photon counting technique to the Cherenkov light collected on the focal plane. Thanks to the fine granularity of the array elements, the Cherenkov pattern was recorded together with the total number of detected photoelectrons increasing as Z^2 as a function of the atomic number Z . In this paper, we report the performance of the SiPM arrays and the excellent resolution achieved by the Digital Cherenkov prototype in the charge identification of the elements present in the beam.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

615

Poster 2 GA - Board: 91 / 395

Simulations of a Distributed Intelligent Array Trigger for the Cherenkov Telescope Array

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It is anticipated that the forthcoming Cherenkov Telescope Array will include a number of medium-sized telescopes that are constructed using a dual-mirror Schwarzschild-Couder configuration. These telescopes will sample a wide (8 degree) field of view using a densely pixelated camera comprising over 10^4 individual readout channels. A readout frequency congruent with the expected single-telescope trigger rates would result in substantial data rates. To ameliorate these data rates, a novel, hardware-level Distributed Intelligent Array Trigger (DIAT) is envisioned. A copy of the DIAT operates autonomously at each telescope and uses reduced metadata from a limited subset of nearby telescopes to veto events prior to camera readout. We present the results of Monte-Carlo simulations that evaluate the efficacy of a "Parallax width" discriminator that can be used by the DIAT to efficiently distinguish between genuine gamma-ray initiated events and unwanted background events that are initiated by hadronic cosmic rays.

Collaboration:

CTA

Registration number following "ICRC2015-I":

750

Poster 2 CR - Board: 170 / 1171

Development of optical systems for the KLYPVE experiment

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KLYPVE is an orbital detector of ultra high energy cosmic rays to be deployed on the Russian Segment of the International Space Station. An important part of the detector, which determines its physical parameters (energy threshold, field of view) is an optical system. For the project, a two-component system composed from a large area mirror-concentrator and a correcting Fresnel lens was developed. Two options were considered: a "Baseline" and a "Multi-eye telescope system" (METS). The first one consists of a 3.4 m diameter mirror and a 1.7 m lens and has $\pm 14^\circ$ FOV. The second one consists of three identical telescopes with $\pm 10^\circ$ FOV (a mirror of 2.4 m diameter and a 1.2 m lens) and can operate in various modes. The production of a mold for the central segment of the mirror was done in SINP MSU. This mold will be used for a carbon-plastic mirror manufacture. It is an important step in the development of lightweight and space qualified optical systems with high performance parameters production technology. A detailed description of the developed optical systems, optimization studies and simulations are presented as well as results of the mirror mold production and tests.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

1235

Poster 2 DM and NU - Board: 256 / 87

Nucleon decay search in Super-Kamiokande

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As a general feature, Grand Unified Theories (GUTs) predict that protons will decay someday. Proton decay search needs large detector which contains tremendous number of protons and backgrounds of this search are cosmic rays, especially, atmospheric neutrinos. Super-Kamiokande, which is known as a famous neutrino detector, also has the highest sensitivity for nucleon decays in the world. This presentation will give the latest results of nucleon decay searches including processes changing baryon number by two, and discuss about future prospects.

Collaboration:

– not specified –

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103

Poster 2 CR - Board: 142 / 1329

Monitoring Environmental Water with Ground Albedo Neutrons from Cosmic Rays

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Neutron monitors on Earth are usually used to track the dynamics of incoming cosmic-ray particles under the assumption that local environmental conditions do not influence the highly shielded signal. Oppositely, in a young research field the local dynamics of environmental water is monitored by detecting less moderated cosmic-ray neutrons. Water in soil, air, snow and vegetation determines the amount of ground albedo neutrons in the sensitive energy range from 1 eV to 100 keV. Plenty of small neutron detectors have been installed on natural or agricultural sites throughout the USA (>50), Europe (>30), Africa (>4), Asia (>2), and Australia (>5), and more to follow. Climate research, hydrologic models and irrigation management rely on the data, which represents area-average water content within tens of hectares due to the fast diffusion of neutrons in air. A major issue is the modulation of the count rate by the dynamics of incoming cosmic-ray neutrons. Conventionally, independent data from neutron monitors are consulted to serve as a reference for the correction of the local detectors. However, the performance of this comparative correction approach is unreliable, because it does not account for displacement (cutoff rigidity, altitude), different energy window, or potential influence of atmospheric conditions on the referenced neutron monitor. In addition, neutron monitor stations are sparse on Earth, and occasionally signals from different locations appear to be significantly inconsistent. The presentation shows how ground albedo neutrons from cosmic-rays are applied to environmental research, and emphasizes the need for a reliable correction for the incoming flux. Being part of a young adjacent community, we like to learn from the experience of cosmic-ray scientists and to discuss correction approaches that account for spatio-temporal variations of incoming cosmic rays at any place on Earth.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

970

Poster 2 GA - Board: 121 / 610

Modern Middleware for the Data Acquisition of the Cherenkov Telescope Array

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The Data Acquisition system (DAQ) of the future Cherenkov Telescope Array (CTA) must be efficient, modular and robust to be able to cope with the very large data rate of up to 100 GByte/s coming from many telescope with different characteristics. The use of modern middleware, namely zeroMQ and protocol buffers, helped to achieve these goals while keeping the development effort to a reasonable level. The protocol buffers are used as an on-line data format, while zeroMQ is employed to communicate between processes. The DAQ framework itself will be placed under the supervision of the Alma Common Software (ACS) based control software.

The protocol buffers from Google are a way to define high-level data structures through an IDL-like specific language and a meta-compiler. zeroMQ is a middleware that augments the capabilities of TCP/IP sockets. It does not implement very high-level features like e.g. CORBA, but only makes the use of sockets easier, more robust and almost as effective as raw TCP ones. The use of these two middlewares enabled us to rapidly develop a robust prototype of the DAQ system including data persistence to compressed FITS files.

Collaboration:

CTA

Registration number following "ICRC2015-I":

362

Poster 2 SH - Board: 14 / 411

Dynamics of zonal components of the cosmic ray distribution during geomagnetic storms

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We present the results of studies of zonal harmonics of the cosmic ray distribution during geomagnetic storms. Zonal harmonics have been determined using a global survey method as a variant of spherical analysis of the world neutron monitor network data. We have analyzed 56 major geomagnetic storms observed in 1997 - 2005. It is shown that a sharp increase ($> 0.7\%$) of zonal component amplitude of the isotropic part of cosmic ray distribution precedes a geomagnetic storm. A probability of precursor manifestation is about 75%, and the time of advance of a magnetic storm is 10 hours on the average. It is shown that the global survey method can be used for the effective short-term prediction of geomagnetic disturbance onset.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0264

Poster 2 SH - Board: 21 / 582

Neutron monitor counting rates at different cut off Rigidity from Galactic Cosmic rays

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Neutron monitor have recorded the flux of high energy cosmic rays from more than half century. Cosmic rays counts from the ground based neutron monitor at different cut off rigidity show intensity changes, which are anti correlated with sunspot numbers. They also lose energy as they propagate towards the Earth and experience various types of modulations due to different solar activity. In this work, we study the first three harmonics of cosmic ray intensity on geo-magnetically quiet days over the period 1960-2010 for three Northern Hemisphere (Oulu, Thule, Apatity) and three Southern Hemisphere (Kerguelen, McMurdo, Sanae) neutron monitoring stations located at different cut off rigidity. The amplitude of first harmonic remains high for low cutoff rigidity as compared to high cutoff rigidity on quiet days. The diurnal amplitude significantly decreases during solar activity minimum years. The diurnal time of maximum significantly shifts to an earlier time as compared to the co rotational direction having different cutoff rigidities. The time of maximum for first harmonic significantly shifts towards later hours and for second harmonic it shifts towards earlier hours at low cutoff rigidity station as compared to the high cut off rigidity station on quiet days. The amplitude of second/third harmonics shows a good positive correlation with solar wind velocity, while the others (i.e. amplitude and phase) have no significant correlation on quiet days. This work examines the record of 6 long running neutron monitors to evaluate cosmic rays fluxes during the recent extraordinary solar minima in a long-term context

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

475

Poster 2 CR - Board: 206 / 580

Primary energy reconstruction from the S(500) observable recorded with the KASCADE-Grande detector

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The primary energy of cosmic rays is reconstructed at KASCADE-Grande using different approaches based on different sets of recorded observables. We present the results of an approach based on the S(500) observable which is the charged particle density recorded at 500 m distance from the shower axis. Previous investigations based on CORSIKA simulations (with QGSJet-II-2 model embedded for high energy interactions) have shown the S(500) to be primary mass insensitive. We compare the result of this approach with another result from a standard reconstruction based on the correlation between the total shower size and the muon size. When analyzing experimental data we observe a systematic shift between the results. This discrepancy between the two methods does not appear when analyzing simulated events. We conclude that a significant contribution to this discrepancy comes from the inability of simulations to accurately describe the shape of the lateral particle distributions (in particular the muon lateral distributions).

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

524

Poster 2 CR - Board: 207 / 581

Effects of the new hadronic interaction models on the reconstruction of KASCADE-Grande observables

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In previous studies based on CORSIKA EAS simulations with the QGSJet-II-02 hadronic interaction model, the observables S(200) and S(500) (the charged particle densities at 200m and 500m from the shower axis) were found to be good candidates for mass discrimination and energy estimation. In order to study the effects of new hadronic interaction models on the reconstruction of EAS from the KASCADE-Grande experiment, a set of CORSIKA simulated showers was computed using the QGSJet-II-04 and EPOS-LHC models. Lateral Energy Correction Functions (LECF) are obtained for the Grande array using a Geant4 simulation code containing a realistic geometry of the Grande station. The LECFs are used to reconstruct the charged particle densities from the energy deposits in the Grande stations. We are using the real and reconstructed lateral distributions of charged particles in order to find corresponding observables for mass discrimination and energy estimation.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

524

Poster 2 CR - Board: 139 / 245**'HADRON-55' COMPLEX SETUP FOR STUDY OF HADRON INTERACTIONS WITHIN THE CENTRAL PART OF COSMIC RAY EAS CORES****Author:** Alexander Borisov¹**Co-authors:** Alexander Chubenko¹; Alexander Shepetov¹; E. Tautaev²; N. Zastrozhnova²; Oleg Dalkarov³; Rauf Mukhamedshin⁴; Rodion Nam⁵; Sergey Shaulov³; Turlan Sadykov²; Valery Zhukov⁵; Victor Pavlyuchenko¹; Vitaly Puchkov¹; Vladimir Ryabov³; Vyacheslav Piscal⁵¹ *P.N.Lebedev Physical Institute, RAS, Moscow, Russia*² *Institute of Physics and Technology, Ministry of Education & Science, Almaty, Republic of Kazakhstan*³ *P.N.Lebedev Physical Institute, RAS, Moscow, Russia*⁴ *Institute for Nuclear Physics, RAS, Moscow, Russia*⁵ *LPI Branch "Tien Shan Mountain Scientific Station", Almaty, Republic of Kazakhstan***Corresponding Author:** asborisov55@mail.ru

The project of a new experiment is proposed in order to obtain direct data on the value of production cross section of charmed particles in interactions of cosmic ray hadrons on lead nuclei at energy $E \sim 75$ TeV in the forward kinematic cone and to determine a contribution of prompt muons to the overall flow of superhigh energy muons within EAS at mountain altitudes. The proposed experiment, which will be carried out at the Tien Shan Mountain Scientific Station (TShMSS) located at an altitude of 3340 m above sea level, will clarify the nature of weakly absorbed hadronic component of cosmic rays, i.e., the nature of the so-called long-flying cosmic ray component which was previously observed in a number of nuclear physics experiments with cosmic rays including those performed at the TShMSS. Besides, anomalies and nearby sources of superhigh energy PCR will be searched within the experiment by scanning the celestial sphere and applying a high-sensitive difference method.

To achieve these objectives, a new 'HADRON-55' hybrid setup representing a two-storey coordinate calorimeter of $55 m^2$ in area is planned to assemble on the basis of the previous 'HADRON-44' hybrid calorimeter and 2-storey X-ray emulsion chamber (XREC). The setup consists of two blocks spaced vertically by 2.2 meters. The upper unit contains a standard Γ -block of an XREC with two underlying layers of ionization chambers arranged in mutually perpendicular directions. Beneath them, a sufficiently thick lead target block is located in which the cosmic ray hadrons interact effectively with lead nuclei. The lower unit represents the XRECs and the underlying ionization calorimeter $1050 g/cm^2$ thick, which consists of the iron absorber with gaps designed for placing of ionization chambers, Geiger and neutron counters. The hybrid calorimeter and the adjacent territory is covered with an array of scintillation detectors of $0.5 \times 0.5 m^2$ of size with total area of $350 m^2$. The specific features of the 'HADRON-55' complex setup make it possible to measure the coordinates of EAS core particle tracks with an accuracy of $\Delta x, y \sim 100$ microns and to determine the primary energy and that of individual particles with an accuracy of $\sigma E/E \sim 25\%$.

It is further assumed that HADRON-55 setup will operate as a part of the TShMSS shower array representing a network of scintillation detectors located on an area of about $2 km^2$.

The detailed study of EAS cores and their fine structure with the 'HADRON-55' setup will allow us to clarify characteristics of hadronic interactions at wide energy range $E_0 = 10^{14} \div 10^{18}$ eV in the forward (fragmentation) kinematic region.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 2 DM and NU - Board: 257 / 241

Search for high-energy neutrinos from dust obscured Blazars

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The recent discovery of high-energy cosmic neutrinos by the IceCube neutrino observatory opens up a new field in physics, the field of neutrino astronomy. Using the IceCube neutrino detector we plan to search for high energy neutrinos emitted from Active Galactic Nuclei (AGN). AGN are believed to be one of the most promising sources for emitting these weakly interacting particles. We discuss a specific type of AGN which we plan to investigate in more detail with data obtained by the IceCube observatory. The main properties of the AGN in which we are interested are given by a high energy jet which is pointing in our line of sight, called Blazars, and in particular the ones that are obscured by nearby dust. The jet-matter interaction is expected to give an increased neutrino production. The properties of this specific type of AGN are expected to give very distinct features in the electromagnetic spectrum, which are discussed in detail.

Collaboration:

– not specified –

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194

Poster 2 GA - Board: 96 / 249

Camera calibration strategy of the SST-1M prototype of the Cherenkov Telescope Array

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The SST-1M telescope is one of the prototypes under construction proposed to be part of the future Cherenkov Telescope Array. It uses a standard Davis-Cotton design for the optics and telescope structure, with a dish diameter of 4 meters and a large field-of-view of 9 deg.

The innovative camera design is composed of a photo-detection plane with 1296 pixels including entrance window, light concentrators, Silicon Photomultipliers (SiPMs), and pre-amplifier stages together with a fully digital readout and trigger electronics, DigiCam.

In this contribution we give a general description of the analysis chain designed for the SST-1M prototype. In particular we focus on the calibration strategy used to convert the SiPM signals registered by DigiCam to the quantities needed for Cherenkov image analysis. The calibration is based on an online feedback system to stabilize the gain of the SiPMs and dedicated events (dark count, pedestal, and light flasher events) to be taken during the normal operation of the prototype.

Collaboration:

CTA

Registration number following "ICRC2015-I":

267

Poster 2 GA - Board: 69 / 248

Lowering the ARGO-YBJ energy threshold to a few tens of GeV by using the double front shower events

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ARGO-YBJ, located at the YangBaJing Cosmic Ray Observatory (4300m a.s.l., Tibet, China), is a full coverage air shower array, with an energy threshold of about 300 GeV for gamma ray astronomy. Most of the recorded events are single showers, satisfying the trigger requirement of at least 20 particles detected in a given time window. However, in ~5% of the events, two randomly arriving showers may be recorded in the same time window, the second one, in general smaller, not needing to satisfy the trigger condition. These events are called double front shower events. By using these small showers, well under the trigger threshold, the detector primary energy threshold can be lowered to a few tens of GeV. In this paper, the angular resolution that can be achieved with these events is evaluated by simulations, and the capabilities of this technique in the search for GRBs are discussed.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

102

Poster 2 GA - Board: 100 / 418

Detector Considerations for a HAWC Southern Observatory

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The High-Altitude Water Cherenkov (HAWC) observatory in central Mexico is currently the world's only synoptic survey instrument for gamma rays above 1 TeV. Because there is significant interest in covering the full TeV sky with a survey instrument, we have examined options for a Southern Hemisphere extension to HAWC. In addition to providing all-sky coverage of TeV sources, a southern site could complement existing surveys of the densest part of the Galactic Plane, provide continuous monitoring of Galactic and extragalactic transient sources in both Hemispheres, and simplify the analysis of spatially extended signals such as diffuse gamma rays and the TeV cosmic-ray anisotropy. To take advantage of the air-shower physics and lower the energy threshold of the experiment as much as possible, a high altitude site above 5000 m a.s.l. (vs. 4100 m a.s.l. at the current site in Mexico) has been specified. To facilitate efficient detector construction at such altitudes, the detector tanks would be assembled at lower altitude and delivered to the site. An all-digital communications and data acquisition scheme is proposed. Possible designs include taking advantage of digital optical module technology from the IceCube experiment as well as new custom electronics. We discuss the physics potential of such an experiment, focusing on the energy threshold, angular resolution, and background suppression capability of the experiment, as well as the advantages of full-sky coverage above 1 TeV.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

261

Poster 2 GA - Board: 52 / 498

A Generic Algorithm for IACT Optical Efficiency Calibration using Muons

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Muons produced in extensive air showers generate ring-like images in Imaging Atmospheric Cherenkov Telescopes when travelling near parallel to the optical axis. From geometrical parameters of these images, the absolute amount of light emitted may be calculated analytically. Comparing the amount of light recorded in these images to expectation is a well established technique for telescope optical efficiency calibration. However, this calculation is usually performed under the assumption of an approximately circular telescope mirror. As the H.E.S.S. experiment entered its second phase in 2012, with the addition of a fifth telescope with a non-circular 600m² mirror, adaptations to the standard muon calibration implementation were required. We present a generalised muon calibration procedure, adaptable to telescopes of differing shapes and sizes, and demonstrate its performance on the H.E.S.S. II array.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

428

Poster 2 SH - Board: 42 / 1229

Solar Influence on Decay Rate (SIDR) Experiment

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The goal of the proposed experiment is to check the evidence for a possible solar influence on nuclear decay rates, and to measure any effect quantitatively.

Simultaneous decay rate measurements with many identical radioactive sources would allow us to study any possible correlations between their rate changes, and to thus improve the accuracy and reliability of the measurements.

Positioning the sources with various distances between them (up to 2000 km), and at different altitudes above sea level and underground, will help to determine which particles, rays and other outside influences can be responsible for nuclear decay rate changes (if they really exist).

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

40

Poster 2 CR - Board: 165 / 1009

Latest emulsion detector for cosmic ray observation: high sensitive emulsion film and high speed readout system

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Nuclear emulsion is a high resolution 3D tracking device. 0.2 μm AgBr crystals penetrated by a charged particle grow into 0.8 μm silver grains which can be observed as a track by a microscope via chemical development process. The recent fully automated readout systems enabled not only high resolution measurements but also large-scale experiments (accelerator experiments, balloon-borne experiments, cosmic ray muon radiography, and so on).

Since 2010, circumstances of the emulsion detector has drastically changed. We have introduced a system of nuclear emulsion gel production to the laboratory in Nagoya University, Japan, and have started self-development and supply of the new, ambitious gel, instead of the photographic film

companies. We have also developed a next-generation readout system, Hyper Track Selector (HTS). The scanning speed is designed to 0.9 m²/h (100 times faster than that of the current system).

Gamma-Ray Astro-Imager with Nuclear Emulsion (GRAINE) is a project of cosmic gamma-ray observation using the balloon-borne emulsion detector. The angular resolution of the emulsion gamma-ray telescope (0.08° @ 1-2 GeV) is one order of magnitude better than that of the Fermi-LAT. In addition, It has the polarization sensitivity using the pair creation mode. Search for exotic particles and measurement of short-lived particle production rate in cosmic rays at balloon altitudes will be also conducted. In the GRAINE 2nd balloon-borne experiment in 2015 May, 50 m² of the new high sensitive emulsion films are used for the middle-scale gamma-ray telescope (aperture area 3600 cm²) which we demonstrate the imaging performance by.

We present the status of the latest emulsion detector and readout system based on results of performance tests conducted for the GRAINE balloon-borne experiment in 2015.

Collaboration:

– not specified –

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846

Poster 2 GA - Board: 125 / 1000

Role of the disk environment in the gamma-ray emission from the binary system PSR B1259-63/LS 2883

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PSR B1259-63/LS 2883 is a very high energy (VHE; $E > 100$ GeV) gamma-ray emitting binary consisting of a 48 ms pulsar orbiting around a Be star with a period of 3.4 years. The Be star features a circumstellar disk which is inclined with respect to the orbit in such a way that the pulsar crosses it twice every orbit. The circumstellar disk provides an additional field of target photons which may contribute to inverse Compton scattering and gamma-gamma absorption, leaving a characteristic imprint in the observed spectrum and light curve of the high energy emission. We study the signatures of Compton-supported, VHE gamma-ray induced pair cascades in the circumstellar disc of the Be star and their possible contribution to the GeV flux. We also study a possible impact of the gamma-gamma absorption in the disk on the observed TeV light curve. We show that the cumulative absorption of VHE gamma-rays in stellar and disk photon fields can explain the modulation of the flux at the periastron passage.

Collaboration:

– not specified –

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826

Poster 2 SH - Board: 19 / 513

The Infrastructure of the time series statistics analysis for the muon monitor

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To find a possible correlation between the muon / neutron counting rate and simultaneously registered solar activity, by using machine learning, we propose the semi-automatic forecasting algorithm for several physical process, e.g. Forbush decrease, GLE, and so on. These correlations have a complex form defined by the spatially and temporally ordered set of events at world-wide monitor stations and satellites. Different muon and neutron monitors hosting facilities around the world establish hierarchical data acquisition detectors. Our infrastructure with the proposed algorithm has also a fault tolerance checking mechanism for those detectors.

Collaboration:

– not specified –

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453

Poster 2 CR - Board: 151 / 623

The new shower system of the Tien Shan mountain station and the goals of future cosmic ray investigations

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The results of the test data collection run held at the new shower installation of the Tien Shan mountain cosmic ray station are discussed. At time, the system consists of ~ 100 detector points built on the basis of plastic scintillator plates with sensitive area of 0.25 m^2 and 1 m^2 . In the core region these detectors form two rather dense carpets with the $3 \text{ m} \times 4 \text{ m}$ uniform spatial step between them; the recommissioning of a set of peripheral detectors spread at the distances within 40-200 m around the core is anticipated during the 2015 summer season. The dynamic range of scintillation amplitude measurements now is about $(3 - 7) \cdot 10^4$ with the perspective of its being extended up to $\sim 10^6$ in nearest future. The full stack of data acquisition, detector calibration, and shower parameters restoration procedures is now completed and the shower size spectrum newly obtained in the range of $N_e = 10^5 - 10^7$ occurs in agreement with conventional data. The results of correlation study between the EAS characteristics and the events registered with the underground neutron detectors are presented. The following investigations in the range of 10^{14} - 10^{18} eV cosmic ray physics are supposed to be carried out at Tien Shan in the nearest years: the study of angular distribution and anisotropy of EAS directions at knee region; the search for the fine structure of cosmic ray spectrum, various "exotics", and the possible traces of the dark matter interaction; the structure of the EAS particles flows immediately in its core region; investigation of the EAS hadrons and particularly of its low-energy neutron component.

Collaboration:

– not specified –

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83

Poster 2 CR - Board: 150 / 622

Dedicated power supply system for silicon photomultipliers

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Silicon photomultipliers (SiPMs) have replaced traditional photomultiplier tubes bit by bit in high-energy physics experiments in the last years. This includes the scientific fields where the demand for highly efficient and stable photo sensors outweigh the need for large active areas. Silicon photomultipliers offer high photon detection efficiencies, low supply voltages and stable operation even under harsh environments, for example bright moon-light conditions. The temperature dependence, however, presents a challenge to the power supply system which has to compensate for this effect along with biasing the SiPMs with a stable voltage with mV precision at up to 100 V (10^{-5} accuracy).

Here, we present an intelligent power supply system for silicon photomultipliers. Up to 64 SiPM channels can be driven with one module, where more than 1 mA of power can be drained per channel. The operating-voltage can be changed in 1 mV steps to allow for temperature variations of the power supply system itself, which is well below 1 mV K^{-1} . A built-in micro-controller applies the voltage correction for temperature changes on the SiPM automatically using up to 64 analogue temperature sensors. The data, like the mean current per channel, temperature and applied voltage is communicated via Ethernet, while the user is able to set the bias-voltage to his needs. Measurements concerning the performance of the power supply system are being shown.

Collaboration:

– not specified –

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456

Poster 2 DM and NU - Board: 258 / 624

Time-dependent search of high energy cosmic neutrinos from variable Blazars with the ANTARES telescope

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ANTARES, the largest neutrino telescope operating in the Northern Hemisphere, performs multiple analyses in the search for neutrino point-source candidates. In a time-dependent search, the background is drastically reduced, and the point-source sensitivity improved, by selecting a narrow time window around the assumed neutrino production period. Blazars are particularly attractive potential neutrino point sources, since they are among the most likely sources of the observed very-high-energy cosmic rays. Neutrinos and gamma-rays may be produced in hadronic interactions with the surrounding medium. Moreover, blazars generally show large time variability in their light curves at different wavelengths and on various time scales. For the time-window selection, their gamma-ray emission measured by the LAT instrument on-board the Fermi satellite is derived, and the resulting light curves are characterised by a time series analysis. The studied periods are determined by applying a threshold on the fluence on the light curves. In addition, the flares reported at TeV energies by the IACTs HESS, MAGIC and VERITAS have been included in a second dedicated analysis. The sensitivities reached with this method improve by a factor 2-3 with respect to a standard time-integrated point source search. The results of the two searches, using data from the years 2008 up to 2012, will be presented.

Collaboration:

ANTARES

Registration number following "ICRC2015-I/":

188

Poster 2 SH - Board: 32 / 1344

Application of correlative and continuous wavelet analyses to comparative studies of correctness of neutron monitor data sets

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Many time series of neutron component data are collected in World Data Centers from the fifties of XX century to nowadays. It is very important to believe that those data are typified as stabilized and

generally of good quality.

In the paper the correctness of the pressure corrected data of individual neutron monitor (NM) stations is examined on the monthly to yearly time scale separately for the periods of different heliospheric magnetic field polarity from 1958 to 2014. Taking no account some short time details as GLE events, one can expect a similar NM intensity response at every station with a similar cut-off rigidity and with similar asymptotic directions to the solar variability on a long time scale. It could be reflected by similar values of the Pearson correlation coefficients and slopes of regression lines between the smoothed solar activity indices and NM data registered at different stations. The solar activity is described by Ottawa/Penticton radio flux. If the correlation coefficient considerably wanders away from the mean value for the determined epoch the data registered at such station should not be used to a further study of long-term variations.

Modern and powerful wavelet technique with establishing of the significance levels and confidence intervals for the resultant power spectra can also be applied to test in time frequency space the existing data of the world wide network.

Some examples of hourly and daily data corrected for the long period cut off drift with GLE increases excluded are presented.

Collaboration:

– not specified –

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999

Poster 2 DM and NU - Board: 291 / 179

Galactic contribution to the IceCube astrophysical neutrino signal

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Neutrino telescope IceCube has recently discovered astrophysical neutrinos with energies in the TeV-PeV range. We use the data of Fermi gamma-ray telescope to demonstrate that the neutrino signal has significant contribution from the Milky Way galaxy. Matching the gamma-ray and neutrino spectra we find that TeV-PeV Galactic cosmic rays form a powerlaw spectrum with the slope $p \simeq 2.5$. This spectral slope is harder than previously thought, but it is compatible with that of the locally observed spectra of cosmic ray nuclei in the same energy range. It is also consistent with the theoretical model of cosmic ray injection by diffusive shock acceleration followed by escape through the Galactic magnetic field with Kolmogorov turbulence. The locally observed cosmic ray proton spectrum is softer than the average Galactic cosmic ray spectrum. This could be explained by variability of injection of cosmic rays in the local interstellar medium over the past 10^7 yr.

Collaboration:

– not specified –

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205

Poster 2 GA - Board: 75 / 600

Exploring the potential X-ray counterpart of the puzzling TeV gamma-ray source HESS J1507-622 with new Suzaku observations

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The unidentified very high energy (VHE, $E > 100$ GeV) gamma-ray source HESS J1507-622 seems to not fit into standard models for sources related to young supernova remnants, pulsar wind nebulae, or young stellar populations in general. This is due to its intrinsically extended, but yet compact morphology, coupled with a relative large offset (3.5 deg) from the Galactic plane. Therefore, it has been suggested that this object may be the first representative of a new distinct class of extended off-plane gamma-ray sources. The distance to HESS J1507-622 is the key parameter to constrain the source's most important properties, such as age and energetics of the relativistic particle population.

In this paper, we report on results of follow-up observations of the potential X-ray counterpart with Suzaku. We present detailed measurements of its spectral parameters and find a high-absorbing hydrogen column density, compatible with the total amount of Galactic gas in this direction. In comparisons to measurements and models of the Galactic 3D gas distribution, we show that the potential X-ray counterpart of HESS J1507-622 may be located at the far end of the Galaxy. If the gamma-ray source is indeed physically connected to this extended X-ray source, this in turn would place the object outside of the usual distribution of Galactic VHE gamma-ray emitters.

Collaboration:

– not specified –

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527

Poster 2 CR - Board: 240 / 864

Barometric effect of the neutron component of cosmic rays with consideration for wind effect at the Antarctic station Mirny and station Mt. Hermon in Israel.

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Estimation of barometric coefficient for neutron component of cosmic rays was performed for Antarctic station Mirny and Mt. Hermon in Israel taking into account effect of dynamic pressure caused by wind in the atmosphere. Hourly data of continue monitoring of neutron component and data of the local meteo station have been used for the period 2007-2014. Wind velocity at the observatory Mirny reaches 20-40 m/s in winter that corresponds to dynamic pressure of 5-6 mb and leads to the error of 5% in variations of neutron component because of dynamic effect in the atmosphere. The results are interesting for high latitude and high mountain detectors, where effect Bernulli may be significant.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0144

Poster 2 GA - Board: 104 / 176**Silicon Photomultiplier Research and Development Studies for the Large Size Telescope of the Cherenkov Telescope Array**

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The Cherenkov Telescope Array (CTA) is the the next generation facility of Imaging Atmospheric Cherenkov Telescopes; two observatories will cover both hemispheres. CTA will reach unprecedented sensitivity, energy and angular resolution in very-high-energy gamma-ray astronomy. Each CTA array will include four Large Size Telescopes (LSTs), designed to cover the low-energy range of the CTA sensitivity (~20 GeV to 200 GeV).

In the baseline LST design, the focal-plane camera will be instrumented with 265 photodetector clusters that include 7 1.5-inch photomultiplier tubes (PMTs). The PMT design is based on mature and reliable technology. Recently, silicon photomultipliers (SiPMs) are emerging as a competitor. Currently, SiPMs have advantages (e.g. lower operating voltage and tolerance to high illumination levels) and disadvantages (e.g. higher capacitance and cross talk rates), but this technology is still young and rapidly evolving. SiPM technology has a strong potential to become superior to the PMT one in terms of photon detection efficiency and price per square mm of detector area. While the advantage of SiPMs could be proven for high-density, small-size cameras, it is yet to be shown for large area cameras as the one of the LSTs.

The CTA-LST SiPM R&D team is committed to developing a SiPM-based module for the LST camera, in view of a possible camera upgrade. We will describe the solutions we are exploring in order to balance a competitive performance with a minimal impact on the overall LST camera design.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

0186

Poster 2 DM and NU - Board: 280 / 175

Detection of tau neutrinos by Imaging Air Cherenkov Telescopes

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This paper investigates the potential to detect tau neutrinos in the energy range of 1-1000 PeV searching for very inclined showers with imaging Cherenkov telescopes. A neutrino induced tau lepton escaping from the Earth may decay and initiate an air shower which can be detected by a fluorescence or Cherenkov telescope. We present here a study of the detection potential of Earth-skimming neutrinos taking into account neutrino interactions in the Earth crust, local matter distributions at various detector sites, the development of tau-induced showers in air and the detection of Cherenkov photons with IACTs. We analysed simulated shower images on the camera focal plane and implemented generic reconstruction chains based on Hillas parameters. We find that present IACTs can distinguish air showers induced by tau neutrinos from the background of hadronic showers in the PeV-EeV energy range. We present the neutrino trigger efficiency obtained for a few configurations being considered for the next-generation Cherenkov telescopes, i.e. the Cherenkov Telescope Array. Finally, for a few representative neutrino spectra expected from astrophysical sources, we compare the expected event rates at running IACTs to what expected for the dedicated IceCube neutrino telescope.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

182

Poster 2 GA - Board: 67 / 174

FACT - First Energy Spectrum from a SiPM Cherenkov Telescope

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The First G-APD Cherenkov Telescope (FACT) is an Imaging Air Cherenkov Telescope located on the Canary Island of La Palma. It is the first of its kind which uses Geigermode-Avalanche Photo Diodes (G-APDs) as photosensors to detect the Cherenkov radiation emitted from secondary particles in a high-energy gamma-ray air shower.

A new analysis chain was developed using modern data mining methods and unfolding techniques

to obtain the energy spectrum of an observed source. This analysis chain was applied to data of the Crab Nebula, the so called “standard candle” in Cherenkov astronomy.

The analysis chain starts with the preprocessing of the raw data. For this task, we developed the data analysis tool *fact-tools*. It performs a raw data calibration, an extraction of the registered Cherenkov photon pulses, a cleaning process, and calculates several parameters describing the measured image of the air shower. *fact-tools* is embedded in the *streams* framework which was developed in cooperation with the department of computer science at the TU Dortmund.

The image parameters calculated by *fact-tools* are used to perform a background suppression. For this separation, we used the data mining framework RapidMiner. It supports the application of a large variety of multivariate methods for classification tasks. The easy to use “drag & drop” graphical user interface allows straightforward designing of the separation process.

The resulting data set is unfolded using the software TRUEE in order to obtain the energy spectrum of the observed source.

The different steps of the analysis chain will be presented, and the Crab Nebula energy spectrum measured by FACT will be shown for the first time.

Collaboration:

FACT

Registration number following “ICRC2015-I”:

190

Poster 2 CR - Board: 197 / 974

Measurement of shower fronts with the ARGO - YBJ experiment

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In gamma-ray astronomy, the time structure of the shower front is crucial to improve the angular resolution of primaries for ground-based experiments. With its full coverage detection area, high time resolution and excellent spatial granularity, the ARGO-YBJ experiment offers a good opportunity to study in detail the temporal behavior of the gamma-ray shower fronts. In this work, by using the data recorded from 2008 January to 2012 October, we extracted a significant sample of gamma ray showers from the Crab Nebula direction. The time profiles of gamma-ray induced and cosmic-ray induced showers are measured and compared. Besides that, the intrinsic time structures of showers are studied.

Collaboration:

ARGO-YBJ

Registration number following “ICRC2015-I”:

747

Poster 2 GA - Board: 70 / 180

Prospects On Testing Lorentz Invariance Violation With The Cherenkov Telescope Array

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The assumption of Lorentz invariance is one of the founding principles of modern physics and violation of that would have deep consequences to our understanding of the universe. Potential signatures of such a violation could range from energy dependent dispersion introduced into a light curve to a change in the photon-photon pair production threshold that changes the expected opacity of the universe. Astronomical sources of Very High Energy (VHE) photons can be used as test beams to probe fundamental physics phenomena, however, such effects would likely be small and need to be disentangled from intrinsic source physics processes. The Cherenkov Telescope Array (CTA) will be the next generation ground based observatory of VHE photons. It will have improved flux sensitivity, a lower energy threshold (tens of GeV), broader energy coverage (nearly 5 decades) and improved energy resolution (better than 10% over much of the energy range) compared to current facilities in addition to excellent time resolution for short timescale and rapidly varying phenomena. The expected sensitivity of this facility leads to us to examine in this contribution the kinds of limits to Lorentz Invariance Violation (LIV) that we could expect to obtain on VHE observations of Active Galactic Nuclei (AGN), Gamma Ray Bursts (GRBs) and pulsars with CTA. With a statistical sample and wide variety of sources CTA has the potential to set model independent limits.

Collaboration:

CTA

Registration number following "ICRC2015-I":

200

Poster 2 DM and NU - Board: 259 / 1120

Reconstruction of track-type neutrino events in KM3NeT/ORCA

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KM3NeT is a next-generation research infrastructure being installed in the deep seas at the south coasts of Europe. Within this infrastructure, KM3NeT/ORCA is a future neutrino telescope targeting the measurement of the neutrino mass hierarchy (NMH) by investigating atmospheric neutrino oscillation in matter in the energy range between 5 and 20 GeV. Charged-current muon-neutrino events significantly contribute to the NMH sensitivity. In these events, the final-state muon induces a track-like topology. The precise reconstruction of such events is an indispensable prerequisite for the NMH measurement.

The algorithm used starts by selecting hits fulfilling space-time coincidence requirements, thus reducing the optical background from the decay of ⁴⁰K in the sea water. The muon direction is determined by applying a likelihood maximisation method based on time residuals with respect to a track hypothesis. The inelasticity parameter, Bjorken- η , is estimated using the time residuals of the hits with respect to track and cascade hypotheses. The interaction vertex and the muon track

length are reconstructed from the time and position of the hits used for the direction reconstruction. The energy of the neutrino is calculated taking into account the reconstructed track length (i.e. the muon energy), the reconstructed Bjorken- y and the number of hits used in the fit. In the poster, the track reconstruction algorithm and the achieved resolutions in neutrino direction and energy are presented.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

908

Poster 2 SH - Board: 1 / 12

ANALYZING THE 2014 JANUARY 6 GROUND LEVEL ENHANCEMENT

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We investigated the variations in the cosmic ray (CR) rigidity spectrum and anisotropy during the 2014 January 6 Ground Level Enhancement (GLE) from the ground-based observations of CRs at the global network of stations and with spacecraft by using the method of spectrographic global survey. Presented are the CR rigidity and variation spectra, as well as the relative variations in the 4-GV CR intensity in the solar-ecliptic geocentric coordinate system during individual periods of the event under investigation. During this GLE, the proton acceleration is shown to reach the particle rigidity of $R \sim 2.4$ GV, and the CR differential rigidity spectra are described neither by the power nor by the exponential function of the particle rigidity within the $\sim 0.3 - \sim 2.4$ GV rigidity range. During this GLE, the Earth was in the IMF loop-like structure

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1114

Poster 2 GA - Board: 74 / 189

Significance for signal changes in γ -ray astronomy

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We describe a straightforward modification of frequently invoked methods for the determination of the statistical significance of a γ -ray signal observed in a counting process.

A simple criterion is proposed to decide whether a set of measurements of the numbers of photons registered in the source and background regions is consistent with the assumption of a constant source activity.

This method is particularly suitable for immediate evaluation of the stability of the observed γ -ray signal.

It is independent of the exposure estimates, reducing thus the impact of systematic inaccuracies, and properly accounts for the fluctuations in the number of detected photons.

The usefulness of the method is demonstrated on several examples.

We discuss intensity changes for γ -ray emitters detected at very high energies by the current γ -ray telescopes (e.g. 1ES 0229+200, 1ES 1959+650 and PG 1553+113).

Some of the measurements are quantified to be exceptional with large statistical significances.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

204

Poster 2 CR - Board: 210 / 15

Effects of the near earth thunderstorms electric field on intensity of the ground cosmic ray electron at YBJ

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It has been found that most of the near earth thunderstorms electric field strength at YBJ (4300 m a.s.l., Tibet, China) is within the range of 1000V/cm from ARGO-YBJ data. In this work, Monte Carlo simulations were performed by CORSIKA to study the intensity change of the ground cosmic rays in near earth thunderstorms electric fields. We found that the number of electrons in secondary particles at YBJ was changed with the strength and polarity of the electric field. In the negative field, the number increases with the strength of the fields. Nevertheless, it increases, or does not change obviously or even declines with different energies of primary particles in the different positive fields. Our results are consistent with the observations obtained from ARGO-YBJ during thunderstorms. What is more, these preliminary results provide important information in understanding the acceleration mechanism of secondary charged particles caused by electric field.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

102

Poster 2 SH - Board: 2 / 17

Computation of ionization effect due to cosmic rays in polar middle atmosphere during GLE 70 on 13 December 2006

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At recent one of the modern topics in solar-terrestrial physics is the study of the possible effect of solar variability, respectively cosmic ray (CR) variations on atmospheric physics and chemistry. An important feature in most of the proposed mechanisms and models is the key role of the induced by cosmic rays ion production in the atmosphere. Since recently is observed an apparent effect on minor constituents and aerosols over polar regions during major solar proton events, the ground level enhancement 70 on 13 December 2006 deserves a special attention. In this work we compute the ion production rate profiles on 13 December 2006 on the basis on a previously applied model based on detailed Monte Carlo simulations of cosmic ray induced atmospheric cascade. The ion production rate during the event is considered as superposition of cosmic rays with galactic and solar origin. The time evolution of ion production is computed in a realistic manner. The spectral and angular characteristics of the solar protons are explicitly considered throughout the event as well their time evolution. The ionization effect during the event is computed at several altitudes above the sea level in a region with geomagnetic cut-off rigidity $R_c \leq 1$ GV. The 24 hour ionization effect is estimated in the region of the Pfozter maximum.

The present study is part of a larger research project on impact of galactic and solar cosmic rays on the atmosphere during 23-rd solar cycle. During the solar cycle 23, sixteen GLE events were observed with intensities ranging $\sim 3 - 277\%$. The first event occurred on 6 November 1997 (GLE 55) and the last event occurred on 13 December 2006 (GLE 70). There was a slight increase in the number of GLE events as one progressed from the rise (4 GLEs) to the maximum (5 GLEs) and to the declining phases (7 GLEs). It should be noted that the last two GLE events of 23-rd solar cycle were the most powerful - GLE 69 reached CR intensity increase 277.3 % and GLE 70 reached increase ~ 92.3 %. In this respect the considered by us GLE 70 represents great interest for the solar-terrestrial and space physics.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

21

Poster 2 GA - Board: 90 / 191

Monte Carlo Studies of the Gamma-ray Cherenkov Telescope for the Cherenkov Telescope Array

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The Gamma-ray Cherenkov Telescope (GCT) is an innovative dual-mirror solution to the small-size telescopes for CTA, capable of imaging the Cherenkov light produced in the atmosphere by cosmic gamma rays with energies from a few TeV to hundreds of TeV. The reduced plate scale resulting from the secondary optics allows the use of compact photosensors, including multi-anode photomultipliers (PMTs) and silicon PMTs. We show preliminary results of Monte Carlo simulations using the packages CORSIKA and Sim telarray in order to understand the relative performance of each photosensor type. We also investigate the effect of the secondary optics in terms of total optical throughput, image resolution and camera response as well as the effect of modifications to the electronics and different camera readout schemes on performance. With the ongoing commissioning of the prototype structure in Meudon and camera in Leicester, we present the expected performance of GCT.

Collaboration:

CTA

Registration number following "ICRC2015-I":

202

Poster 2 GA - Board: 64 / 185

Unexpected gamma-ray signal in the vicinity of 1ES 0229+200

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We report on an unidentified gamma-ray signal found in the region around the BL Lac object 1ES 0229+200.

It was recognized serendipitously in our analysis of 6.2 years of Fermi-LAT data at a distance less than 3° away from the blazar.

The observed excess of counts manifests itself as an unexpected local maximum in the test statistic map.

Although several Fermi-LAT sources have been identified in this area we were not able to link them to the position of this residual signal.

A clear association with sources visible in other wavebands was not successful either.

We briefly discuss characteristics of this unresolved phenomenon.

Our results suggest a steep energy spectrum and a point-like nature of this candidate gamma-ray emitter.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

204

Poster 2 DM and NU - Board: 260 / 1113

Effect of local terrain in neutrino propagation based on Simulation with topographic data

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Extremely high energy neutrinos are attenuated by the materials surrounding the neutrino detector. Topography data can provide spatial distribution of material and become an essential factor in high energy neutrino experiment, especially for the earth skimming neutrino experiment. This study introduced the Antarctica topography data, including composite layers of rock, ice, and water, to investigate the topography effect for near horizontal neutrino events. We also apply the different neutrino experiment setups (balloon, surface, and underground types) into the simulation to estimate the topography effect for neutrino observation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

879

Poster 2 SH - Board: 3 / 18

Computation of ion production rate profiles induced by cosmic rays during Bastille day 14 July 2000 ground level enhancement GLE 59

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The galactic cosmic rays are the main source of ionization in the Earth stratosphere and troposphere. They play an important role in various processes related to atmospheric physics and chemistry. Sporadically solar energetic particles enhance the ion production rate, specifically over polar caps. At recent was observed an apparent effect on minor constituents and aerosols over polar region during major solar proton events, specifically during the greatest GLE event (of 23-rd solar cycle) on 20 January 2005. Solar cycle 23 provided several strong ground level enhancements. The studied Bastille

day event on 14 July 2000 is the first major event positioned exactly at the maximum of solar cycle 23. The previous four events (GLE 55 –58) in the rise phase of solar cycle 23 were observed with intensities ranging ~ 3 –11%, i.e. they were still relatively weak.

In the work presented here we apply a full Monte Carlo 3-D model for cosmic ray induced ionization in order to compute the ion production during the Bastille day event. The model is based on atmospheric cascade simulation with CORSIKA code using FLUKA and QGSJET II hadron generators. The ion production rate profiles during the event are considered as a superposition of cosmic rays with galactic and solar origin. The time evolution of ion production rate is computed considering the variation of solar proton spectra throughout the event, apparent source position and anisotropy. The ion production rate is computed as a function of the altitude above the sea level at several geomagnetic cut-off rigidities, namely 1 GV, 2 GV and 3 GV. The total ionization effect is also estimated. The present study is part of a larger research project on impact of galactic and solar cosmic rays on the atmosphere during 23-th solar cycle. During the solar cycle 23, sixteen GLE events were observed. The greatest of them are: the considered here Bastille day event on 14 July 2000 (GLE 59), the Easter events on 15 and 18 April 2011 (GLEs 60 and 61), the Halloween events on October-November 2003 (GLEs 65, 66 and 67), the GLE 69 on 20 January 2005 and the GLE 70 on 13 December 2006. The comparative study of the effects of these GLE events is of great importance for space physics as well as for space weather and space climate.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

21

Poster 2 CR - Board: 152 / 659

Design and Performance of the ISS-CREAM Boronated Scintillator Detector.

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Cosmic Ray Energetics And Mass for the International Space Station (ISS-CREAM) is a new instrument developed to measure the composition and spectrum of cosmic-ray particles up to close to the knee of the cosmic-ray energy spectrum 10^{12} – 10^{15} eV. The instrument utilizes two modified detectors from the highly successful CREAM balloon instrument, a sampling calorimeter and silicon charge detector. Two new detectors systems, the Top and Bottom Counting Detector (T/BCD) and Boronated Scintillator Detector (BSD) have been built to enable making measurements of high-energy electrons in the instrument. In this paper we focus on the Boronated Scintillator Detector, which detects thermal neutrons in the showers produced by cosmic-rays interacting in the calorimeter. We can discriminate between hadrons and electrons by looking at the number of thermal neutrons produced in these showers. A larger yield of neutrons is produced from hadronic interaction by cosmic-ray nuclei than electromagnetic interactions by high-energy cosmic-ray electrons in showers that deposit equal amounts of energy in the calorimeter. The BSD consists of a detector enclosure containing the boronated scintillator and photomultiplier tubes and an electronic enclosure with signal conditioning, control, communication, housekeeping and power conditioning electronics. We present data on the performance of the detector as measured in the lab and at the CERN H2 beamline in 2012. We also discuss the design challenges and our successful approach in building a space-qualified detector within the constraints of a balloon detector budget.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

582

Poster 2 CR - Board: 194 / 887

All particle CR Energy spectrum by the data of the Tunka-HiSCORE prototype array.

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The first stage of the Tunka-HiSCORE prototype array operated in the Tunka Valley in March and April of 2014. It consisted of 9 optical stations with the total area of 0.3x0.3 km². Reconstruction methods of extensive air shower parameters are based on the experience of the Tunka-133 data processing. Primary energy spectrum in the energy range of 200 TeV – 30 PeV is obtained as the first result of the Tunka-HiSCORE prototype operation. The spectrum has a complicated structure around the energy of the classic knee (3 PeV). The energy threshold of the Tunka-HiSCORE array obtained with this analysis lets us estimate a possible energy threshold for gamma quanta registration in future improved HiSCORE experiment.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0758

Poster 2 CR - Board: 140 / 324

PMT Array Nonlinearity On-line Calibration using the Photoelectron Meter for Image Air Cherenkov Telescope

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The PMT array is the most important detection unit for IACT. The high precision Cosmic ray energy spectrum measurement relies on the performance of the PMT array. The PMT gain can be ageing over time, which can impact the performance of the PMT array. A facility of photoelectron meter is developed for high precision online nonlinearity calibration and monitoring the performance of the PMT array of IACT. The photoelectron meter can emit four kinds light with ratio of 1:2:3:4 and the light flux can be adjusted with the fixed ratio. The system uncertainty of the photoelectron meter is less than 0.5% and the precision of nonlinearity calibration is better than 1%.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

39

Poster 2 GA - Board: 118 / 329

Data model issues in the Cherenkov Telescope Array project

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The planned Cherenkov Telescope Array (CTA), a future ground-based Very-High-Energy (VHE) gamma-ray observatory, will be the largest Cherenkov project of its kind. It aims to provide an order of magnitude increase in sensitivity compared to currently operating VHE experiments and open access to guest observers. These features, together with the thirty years lifetime planned for the installation, impose severe constraints on the data model currently being developed for the project. In this contribution we analyze the challenges faced by the CTA data model development and present the requirements imposed to face them. While the full data model is still not completed we show the organization of the work, status of the design, and an overview of the prototyping efforts carried out so far. We also show examples of specific aspects of the data model currently under development.

Collaboration:

CTA

Registration number following "ICRC2015-I":

197

Poster 2 GA - Board: 79 / 203

Performance of the MAGIC telescopes under moonlight

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MAGIC is a system of two 17m diameter Imaging Atmospheric Cherenkov Telescopes (IACT) located at the Observatorio del Roque de los Muchachos in the Canary island of La Palma. It observes the gamma-ray sky from ~ 50 GeV to more than 50 TeV. The IACT technique works preferentially in very dark condition. The best performance and lowest energy threshold are reached at dark astrophysical sites during moonless nights. However, the MAGIC telescopes have been designed to operate also with brighter Night Sky Background (NSB) light than dark nights. They can observe during twilight and moonlit nights. This allows us to increase the available observation time per year by about 50%. Here, we report about the performance of the MAGIC telescopes during moonlit nights based on observations of the Crab Nebula. Data analysis and Monte Carlo simulations must be adapted to the higher noise level induced by the moonlight. While the energy threshold depends dramatically on the NSB level, we show that other performance characteristics, such as the sensitivity, do not degrade significantly.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

206

Poster 2 GA - Board: 120 / 204

First results on the two square meters multilayer glass composite mirror design proposed for the Cherenkov Telescope Array developed at INFN

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The Cherenkov Telescope Array (CTA) is a future ground-based gamma-ray astronomy detector that will consist of several tens of Imaging Atmospheric Cherenkov Telescopes of different sizes. The total reflective surface of roughly $10,000 \text{ m}^2$ requires unprecedented technological efforts towards a cost-efficient production of light-weight and reliable mirror substrates at high production rate.

We report on a new mirror concept proposed for CTA developed by INFN, which is based on the replication from a spherical mold under pressure.

The mirror substrate is an open structure design made by thin glass layers at the mirror's front and rear interspaced by steel cylinders.

A first series of nominal size mirrors has been produced, for which we discuss the optical properties in terms of radius of curvature and focusing power.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

0186

Poster 2 GA - Board: 80 / 209

Monte Carlo Performance Studies of Candidate Sites for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) is the next-generation gamma-ray observatory with sensitivity in the energy range from ~20 GeV to beyond 300 TeV. CTA is proposed to consist of two arrays of 40-100 imaging atmospheric Cherenkov telescopes, with one site located in each of the Northern and Southern Hemispheres. The evaluation process for the candidate sites for CTA is supported by detailed Monte Carlo simulations, which take different attributes like altitude and geomagnetic field configuration into account. In this contribution we present the comparison of the sensitivity and performance of the different CTA site candidates for the measurement of very-high energy gamma rays.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

152

Poster 2 GA - Board: 81 / 77

Constraints on particle acceleration in Rosette and Orion nebulae with Fermi-LAT observations

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Rosette and Orion nebulae are two young massive star clusters in which no supernova explosion has occurred yet. That makes two very good candidates to study particle acceleration in a super bubble induced by the collective effects of stellar winds. Using data from Fermi-LAT and a phenomenological model, upper limits on the fraction of mechanical energy converted into accelerated particles have been obtained. The potential gamma-ray flux have been finally compared to the HESS-II and CTA Cherenkov telescopes sensitivities.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1249

Poster 2 CR - Board: 175 / 1349

Design, Fabrication and Performance of the Silicon Charge Detector for the ISS-CREAM

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The ISS-CREAM experiment is a space-borne mission designed for the precision measurement of energy and elemental composition of cosmic rays. It will be launched to the International Space Station. The Silicon Charge Detector (SCD) is an instrument equipped with four layers of high-precision silicon pad sensors and readout electronics arranged in such a manner that it is free of dead area. Therefore the SCD is capable of the precise measurement of elemental composition of cosmic rays with the charge resolution of $\delta Z \leq 0.2e$ for proton ($Z=1$) to nickel ($Z=28$). The SCD has been integrated into the ISS-CREAM payload which currently undergoes a series of space qualification tests. We will present the design and fabrication of the SCD. We will also present thermal-vacuum and vibrational characteristics of the SCD, and the response of the SCD to ground mouns.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1002

Poster 2 SH - Board: 5 / 74

SENSITIVITY OF THE WORLD-WIDE NEUTRON MONITOR NETWORK TO SOLAR NEUTRONS: A REVISITED APPROACH

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Observations of intense sporadic solar-neutron events provide a unique opportunity to study energetic processes of particle acceleration during solar flares. Such neutrons are produced in nuclear reactions of high-energy (from several hundred MeV/nuc to several GeV/nuc) particles in the solar atmosphere and surface. The existing neutron monitor (NM) network provides a continuous record of cosmic ray intensity over several solar cycles but can also serve as a suitable detector for solar neutrons.

Here we revise the sensitivity of the world wide neutron monitor network to solar neutrons using a newly computed yield function for solar neutrons. The yield function was computed using a Monte-Carlo simulation of the neutron-induced atmospheric cascade and updated information about the NM detection efficiency. The simulation was performed with the PLANETOCOSMICS code, which incorporates the full complexity of the atmospheric cascade development, namely secondary particle propagation and attenuation in the Earth's atmosphere.

Subsequently a technique based on the modelled NM response to solar neutrons is applied in order to estimate the sensitivity of world wide neutron monitor network to solar neutrons. The results are widely discussed in application of the solar neutron event

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0017

Poster 2 CR - Board: 136 / 71

Feasibility study of detection of high-Z material in nuclear waste storage facilities with atmospheric muons

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Muon radiography is a well-established technique which is widely used in investigating the internal density structure of targets of different size and composition. Some examples of successful applications are the search for hidden chambers in archaeological sites and the monitoring of geological structures like volcanoes. The two main approaches to muon radiography are based on the effects of multiple Coulomb scattering and on absorption inside the target of atmospheric muons. The results of a Monte Carlo feasibility study of using muon radiography to investigate the presence of high-Z material (e.g. uranium) inside nuclear waste storage facilities using both the above mentioned techniques are presented. Albeit muon radiography has already been successfully applied to this kind of investigation in the past, this is the first time that it is benchmarked against the detection of cm-sized, high-Z samples inside building-sized storage facilities. For both multiple scattering and absorption approaches, preliminary results show that uranium samples of typical size greater than 5 cm can be detected inside a storage silo with a size of some meter filled with concrete, with a data taking period of several weeks. Smaller samples with size 2 cm are not detectable due to multiple scattering within the concrete matrix. The dependence of these results on the position of the samples and on the duration of data acquisition have been investigated and are reported as well, together with an estimate of the detection probability for fake signals.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

95

Poster 2 CR - Board: 189 / 1262

Galactic cosmic ray propagation models using Picard

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We present results obtained from our newly developed Galactic cosmic ray transport code Picard, that solves the cosmic ray transport equation. This code allows for the computation of cosmic ray spectra and the resulting gamma-ray emission. Relying on contemporary numerical solvers allows for efficient computation of deca-parsec scale resolution models. Picard can handle locally anisotropic spatial diffusion acknowledging a full diffusion tensor. We used the framework to investigate the transition from axisymmetric to spiral-arm cosmic ray source distributions. Wherever possible we compare model predictions with constraining observables in cosmic ray astrophysics.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

599

Poster 2 DM and NU - Board: 292 / 1149

High energy neutrino production in the core region of radio galaxies due to particle acceleration by magnetic reconnection

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Detection of astrophysical high energy (HE) neutrinos in the range of TeV- PeV energies by IceCube observatory has opened new era in high energy astrophysics. Neutrinos with energies \sim PeV imply that they are originated from a source where cosmic rays (CRs) can be accelerated up to \sim 1017eV. Recently it has been shown that the observed TeV gamma-rays from radio galaxies may have a hadronic origin and in such a case this may lead to neutrino production. In this work we show that HE protons accelerated by magnetic reconnection in the core region of radio galaxies may produce HE neutrinos via decays of charged pions produced by photo-meson process. We have also calculated the diffuse intensity function for the HE neutrinos which can explain the detected IceCube data.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

829

Poster 2 CR - Board: 190 / 1267

Study of Cosmic-Ray Transport with the GALPROP Code

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The isotopes ^2H and ^3He in the cosmic radiation are mainly secondary products from interactions of primary cosmic rays in the interstellar medium. Secondary-to-primary ratios give important information on processes that occurred during the propagation of cosmic rays, independent of the unknown source spectrum. Boron-to-Carbon ratio data have been primarily used to study cosmic-ray transport. As statistics have increased and mass resolution have improved, recent measurements on cosmic-ray hydrogen and helium isotopes provide another probe for their propagation in the Galaxy. In this paper, we use the GALPROP numerical code for calculating the propagation of relativistic charged particles. The standard GALPROP code had to be modified to be suitable for hydrogen and helium isotopes in the energy region 0.2 to 1.5 GeV/n. The proton fusion process for production of ^2H had to be added, and production cross sections for light isotopes had to be updated at these energies. We will present the modifications made on GALPROP for its application to proton and helium isotopes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

934

Poster 2 CR - Board: 247 / 691**The Effects of Three Dimensional Structures on Cosmic-Ray Propagation and Interstellar Emissions****Author:** Gudlaugur Johannesson¹**Co-authors:** Andrew Strong²; Elena Orlando³; Igor Moskalenko³; Troy Porter³¹ *Science Institute, University of Iceland*² *Max-Planck-Institut fuer extraterrestrische Physik*³ *Stanford University***Corresponding Author:** gudlaugu@hi.is

A study of interstellar emissions from radio to high-energy gamma rays (> 100 MeV) arising from CR interactions with interstellar gas, radiation and magnetic fields is currently the best way to gain insight into the physics of CRs throughout the Milky Way. To properly utilize the high quality data of modern instruments such as the Fermi-LAT, a detailed model of these interstellar emissions is necessary. In this paper we discuss the effects that results from inclusion of three-dimensional (3D) structures into the distributions of interstellar gas and CR sources using the GALPROP code.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

379

Poster 2 GA - Board: 85 / 699**SiPM and front-end electronics development for Cherenkov light detection****Author:** Giovanni Ambrosi¹**Co-authors:** Alberto Gola²; Alessandro Ferri; Claudio Piemonte³; Daniela Simone⁴; Elisabetta Bissaldi⁵; Fabio Acerbi³; Francesco Giordano⁶; Gaetano Zappala³; Giovanni Paternoster³; Maria Ionica⁷; Nicola Zorzi⁸; Riccardo Paoletti⁹¹ *Universita e INFN, Perugia (IT)*² *F*³ *FBK*⁴ *INFN Bari*⁵ *INFN Trieste*⁶ *University and INFN Bari*

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The Italian Institute of Nuclear Physics (INFN) is involved in the development of a demonstrator for a SiPM-based camera for the Cherenkov Telescope Array experiment, with a pixel size of $6 \times 6 \text{mm}^2$.

The camera houses about two thousands electronics channels and is both light and compact. In this framework, an R&D program for the development of SiPMs suitable for Cherenkov light detection (so called NUV SiPMs) is ongoing.

Different photosensors have been produced at Fondazione Bruno Kessler, with different microcell dimensions and fill factor, in different geometrical arrangements.

At the same time, INFN is developing front-end electronics based on the waveform sampling technique optimized for the new NUV SiPM. Measurements on $1 \times 1 \text{mm}^2$, $3 \times 3 \text{mm}^2$, and $6 \times 6 \text{mm}^2$ NUV SiPM coupled to the front-end electronics will be presented; first imaging capability of a 16-channel matrix system will also be shown.

Collaboration:

CTA

Registration number following "ICRC2015-I":

634

Poster 2 CR - Board: 186 / 548

Recent extensions to GALPROP

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Recent extensions to GALPROP

Some recent extensions to the GALPROP cosmic-ray propagation package will be described. These are built on the public version released a few years ago.

The enhancements include: an accurate solution option, improved convection formulation, alternative spatial boundary conditions, polarized synchrotron emission, new magnetic field models, updated gamma-ray production cross-sections, free-free radio emission and absorption, primary positrons, additional injection spectral breaks, deuterium production by pp fusion, hadronic energy losses, improved Healpix skymap format, compatibility with latest Healpix release, and various bug fixes.

The Explanatory Supplement has been extensively updated, including details of these enhancements.

The latest version is available at <https://sourceforge.net/projects/galprop>.

A compatible plot package for GALPROP output is at <https://sourceforge.net/projects/galplot>.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

491

Poster 2 CR - Board: 226 / 598

Characterization of Prompt Atmospheric Lepton Fluxes

Authors: Emily Dvorak¹; Paul Dieterle²**Co-authors:** Bai Xinhua ¹; Kyle Jero ³; Paolo Desiati ³¹ *South Dakota School of Mines and Technology*² *California Institute of Technology*³ *Wisconsin IceCube Particle Astrophysics Center, University of Wisconsin - Madison***Corresponding Author:** desiati@wipac.wisc.edu

The IceCube Neutrino Observatory at the South Pole functions as a detector for high-energy atmospheric muons and neutrinos produced by cosmic ray interactions in the atmosphere. At the lowest energies, pion and kaon decays contribute the most to leptonic fluxes. Above a couple of hundred TeV, the prompt decay of charmed mesons becomes more important. The production processes of these prompt leptons are neither well-understood nor well-characterized. In this work we use air showers generated by CORSIKA to study both the muon and neutrino fluxes with the hadronic interaction model, DPMJET 2.55. Atmospheric lepton fluxes at both the surface and at the depth of the IceCube detector are simulated up to 1×10^9 GeV. Muon bundle multiplicities and lateral distributions are characterized. Additionally, the sensitivity of muon and neutrino energy spectra to cosmic ray primary composition and atmosphere annual modulations are studied.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

309

Poster 2 GA - Board: 73 / 995

Radio observations of the evolved pulsar wind nebula HESS J1303-631 with ATCA

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The initially unidentified very high energy (VHE; $E > 100$ GeV) gamma-ray source HESS J1303-631 was recently associated with the pulsar PSR J1301-6305 basing on its energy-dependent morphology.

Subsequent detection of X-ray and GeV counterparts also support the identification of the H.E.S.S. source as evolved pulsar wind nebula (PWN). We report here on recent radio observations of the PSR J1301-6305 field of view (FOV) with ATCA dedicated to search for the radio counterpart of this evolved PWN. Observations at 5.5 GHz and 7.5 GHz do not reveal any extended emission associated with the pulsar. The analysis of the archival 1.384 GHz and 2.368 GHz data also does not show any significant emission. 1.384 GHz data reveal a hint of an extended shell-like emission in the PSR J1301-6305 FOV which might be a supernova remnant. We discuss the implications of the non-detection at radio wavelengths on the nature and evolution of the PWN as well as the possibility of the SNR candidate being a birth place of PSR J1301-6305.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

826

Poster 2 CR - Board: 163 / 997

Large scintillator EN-detector with natural boron for EAS study

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The URAN array for EAS study is now under construction in MEPhI in collaboration with INR RAS. The basic element detector for the array is EN-detector sensitive to both thermal neutron and electromagnetic components. For this study we developed a novel type of EN-detector based on a thin layer of alloyed mixture of inorganic scintillator ZnS(Ag) with B₂O₃ as a target for neutrons. Main feature of the detector is its sensitivity to hadronic EAS component through secondary neutrons produced by high energy hadrons in the vicinity of the detector. Neutron component is not almost studied, though it is a part of the main EAS component –hadronic one. Some new features of a novel EN-detector are described. It is shown that this relatively cheap detector variant can have rather good performances. Results of measurements are compared with Monte-Carlo simulations using GEANT4 code.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

51

Poster 2 CR - Board: 199 / 992

A study of radio frequency spectrum emitted by high energy air showers with LOFAR

Author: Laura Rossetto¹

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The LOW Frequency ARay (LOFAR) is a multipurpose radio antenna array aimed to detect radio signals in the frequency range 10–240 MHz, covering a large surface in Northern Europe with a higher density in Northern Netherlands.

The detection of the radio signal emitted by cosmic ray induced air showers allows to reconstruct the geometry of the observed cascade. Thus, several properties of primary particles (e.g. arrival direction, mass composition) can be inferred.

We describe a study of several geometrical parameters of the radio signal emitted by extensive air showers propagating in the atmosphere, and their correlation with the observed radio frequency spectrum. In order to find the best parameters which describe the correlation between primary cosmic ray information and the emitted radio signal, a cross-check between real data and simulations has been done.

Regarding real data, cosmic ray radio signals detected by LOFAR since 2011 have been analyzed. For the simulation of the radio signals, the CoREAS code, a plug-in of the CORSIKA particle simulation code, has been used.

The final aim of this study is to find a method to infer information of primary cosmic rays in an independent way from the well-established fluorescence and surface detector techniques, in view of affirming the radio detection technique as reliable method for the study of high energy cosmic rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0085

Poster 2 SH - Board: 9 / 120

SciBar Cosmic Ray Telescope (SciCRT) at Mt. Sierra Negra, Mexico as a component muon detector of the Global Muon Detector Network (GMDN)

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We plan to use the SciCRT as a new muon detector and fill a gap remaining in the viewing directions of the present GMDN which currently consists of four multi-directional muon detectors in Japan, Australia, Brazil and Kuwait. In order to minimize the data acquisition time, the muon measurement is triggered by the four-fold coincidence between pulses from the top and bottom pairs of the x- and y-layers of scintillation bars in SciCRT. In this paper, we analyze the muon trigger data recorded at the observation site, at the top of Mt. Sierra Negra (4,600 m above sea level), for one month of September, 2014. It is confirmed that the observed zenith angle and azimuth angle distributions of muon events are consistent with expectations from the response function of atmospheric muons to the primary galactic cosmic rays. We also analyze the observed temporal variation of the muon event rate and compare it with the observation by GMDN. We then evaluate the current performance of the SciCRT as a new component detector of GMDN.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

126

Poster 2 GA - Board: 56 / 129

Redshift measurement of the BL-Lac gamma-ray blazar PKS 1424+240

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Gamma-ray emission in the range of VHE (TeV) is strongly attenuated by the photon-photon interaction with the extragalactic background light (EBL), the diffuse cosmological radiation field (UV to far-IR) encompassing all radiative energy releases since recombination. As a consequence all discovered VHE sources are relatively close ($z < 0.6$, except perhaps for the recent detection of the blazar S3 0218+357 at $z=0.944$ – ATel \#6349). For HE (GeV) gamma-rays this attenuation is negligible so, modeling the drop from HE to VHE caused by this interaction it is possible to either study the EBL or to have an estimation of the redshift. The majority of the extragalactic VHE gamma-ray sources are BL-Lac blazars. The lack of both emission and absorption lines in BL-Lacs makes the estimation of spectroscopic redshifts very difficult, then the method using gamma-ray observations is applied

whenever possible.

Motivated by the evidence that BL-Lacs are typically hosted by elliptical galaxies, which in turn are associated to groups or clusters, we have proposed an alternative method to estimate the redshift of blazars in an indirect way (Muriel et al., A&A 574, 101, 2015), for which spectroscopic observations of the nearby galaxies are necessary.

The BL-Lac blazar PKS 1424+240 was detected at HE by Fermi-LAT and at VHE by H.E.S.S. Estimations for its redshift include three attempts using gamma-ray observations and one obtained by analyzing Ly_β and Ly_γ absorption lines observed in the far-UV spectra (from HST/COS) caused by absorbing gas along the line of sight. They allowed to constrain the redshift range to $0.6 < z < 1.19$, which places PKS 1424+240 in the very interesting condition to be one of the few most distant blazars detected at VHE, with redshift in a range never populated by other VHE source.

We have proposed to perform optical spectroscopic observations of PKS 1424+240 and the visible galaxies within the field at high S/N ratio using Gemini. In this work we present the analysis of those spectra.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

140

Poster 2 GA - Board: 108 / 529

Upgrade paths for the HAWC gamma-ray observatory

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The initial concept of the HAWC Observatory, an air shower array of 300 water Cherenkov detectors on the slope of Sierra Negra in Mexico, has been successfully carried out with the completion of construction in December 2014. The HAWC detector, located 4100 m above sea level, has begun continuous operation surveying the sky for cosmic rays and gamma rays between 100 GeV and 100 TeV. The experience of the Milagro experiment, the predecessor to HAWC, has shown that the effective area of such an array can be dramatically increased by adding an outrigger array of small particle detectors. The outriggers improve the identification of shower cores that do not fall on the central array, leading to a more effective reconstruction of these showers, especially at high energies.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

155

Poster 2 CR - Board: 192 / 416

EAS lateral distribution measured by the ARGO-YBJ experiment

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The measurement of the lateral distribution of extensive air showers by the ARGO-YBJ experiment is presented. The ARGO-YBJ experiment has two kinds of readout: a digital readout for small particle densities (<23 strips/m²) and an analog readout for large particle densities (up to 10⁴/m²). For lateral distribution studies, the inner core region is measured by the analog readout, while farther regions are measured by the digital readout. This allows the study of the lateral distribution function in a wide interval of distances from the shower core.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

420

Poster 2 DM and NU - Board: 262 / 417

Atmospheric muon and electron neutrino energy spectrum measured by first year of IceCube-86 detector

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Due to the large amount of flux, atmospheric neutrino is the main background for the IceCube neutrino telescope. Precise measurement of its spectrum allows us to reduce uncertainty of any kind of signal analysis. In this paper, we measure atmospheric muon and electron neutrino spectrum from first year of IceCube-86 detector. Track type events originate from muon neutrino and cascade type events originate from both muon and electron neutrino are analyzed together by likelihood fit. Normalization and modified spectrum index compare to the model spectrum are determined.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

0392

Poster 2 SH - Board: 15 / 412

Investigation of short-term disturbances of the solar wind using a tensor anisotropy method

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In this work the dynamics of tensor anisotropy of cosmic rays during the passage of large-scale disturbances of the solar wind for the 22-24 solar cycles is studied. The information on the anisotropy was obtained using a global survey method by data of the worldwide neutron monitor network. For the analysis of the obtained results the data on the interplanetary magnetic field state and solar wind parameters are used.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0264

Poster 2 CR - Board: 237 / 839

Imaging and non-imaging Cherenkov hybrid reconstruction

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Air showers with primary energies between 3 and 100 PeV which are pointed toward TALE give rise to an optical signal dominated by Cherenkov radiation rather than fluorescence light. The reconstruction of these showers can be greatly improved for a sample of these showers by placing a small (400 m square) array of non-imaging Cherenkov counters (25 counters) below the field of view of TALE. Estimates of the hybrid reconstruction resolutions for shower geometry, energy and X_{max} are presented along with estimates of the hybrid aperture. NICHE counter designs and construction plans will be presented.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I/":

712

Poster 2 DM and NU - Board: 293 / 362

Search for extragalactic astrophysical counterparts of IceCube neutrino events

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Detection of 35 very high-energy (VHE) neutrinos by the IceCube Neutrino Observatory has opened a new chapter in multi-messenger astronomy. Due to large errors in measuring the directions of the neutrino shower-type events, which dominate the current event list, it is difficult to identify their astrophysical sources. We perform cross-correlation study of IceCube neutrino events with extragalactic candidate sources using X-ray and gamma-ray selected source catalogues such as Swift-BAT, 3LAC and TeV-Cat. We apply different cuts on the X-ray and gamma-ray fluxes of the sources in these catalogues, and use different source classes in order to study correlation. We use invariant statistic and Monte Carlo simulations to evaluate statistical significance of any correlation. Finally we study physical scenario in which VHE neutrinos can be produced at the candidate sources.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

350

Poster 2 GA - Board: 62 / 447

Long-term TeV Observations of the Gamma-ray Binary HESS J0632+057 with VERITAS

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HESS J0632+057 is a X-ray binary, previously observed over six years with the Imaging Air Cherenkov Telescopes H.E.S.S., MAGIC, and VERITAS. New data taken in the last three years with the VERITAS observatory as part of its long-term observing plan are presented here. They cover the entire period of about 315 days including the enhancements at the phases of about 0.35 and, for the first time detected with VERITAS, around 0.75. The results are discussed along with simultaneous observations with the X-ray satellite Swift.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

152

Poster 2 CR - Board: 249 / 388

Investigation of cosmic-ray sources with gamma ray initiated showers

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The main problem of ultra-high energy cosmic rays (UHECRs) is where they come from. Point UHECR sources seem to be appropriate but they are not discovered. Information about UHECR origin is obtained from particle energy spectrum. In space, particles lose energy in interaction with cosmic microwave background. This results in a lack of particles at $E > 10^{20}$ eV at the Earth (GZK-effect) if UHECRs come from distances of more than ~ 100 Mpc. The spectrum of UHECRs collected from nearer distances have no GZK-suppression. Experimental data indicate that UHECR energy spectrum is suppressed. However, there may be one more reason for spectrum suppression along with GZK-effect. Particles are accelerated to the maximum energy of $\sim 10^{21}$ eV due to conditions in possible UHECR sources. As sources are still unknown, the acceleration energy limit cannot be ruled out. So the reason for the spectrum suppression is not clear.

Another effect of UHECR interaction with cosmic microwave background is electromagnetic cascades that particles initiate in extragalactic space (Hayakawa (1966), Prilutski&Rozenal (1970)). In cascade, transverse distances between particles are gigantic (in spite of small angle distances) due to large lengths at which cascades develop. Therefore intensity of cascade particles is low. However we demonstrate that it is possible to study source remoteness and initial particle energy spectra by studying cascades.

We have calculated intensity of cascade quanta at $E \sim 10^{14}$ eV and found that it depends on above mentioned source characteristics. As in the Earth atmosphere cosmic rays initiate air showers, selecting quanta-initiated showers (and excluding those from the galactic plane, gamma-ray sources, etc.) makes it possible to obtain UHECR-source parameters. The statistics of showers registered at 10^{14} eV being $\sim 10^8$, the number of quanta-initiated showers is 0 or ~ 1000 depending on source characteristics. This difference is large enough to use this method for studying UHECR sources.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1042

Poster 2 CR - Board: 233 / 784

ESTIMATION OF CHARM PRODUCTION CROSS SECTION IN THE FORWARD KINEMATIC CONE AT ENERGIES $E_{lab} \sim 75$ TEV ACCORDING TO THE HIGH MOUNTAIN EXPERIMENT WITH TWO-STOREY XREC

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One-year exposition data on absorption of high-energy cosmic ray hadrons with energies of tens of TeV in two-tier X-ray emulsion chamber (XREC) with large air gap (~ 2.2 m) are presented. The experiment was carried out at the Tien Shan High Mountain Research Station located at the altitude of 3340 m a.s.l. It is shown that the abnormal behavior of the hadron absorption curve, which was formerly observed in some cosmic ray experiments with deep lead calorimeters, can be accounted for by assuming a rapid growth of charmed particle production efficiency in the forward cone with

increasing energy. The experimental results of both the two-storey XREC exposition and earlier expositions of homogeneous lead calorimeters are compared with simulation data calculated on the basis of a phenomenological hadronic interaction model (code FANSY 1.0) implementing quark-gluon string theoretical approaches and assuming various charm production cross section parameters. A preliminary result of charm production cross section in the forward cone at energy $E_{lab} \sim 75$ TeV is discussed. Particularly, the result is compared with those of collider experiments (RHIC and LHC) obtained for kinematic central region characterizing by relatively low pseudorapidities.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0176

Poster 2 DM and NU - Board: 281 / 630

The Giant Radio Array for Neutrino Detection

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High-energy neutrino astronomy will probe the working of the most violent phenomena in the Universe. The GRAND (Giant Radio Array for Neutrino Detection) project consists of an array of 200 000 radio antennas deployed over a total area of 200 000 km² in a mountainous site. The array aims at detecting high energy neutrinos ($E > 10^{16}$ eV) via the measurement of air showers induced by the decay in the atmosphere of tau leptons produced by the interaction of the cosmic neutrinos under the Earth surface. Our objective with GRAND is to reach a neutrino sensitivity of 2×10^{-11} GeV/cm²/s/sr above 3×10^{16} eV. This sensitivity ensures the detection of cosmogenic neutrinos even in the most pessimistic source models of ultrahigh energy cosmic rays (UHECRs), and about a 100 events per year are expected for the standard source models. GRAND would also probe the neutrino signals produced at the potential sources of UHECRs.

We show how our preliminary array layout should allow us to reach our sensitivity goals, and estimate the associated experimental characteristics for high-energy neutrino detection. We assess the possibility to adapt GRAND to other astrophysical radio measurements (the study of the Epoch of Reionization for example). In particular, such a detector would constitute the largest observatory on ground for UHECR detection. We discuss in this token the technological options for the detector and the steps to be taken to achieve the GRAND project.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

426

Poster 2 CR - Board: 160 / 911

Upgrade of a data acquisition system for SciBar Cosmic Ray Telescope (SciCRT) at Mt. Sierra Negra, Mexico

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SciCRT (SciBar Cosmic Ray Telescope) is a new project to observe cosmic rays via a full active scintillator tracker. Our aim is to detect high energy solar neutrons produced by the interaction between accelerated ions and the solar atmosphere and to observe the anisotropy of galactic cosmic-ray muons. In the previous ICRC in Brazil, we reported that the detector has been installed at Mt. Sierra Negra (4,600 m above sea level) in April, 2013.

We also reported that the current VME-based data acquisition (DAQ) system does not have enough ability to deal with all the galactic cosmic-ray background neutrons at such a high altitude mountain. Moreover the readout noise makes the current DAQ process complicated.

Therefore we have developed a fast readout DAQ system, optimized to our experimental environment with the KEK electronics system group. We employed a hardware-based network processor (SiTCP) developed for high energy physics. We have developed a brand-new back-end board based SiTCP and tested it at Mt. Sierra Negra in 2014. Then we determined the final design for the new back-end board. We plan to replace the muon and a part of the neutron DAQ system with the new DAQ system in the middle of 2015.

We will introduce the configuration of the new DAQ system and report new results from the experiment with the new DAQ system at Mt. Sierra Negra, which is planned to be installed in June 2015.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

759

Poster 2 DM and NU - Board: 263 / 578**Rejection of atmospheric muons in KM3NeT/ORCA****Author:** Luigi Antonio Fusco¹¹ *University of Bologna***Corresponding Author:** lfusco@bo.infn.it

KM3NeT is a future research infrastructure hosting the next-generation underwater neutrino observatory in the Mediterranean Sea. Within KM3NeT, the ORCA detector will be devoted to the measurement of the neutrino mass hierarchy, by investigating matter-induced effects in the oscillation pattern of atmospheric neutrinos. The main background for this search is given by atmospheric muons coming from cosmic-ray air showers and reaching the detector. Downward-going atmospheric muons can mimic upward going neutrino induced events and represent a major difficulty in this high precision measurement. Monte Carlo simulations have been used to establish a rejection strategy for these events, based only on the output of event reconstruction algorithms without requiring a larger surrounding detector or the use of a part of the instrumented volume for veto purposes. A percent-level contamination of atmospheric muons in the final selected sample can be obtained without significant deterioration of the detector performance.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

74

Poster 2 SH - Board: 20 / 576**Cosmic ray Daily variation on Anomalous day****Author:** arvind dubey¹**Co-author:** santosh kumar ²¹ *rani durgawati university jabalpur india*² *rani durgawati university jabalpur***Corresponding Author:** arvinddubey3768@gmail.com

The Characteristics of the daily variation of cosmic ray intensity on different types of Anomalous days has been studied by using data of Neutron Monitors. It is observed that Cosmic ray intensity remains statistically low during the period of 1996-1998 on both Beijing and Moscow Neutron monitor station. These data is subjected to Harmonic Analysis Fourier techniques for an tire period of consideration that is 1996-2006. The amplitude and phase of diurnal and semi diurnal anisotropies on these stations particularly on Anomalous days have been discussed. The occurrence of these events

is dominated during solar activity minimum years. The number of days of occurrence is more anti correlated with solar cycle.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

475

Poster 2 GA - Board: 66 / 61

Analytical Real-Time Analysis sensitivity evaluation of the Cherenkov Telescope Array

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Co-authors: Andrea Bulgarelli ¹; Andrea Zoli ¹; Giovanni De Cesare ¹; Marc Ribo ²; Paola Grandi ¹; Sera Markoff ³; Susumu Inoue ⁴

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The Cherenkov Telescope Array (CTA), the new generation very high-energy gamma-ray observatory, will improve on the flux sensitivity of the current Cherenkov telescopes by an order of magnitude over a continuous range from about 10 GeV to above 100 TeV. With tens of telescopes distributed in the North and South hemispheres, the large effective area and field of view coupled with the fast pointing capability make CTA a crucial instrument for the detection and physical understanding of transient, short-timescale variability phenomena (e.g. Gamma-Ray Bursts, Active Galactic Nuclei, gamma-ray binaries, serendipitous sources). The key CTA system for the fast identification of flaring events is the Real-Time Analysis (RTA) pipeline, a science alert system that will automatically detect and generate science alerts with a latency of 30 seconds with respect to the triggering event collection and ensure fast communication to/from the astrophysics community. According to the CTA design requirements, the RTA search for a true transient event should be performed on multiple time scales (from minutes to hours) while being sensitive to a flux at most three times the one given by the nominal CTA sensitivity.

Given the CTA requirement constraints on the RTA efficiency and the fast response ability demanded by the transient science, we perform a preliminary evaluation of the RTA sensitivity as a function of the CTA high-level technical performance (e.g. effective area, point spread function) and the observing time. This preliminary analytical approach allows the exploration of the complex parameter space defined by the scientific and technological requirements, with the aim of defining the feasibility range of the input parameters and the minimum background rejection capability of the RTA pipeline.

Collaboration:

CTA

Registration number following "ICRC2015-I":

249

Poster 2 GA - Board: 101 / 62

Central Acceptance Testing for Camera Technologies for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) is an international initiative to build the next generation ground based very-high energy gamma-ray observatory. It will consist of telescopes of three different sizes with several different technologies for the cameras that detect the Cherenkov light from the observed air showers. In order to ensure the compliance of each camera technology with CTA requirements, CTA will perform central acceptance testing of each camera technology. To assist with this, the Camera Test Facilities (CTF) work package is developing a detailed test program covering the most important performance, stability and durability requirements and is setting up the necessary equipment. Two different setups for performance tests on camera subunits are being built, which may provide an early feedback for camera development. When fully integrated cameras are available, their performance may be tested with a portable setup at their construction site. Performance testing will include a wide range of tests like signal amplitude, time resolution, dead-time determination, trigger efficiency, performance testing under temperature and humidity variations and several others. Stability and durability tests will include the long-term functionality of movable parts, water tightness of the camera housing, temperature and humidity cycling, resistance to vibrations during transport or due to possible earthquakes, UV-resistance of materials and several others. Some durability tests will need to be contracted out because they will need dedicated equipment not currently available within CTA.

The planned test procedures and the current status of the test facilities will be presented.

Collaboration:

CTA

Registration number following "ICRC2015-I":

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Poster 2 GA - Board: 116 / 63

Calibration of the Cherenkov Telescope Array

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The construction of the Cherenkov Telescope Array (CTA), consisting of two observatories designed to observe the very high energy gamma-ray sky with unprecedented sensitivity and precision, will soon start. We will present the baseline methods and their extensions currently foreseen to achieve the strong requirements on allowed systematic uncertainties for the reconstructed gamma-ray energy and flux scales, as well as on the pointing resolution, and on the overall duty cycle of the observatory.

Onsite calibration activities will include a robust and efficient calibration of the telescope cameras, and various methods and instruments to achieve calibration of the overall optical throughput of each telescope, leading to both inter-telescope calibration and an absolute calibration of the entire observatory. One important aspect of onsite calibration is a correct understanding of the atmosphere above the telescopes, which constitutes the calorimeter of this detection technique. It will be constantly monitored with state-of-the-art instruments to obtain a full molecular and aerosol profile up to the stratosphere. In order to guarantee the best use of the observation time, in terms of usable data, an intelligent scheduling system is required, which gives preference to those sources and observation programs that can cope with the given atmospheric conditions, especially if the sky is partially covered by clouds, or slightly contaminated by dust. Ceilometers in combination with all-sky-cameras will provide the observatory with a fast, online and full-sky knowledge of the expected conditions for each pointing direction. For a precise characterization of the adopted observing direction, wide-field optical telescopes and Raman Lidars will provide information about the height-resolved and wavelength-dependent atmospheric extinction, throughout the field-of-view of the cameras.

Collaboration:

CTA

Registration number following "ICRC2015-I":

200

Poster 2 GA - Board: 102 / 65

Characterization and commissioning of the SST-1M camera for the Cherenkov Telescope Array

Authors: Domenico Della Volpe¹; Enrico Junior Schioppa²; Frank Raphael Cadoux²; Isaac Troyano Pujadas²; Krzysztof Zietara³; Matthieu Heller²; Pawel Rajda⁴; Teresa Montaruli²; Yannick Favre²

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The prototype camera of the single-mirror Small Size Telescopes (SST-1M) proposed for the Cherenkov Telescope Array (CTA) project was developed using large silicon photomultipliers (SiPM) coupled to hollow light concentrators.

The camera is composed of a silicon photo-sensor plane designed at the University of Geneva, and a readout and trigger system (DigiCam) developed in Krakow. The full camera will be installed on the telescope structure at IFJ PAN in summer 2015.

In this contribution, we review the steps that led to the development of the photo-detection plane and the readout electronics. We also describe the test and calibration techniques adopted and we outline the plans for the operation and commissioning of the camera after its installation on the SST-1M prototype.

Collaboration:

CTA

Registration number following "ICRC2015-I":

129

Poster 2 SH - Board: 49 / 67

Diffusion of Cosmic Rays in Turbulent Plasmas: Analytical Theory and Simulations

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A fundamental problem in Space Science and Astrophysics is the interaction between energetic particles and a turbulent plasma. We have developed a test-particle code to simulate the interaction of charged particles with turbulent magnetic fields. Diffusion coefficients along and across the mean magnetic field are calculated and compared to different analytical theories. Different turbulence models were considered such as slab, 2D, composite, and isotropic geometries. We have also included wave propagation effects via the interaction with shear Alfvén waves. We explored the transport regimes in which the Bohm limit and the quasi-linear limit are valid. We have also shown that the so-called Unified Non-linear Transport Theory (UNLT) is indeed a strong tool for calculating perpendicular transport upon agreement with numerical simulations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1067

Poster 2 GA - Board: 103 / 252

The Instrument Response Function Format for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) is a future ground-based observatory (with two locations, in the northern and southern hemispheres) that will be used in the study of the very-high-energy gamma-ray sky. CTA observations will be proposed by external users or initiated by the observatory, with the resulting measurements being processed by the CTA observatory and the reduced data made accessible to the corresponding proposer. Instrument Response Functions (IRFs) will also be provided to convert the quantities measured by the array(s) into relevant science products (i.e. spectra, sky maps, light curves).

As the response of the telescopes depend on many correlated observational and physical quantities (e.g. gamma-ray arrival direction, energy, telescope orientation, background light, weather conditions etc.) the CTA IRFs could grow into increasingly larger and larger file sizes, which can become unwieldy or impractical for use in specific observation cases. To this end, a customised IRF format (complying with the FITS standard) is under development to reduce the IRF file sizes into more manageable levels.

This proposed format is attractive due to its ability to store multiple parameters (in chosen ranges) relating to instrument performance in both binned and parameterized formats, for various array and observing conditions. Details of the format, preliminary design and testing of the prototype will be provided below.

Collaboration:

CTA

Registration number following "ICRC2015-I":

269

Poster 2 CR - Board: 181 / 250

On the Contribution of "Fresh" Cosmic Rays to the Excesses of Secondary Particles

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The standard model of cosmic ray propagation has been very successful in explaining all kinds of the Galactic cosmic ray spectra. However, high precision measurement recently revealed the appreciable discrepancy between data and model expectation, from spectrum observations of γ -rays, e^+/e^- and probably the B/C ratio starting from ~ 10 GeV energy.

In this work, we propose that the fresh cosmic rays, which are supplied by the young accelerators and detained by local magnetic field, can contribute additional secondary particles interacting with local materials.

As this early cosmic ray has a hard spectrum, the model calculation results in a two-component γ -ray spectrum, which agree very well with the observation.

Simultaneously, the expected neutrino number from the galactic plane could contribute $\sim 60\%$ of IceCube observed neutrino number below a few hundreds of TeV.

The same pp-collision process can account for a significant amount of the positron excesses. Under this model, it is expected that the excesses in \bar{p}/p and B/C ratio will show up when energy is above ~ 10 GeV.

We look forward that the model will be tested in the near future by

new observations from AMS02, IceCube, AS γ , HAWC and future experiments such as LHASSO, HiSCORE and CTA.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

263

Poster 2 GA - Board: 72 / 251

Study of hadron and gamma-ray acceptance of the MAGIC telescopes: towards an improved background estimation

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The MAGIC telescopes are an array of two imaging atmospheric Cherenkov telescopes (IACTs) studying the gamma ray sky at very high-energies (VHE; $E > 100$ GeV). The observations are performed in stereoscopic mode, with both telescopes pointing at the same position in the sky. Differently from the other running IACTs, the MAGIC field of view (FoV) acceptance for hadrons and gamma rays has a complex shape, which depends on several parameters such as the azimuth and zenith angle of the observations.

In the standard MAGIC analysis, the strategy adopted for estimating this acceptance is not optimal in the case of complex FoVs.

In this contribution we present the results of systematic studies intended to characterise the acceptance for the entire FoV. These studies open the possibility to apply improved background estimation methods to the MAGIC data, useful to investigate the morphology of extended or multiple sources.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

267

Poster 2 DM and NU - Board: 276 / 508

Simulation Studies for a Surface Veto Array to Identify Astrophysical Neutrinos at the South Pole

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Motivated by the evidence of astrophysical neutrinos seen in IceCube, we consider various array configurations of particle detectors and study their efficiency for identifying neutrinos of astrophysical origin when combined with IceCube or a next generation neutrino detector at the South Pole. The identification of astrophysical neutrinos is accomplished by tagging muons and neutrinos of atmospheric origin by detecting the accompanying air shower. We will report on the various simulation approaches we have used to understand the capabilities of such arrays in the identification of astrophysical neutrinos and we will discuss how the veto efficiency is determined by the sensitivity to the muon and/or electromagnetic components of the air showers. The configurations considered include various array layouts and detector station sizes.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

460

Poster 2 CR - Board: 185 / 403

New Calculation of Secondary Antiprotons in Cosmic Rays

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A dramatic increase in the accuracy and statistics of space-borne cosmic ray (CR) measurements has yielded several breakthroughs over the last several years. The most puzzling is the rise in the positron fraction above 10 GeV over the predictions of the propagation models assuming pure secondary production. Antiprotons are produced in CR interactions with interstellar gas and are, therefore, called secondary. These are the same interactions that produce charged and neutral mesons which decay to secondary electrons and positrons and gamma-rays. However, in contrast to CR electrons and positrons that can be produced copiously in pulsars, there is no known astrophysical source of primary antiprotons. Therefore, antiproton data and their correct interpretation hold the key to the resolution of many astrophysical puzzles. We calculated antiproton production in pp-, pA-, and AA-interactions using EPOS-LHC and QGSJET-II-04, two of the most advanced Monte Carlo generators tuned to accelerator data including those from the LHC. The new cross sections were incorporated into the GALPROP code to calculate the spectrum of secondary antiprotons in CRs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

382

Poster 2 GA - Board: 71 / 505

The very high energy source catalogue at the ASI Science Data Center

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The increasing number of Very High Energy (VHE) sources discovered by the current generation of Cherenkov telescopes made particularly relevant the creation of a dedicated source catalogs as well as the cross-correlation of VHE and lower energy bands data in a multi-wavelength framework. The “TeGeV Catalogue” hosted at the ASI Science Data Center (ASDC) is a catalogue of VHE sources observed by ground-based Cherenkov telescopes. The TeGeVcat collects all the relevant information publicly available about the observed GeV/TeV sources. The catalogue contains also information about public light curves while the available spectral data are included in the ASDC SED Builder tool directly accessible from the TeGeV catalogue web page. In this contribution we will report a comprehensive description of the catalogue and the related tools.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

444

Poster 2 CR - Board: 184 / 401

Bayesian Approach to Galactic Cosmic Ray Propagation

Authors: Aaron Vincent¹; Gudlaugur Johannesson²; Roberto Ruiz De Austri³**Co-authors:** Andrew Strong⁴; Elena Orlando⁵; Igor Moskalenko⁵; Roberto Trotta⁶; Troy Porter⁵¹ *IPPP, Durham University*² *Science Institute, University of Iceland*³ *IFIC*⁴ *MPE fuer extraterrestrische Physik*⁵ *Stanford University*⁶ *Imperial College London***Corresponding Author:** imos@stanford.edu

The fully Bayesian approach to the problem of deriving constraints for cosmic ray (CR) model parameters has several advantages. These are: (i) an efficient global scan of the whole parameter

space allowing us to explore and take into account parameter correlations and degeneracies, (ii) a best-fit point and statistically well-defined errors on the parameters, (iii) the ability to include and marginalize over “nuisance” parameters (such as modulation potential and error rescaling parameters) making the analysis more robust. For this study, we use the latest version of the CR propagation code GALPROP together with the BAMBI code, the most efficient Bayesian analysis code available to date that combines MultiNest with Neural networks. The results of the analysis will be reported during the conference.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

382

Poster 2 SH - Board: 40 / 722

SOLAR EVENT SIMULATIONS USING HAWC SCALER SYSTEM

Author: Olivia Enriquez-Rivera¹**Co-authors:** Alejandro Lara¹; Rogelio Caballero¹¹ *Instituto de Geofísica, UNAM***Corresponding Author:** olienriquezrivera@gmail.com

The High Altitude Water Cherenkov Observatory (HAWC) is an air shower array located near the volcano Sierra Negra in Mexico. The observatory has a scaler system sensitive to low energy cosmic rays (the geomagnetic cutoff for the site is 8 GV) suitable to perform studies of cosmic ray transients of solar origin such as Ground Level Enhancements (GLEs) and Forbush Decreases (FDs). One important step before using the scaler data to do solar analysis is to simulate HAWC’s response to solar induced phenomena. In this work, we use HAWC effective areas from different array configurations (different number of detectors and photomultiplier tubes per detector) to perform simulations of FDs and GLEs.

Collaboration:

HAWC

Registration number following “ICRC2015-I”:

271

Poster 2 GA - Board: 107 / 467

The background from single pi0 events in the IACT observations

Author: Dorota Sobczynska¹¹ *University of Lodz***Corresponding Author:** dsobczynska@uni.lodz.pl

A system of Imaging Air Cherenkov Telescopes (IACTs) can be triggered by hadronic events containing Cherenkov light from at most two electromagnetic subcascades, which are products of the single π^0 decay. The recorded images of those showers have a similar shape to the primary γ -ray events. Therefore, they are hardly reducible background for observations using IACTs.

In this paper, the impact of the single π^0 events on the efficiency of the γ /hadron separation was studied using the Monte Carlo simulations. The fractions of events containing the light from single π^0 in the expected total protonic background depends on the trigger threshold, reflector area and altitude of the observatory. The calculated quality factors are correlated with the contributions of single π^0 events in the proton initiated showers with primary energies below 200 GeV. The occurrence of the single π^0 images is one of the main reasons for the deterioration of the γ /hadron separation efficiency at low energy.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0415

Poster 2 DM and NU - Board: 282 / 585

Observation of neutrinos with JEM-EUSO: an updated view

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Similarly to extreme energy cosmic rays (EECRs), neutrinos at energies exceeding 5×10^{19} eV are expected to interact in the Earth's atmosphere and create extensive air showers. The JEM-EUSO mission, developed to be hosted onboard the JEM module of the International Space Station, aims at detecting these extensive air showers from space by means of the fluorescent and diffusively reflected Cherenkov light they produce.

In the present paper we investigate the capability of JEM-EUSO to trigger, and detect neutrino induced events. We also discuss the reconstruction of the primary particles' main properties.

In this study we consider the most recent design of JEM-EUSO, which will be launched with Falcon 9 and delivered to the ISS by the SpaceX Dragon free-flying spacecraft.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

1222

Poster 2 CR - Board: 146 / 466

Atmospheric effects on the ground-based calibration of orbital UV Telescopes

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One of the major issues in the detection of the UV yield of orbital UV telescopes is the optical calibration of the focal surface detector, which in turn requires advanced knowledge of the atmosphere in the FoV of the telescope. As such, we report here on the evaluation of the GLS as a ground-based optical system for the in-orbit calibration of orbital instruments such as the Mini-EUSO, JEM-ESUO and TUS orbital UV telescopes. Our study is done using GBSatCal (Ground-Based Satellite Calibration) software package, which has been designed specifically for this task. This package allows us to consider different types of radiation sources (e.g. lasers, Xe-flashers and high-power UV LEDs), of focal surface detector geometries and of atmospheric models (e.g. USAS 1976 and NRLMSISE-00), as well as to determine the optimal calibration geometry.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

425

Poster 2 CR - Board: 208 / 892

KASCADE-Grande energy spectrum of cosmic rays interpreted with post-LHC hadronic interaction models

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Previous results obtained by KASCADE-Grande using QGSjetII-02, EPOS1.99 and SIBYLL hadronic interaction models have shown that the energy spectrum of cosmic rays between 10^{16} eV and 10^{18} eV exhibits a significant hardening at approximately 2×10^{16} eV, a slight but statistically significant steepening close to 10^{17} eV, the 'knee', caused by the heavy component of primary cosmic rays, and an 'ankle' like

feature of the light component just above 10^{17} eV.

In this paper, we report on results of similar analyses performed using the post-LHC versions of these models: QGSjetII-04 and EPOS-LHC.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

314

Poster 2 SH - Board: 22 / 638

Simulations of Polar-Region Atmospheric Ionization Induced by the Ground Level Enhancement of January 20, 2005

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Ionizing radiation in the Earth's troposphere is mainly due to Galactic cosmic rays, but ground level enhancements (GLEs) can produce relativistic ions with such enormous intensity that their ionization effect in the Earth's lower atmosphere is significant. One of the largest GLEs ever observed occurred on January 20, 2005, which resulted in very large increases in the count rates of ground-based particle detectors, especially near the polar regions. We use data recorded by two neutron monitor stations located near the magnetic south pole (McMurdo) and north pole (Inuvik) to reconstruct particle energy spectra at the top of the atmosphere for each location as a function of time. We create realistic atmospheric models from measured meteorological data and use them along with the reconstructed particle flux to perform Monte Carlo simulations of particle-air interactions. We calculate atmospheric ionization at different altitudes and times during this GLE for each location. The time-dependent ionization profiles will also be useful for studying radiation dosage on aircraft. Partially supported by the Thailand Research Fund and a postdoctoral fellowship from Mahidol University.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

262

Poster 2 DM and NU - Board: 267 / 800

Astrophysical interpretation of small-scale neutrino angular correlation searches with IceCube

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IceCube, a cubic-kilometer sized neutrino detector at the geographical South Pole, has recently discovered a diffuse all-flavor flux of astrophysical neutrinos. However, the corresponding astrophysical sources have not been identified yet. We focus on the results of the angular correlation analysis (arXiv:1408.0634). This analysis is sensitive to clusters of muon neutrino arrival directions as expected from populations of astrophysical sources too weak to be detected individually. We present a method to reinterpret these results for arbitrary source count distributions. We exemplarily show the resulting limits for the test of a class of source count distribution based on Fermi observations of resolved blazars.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

702

Poster 2 CR - Board: 220 / 352

A template method for measuring the iron spectrum in cosmic rays with Cherenkov telescopes

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The energy-dependent abundance of elements in cosmic rays plays an important role in understanding their acceleration and propagation. Most current results are obtained either from direct measurements by balloon- or satellite-borne detectors, or from indirect measurements by air shower detector arrays on the Earth's surface. Imaging Air Cherenkov Telescopes (IACTs), used primarily for γ -ray astronomy, can also be used for cosmic-ray physics. They are able to measure Cherenkov light emitted both by heavy nuclei and by secondary particles produced in their air showers, and are thus sensitive to the charge and energy of cosmic ray particles with energies of tens to hundreds of TeV.

A template-based method, which can be used to reconstruct the charge and energy of primary particles simultaneously from images taken by IACTs, will be introduced. Heavy nuclei, such as iron, can be separated from lighter cosmic rays with this method, and thus the abundance and spectrum of these nuclei can be measured in the range of tens to hundreds of TeV.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

225

Poster 2 DM and NU - Board: 266 / 351

Search for nuclearites with the ANTARES neutrino telescope

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About thirty years ago, strange quark matter (SQM) was hypothesized to be the ground state of hadronic matter and was also suggested as a cold dark matter candidate. Although there is no experimental or astrophysical evidence for its existence so far, SQM may be present in the cosmic radiation as relic particles of the early Universe, or as fragments released in binary strange star collisions or supernovae.

The ANTARES neutrino telescope is sensitive to massive and stable SQM particles, denoted as nuclearites. Their velocity is assumed to be $\beta \sim 10^{-3}$, typical of objects gravitationally trapped inside the galaxy. Nuclearites reaching the ANTARES depth would yield a large amount of light in the detector, by means of the blackbody radiation emitted by the heated water molecules along their path. A dedicated analysis will be presented, as well as upper limits on a flux of downgoing nuclearites.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

338

Poster 2 DM and NU - Board: 261 / 807

IceTop as Veto for IceCube

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The IceCube neutrino observatory includes a surface array, IceTop, designed to detect and study cosmic rays. This array, located directly above IceCube, can be used to distinguish astrophysical neutrinos from atmospheric neutrinos and penetrating muons, increasing the effective volume of the IceCube detector for the southern sky. In this contribution we present the efficiency of such a veto technique as a function of energy, and compare data and simulation. In particular we focus on one event which was found in a separate analysis (starting event search) in IceCube and passing through IceTop and we study the probability of this event being background.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

709

Poster 2 CR - Board: 216 / 216

Measuring the e^+e^- Flux above 1 TeV with HAWC

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The High-Altitude Water Cherenkov (HAWC) Observatory records the air showers produced by cosmic rays and gamma rays at a rate of about 15 kHz. While the events observed by HAWC are

99.9% hadronic cosmic rays, this background can be strongly suppressed using topological cuts that preferentially select electromagnetic air showers. Using this capability of HAWC, we can create a sample of air showers dominated by gamma rays and cosmic electrons and positrons. HAWC is one of the few operating observatories capable of measuring showers produced by e^- and e^+ primaries above 1 TeV, and can record these showers from 2/3 of the sky each day. We describe the sensitivity of HAWC to leptonic cosmic rays, and discuss prospects for the measurement of the e^+e^- flux and possible approaches for e^+ and e^- charge separation with the HAWC detector.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

721

Poster 2 CR - Board: 231 / 768

Searching for primordial black hole evaporation signal with AMON

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Primordial black holes (PBHs) are expected to explode violently during the last few seconds of their lives, producing jets of high energy particles. These particles could be detected in coincidence by several observatories with large fields of view, such as IceCube and ANTARES (neutrinos), HAWC and Fermi LAT (gamma rays) and Pierre Auger (neutrons). The short temporal structure of the anticipated PBH evaporation signal provides a very low false positive rate for any possible detection. We will present the discovery potential of the Astrophysical Multimessenger Observatory Network (AMON) for PBH evaporation events. AMON aims to discover multimessenger transient sources by performing real-time and archival coincidence searches from multiple observatory subthreshold data streams. In this approach, a distinctive PBH evaporation signature may be probed by conducting coincidence analysis from a few years of subthreshold neutrino, gamma-ray and neutron data. Detection of PBHs would be a scientific breakthrough confirming Hawking's hypothesis of black hole radiation and cosmological models of phase transitions, and would allow us to probe physics at the highest energy scale as well as quantum gravity. The fraction of the mass of dark matter that may have initially existed in the form of PBHs could be measured as well.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

372

Poster 2 CR - Board: 215 / 213

Observation of intense fluxes of charged particles in association with thundercloud in Tibet

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To measure the correlation between thundercloud and atmospheric charged particles, we have installed some atmospheric electric field meter at a site on the Tibet Air Shower Array (4,300m a.s.l.) since February 2010. In this paper, we report some results of coincident observation of data from the array and atmospheric electric field during thunderstorm.

In addition, we present comparisons of a Monte Carlo simulation with the relativistic runaway electron avalanche in cosmic-ray air shower.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

105

Poster 2 CR - Board: 156 / 760

Study on Temperature effect in DAMPE BGO ECAL

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The DARK Matter Particle Explorer (DAMPE) is an orbital experiment which aims at searching dark matter by measuring the spectra of gamma, electron and positron originating from space. The BGO electromagnetic calorimeter (ECAL) is one of the core sub-detectors of DAMPE for energy measurement from 5 GeV to 10 TeV. The Calorimeter consists of 308 BGO crystal bars with the dimension of 2.5cm×2.5cm×60cm each. The light output of BGO crystal depends not only on the energy deposited by particles but also on the temperature. We have studied the temperature dependence of the BGO calorimeter response to cosmic rays in the thermal vacuum chamber. A temperature correction method is also reported in this paper.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

620

Poster 2 CR - Board: 230 / 766

The cosmic-ray energy spectrum above $\sim 10^{16}$ eV measured with the LOFAR Radboud Air Shower Array

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The LOFAR Radboud Air Shower Array (LORA) is an array of 20 plastic scintillation detectors installed in the center of the LOFAR radio telescope in the Netherlands to measure extensive air showers induced by cosmic rays in the Earth's atmosphere. The primary purpose of LORA is to trigger the read-out of the LOFAR radio antennas to record radio signals from air showers, and to assist the reconstruction of air shower properties with LOFAR by providing basic air shower parameters such as the position of the shower axis on the ground, the arrival direction and the energy of the incoming cosmic ray. In this contribution, we will describe the various steps of data analysis and Monte-Carlo simulation involved in the energy reconstruction of air showers measured with LORA, and present the all-particle cosmic-ray energy spectrum above $\sim 10^{16}$ eV reconstructed for the two extreme scenarios: pure protons and iron nuclei.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

666

Poster 2 CR - Board: 183 / 1076

Theoretical uncertainties in extracting cosmic ray diffusion parameters: the boron to carbon ratio

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PAMELA and, more recently, AMS-02, are ushering us into a new era of greatly reduced statistical uncertainties in experimental measurements of cosmic ray fluxes. In particular, new determinations of traditional diagnostic tools such as the boron to carbon ratio (B/C) are expected to significantly reduce errors on cosmic-ray diffusion parameters, with important implications for astroparticle physics, ranging from inferring primary source spectra to indirect dark matter searches. It is timely to stress, however, that the conclusions inferred crucially depend on the framework in which the data are interpreted as well as from some nuclear input parameters. We aim at assessing the *theoretical* uncertainties affecting the outcome, with models as simple as possible while still retaining the key dependences.

We compare different semi-analytical, two-zone model descriptions of cosmic ray transport in the Galaxy: infinite slab/1D, cylindrical symmetry/2D with homogeneous sources, cylindrical symmetry/2D with inhomogeneous source distribution. We test for the effect of a primary source contamination in the boron flux by parametrically altering its flux, as well as for nuclear cross-section uncertainties. All hypotheses are compared via χ^2 minimization techniques to preliminary results from AMS-02.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

839

Poster 2 GA - Board: 55 / 285

Prospects for Gamma Ray Bursts detection with LHAASO

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The LHAASO (Large High Altitude Air Shower Observatory) experiment, currently under design, is planned to be installed in the Sichuan Province (China) at 4410 m a.s.l. with the aim

of studying the highest energy gamma-ray sources and cosmic rays in the wide energy range from hundreds of GeV to hundreds of TeV. Among its different components, optimized to study different energy regions, the WCDA (Water Cherenkov Detector Array) will be one of the most important. Four ponds, 150x150 m² each, will be equipped with 3600 PMTs to detect the Cherenkov light produced by ultra-relativistic particles. Each PMT will monitor a volume cell of 5x5x4 m³.

Data (signal amplitude, with a threshold set at 1 pe level, and arrival time) from each PMT are collected and sent to a DAQ system able to build and record events with all multiplicities starting from a single PMT fired. For small multiplicities, the primary energy for gammas corresponds to a few GeV, well overlapping the actual satellite detectors, and starting from three PMTs fired a rough arrival direction can be determined, lowering the background and greatly increasing the sensitivity. In this paper, the expected rate and typology of GRBs detectable in follow-up mode with LHAASO has been evaluated using a GRB model (based on available data from Fermi GBM/LAT and Swift), an EBL absorption model and the effective area and angular resolution as a function of energy calculated by means of Monte Carlo simulations for different primary particles (gamma, h), event multiplicities and zenith angles.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

293

Poster 2 DM and NU - Board: 268 / 282

Low-energy (100 GeV - few TeV) neutrino point source searches in the Southern sky with IceCube

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IceCube searches for neutrino point sources in the southern sky have traditionally been restricted to energies well above 100 TeV, where the background of down-going atmospheric muons becomes sufficiently low to be tolerated in searches. Recent developments of a data stream dedicated to the study of low-energy neutrinos from the Southern hemisphere enables searches to be extended far below this threshold. This data stream utilizes powerful veto techniques to reduce the atmospheric muon background, allowing IceCube for the first time to perform a search for point-like sources of neutrinos in the southern sky at energies between 100 GeV and a few TeV. We will present the event selection along with the results obtained using one year of data from the full detector.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

289

Poster 2 GA - Board: 86 / 284

Design of a prototype device to calibrate the Large Size Telescope camera of the Cherenkov Telescope Array

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Registration number following "ICRC2015-I":

1053

Poster 2 DM and NU - Board: 269 / 1094

Improved methods for solar Dark Matter searches with the IceCube neutrino telescope

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Gravitationally captured Dark Matter in the form of Weakly Interacting Massive Particles (WIMPs) can annihilate into standard-model particles, such as neutrinos. The IceCube neutrino detector at the South Pole is an excellent instrument to search for such a neutrino signal from the Sun. We present an alternative analysis approach which improves on previous ones, in background-dominated regions in particular. Newly developed techniques based on hit clustering and hit-based vetos allow a more accurate reconstruction and identification of events in the detector and thereby a stronger rejection of background. These techniques are applicable also to other IceCube analyses and event filters.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

895

Poster 2 DM and NU - Board: 270 / 267

Neutrino-triggered target-of-opportunity programs in IceCube

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IceCube is capable of monitoring the whole sky continuously, while optical and high energy photon telescopes have limited fields of view and are not likely to observe a potential neutrino-flaring source at the time such neutrinos are recorded. The use of neutrino-triggered alerts thus aims at increasing the availability of simultaneous multi-messenger data, which can increase the discovery potential as well as constrain the phenomenological interpretation of the high energy emission of selected

source classes. The requirements of a fast and stable online analysis of potential neutrino signals and its operation will be discussed. The status and the recent improvements of a neutrino-triggered program in IceCube are described. The currently running systems generate real-time alerts based on multiplets of neutrinos occurring close in time and space, and these alerts are received for follow-up observations by various instruments, ranging from optical (PTF) and X-ray (Swift) to gamma-ray (H.E.S.S., MAGIC and VERITAS). The possibility in the near future to additionally send alerts based on single high energy neutrino events of likely astrophysical origin will also be discussed.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

182

Poster 2 CR - Board: 202 / 1031

ARGO-YBJ measurements on the EAS-footprint stretching as an effect of the geomagnetic field

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In a latest paper the ARGO-YBJ experiment proved the effect of the geomagnetic field (GeoMF) on the development of extensive air showers (EAS) and the dependence of the trigger rate (λ) on the coupling angle (ξ) between GeoMF and EAS axis, according to the formula $\lambda = \lambda_0(1 - \eta \sin^2\xi)$. The value λ_0 depends on the EAS zenith angle, while the parameter η depends on the position of the EAS core. Indeed η is positive (negative) and the trigger rate is reduced (enhanced) for showers with the core inside (outside) the trigger area.

In this work the strong dependence of η on the core position is studied very deeply and the results make more evident that the charged-particle lateral distribution is stretched by the magnetic forces. This means that the particle density is reduced near the EAS-core and increased on the EAS-tails. Obviously the effect depends on the GeoMF-EAS coupling and is confirmed looking at the lateral distribution as a function of core position and EAS direction.

Collaboration:

ARGO-YBJ

Registration number following "ICRC2015-I":

778

Poster 2 SH - Board: 26 / 1089

Long-term measurements of cosmic ray fluxes in the atmosphere

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The experimental data on galactic cosmic ray fluxes in the atmosphere are presented for 5 eleven year solar cycles from the 19-th solar cycle till the 24-th one. The cosmic ray data were obtained in the northern and southern polar atmospheres and in the northern atmosphere of the middle latitude. The analysis of monthly averages is made, namely: the relationship cosmic ray fluxes with solar activity (sunspot number and sunspot group number, strength of interplanetary magnetic field at 1 a.u.); changes of cosmic ray fluxes during the periods of inversions of solar polar magnetic field (hysteresis effect). It is shown also that the relationship between cosmic ray fluxes and global temperature in the boundary layer of the Earth's surface is absent.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

243

Poster 2 SH - Board: 48 / 56

The Influence of Turbulence on the Transport of Energetic Particles

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We explore the influence of magnetic turbulence on the transport of energetic particles, mainly cosmic rays, by using test-particle simulations. We compute parallel and perpendicular diffusion coefficients for two-component turbulence, isotropic turbulence, a model based on Goldreich-Sridhar scaling, noisy reduced magneto-hydrodynamic turbulence, and a noisy slab model. We have shown that for all considered turbulence models, the diffusion coefficients are similar. They have the same rigidity dependence and only the absolute values of the diffusion coefficients are different. This conclusion is in agreement with recent analytical findings based on the unified nonlinear transport theory indicating that only fundamental properties of turbulence such as the length scales and magnetic fields control the diffusion coefficients. To double-check the validity and accuracy of our numerical results, we use a second test-particle code. We show that both codes provide very similar results confirming the validity of our conclusions.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1067

Poster 2 SH - Board: 4 / 53

The cosmic-ray ground-level enhancements of 29 September 1989 and 20 January 2005

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Ground-level enhancements (GLEs) of the intensity of cosmic rays are an inherent part of large cosmic-ray storms.

The GLE of 29 September 1989 was one of the largest of 71 solar energetic particle events observed by neutron monitors on Earth. It was smaller than the record-breaking GLE 5 of 23 February 1956, but by some measures it was larger than GLE 69 of 20 January 2005. It is also the most extensively studied of the 71 GLEs, and it was observed by more than 50 ground-based detectors in the worldwide network. Moraal and Caballero-Lopez, *ApJ.*, 790:154, 2014 made another study of the event, with the main difference from previous studies that all the existing observations were employed, instead of the usual selection of stations. The main conclusion was that the event is the best example available of a “classical” GLE that has a gradual increase towards peak intensity, and does not contain multiple distinct peaks, as inferred previously.

GLE 69 of 20 January 2005 was studied earlier by McCracken et al., *JGR* 113, A12101, 2008. This event had entirely different characteristics, showing a very large prompt increase, merging into a much smaller gradual increase later in the event.

In combination, GLEs 42 and 69 can be understood as that in both of them there was a prompt and a gradual acceleration mechanism. The time scales of these mechanisms were a few to several minutes, and several 10s of minutes to one hour, respectively. In GLE 42 the effect of the prompt, initial acceleration was hardly observed at Earth, because the disturbance on the sun and its assumed associated flare were hidden behind the western limb. However, the ensuing CME had a very large angular extent, so that the particles presumably accelerated in its shock envelope were readily detectable at Earth. In the case of GLE 69 the flare site at ~ 60° W was quite optimally connected to Earth via the Parker spiral magnetic field, so that the promptly accelerated particles were very well visible at Earth, while those that were accelerated by the secondary mechanism remained engulfed below these prompt particles until about an hour into the event.

The two events were so large that they provide the clearest example of this double acceleration hypothesis, this interpretation is not subject to statistical uncertainties, and it can be distinguished from the fluctuations introduced by propagation effects.

The comparison suggests that solar storms contain two acceleration mechanisms, the first, prompt one probably deep in the corona, associated with the solar flare, and the second, gradual one in the envelope of the associated CME.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

66

Poster 2 CR - Board: 174 / 1337

Detecting particles with cell phones: the Distributed Electronic Cosmic-ray Observatory

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In 2014 the number of active cell phones worldwide for the first time surpassed the number of humans. Cell phone camera quality and onboard processing power (both CPU and GPU) continue to improve rapidly. In addition to their primary purpose of detecting photons, camera image sensors on cell phones and other ubiquitous devices such as tablets, laptops and digital cameras can detect ionizing radiation produced by cosmic rays and radioactive decays. While cosmic rays have long been understood and characterized as a nuisance in astronomical cameras, they can also be identified as a signal in idle camera image sensors. We present the Distributed Electronic Cosmic-ray Observatory (DECO), a platform for outreach and education as well as for citizen science. Consisting of an app and associated database and web site, DECO harnesses the power of distributed camera image sensors for cosmic-ray detection.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1113

Poster 2 CR - Board: 162 / 984

Report on Space-Qualified Readout Electronics for the BGO Calorimeter of DAMPE Mission

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A satellite-borne high energy cosmic ray detector to be launched in the near future, named DARK MATTER PARTICLE EXPLORER (DAMPE), is now being developed in China. The major scientific objectives of DAMPE mission are primary cosmic ray, gamma ray astronomy and dark matter particles, by observing cosmic rays with an energy range from 5 GeV to 10 TeV. An electromagnetic calorimeter, which contains 308 BGO (Bismuth Germanate) crystal logs and 616 PMTs (photomultiplier tubes), is a critical sub-detector, for measuring the energy of cosmic particles, distinguishing positrons/electrons and gamma rays from hadron background, and providing trigger information. In order to achieve a maximum dynamic range to 1.8×10^5 for the BGO detector unit, each PMT base incorporates a three dynode (2, 5, 8) pick off, which results in 1848 signal channels and a complex readout system with

16 front-end electronic (FEE) boards.

From year 2013 to 2014, a Qualification Model for the BGO Calorimeter, together with its readout electronics, was successfully developed and pass ground-based cosmic ray tests and a serial of qualification level environmental tests. Later several test beam experiments for the DAMPE Qualification Model were carried out with the CERN PS and SPS facilities, which proved the major specifications of the BGO Calorimeter, such as energy range and resolution, and the capability of its readout electronics. Right now we have finished the construction of the Flight Model of BGO Calorimeter and doing environmental tests. The progress and some details related to the high reliability design and quality control for the readout electronics, will be introduced in this paper.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

298

Poster 2 SH - Board: 50 / 68

PERPENDICULAR DIFFUSION OF ENERGETIC PARTICLES IN NOISY REDUCED MAGNETOHYDRODYNAMIC TURBULENCE

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A model for noisy reduced magneto-hydrodynamic (NRMHD) turbulence was recently proposed. This model was already used to compute the diffusion coefficient of random walking magnetic field lines based on the nonlinear diffusion theory. We use the same model to investigate the diffusion of energetic particles across the mean magnetic field. To do that we have used two analytical theories, namely, the Non-Linear Guiding Centre (NLGC) theory and the Unified Non-Linear Transport (UNLT) theory. Furthermore, we performed test-particle simulations to obtain field line diffusion and particle transport coefficients. It is shown that both theories provide very different results for the aforementioned turbulence model. In addition, only the UNLT theory agrees with simulations confirming that it accurately describes perpendicular transport and that it is a powerful tool in diffusion theory.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1067

Poster 2 GA - Board: 119 / 202

Parallel waveform extraction algorithms for the Cherenkov Telescope Array Real-Time Analysis

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The Cherenkov Telescope Array (CTA) is the next generation observatory for the study of very high-energy gamma rays from about 20 GeV up to 300 TeV.

Thanks to the large effective area and field of view, the CTA observatory will be characterized by an unprecedented sensitivity to transient flaring gamma-ray phenomena compared to both current ground (e.g. MAGIC, HESS) and space (e.g. Fermi) gamma-ray telescopes. In order to trigger the astrophysics community for follow-up observations, or being able to quickly respond to external science alerts, a fast analysis pipeline is crucial. This will be accomplished by means of a Real-Time Analysis (RTA) pipeline, a fast and automated science alert trigger system, becoming a key system of the CTA observatory. Among the CTA design key requirements to the RTA system, the most challenging is the generation of alerts within 30 seconds from the last acquired event, while obtaining a flux sensitivity not worse than the one of the final analysis by more than a factor of 3.

A dedicated software and hardware architecture for the RTA pipeline must be designed and tested. We present comparison of OpenCL solutions using different kind of devices like CPUs, Graphical Processing Unit (GPU) and Field Programmable Array (FPGA) cards for the Real-Time data reduction of the Cherenkov Telescope Array (CTA) triggered data.

Collaboration:

CTA

Registration number following "ICRC2015-I":

536

Poster 2 DM and NU - Board: 294 / 111

Improved predictions of ultra-high-energy neutrinos and cosmic rays from gamma-ray bursts

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Gamma-ray bursts (GRBs) conceivably contribute to the flux of ultra-high-energy (UHE) cosmic rays and neutrinos, with the latter expected to be produced in proton-photon interactions inside the relativistic plasma jets of GRBs. We consider UHE particle production in a model where cosmic rays are emitted both as neutrons and as protons that are able to overcome their magnetic confinement and "leak out" of the source. In this context, present-day cosmic-ray and neutrino observations and bounds are already able to constrain the possibility that GRBs are the main sources of both types of particles. Furthermore, we discuss particle emission using a simulated evolving GRB jet, where the total particle spectra result from the superposition of multiple internal collisions, each one occurring under different conditions of particle creation. Thus, we demonstrate the need for

multi-messenger studies in order to build a complete and unbiased picture of cosmic accelerators. From our simulations, we also derive a new and robust minimal diffuse GRB neutrino flux prediction that could be tested in next-generation neutrino telescopes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

124

Poster 2 CR - Board: 179 / 119

COSMIC RAYS: A VIEW INTO GALACTIC INTERACTIONS AND THE NEW PHYSICS

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It is known that close galactic fly-bys and interactions give rise to shock waves that disrupt the interstellar medium of galaxies and impact their morphologies. These large-scale shocks that form in the interstellar medium of interacting systems will be the sites of particle acceleration giving rise to a population of tidal cosmic rays, in addition to standard galactic cosmic rays present in star-forming galaxies. Abundance measurements in such systems can help us probe the presence of this cosmic-ray population and in turn test the long-lasting primordial lithium problem and the need for the new physics. Such additional cosmic-ray population will also result in non-thermal radiation which will affect the radio brightness of these galaxies and in turn impact the well-established far infrared-radio correlation, usually used as a star-formation rate tracer, among other things. Finally, we will discuss how radio and infrared signatures of these cosmic rays can in turn be used as indicators of galactic interactions which could be especially powerful for minor mergers and at high redshifts.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

128

Poster 2 GA - Board: 88 / 536

A concept of wide-angle Cherenkov gamma-ray instrument with minimal imaging

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The energy range >100 TeV is of central importance for high-energy astrophysics. PeV accelerators are expected to produce also copious photons of about a decade less in energy. Thus registering gamma-rays with energies above 100 TeV will pinpoint the galactic sources able to accelerate particles up to PeV energies (so-called PeVatrons).

We suggest a concept of a novel wide-angle imaging detector for gamma-rays with energies from largely unexplored range between 10 TeV and several PeV. The All-Sky Gamma-Ray Detector (ASGaRD) is an array of optical modules with wide (~ 50 degree) field of view and a low cost imaging, allowing affordable coverage of large areas for high energies. The ASGaRD optical modules comprise a Fresnel lens with a multipixel SiPM camera, followed by a novel dead-time-free data acquisition system based on FPGAs.

ASGaRD is designed for simultaneous observation of large portions of the sky and to reach to energies of about 10 PeV. We study the capability of ASGaRD to yield a better gamma-ray sensitivity (for $E > 20$ TeV) than CTA and HAWC, at a fraction of the cost. The power of the background reduction given the limited, as compared to the Imaging Atmospheric Cherenkov Telescopes (IACTs), image quality is investigated. We address also the ability of ASGaRD to complement both, the wide-field non-imaging and the narrow-field imaging gamma-ray experiments for energies beyond 10 TeV by studying the performance of hybrid ASGaRD/IACTs arrays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

485

Poster 2 CR - Board: 173 / 1331

THE ARCADE PROJECT

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The Atmospheric Research for Climate and Astroparticle Detection (ARCADE) project aims to a better comprehension of the limits of applicability, systematics and possible enhancements of the typical techniques used for the measurement of the aerosol attenuation profiles of UV light in cosmic rays and gamma rays experiments. Aerosols are indeed the most variable component in the atmosphere on a short time scale, and experiments based on the detection of the UV light in atmosphere need a continuous monitoring of the aerosol stratification to obtain a reliable evaluation of the properties of the primary particles. The ARCADE project is measuring the aerosol attenuation of UV light due to aerosols with multiple techniques and instruments simultaneously on the same air mass. For this purpose, a Raman + elastic Lidar with a laser source at 355 nm has been built and is currently taking data in Lamar, Colorado together with the Atmospheric Monitoring Telescope (AMT) to detect UV light at a distance of 40 km from the Lidar laser source. The system has been

installed on site in 2014 and is currently taking data every month during moonless nights. A full simulation of the AMT system has been developed, calibration campaigns based on a near laser system have been performed and the data analysis has started. The setup of the system is described and preliminary results are shown.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

161

Poster 2 GA - Board: 93 / 424

THE ARCADE RAMAN LIDAR SYSTEM FOR THE CHERENKOV TELESCOPE ARRAY

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The Cherenkov Telescope Array (CTA) is the next generation of ground-based very high energy gamma-ray instruments; the facility will be organized in two arrays, one for each hemisphere. The atmospheric calibration of the CTA telescopes is a critical task. The atmosphere affects the measured Cherenkov yield in several ways: the air-shower development itself, the variation of the Cherenkov angle with altitude, the loss of photons due to scattering and absorption of Cherenkov light out of the camera field-of-view and the scattering of photons into the camera. In this scenario, aerosols are the most variable atmospheric component of the atmosphere in time and space and therefore need a continuous monitoring. Lidars are among the most used instruments in atmospheric physics to measure the aerosol attenuation profiles of light. The ARCADE Lidar system is a very compact and portable Raman Lidar system that has been built within the FIRB 2010 grant and is currently taking data in Lamar, Colorado. The ARCADE Lidar is proposed to operate at the CTA sites with the goal of making a first survey of the aerosol conditions of the selected site and to use it as a calibrated benchmark for the other Lidars that will be installed on site. It is proposed for CTA that the ARCADE Lidar will be first upgraded in Italy and then tested in parallel to a Lidar of the EARLINET network in L'Aquila. Upgrades include the addition of the water vapour Raman channel to the receiver and the use of new and better performing electronics. It is proposed that the upgraded system will be installed at both CTA sites, starting from the first selected site in 2016.

Collaboration:

CTA

Registration number following "ICRC2015-I":

161

Poster 2 GA - Board: 94 / 308

Using UV-pass filters for bright Moon observations with MAGIC

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MAGIC is a system of two Imaging Atmospheric Cherenkov Telescopes (IACT) that observe Very High Energy (VHE) gamma ray sources. The PMTs in their cameras are designed to operate under moonlight, but they are limited to Moon phases below 93% (300 Moon hours per year), as they can get damaged if the amount of light they receive is too high. As a result, they cannot be used 2-3 days before and after Full Moon. We have selected commercial inexpensive UV-pass filters rejecting light above a wavelength of 420 nm, where the moonlight intensity is stronger. We mounted them on light-weight frames that can be easily installed on the telescope cameras. Test observations have been performed during the last nine months, from which a moonlight transmission of about 20% and a Cherenkov light transmission of about 45% are estimated. This allows the observation of sources down to an angular distance of 5 degrees to the Moon during Full Moon: essentially in the whole sky and all possible moonlight conditions. Therefore, we can record 700 more Moon hours per year and extend the duty cycle of MAGIC by about 50%, including nights when VHE observations with IACTs are currently not feasible. Especially interesting is the possibility to observe the deficit in the cosmic ray flux produced by the presence of the Moon (the so-called "Moon shadow"). Here we evaluate the performance, in terms of sensitivity and energy threshold, of the MAGIC telescopes equipped with the UV filter under different moonlight intensities, as inferred from Crab Nebula observations and Monte Carlo simulations.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

62

Poster 2 GA - Board: 63 / 305

Using muon rings for the optical throughput calibration of the SST-1M prototype for the Cherenkov Telescope Array

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Imaging Atmospheric Cherenkov Telescopes (IACTs) are ground-based instruments devoted to the study of very high energy gamma-rays coming from space. The detection technique consists in observing images created by the Cherenkov light emitted when gamma rays, or more in general

cosmic rays, propagate in the atmosphere. While in case of protons or gammas the images present a filled and more or less elongated shape, energetic muons penetrating the atmosphere are visualized as characteristic circular rings or arcs. A relatively simple analysis of the ring images allows the reconstruction of all the relevant parameters of the detected muons, such as the energy, the impact parameter, and the incoming direction, with the final aim to use them to calibrate the total optical throughput of the given IACT telescope. We present the results of preliminary studies on the use of images created by muons as optical throughput calibrators of the single mirror small size telescope prototype SST-1M proposed for the Cherenkov Telescope Array.

Collaboration:

CTA

Registration number following "ICRC2015-I":

308

Poster 2 DM and NU - Board: 271 / 300

Model-independent search for neutrino sources with the ANTARES neutrino telescope

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ANTARES is the largest operational neutrino telescope in the Northern Hemisphere, located in the Mediterranean Sea at a depth of 2500 metres. The direction and energy of the observed particles are reconstructed from the time and amplitude information recorded by the photomultipliers. The collected set of reconstructed events can be analysed with respect to the spatial, temporal and energy distribution.

The approach shown in this presentation focuses on the spatial distribution, searching unbiasedly for a significant excess of neutrinos with an arbitrary size and shape from any direction in the sky. Techniques originating from the domain of pattern recognition and image processing are used. In contrast to a dedicated search for a specific neutrino emission model this approach is sensitive to a wide range of possible source structures. The result of this method applied to the ANTARES data will be presented.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

301

Poster 2 GA - Board: 61 / 303

Application of Complex Event Processing Software to Error Detection and Recovery for Arrays of Cherenkov Telescopes

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Data acquisition (DAQ) and control systems for arrays of Cherenkov telescopes comprise hundreds of distributed software processes that implement the readout, control and monitoring of various hardware devices. A multitude of different error conditions (malfunctioning detector hardware, crashing software, failures of network and computing equipment etc.) can occur and must be dealt with to ensure the speedy continuation of observations and an efficient use of dark time.

Flexible, fast and configurable methods for automatic and centralized error detection and recovery are therefore highly desirable for the current generation of ground-based Cherenkov experiments (H.E.S.S., MAGIC, VERITAS) and will be important for the Cherenkov Telescope Array (CTA), a more complex observatory with O(80) telescopes. The contribution describes a Java-based software demonstrator that was developed for the High Energy Stereoscopic System (H.E.S.S.)

and uses the complex event processing engine ESPER for error detection and recovery. The software demonstrator analyses streams of error messages in the time domain and aims to apply recovery procedures that reflect the knowledge of DAQ and detector experts.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 2 GA - Board: 95 / 370

Prototype of the SST-1M Telescope Structure for the Cherenkov Telescope Array

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A single-mirror small-size (SST-1M) Davies-Cotton telescope with a dish diameter of 4 m has been built by a consortium of Polish and Swiss institutions for the southern observatory of the Cherenkov Telescope Array (CTA). The design represents a very simple, reliable, and cheap solution for a small size telescope of CTA. The mechanical structure prototype with its drive system is now being tested at the Institute of Nuclear Physics PAS in Krakow. Here we present the design of the prototype and results of the performance tests of the structure and the drive and control system.

Collaboration:

CTA

Registration number following "ICRC2015-I":

357

Poster 2 CR - Board: 236 / 827

Seasonal thermal neutron flux variations at high altitude

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The PRISMA project developed for cosmic ray study above 30 TeV is now realized as 2 prototypes at different altitudes. Special en-detectors are used for both electron and neutron components recording. An array of 4 such detectors is running in Yang Ba Jing (Tibet, China) at altitude 4300 m a. s. l. since January 2013. To be sure that thermal neutron background is stable we also study its variations. Here we present the results of this study, namely seasonal thermal neutron flux variations at high altitude.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1185

Poster 2 DM and NU - Board: 272 / 1151

GEANT4 simulation of optical modules in neutrino telescopes

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Neutrinos have a very important role in the multi-messenger astronomy, therefore, in recent years, large underwater and under-ice neutrino telescopes have been designed to allow the detection of high energy neutrinos. The neutrino energy spectrum and direction are inferred based on the detection of the Cherenkov light induced by the secondary charged particles in the medium.

Optical modules (OMs), i.e. glass spheres containing the photomultiplier tubes (PMTs) for light detection at the single photon level, and the associated electronics, are central components of such neutrino telescopes. They require detailed simulations which are usually based on parametrized results of laboratory measurements. Here an alternative approach is presented, where the light detection in OMs is simulated using the latest GEANT4 simulation library. This simulation is close to the experimental conditions, easily allowing the definition of any geometry of the OMs and common PMT types to simulate precisely the photon propagation in various detection units geometry. It is able to perform a precise simulation of the interaction of the photon in the photocathode, taking in account the optical properties of alkali photocathodes and a dedicated algorithm.

This simulation has been applied to 10-inch Hamamatsu PMTs in 17-inch spheres (ANTARES), 10-inch Hamamatsu PMTs in 13-inch spheres (NEMO), and multiple 3-inch PMTs in 17-inch spheres (KM3NeT). The methods, the results achieved and their relevance for data analysis in neutrino telescope will be presented.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

0597

Poster 2 CR - Board: 172 / 1209

Cherenkov water calorimeter on the basis of quasispherical modules

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Cherenkov water detector (CWD) with the volume of 2000 m³ (a pool with the dimensions of 26 m x 9 m x 9 m) is the basis of the NEVOD experimental complex which is designed for studying of various cosmic ray components, including muons generated by the neutrinos from the lower hemisphere. Inside the pool the detecting system in form of a spatial lattice of quasi-spherical modules (QSMs) is located. Each QSM consists of six FEU-200 flat-photocathode photomultipliers (15 cm diameter) oriented along the axes of orthogonal coordinate system. Such arrangement of photomultipliers makes the QSM amplitude response independent of the arrival direction of the Cherenkov radiation from relativistic charged particles passing through the detector. At the same time, analysis of the amplitude responses of even a single QSM's photomultipliers allows to determine the arrival direction of Cherenkov radiation, and the QSM spatial lattice enables reconstruction of the individual particle tracks. To register powerful energy deposits inside the detector, the two-dynode PMT signal readout system providing a total dynamic range of the measuring channel 1 - 10⁵ ph.e. was developed. Small distances between the QSMs and a wide dynamic range ensure the detector with the properties of a calorimeter for measuring of the energy deposit of muon bundles and cascade showers generated by the near-horizontal muons. For the calibration of the PMTs, the events with single muons are used. Such events are selected using the system of calibration telescopes (SCT) and the coordinate detector DECOR deployed around the pool.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

Poster 2 DM and NU - Board: 274 / 822

Measuring Neutrinos with the ARIANNA Hexagonal Radio Array

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The ARIANNA collaboration has recently completed the installation of a seven-station hexagonal array of radio detectors. This Hexagonal Radio Array (HRA) serves as a prototype for a large neutrino telescope planned for construction on the Ross Ice Shelf of Antarctica. Upgraded hardware installed during the 2014 deployment season will be summarized. A review of ice properties at the ARIANNA experiment site will be presented and detailed studies performed during the 2014 season will be described. The ability of the HRA to determine the arrival angle of radio pulses will be detailed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

471

Poster 2 SH - Board: 6 / 88

Simultaneous Observation of Solar Neutrons from the ISS and High Mountain Observatories in association with a flare on July 8, 2014

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At 16:06UT on July 8, 2014, an M6.5-class flare was observed at N12E56 of the solar surface. In association with this flare, solar neutron detectors located on two high mountains, Mt. Sierra Negra and Chacaltaya and at the space station observed enhancements in the neutral channel. The authors analyzed these data and a possible scenario of enhancements produced by high-energy protons and neutrons is proposed; based on data from continuous observation of a solar surface using the ultraviolet telescope onboard the Solar Dynamical Observatory (SDO).

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1090

Poster 2 SH - Board: 10 / 240

Applications of the Adelaide HEAMS muon detector

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The HEAMS muon detector is a sea-level spaced telescope consisting of four one square metre scintillators vertically above a second set of four. Coincidences taken with an FPGA data acquisition system can produce a number of directional beams with various useful energies in the range 50 GeV to 1 TeV.

HEAMS is located at 35 degrees south and accesses an understudied declination/latitude range for these energies. The detector system will be described and solar and sidereal data mainly covering mid-southern latitudes will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

179

Poster 2 DM and NU - Board: 275 / 1282

Muon track reconstruction and muon energy estimate in the KM3NeT/ARCA detector

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KM3NeT is a large research infrastructure that will consist of a network of deep-sea neutrino telescopes in the Mediterranean Sea, of which the ARCA detector installed at the CapoPassero site (Italy) is optimised for studying high-energy neutrinos of cosmic origin. The “golden channel” for neutrino astronomy with Cherenkov telescopes is the muon-neutrino charged-current interaction. The final-state muon has a track length in water (for neutrino energies above 1 TeV) of the order of kilometres and its trajectory is almost co-linear to the parent neutrino direction, thus pointing back to the neutrino source. The neutrino direction is reconstructed from the arrival times of the photons at the photomultiplier tubes. After an initial hit selection requiring space-time coincidences between hits, the reconstruction proceeds through four consecutive fitting procedures. The pointing accuracy reached is about 0.1° for neutrino energies above 10TeV. Together with the track reconstruction, also the muon energy has to be estimated and it can also be used for the distinction of muons generated by neutrinos of cosmic origin from the background of atmospheric muons and neutrinos, both produced by the interaction of primary cosmic rays in the atmosphere. The method to determine the muon energy is based on a Neural Network. The main aspects of the techniques employed for the track reconstruction and energy estimate will be discussed and the results achieved presented.

Collaboration:

KM3NeT

Registration number following “ICRC2015-I”:

1229

Poster 2 GA - Board: 122 / 78

DigiCam - Fully Digital Compact Read-out and Trigger Electronics for the SST-1M Telescope proposed for the Cherenkov Telescope Array

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The SST-1M is one of three prototype small-sized telescope designs proposed for the Cherenkov Telescope Array, and is built by a consortium of Polish and Swiss institutions. The SST-1M will operate with DigiCam - an innovative, compact camera with fully digital read-out and trigger electronics. A high level of integration will be achieved by massively deploying state-of-the-art multigigabit

transmission channels, beginning from the ADC flash converters, through the internal data and trigger signals transmission over backplanes and cables, to the camera's server link. Such an approach makes it possible to design the camera to fit the size and weight requirements of the SST-1M exactly, and provide low power consumption, high reliability and long lifetime. The structure of the digital electronics will be presented, along with main physical building blocks and the internal architecture of FPGA functional subsystems.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

98

Poster 2 CR - Board: 137 / 220

An Estimate of the Live Time of Optical Measurements of Air Showers at the South Pole

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The recent observation of PeV neutrinos at the IceCube Neutrino Observatory has revived interest in deploying large-exposure optical air shower detectors at the South Pole. The main challenge for such detectors, which were last deployed at the Pole in the 1990s, is the poor atmospheric conditions prevalent during austral winter. To investigate the clarity of the atmosphere we have studied archival weather data from the Atmospheric Research Observatory at the South Pole. Using several years of winter measurements with radiosondes and the MPLNET 532 nm lidar station, we obtained estimates of the cloud coverage and optical clarity of the site. Based on past data, it is likely that an optical detector will achieve <45% uptime during the dark period at the Pole, making the total annual live time comparable to the live time of optical air shower detectors in the middle latitudes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

151

Poster 2 CR - Board: 224 / 564

Search for dark matter with LHAASO

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Detection of gamma rays from the annihilation or decay of dark matter particles is a promising method for identifying dark matter, understanding its intrinsic properties, and mapping its distribution in the universe.

The searches feature many different target types, including dwarf spheroidal galaxies, galaxy clusters, the Milky Way halo and inner Galaxy and unassociated Fermi-LAT sources.

The LHAASO experiment is a new generation Extensive Air Shower array devoted to detect photon-induced showers in the wide energy range from few hundreds GeV up to PeV and to study cosmic ray physics up to 10^{18} eV.

Due to its all-sky field of view and high duty-cycle (about 100%), the dwarf spheroidal galaxies are the most promising target for LHAASO, due the possibility to monitor in the same time different objects.

LHAASO will also allow to look for dark matter signatures from unknown locations of the Northern sky with unprecedented sensitivity above tens TeV.

In this contribution we present the LHAASO sensitivity to the gamma-ray signatures of high-mass (multi-TeV) dark matter annihilation.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

478

Poster 2 DM and NU - Board: 264 / 504

The Online Follow-Up Framework for Neutrino-Triggered Alerts from IceCube

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The current operation of online programs for sending follow-up alerts to optical, X-ray and gamma-ray telescopes shows the feasibility of neutrino-triggered multi-messenger astronomy. Building on the experience of these programs, we generalize the approach and merge them into a combined generic framework. The upgrade consists of a single event stream selected at the South Pole and transmitted North, where an online search for transients and flaring points is performed. The performance will be compared to the previous online system, as well as to established offline point source searches in IceCube. Potential discovery scenarios accessible with the new system will be discussed.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

1242

Poster 2 SH - Board: 41 / 1026

Current status of MuSTanG at the Christian-Albrechts-University Kiel

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MuSTanG - the Muon Spaceweather Telescope for Anisotropies at Greifswald - detects muons using 32 scintillator detectors with an area of 0.25m² each. These are organized into two 4x4 stacks. MuSTanG was designed to investigate anisotropy changes of galactic cosmic ray intensities caused by the interplanetary counterpart of Coronal Mass Ejections. In August 2014 MuSTanG has been transported from Greifswald to Kiel (Latitude N54°{circ} 20'50", Longitude E10°{circ} 6' 42"). In this contribution we present the current instrument status, first data from the new location and GEANT 4 and PLANETOCOSMICS simulations that allow us to determine the asymptotic directions as well as the instrumental response functions. In addition future plans will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

803

Poster 2 GA - Board: 109 / 723

Prospects for Gamma-Ray Bursts detection by the Cherenkov Telescope Array

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The first Gamma-Ray Burst catalog presented by the Fermi-LAT collaboration includes 28 GRBs, detected above 100 MeV over the first three years since the launch of the Fermi mission. However, more than 100 GRBs are expected to be found over a period of six years of data collection thanks to a new detection algorithm and to the development of a new LAT event reconstruction, the so-called "Pass 8". Our aim is to provide revised prospects for GRB alerts in the CTA era in light of these new LAT discoveries.

We focus initially on the possibility of GRB detection with the Large Size Telescopes (LSTs). Moreover, we investigate the contribution of the Middle Size Telescopes (MSTs), which are crucial for

the search of larger areas on short post trigger timescales. The study of different spectral components in the prompt and afterglow phase, and the limits on the Extragalactic background light are highlighted. Different strategies to repoint part of - or the entire array - are studied in detail.

Collaboration:

CTA

Registration number following "ICRC2015-I":

634

Poster 2 SH - Board: 28 / 1203

Non-geoeffective interplanetary disturbances observed by muon hodoscope URAGAN

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Cosmic rays flux detected on the Earth's surface penetrates the heliosphere and carries information about the processes occurring in it. Muon hodoscope URAGAN allows reconstruct the tracks of cosmic ray muons with a high angular accuracy (about 1 degree) in a wide range of zenith (0-80 degrees) and azimuthal angles (0-360 degrees) in real time. Methods developed for URAGAN muon hodoscope data analysis allow measure not only the total intensity of the detected particles, but also the local anisotropy of cosmic rays with a single setup. Comparison of the parameters of the local anisotropy of the muon flux with the data of the different satellites (STEREO, SOHO, ACE, etc.) showed that the cosmic ray flux on the Earth's surface is affected not only by the emissions directed toward the Earth, but also by the CMEs directed in the opposite direction, for example, a series of CMEs of 2012 detected only by STEREO-A. The paper presents the first results of the analysis of these events, which showed that during such CMEs strong changes in the parameters of the angular distribution of the muon flux were observed, which were not seen in the integral counting rate of the muon hodoscope. This fact explains the presence of periods with the increased local anisotropy of the muon flux in the absence of disturbances in the magnetosphere and nearby interplanetary magnetic field. At the same time, the events directed toward the Earth have more influence on the integral muon flux than on the angular characteristics.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

48

Poster 2 GA - Board: 113 / 83

TARGET: toward a solution for the readout electronics of the Cherenkov Telescope Array

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TARGET is an application specific integrated circuit (ASIC) designed to perform the readout of signals recorded by the photosensors in cameras of very-high-energy gamma-ray telescopes exploiting the imaging of Cherenkov radiation from atmospheric showers. TARGET capabilities include sampling at a high rate (typically 1 GSample/s), digitization, and triggering on the sum of four adjacent pixels. The small size, large number of channels read out per ASIC (16), and low cost per channel make TARGET ideally suited for the readout in systems with a large number of telescopes instrumented with compact photosensors like multi-anode and silicon photomultipliers. The possible advantages of such systems are better sensitivity, and, for telescopes with dual-mirror optics, a larger field of view and improved angular resolution. The two latest generations of TARGET ASICs, TARGET-5 and TARGET-7, are soon to be used for the first time in two prototypes of small-sized and medium-sized dual-mirror telescopes proposed in the framework of the Cherenkov Telescope Array (CTA) project. In this contribution we report on the performance of the ASICs and discuss further developments.

Collaboration:

CTA

Registration number following "ICRC2015-I":

97

Poster 2 GA - Board: 106 / 469

Layout design studies for medium-size telescopes within the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) is an international project for a next-generation ground-based gamma-ray observatory. CTA, conceived as an array of tens of imaging atmospheric Cherenkov telescopes, comprising small, medium and large-size telescopes, is aiming to improve on the sensitivity of current-generation experiments by an order of magnitude and provide energy coverage from 20 GeV to more than 300 TeV. In this study we explore how the medium-size telescopes layout design and composition impacts the overall CTA performance by analyzing Monte Carlo simulations including Davies-Cotton and Schwarzschild-Couder medium-size telescopes.

Collaboration:

CTA

Registration number following "ICRC2015-I":

416

Poster 2 CR - Board: 148 / 500

Perspectives for ultrahigh-energy particle observation based on the lunar orbital LORD space experiment

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The problem of searching for highest-energy cosmic rays and neutrinos in the Universe is reviewed. Possibilities for using the radio method for detecting particles of energies above the CZK cut-off are analyzed. The method is based on the registration of coherent Cherenkov radio emission produced by cascades of most energetic particles in radio-transparent lunar regolith. The Luna-26 space mission to be launched in the nearest future involves the Lunar Orbital Radio Detector (LORD). The potentialities of the LORD space instrument to detect radio signals from showers initiated by ultrahigh-energy particles interacting with lunar regolith are examined. The comprehensive Monte Carlo calculations were carried out within the energy range of 10^{20} to 10^{25} eV with the account for physical properties of the Moon such as its density, lunar-regolith radiation length, radio-wave absorption length, refraction index, reflection from the lower regolith boundary, and orbit altitude of a lunar satellite. The design of the LORD space instrument and its scientific potentialities for registration of low-intense cosmic-ray particle fluxes of energies above the GZK cut-off up to 10^{25} eV are discussed, as well. The designed LORD module (including the antenna, amplification, and data-acquisition systems) now is under construction. The LORD space experiment will make it possible to obtain important information on the highest-energy particles in the Universe, to verify modern models for the origin and the propagation of ultrahigh-energy particles. It is expected that the LORD space experiment will surpass in its apertures and detection capability the majority of well-known current and proposed experiments that deal with the detection of both ultrahigh-energy cosmic rays and neutrinos. The future prospects in the study of ultrahigh-energy particles by orbital radio detectors are also considered, namely, a multi-satellite lunar systems and space missions to largest ice planets of the solar system.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

83

Poster 2 DM and NU - Board: 286 / 955

Design Study of an Air Cherenkov Telescope for Efficient Air-Shower Detection at 100 TeV at the South Pole on Top of IceCube

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Air-Cherenkov Telescopes with SIPM based cameras have the potential to detect cosmic rays with a high duty cycle and efficiency in harsh environments.

For IceCube, the world's largest high-energy neutrino observatory presents unique opportunities to detect cosmic-ray air showers in coincidence with the deep-ice detector and an extended air-Cherenkov telescope array.

For neutrino astronomy, the main purpose of IceCube, a large background-free sample of well-reconstructed astrophysical neutrinos in the 1.5 km deep light detector is essential. The main backgrounds for this signal are muons and neutrinos produced in cosmic-ray air showers detected in the deep ice detector.

The coincident detection of air showers with an air-Cherenkov telescope could be used to reduce the cosmic background in IceCube and significantly strengthen the sensitivity of the detector to neutrinos from the Southern Hemisphere.

Here we present an air-Cherenkov prototype telescope. It is designed to withstand the harsh environment at the South Pole. We describe the design and physics potential of this instrument.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

505

Poster 2 CR - Board: 211 / 40

Electron and thermal neutron lateral distribution functions in EAS at high altitude

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PRISMA-YBJ is a novel type array to study Extensive Air Showers (EAS) in the range of 10^{14} - 10^{16} eV. The main feature of this type array is the simultaneous measurement of the electron and the neutron components of EAS on all area of array with the same scintillator detectors (en-detectors). This allows detailed studies of low-investigated hadronic component in the "knee" region. The simulation of lateral distribution of thermal neutrons from the parent hadron track was made with GEANT4.

The independence of lateral distribution function shape from the parent hadron energy and particle type is demonstrated. The power law dependency for the number of thermal neutrons on parent hadron energy is obtained. Also the simulation of the PRISMA-YBJ experiment was made using CORSIKA and GEANT4. The results of the simulation are compared with experimental data and very good agreement is shown.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

44

Poster 2 CR - Board: 168 / 1163

Large-area high-altitude sampling calorimetry for cosmic rays: current potential and sensitivity

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Understanding the energy spectrum and the mass composition in the range 10 TeV - 10 PeV is crucial to establish a robust model of galactic cosmic rays. To do that, precise measurements are needed, with systematic uncertainties sufficiently low to discriminate among models. In this regard, the issues of the energy and the mass of the knee are scientific cases of particular importance. Contrary to what commonly thought today, experiments are still far to give compatible results, with differences larger than quoted uncertainties, related to detector features (high background, inefficiency) and analysis methods (selections, unfolding). Here we provide results based on the detailed simulation of a simple yet efficient experimental layout, using 1 radiation length of lead followed by 20 radiation lengths of soil, with increasing thickness to ensure sensitivity all over the energy range. Particular emphasis will be put on the sensitive layers of the device, made of Resistive Plate Chambers, never used for large-scale calorimetry up to now. The analog readout, based on a logarithmic amplifier, together with excellent time resolution (few hundreds ps), will allow to detect hadrons interacting within $\sim 100\text{g/cm}^2$ from the detector surface, measuring single hadrons in the calorimeter as well as newborn showers with secondaries distinctively distributed in time and space. The approach entirely relies on well tested key-features of recent high-altitude extensive air shower detectors, which guarantee its feasibility. This contribution is intended to show that large-area high-altitude sampling calorimetry, suitably implemented, provides better sensitivity than any alternative approach attempted to date.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0911

Poster 2 CR - Board: 222 / 462

The study of cosmic rays with a wide-angle Cherenkov telescope

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This report presents an observation method of Cherenkov light from extensive air showers (EAS) generated by cosmic rays (CRs) above 1016 eV and preliminary observations. The interest in Cherenkov light differential detectors of EAS is caused by the possibility to measure the depth of cascade maximum, X_{\max} , and/or the shower age via angular and temporal distributions of the Cherenkov signal. In particular, it was shown using EAS model simulations that the pulse width measured at the periphery of the shower, $r > 300$ m, at sea level is pronouncedly connected with X_{\max} . Cherenkov detector is a wide-angle telescope working in coincidence with scintillation detectors, integral and differential Cherenkov detectors Yakutsk complex EAS. This provides the data on lateral distribution of photon intensity and total flux of Cherenkov light in EAS. The detector is located near (about 2m) with one of the integral Cherenkov detector. This detector's signal was calibrated using plastic optical radiator. So, we have a possibility to normalize an integral signal from telescope to that of the Cherenkov detector. We have completed the field testing of the prototype wide FOV telescope. A number of EAS events are detected in coincidence with the surface detectors of the Yakutsk array. A detection efficiency of the telescope is measured as well as the effective radius of the telescope detecting area. The report details the technical specifications of the telescope, as well as the results of the first experimental observations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

418

Poster 2 SH - Board: 34 / 482

Ion acceleration by shock surfing

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Collisionless shocks in space conditions are a source of energetic particles. The particles having low velocity along the normal to the surface of the shock front can be multiply reflected from the electric cross potential of a quasiperpendicular shock and be accelerated by shock surfing. Shock surfing can provide pre-acceleration of particles for subsequent diffusive shock acceleration. The research of shock surfing is of interest for calculation of injection and element composition of the accelerated particles.

The calculation method of distribution function of the accelerated particles by shock surfing in that case, when the characteristics of the shock front (the electrostatic field strength and the width of the shock front) are specified. The results of calculation of particle spectra before and behind the shock front depending on taken parameters are shown.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

265

Poster 2 CR - Board: 147 / 476

An Electric Field Detector for high-performance measurements of the electric field in the ionosphere

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An Electric Field Detector (EFD) for space applications has been designed and built in the framework of the CSES (China Seismo-Electromagnetic Satellite) mission. The instrument has been conceived for space-borne measurements of electromagnetic phenomena such as seismo-electromagnetic perturbations and more in general to investigate lithosphere-atmosphere-ionosphere EM coupling. The EFD consists of four probes designed to be installed on booms deployed from a 3-axes stabilized satellite. It measures electric field in a wide band of frequencies extending from quasi-DC up to about 5 Mhz subdivided in four frequency bands by a signal processing unit, with a resolution of the order of 1 μ V/m with a wide dynamic range of 120 dB in the lower DC-ULF band. The resolution value is 40 times better than any other recent instrument of similar feature. With these characteristics, the described EFD represents the most performing and updated device so far developed for electric field measurements in near-space applications. The detector has been fully tested in laboratory both in a Faraday cage and in a Plasma Chamber that simulates the real ionospheric conditions. Topic of this talk is the technical description of the EFD, its main characteristics and the test results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0320

Poster 2 DM and NU - Board: 295 / 1360

MCEq - numerical code for inclusive lepton flux calculations

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The flux of atmospheric leptons is the main background for measurements of astrophysical neutrinos. This natural beam can be used in studies of neutrino phenomenology at very high energies, such as in searches for sterile neutrinos or the determination of the mass hierarchy. The success of the measurements crucially depends on the precision of theoretical calculations. The presented open-source code enables researchers to calculate lepton fluxes at high computational speed and high precision, while granting access to the majority of physical parameters of the calculation. The program makes it easy to study the influence of hadronic interactions, decays of heavy quarks, models of the primary cosmic-ray flux and atmosphere. We will use the new version of the interaction model SIBYLL 2.3 to calculate predictions for various inclusive flux observables using the matrix cascade equation (MCEq) approach.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

975

High-Light Talks / 391

Multi-Messenger Aspects of Cosmic Neutrinos

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I will discuss the recent observation of TeV to PeV neutrinos by the IceCube Cherenkov telescope in the context of multi-messenger astronomy. The corresponding energy range of hadronic gamma-rays is not directly accessible by extragalactic gamma-ray astronomy due to interactions with cosmic radiation backgrounds. Nevertheless, the isotropic sub-TeV gamma-ray background observed by Fermi-LAT contains indirect information from secondary emission produced in electromagnetic cascades and constrains hadronic emission scenarios. On the other hand, observation of PeV gamma-rays would provide a smoking-gun signal for Galactic emission. Interestingly, the overall energy density of the observed neutrino flux is close to a theoretical limit for neutrino production in the sources of ultra-high energy cosmic rays and might indicate a common origin of these phenomena. I will highlight various multi-messenger relations involving cosmic neutrinos and proposed source scenarios.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

374

High-Light Talks / 1291

Searching for Dark Matter Shining in Gamma Rays in the Galactic center

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The center of the Milky Way is predicted to be the brightest region in the gamma-ray sky produced by dark matter annihilation or decay. In recent years, claims have been made of an excess consistent with a dark matter annihilation signal in the data collected by the Fermi Large Area Telescope towards the Galactic center. These results are intriguing, however the complexity involved in modeling the foreground and background emission from conventional astrophysical sources makes a conclusive interpretation of these results challenging. In this talk, I will summarize the current status of these searches, including the results from the Fermi LAT collaboration, and discuss prospects for improving these searches.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

964

High-Light Talks / 1373

Radio detection of Cosmic Rays with LOFAR

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With LOFAR we measure the properties of the radio emission of extensive air showers with high precision in the frequency range 30 to 240 MHz. This allows us to establish key features, such as the lateral density distribution of the radio signals, the shape of the shower front, and the polarization of the radio signal. We obtained the first quantitative measurements in the frequency range 120-240 MHz. These findings are essential to understand the emission processes in the atmosphere. Two contributions dominate the radio emission: geomagnetic radiation and a charge excess component. The measurements indicate that the ratio between those two is a function of the distance to the shower axis and the zenith angle of the shower. The precision measurements are also used to verify the numerical simulation code for the emission. This code (CoReas) is in turn essential to measure the depth of the shower maximum with the radio technique. We analyze simultaneously measurements of the radio emission and the particle detectors at LOFAR, which allows us to determine the depth of the shower maximum with an accuracy, comparable to that of established techniques. We measure the properties of cosmic rays (arrival direction, energy, and particle type/mass) with the radio technique. Recent results will be presented.

Registration number following "ICRC2015-I":

868

Collaboration:

– not specified –

High-Light Talks / 1222

An Investigation of the Causes of Solar-Cycle Variations in SEP Fluences and Composition

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Measurements with ACE, STEREO, and GOES show that the number of large solar energetic particle (SEP) events in solar cycle 24 is reduced by a factor of ~ 2 compared to this point of cycle 23, while the fluences of >10 MeV/nuc ions from H to Fe are reduced by factors ranging from ~ 4 to ~ 10 . We investigate the origin of these cycle-to-cycle differences by evaluating possible factors that include: 1) the properties of the associated CMEs; 2) seed particle densities; 3) the interplanetary magnetic field strength; 4) interplanetary turbulence levels; 5) the relative contribution of particles in the energetic storm particle (ESP) portion of the SEP events. These properties will be evaluated in the context of existing SEP acceleration models.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

376

Invited Review Talks / 389

Solar Energetic Particles and Solar Events - Lessons Learned from Multi-Spacecraft Observations

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Never before has the heliosphere and the Sun been so carefully monitored by so many spacecraft; near 1 AU at multiple longitudes and at other radial distances. The instrumentation on these spacecraft are continually observing solar activity and measuring the characteristics of solar energetic particle (SEP) events, providing a wealth of information on the acceleration and transport of SEPs. In February, 2011 the STEREO spacecraft reached a separation of 180° and since then we have had routine monitoring of the 'backside' of the Sun. This unprecedented view has allowed observations of active regions and solar activity after a region has rotated out of the view of the near-Earth spacecraft as well as the generation of new regions before they rotate into view from the east. The multiple viewpoints afforded by spectrometers and coronagraphs on the STEREO and near-Earth spacecraft has yielded more accurate information regarding the speed, direction, and evolution of coronal mass ejections (CMEs) which drive the interplanetary shocks that generate large SEP events. The multi-spacecraft observations of SEP events has revealed unexpectedly fast longitudinal transport and

filling of the inner heliosphere with energetic particles. This talk reviews these capabilities and observations and focuses on what has been learned from them regarding the acceleration and transport of SEPs and the related solar activity.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

371

Invited Review Talks / 1395

Status overview of gamma-ray astronomy

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Gamma-ray astronomy reveals the sites and mechanisms of powerful astrophysical accelerators and tests the limits of our understanding of matter and energy in the Universe. Current instruments, both in space and on the ground, are deepening the view of the gamma-ray sky, broadening spectral coverage, and capturing variability and transient activity in a rich variety of astrophysical objects.

The Fermi Gamma-ray Space Telescope has dramatically expanded the known classes of gamma-ray emitters and resolved new features of the gamma-ray sky. Fermi's Large Area Telescope (LAT) and Gamma-ray Burst Monitor (GBM) have captured activity that pushes the limits of existing emission models. The newly released reconstruction of the entire LAT data set provides an immediate boost to all high-energy photon studies and extends the energy reach of the instrument.

Meanwhile, the ground-based gamma-ray detectors, such as VERITAS, MAGIC, and HESS, have been enhancing performance at the low energy end of their range, bringing overlap in the observations between these techniques. Ground-based efforts have expanded the catalog of sources above 100 GeV in both size and variety, and the freshly completed HAWC array now provides wide-field observations that open up new monitoring and survey capability.

The expanded, complementary coverage across a broad segment of the gamma-ray spectrum has brought new insights into the acceleration of energetic particle populations and the resulting, often complex gamma-ray emission components. The future promises a continued wealth of discoveries with current instruments and next-generation observatories. In this review, I will highlight select areas within gamma-ray astronomy that have shown significant progress and raised new questions. I will also consider some topics that may be addressed by future observations and instruments.

Registration number following "ICRC2015-I/":

1075

Collaboration:

– not specified –

Parallel CR12 Radio / 549

Multi-scale and multi-frequency studies of cosmic ray air shower radio signals at the CODALEMA site

Author: Richard Dallier¹

Co-authors: Alain Lecacheux²; Benoît Revenu³; Didier CHARRIER⁴; Diego TORRES-MACHADO⁵; Florian Gaté⁴; Herve Carduner⁴; Jean-Luc Beney⁴; Laurent Denis⁶; Lilian Martin⁷; Vincent Marin⁴

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Since 2003, the Nançay Radio Observatory hosts the CODALEMA experiment, dedicated to the radio detection of cosmic ray induced extensive air showers. After several instrumental upgrades, CODALEMA is now composed of:

- 57 self-triggering radio detection stations working in the 20-250 MHz band, spread over 1 km²;
- an array of 13 scintillators acting as a particle detector;
- a compact array of 10 cabled antennas, triggered by the particle detector, to test the capabilities of a phased antenna cluster to cleverly select air shower events.

In addition, CODALEMA supports the EXTASIS project, aiming at detecting the low-frequency signal produced by the sudden deceleration of the air shower particles hitting the ground. Beside these dedicated arrays, the Nançay site will host the NenuFAR radio telescope (recognized as a SKA pathfinder), made of 1824 dual crossed-polarization antennas similar to the CODALEMA ones. All these arrays present different antenna density and extent, and could be operated in a joint mode to record simultaneously the radio signal coming from an air shower. Therefore, the upgraded CODALEMA facilities could offer a complete description of the air shower induced electric field at small, medium and large scale, and over an unique and very wide frequency band (from ~2 to ~250 MHz). The use of multi-band detectors combined with composite trigger algorithms could help boosting the radio detection technique as a candidate for a further very large cosmic ray observatory, or in the frame of a large radio telescope such as SKA. We describe the current instrumental set-up and the last results obtained, together with the prospective developments of the radio detection technique.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

494

Parallel SH 04 STEREO / 81

Filament Eruptions Outside of Active Regions as Sources of Large Solar Energetic Particle Events

Author: Stephen Kahler¹

Co-authors: Hong Xie²; Nat Gopalswamy³; Neeharika Thakur²; Pertti Makela²; Sachiko Akiyama²; Seiji Yashiro²

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Gradual solar energetic ($E > 10$ MeV) particle (SEP) events are produced in shocks driven by fast CMEs, which are nearly always spatially associated with ARs. Several cases of SEP events associated with CMEs originating in large filament eruptions (FEs) from outside ARs have previously been known, but four more such cases from solar cycles 23 and 24 have been described by Gopalswamy et al.(2015). The CMEs were fast (~ 1000 km s⁻¹), appeared as coronagraph halo CMEs, and were associated with interplanetary type II bursts over a wide wavelength range. On the basis of their observed weak post-eruption arcade X-ray flare enhancements, several more candidate large SEP events resulting from eruptions of filaments adjacent to but outside ARs were identified. Thus, large SEP events can arise not only from unobserved ARs behind the disk, but also from non-AR filament eruptions. SEP event forecasting, currently based on observations of front-side solar ARs and X-ray flares, therefore can not predict either kind of SEP event. For the two SEP events with STEREO observations we confirm that despite their good magnetic connections to Earth, the SEP longitudinal distributions are broad. Neither Ulysses SEP observations nor CMEs associated with shocks and type II bursts give any indication that high-latitude polar-crown filament eruptions may have produced SEP events.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

22

Parallel GA11 Instruments / Prospects / 1312

Combination of shower-front sampling and imaging in the Tunka Advanced International Gamma-ray and Cosmic ray Astrophysics (TAIGA) project

Author: Maike Kunnas¹

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For observation of extensive air showers from gamma rays and cosmic rays, shower front sampling arrays (non-imaging technique or timing-arrays) provide good core position, energy and angular resolution while covering a large area and possessing a wide field of view, yielding good sensitivity at the highest energies. However, the gamma-hadron separation power of this method is only poor compared to other techniques.

In matters of gamma hadron separation and reconstruction, imaging air Cherenkov telescopes (IACT) are the instrument of choice, but a stereoscopic view of a shower is needed for accurate reconstruction. This makes it difficult to achieve sufficiently large effective areas needed for sensitive observations at and above 100 TeV.

A combination of these experimental approaches, using the strengths of both techniques while compensating their weaknesses, could optimize the sensitivity to the highest energies.

The TAIGA project plans to combine the non-imaging HiSCORE array with small HEGRA-like imaging telescopes. Here, we present the first hybrid simulation combining imaging and non-imaging detectors. These simulations are used to explore and optimize the hybrid reconstruction technique and its sensitivity.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

925

Parallel GA12 EGAL / 787**Reconciliation of the VHE γ -ray/X-ray correlation studies in Mrk 421 and break-down at high VHE fluxes****Author:** Barbara Patricelli¹**Co-authors:** Magdalena González ²; Nissim Fraija ²¹ *University of Pisa, INFN Pisa and Astronomy Institute of UNAM*² *Astronomy Institute of UNAM***Corresponding Author:** barbara.patricelli@pi.infn.it

The blazar Mrk 421 is one of the closest, brightest and fastest varying source in the extragalactic X-ray/TeV sky. In the last years, many multiwavelength campaigns have been carried out to study the correlation between the VHE γ -ray and X-ray fluxes of this source and, although the activity in these two energy ranges seems to be correlated in many observations, no conclusive results have been achieved yet. In this work we present a robust and comprehensive study of the (VHE) γ -ray/X-ray correlation of Mrk 421 with data taken with different VHE experiments (i.e. Whipple, HEGRA CT1, Milagro) on different time scales and different levels of activity of the source. We show that at monthly time scales the correlation is robust, consistent between instruments and that can be described as a linear function. Furthermore, most of the fluxes on shorter time scales are consistent with the correlation within 3σ . However, a breakdown of the correlation is clearly evident at high states of activity with fluxes greater than $2.5 \cdot 10^{-10} \text{ cm}^{-2} \text{ s}^{-1}$ at energies above 400 GeV independently of the time scale, observational period or instrument. The breakdown is observed as an arbitrary decrement in the X-ray flux while the source remains in a high state of activity in VHE γ -rays. Even for single flares, the X-ray and VHE γ -ray emissions lie on the correlation until the VHE γ -ray flux reaches values higher than the mentioned above. The results are interpreted and discussed within the standard SSC model

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

688

Parallel DM 04 / 1174**Dark Matter searches with Fermi LAT in direction of dwarf spheroidals****Authors:** Alex Drlica-Wagner¹; Brandon Anderson²; Johann Cohen-Tanugi³; Matthew Wood⁴¹ *FermiLab*² *Stockholm University*

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The dwarf spheroidal satellite galaxies of the Milky Way are some of the most dark-matter-dominated objects known. Due to their proximity, high dark matter content, and lack of astrophysical backgrounds, dwarf spheroidal galaxies are widely considered to be among the most promising targets for the indirect detection of dark matter via gamma rays. Here we report on gamma-ray observations of Milky Way dwarf spheroidal satellite galaxies based on 6 years of *Fermi* Large Area Telescope data processed with the new Pass 8 reconstruction and event-level analysis. None of the dwarf galaxies are significantly detected in gamma rays, and we present upper limits on the dark matter annihilation cross section from a combined analysis of the 15 most promising dwarf galaxies. The constraints derived are the tightest to date using gamma rays and lie below the canonical thermal relic cross section for WIMPs of mass < 100 GeV annihilating via the $b\bar{b}$ and $\tau\tau$ channels.

Collaboration:

FERMI

Registration number following "ICRC2015-I/":

1183

Parallel GA11 Instruments / Prospects / 1011

A Neural Network-based Reconstruction Algorithm for monoscopically detected Air Showers observed with the H.E.S.S. Experiment

Author: Thomas Murach¹

Co-authors: Michael Gajdus²; Robert Parsons

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The H.E.S.S. experiment entered its second phase with the addition of a new, large telescope called CT5 that has been added to the centre of the existing array of four smaller telescopes. Because of its larger mirror area the new telescope is able to detect fainter air showers, thereby lowering the energy threshold of the array from $O(100)$ GeV down to a few tens of GeV. Due to the power law dropoff of typical gamma ray and cosmic ray spectra a majority of all detected air showers are of low energies, thus being detected by CT5 only, which motivates the need for a reconstruction algorithm based on information of CT5 alone. Exploiting such monoscopic events using a suitable reconstruction mechanism it will be possible to close the gap between spectra measured by Fermi-LAT and the H.E.S.S. experiment in its first phase. Also the chances of detecting transient events like gamma ray bursts are increased significantly due to the low energy threshold and large effective area of CT5.

In this talk a newly developed reconstruction algorithm for monoscopic events based on neural networks is presented. This algorithm uses MLP networks to reconstruct the shower direction, the energy of the particle initiating the air shower and to discriminate between gamma rays and hadrons. The performance of this algorithm is evaluated and compared to other existing reconstruction algorithms. Furthermore results of first applications of the algorithm to measured data are shown.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

848

Parallel SH 04 STEREO / 91**First near-relativistic electron spike event observed simultaneously by both STEREO spacecraft****Author:** Andreas Klassen¹**Co-authors:** Bernd Heber¹; Nina Dresing¹; Raúl Gómez-Herrero²¹ *University of Kiel*² *Universidad de Alcalá***Corresponding Author:** klassen@physik.uni-kiel.de

Solar electron spike events are a special subclass of near-relativistic electron events characterized by their short duration, symmetric time profile and their strongly anisotropic pitch angle distribution. All previous studied spike events until now were observed by a single spacecraft only.

We present for the first time measurements of an electron spike event that was observed simultaneously by both closely spaced STEREO spacecraft on May 2, 2014. Thereby the orbital-longitudinal separation angle between STEREO-A (STA) and STEREO-B (STB) was less than 38°.

The spikes at STA and STB are characterized by very short durations ($\text{FWHM} \leq 12$ min) and almost symmetric time profiles. They exhibit nearly identical properties in: durations, pitch angle distributions (PADs), energy spectra, and intensities. The spike parent source was situated

close to the STA nominal magnetic footpoint and was separated by 48° from STB's footpoint.

The intensity distribution and the relative onset timing behaved oppositely to what is expected: STB measured a higher intensity and an earlier spike onset than the better connected STA.

We suggest that the spike electrons undergo a substantial non-radial injection into interplanetary space from the parent source, a flaring active region, and propagate in a strong non-radial diverging magnetic field.

In addition we show that due to the spike properties it is evident that, irrespective of how the electrons were injected into the IP medium, the en-route particle scattering conditions along the paths to STA and STB were very similar.

Obviously both s/c detected different parts of the same short particle beam with an angular extension of at least 38° at 1 AU, comparable with the longitudinal separation between STA and STB.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1105

Parallel CR12 Radio / 912

The Energy Content of Extensive Air Showers in the Radio Frequency Range of 30-80 MHz

Author: Christian Glaser¹

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At the Auger Engineering Radio Array (AERA) of the Pierre Auger Observatory, we have developed a new method to measure the total amount of energy that gets transferred from the primary cosmic ray into radio emission. We find that this radiation energy is itself an estimator of the cosmic ray energy. It scales quadratically with the cosmic-ray energy, as expected for coherent emission. We measure 15.8 MeV radiation energy for a 1 EeV air shower arriving perpendicular to the geomagnetic field, in the frequency band of the detector from 30 to 80 MHz. These observations are compared to the data of the surface detector of the Observatory, which provide well-calibrated energies and arrival directions of the cosmic rays. We find energy resolutions of the radio reconstruction of 22% for the complete data set, and 17% for a high-quality subset containing only events with at least five stations with signal.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

775

Parallel DM 04 / 66

Constraining the Dark Matter lifetime with very deep observations of the Perseus cluster with MAGIC

Author: Joaquim Palacio¹

Co-authors: Camill Maggio²; Fabio Zandanel³; Javier Rico⁴; Michele Doro²; Monica Vazquez Acosta⁵; Pierre Colin⁶

¹ Institut de Física d'Altes Energies

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We present the results on Dark Matter searches from the Perseus galaxy cluster observations with the MAGIC Telescopes. MAGIC is a system of two Imaging Atmospheric Cherenkov Telescopes located in the Canary island of la Palma, Spain. Galaxy clusters are the largest known gravitationally bound structures in the Universe, with masses of $\sim 10^{15}$ Solar Masses. There is strong evidence that galaxy clusters are Dark Matter dominated objects, and therefore promising targets for dark matter searches, particularly for decay signals. We analyze almost 300 hours of good-quality observations of Perseus taken between 2009 and 2015. This is the deepest observational campaign on any galaxy cluster performed so far in the very high energy range of the electromagnetic spectrum. We search for signals of dark matter particles in the mass range between 100 GeV and 20 TeV. We apply a likelihood analysis optimized for the spectral and morphological features expected in the dark matter annihilation and decay signals from the Perseus cluster. We achieve sensitivities to decay life times above $\sim 10^{26}$ s for masses of the order of hundreds of GeV. This result is the most stringent limit

obtained on the lifetime of dark matter candidates in the studied mass range, improving previous limits by one order of magnitude.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

87

Parallel GA12 EGAL / 783

Recent follow-up observations of GRBs in the very high energy band with the MAGIC Telescopes

Author: Alessandro Carosi¹

Co-authors: Elena Moretti ²; Francesco Longo ³; Koji Noda ⁴; Lucio Angelo Antonelli ⁵; Markus Garczarczyk ⁶; Markus Gaug ⁷; Martin Will ⁸; Masahiro Teshima ⁹; Massimo Persic ⁵; Saverio Lombardi ⁵; Stefano Covino ¹⁰; Susumu Inoue ¹¹; Takeshi Toyama ²

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⁵ *INAF*

⁶ *DESY*

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Gamma-ray burst (GRBs) are primary targets for all modern IACT telescope. The MAGIC collaboration has identified the detection of GRBs in the VHE regime as one of its multi-year key observational programs (KOP). However, the transient and unpredictable nature of GRBs makes pointing and rapid follow-up observations to observe the prompt emission phase difficult for large ground-based Cherenkov facilities. Thanks to its fast pointing speed and low-energy sensitivity, MAGIC is particularly well suited for GRB studies in the VHE range below ~ 100 GeV during the prompt-to-early afterglow phase.

Since beginning operation in 2005, MAGIC has performed 72 follow-up observations that, to date, have yielded no significant detections. However, in the last two years, the MAGIC system upgrade and an improved GRB observation procedure has made possible follow-up of GRBs within ~ 100 s after the event onset, hence opening a new phase in MAGIC GRB monitoring. In this contribution, I will show the achieved MAGIC performance for prompt observations and transient source detection, and will also report results from some GRB MAGIC observations.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

444

Parallel DM 04 / 279

Dark matter search in the inner Galactic halo with H.E.S.S. II

Author: Valentin lefranc¹

Co-author: Emmanuel Moulin¹

¹ CEA

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The presence of dark matter in the Universe is nowadays widely supported by a large body of astronomical and cosmological observations. One of the best target to look for dark matter self-annihilation into very high energy gamma-rays is the Galactic center region. A search for such emission is performed with the ground-based H.E.S.S. array of Cherenkov telescopes toward the central 150 parsecs around the Galactic center. Constraints are derived on the velocity-weighted annihilation cross section thanks to a 2D likelihood method using both spectral and spatial morphologies of signal and background. Combining this new data analysis method together with the new second-phase, 5-telescope array performances, searches for annihilating dark matter with H.E.S.S. observations are presented.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

1210

Parallel SH 04 STEREO / 171

STEREO observations of the 7 Nov 2013 SEP event - an event inside a magnetic loop

Author: Nina Dresing¹

Co-authors: Andreas Klassen²; Bernd Heber¹; Raúl Gómez-Herrero³

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² University of Kiel

³ SRG, University of Alcalá, Spain

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The Solar Electron and Proton Telescope (SEPT) carried on board both of the STEREO spacecraft provides four viewing directions to measure energetic electron and ion anisotropies. Two sectors cover the direction of the nominal magnetic field spiral in the ecliptic, with one looking towards the Sun and the other away from the Sun (Anti-Sun). The other two telescopes view towards north and south, i.e. perpendicular to the ecliptic plane.

On 7 Nov 2013 both STEREO spacecraft detected the same solar energetic particle (SEP) event with nearly simultaneous energetic electron onsets. The event shows strong anisotropy at both positions. However, while the first arriving particles are detected in the SUN telescope by STEREO^A as expected for SEP events, STEREO^B detects the first arriving particles in the NORTH telescope with a strong bi-directional particle distribution along the north/south direction.

There are two main ideas explaining bi-directionality: i) A particle beam which is mirrored at a magnetically closed structure or turbulence or ii) two incident beams streaming towards each other. The latter idea may imply two separate sources.

In this work we will show that STEREO B was embedded in a magnetic flux rope with both loop legs still connected to the Sun during the SEP event. We investigate in-situ plasma, magnetic field and energetic particle observations to sketch the special magnetic field topology comprising STEREO B. By combining in-situ with remote sensing and radio observations we can show that the most likely explanation for the bi-directional electron distribution at STEREO B is a SEP injection into both loop legs of the magnetic cloud.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0822

Parallel CR12 Radio / 977

A lateral distribution function for the radio emission of air showers

Author: Anna Nelles¹

Co-authors: Arthur Corstanje¹; Falcke Heino²; Gia Trinh³; J.E. Enriquez⁴; Jörg Hörandel⁵; Jörg P. Rachen⁴; Laura Rossetto⁴; Olaf Scholten⁶; Pim Schellart⁷; Sander ter Veen⁴; Satyendra Thoudam⁴; Stijn Buitink⁸; Tijs Karskens⁴

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The international LOFAR radio telescope has been used now for four years to detect air showers. Its high antenna density has allowed us to measure the subtle features of the radio emission of air showers. Together with air shower simulations, these data have been used to model the detected signals. The not rotational symmetric footprint is described by an analytical function with as few as four free parameters. The parameters are related to the position of the shower axis, the energy and the distance to the shower maximum. We will show how this parametrization is used for a fast reconstruction of all relevant air shower parameters and what accuracies are obtained in comparison to a full Monte Carlo simulation.

We will furthermore elaborate on the absolute scale of our measurements and the predicted signal strengths.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

471

Parallel GA11 Instruments / Prospects / 1172

A Novel Method for Detecting Extended Sources with VERITAS

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The current standards for estimating the background contribution in IACT data analysis are the ring background model and the reflected region methods. However, these two techniques are poorly suited for analyses of sources with extensions comparable to the detector's field of view (greater than $\sim 1^\circ$). Nearby pulsar wind nebulae, supernova remnants interacting with molecular clouds, and dark matter signatures from galaxy clusters are just a few potentially highly extended source classes. A three dimensional maximum likelihood analysis is in development that seeks to resolve this issue for data from the VERITAS telescopes. The technique incorporates relevant instrument response functions to model the distribution of detected gamma-ray like events in two spatial dimensions. Additionally, we incorporate a third dimension based on a gamma-hadron discriminating parameter. The inclusion of this third dimension significantly improves the sensitivity of the technique to highly extended sources. We will present this promising technique as well as systematic studies demonstrating its potential for revealing sources of large extent in VERITAS data.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

638

Parallel GA12 EGAL / 728

Gamma-Ray Burst observations with Fermi

Author: Elisabetta Bissaldi¹

Co-authors: Andreas von Kienlin²; Francesco Longo³; Giacomo Vianello; Nicola Omodei⁴

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After almost 7 years of science operation, the Fermi mission has brought great advances in the study of GRBs. Over 1500 gamma-ray bursts (GRBs) have been detected by the Gamma-ray Burst Monitor (GBM), and more than 100 of these are also detected by the Fermi Large Area Telescope (LAT) above 30 MeV.

We will give an overview of these observations, presenting the common properties in the GRB temporal and spectral behavior at high energies. We will also highlight the unique characteristics of some individual bursts. The main physical implications of these results will be discussed, along with open questions regarding GRB modelling in their prompt and temporally-extended emission phases.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

634

Parallel GA11 Instruments / Prospects / 676**VERITAS Observations under Bright Moonlight****Author:** Sean Griffin^{None}**Corresponding Author:** griffins@physics.mcgill.ca

The presence of moonlight is usually a major limiting factor for Imaging Atmospheric Cherenkov Telescopes due to the high sensitivity of the camera photomultiplier tubes (PMTs). In their standard configuration, the extra noise limits the sensitivity of the experiment to gamma-ray signals and the higher PMT currents also accelerates PMT aging. Since fall 2012, observations have been carried out with VERITAS under bright moonlight (Moon illumination > 35%), in two observing modes, by reducing the voltage applied to the PMTs and with UV bandpass filters, which allow observations up to ~80% Moon illumination resulting in 25% more observing time over the course of the year. In this presentation, we provide details of these new observing modes and their performance relative to the standard VERITAS observations.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

595

Parallel CR12 Radio / 492**Probing atmospheric electric fields in thunderstorms through radio emission from extensive air showers****Author:** Gia Trinh¹

Co-authors: Anna Nelles²; Arthur Corstanje²; Casper Rutjes³; H. Falcke²; J.E Enriquez⁴; J.P. Rachen²; Jörg Hörandel⁵; L. Rossetto²; Olaf Scholten⁶; Pim Schellart⁷; S. ter Veen²; Satyendra Thoudam⁸; Stijn Buitink⁹; T. Karskens²; Ute Ebert¹⁰

¹ KVI-CART, University of Groningen, The Netherlands² Radboud University Nijmegen³ CWI, Amsterdam⁴ Department of Astrophysics, Radboud University Nijmegen⁵ Ru Nijmegen/Nikhef⁶ KVI-CART, University of Groningen⁷ R⁸ Radboud University⁹ Rijksuniversiteit Groningen

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Energetic cosmic rays impinging on the atmosphere create a particle avalanche called an extensive air shower. In the leading plasma of this shower electric currents are induced that generate radio waves which have been detected with LOFAR, a large array of simple antennas primarily developed for radio-astronomical observations.

LOFAR has observed air showers under fair-weather conditions as well as under atmospheric conditions where thunderstorms occur. For air showers under fair-weather conditions the intensity as well as the polarization of the radio emission can be reproduced rather accurately by the standard model using a superposition of a geomagnetically-induced transverse current and a charge-excess contribution.

For air showers measured under thunderstorm conditions we observe large differences in the intensity and polarization patterns from the fair weather model. We observe for these showers that it is not possible to get a good fit of the measured intensity pattern. For the same air showers the dominant polarization direction differs from the orientation observed in the fair-weather condition.

We show that this difference is a consequence of atmospheric electric fields. We also show that the basic effects of atmospheric electric fields on radio emission from air showers are understood. Therefore, measuring radio emission from extensive air showers during thunderstorm conditions provides a new tool to probe the atmospheric electric fields present in thunderclouds.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

441

Parallel SH 04 STEREO / 373

Insights Into Particle Transport Obtained from Solar Energetic Particle Anisotropies

Author: Richard Leske¹

Co-authors: Alan Cummings¹; Allan Labrador¹; Christina Cohen¹; Edward Stone¹; Eric Christian²; Mark Wiedenbeck³; Richard Mewaldt¹; Tycho von Rosenvinge²

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² *NASA/Goddard Space Flight Center*

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Solar energetic particle (SEP) pitch angle distributions are shaped by the competing effects of magnetic focusing and scattering as the particles travel through interplanetary space. Therefore, measurements of SEP anisotropies provide insight into particle transport and can probe interplanetary conditions at remote locations from the observer. The Low Energy Telescopes (LETs) onboard the twin STEREO spacecraft measure pitch angle distributions for protons and heavier ions at energies of about 2-12 MeV/nucleon. Using these instruments, we have observed a wide variety of SEP anisotropies, such as bidirectional flows within interplanetary coronal mass ejections, sunward-flowing particles when the spacecraft was magnetically connected to the back side of a distant shock, and loss cone distributions in which particles with large pitch angles magnetically mirror at an interplanetary field enhancement that is too weak to reflect particles with the smallest pitch angles. One of the more puzzling observations is unusual oscillations on a timescale of several minutes in

the width of a beamed distribution at the onset of the very large 23 July 2012 SEP event. We present STEREO/LET anisotropy observations and discuss their implications for SEP transport. In particular, we note that the shapes of the pitch angle distributions often depend on energy and particle species, which may allow an empirical determination of the rigidity dependence of the pitch angle diffusion coefficient.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

360

Parallel DM 04 / 757

Status of cosmic ray antideuteron searches

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The precise measurement of cosmic ray antiparticles serves as important means for identifying the nature of dark matter. Recent years showed that identifying the nature of dark matter with cosmic ray positrons and higher energy antiprotons is difficult, and has led to a significantly increased interest in cosmic ray antideuteron searches. Antideuterons may also be generated in dark matter annihilations or decays, offering a potential breakthrough in unexplored phase space for dark matter. Low-energy antideuterons are an important approach because the flux from dark matter interactions exceeds the background flux by more than two orders of magnitude in the low-energy range for a wide variety of models without relying on any boosting mechanisms, e.g., due to DM clumpiness, Sommerfeld enhancement, or large galactic halo size. This talk is based on a community effort from 2014 that brought together theorists and experimentalist in the field to discuss the current status, perspectives, and challenges for cosmic ray antideuteron searches. It will review the motivation for antideuteron searches, discuss the theoretical and experimental uncertainties of antideuteron production and propagation in our Galaxy, as well as give an experimental cosmic ray antideuteron search status update.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

675

Parallel GA12 EGAL / 485

First study of Mrk501 through the eyes of NuSTAR, VERITAS and the *LIDAR-corrected* eyesight of MAGIC

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The blazar Mrk501 is among the brightest X-ray and TeV sources in the sky, and among the few sources whose (radio to VHE gamma-rays) Spectral Energy Distributions can be characterized by current instruments by means of relatively short observations (minutes to hours). In 2013, we organized an extensive multi-instrument campaign involving the participation of Fermi LAT, MAGIC, VERITAS, F-GAMMA, Swift, GASP-WEBT, and other collaborations/groups and instruments which provided the most detailed temporal and energy coverage on Mrk501 to date. This observing campaign included, for the first time, observations with the Nuclear Stereoscopic Telescope Array, NuSTAR, which is a satellite mission launched in mid-2012. NuSTAR provides unprecedented sensitivity in the hard X-ray range 3-79 keV, which, together with MAGIC and VERITAS observations, is crucial to probe the highest energy electrons in Mrk501.

The multi-instrument campaign covered a few day long flaring activity in July 2013 which could be studied with strictly simultaneous NuSTAR and MAGIC observations. A large fraction of the MAGIC data during this flaring activity were affected by a sand layer from the Saharan desert, and would have been removed in any standard Cherenkov Telescope data analysis. However, we were able to use atmospheric information from a LIDAR facility that is operational at the MAGIC site, and apply an event-by-event correction in order to reliably use these data. This is the first time that LIDAR information is used to produce a physics result with Cherenkov Telescope data taken during adverse atmospheric conditions, and hence sets a precedence for the current and future ground-based gamma-ray instruments.

In the conference we will report the observational results, focusing on the LIDAR-corrected MAGIC data and the strictly simultaneous NuSTAR and MAGIC/VERITAS data, and will discuss the scientific implications.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

185

Parallel SH 04 STEREO / 818

Constraints on Mechanisms for Longitudinal Spreading of Impulsive SEPs from Multispacecraft Observations of Scatter-free Events

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Impulsive solar energetic particle (ISEP) events are understood to involve particle acceleration in relatively compact regions of the solar corona where reconnection causes the release of magnetic energy and produces both turbulence and larger scale motions that can interact with and accelerate charged particles. In many cases the longitudinal spread of ISEPs observed at 1 AU is relatively

narrow and possibly consistent with a point source of acceleration. However, several ISEP events observed with the two STEREO spacecraft and near-Earth instruments have had exceptionally wide longitudinal spreads, sometimes significantly greater than 90 degrees. It has been suggested that this spreading could be caused by interplanetary scattering in conjunction with co-rotation of the interplanetary field. There exists a subset of ISEP events that are referred to as “scatter free” due to characteristics such as velocity dispersion, strong particle anisotropy, and/or flux dropouts observed at 1 AU. We report on scatter-free events observed by both of the STEREOs in 2014 when the spacecraft were separated by 38 degrees. Producing such a large spread in the absence of significant interplanetary scattering requires a process other than cross-field diffusion for the longitudinal transport and suggests that the spreading could have its origin in the solar corona. We will discuss the observations and candidate explanations for the spreading and will point out the relevance of these results to measurements that will be made close to the Sun by the Solar Probe Plus and Solar Orbiter missions, which are now under development.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

703

Parallel CR12 Radio / 1067

Polarization and radio wavefront of air showers as measured with LOFAR

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The LOFAR radio telescope located in the north of the Netherlands offers a high density of omnidirectional radio antennas. In its central part, it consists of over 1100 dual-polarized antennas in an area of 12 km², of which nearly 300 are placed in the central ring of 320 m diameter.

LOFAR is therefore well suited for detailed studies of the radio signal from air showers, and has been measuring since mid-2011 at primary energies in the range of 10¹⁷ to 10¹⁸ eV.

We present high-precision measurements of the polarization of the radio signal, and the shape of the radio wavefront from the lateral distribution of signal arrival times.

Polarization and timing of the incoming radio pulse are complementary observables to the lateral distribution of signal power. These are shown to provide additional information on the air shower geometry and on the contribution of different radio emission mechanisms, such as the geomagnetic and charge excess processes.

A comparison of measured polarization and timing with CoREAS air shower simulations will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

318

Parallel GA12 EGAL / 237

First results from HAWC on GRBs

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We will present the first results of HAWC in searching for VHE gamma-ray emission from GRBs reported by Fermi, Swift and other satellite. The HAWC gamma-ray observatory is operating in central Mexico at an altitude of 4,100 m a.s.l. With an instantaneous field of view of approximately 2 sr and over 95% duty cycle (up time fraction), HAWC is an ideal detector to perform ground based gamma-ray observations of gamma-ray bursts (GRBs). Though optimized for TeV observations, HAWC has significant sensitivity to short transients of energies as small as 50 GeV. Beside initial results, we will also describe the sensitivity of HAWC to GRBs. We will show that HAWC is sensitive enough to detect several historical GRBs if their emission extends only barely beyond the highest energy observed by Fermi LAT. We describe the analysis methods used for fast online and offline HAWC follow up of GRBs reported by satellites.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

1174

Parallel GA11 Instruments / Prospects / 1177

FACT - Status and Experience from Three Years Operation of the First SiPM Camera

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The First G-APD Cherenkov Telescope (FACT) is pioneering the usage of solid state photosensors (G-APD, also known as SiPM). The 1440 pixel camera is installed in a 10m² refurbished HEGRA telescope on the Canary Island La Palma.

Physics data-taking with FACT started in October 2011, few hours after installation of the camera. Since Summer 2012, FACT is operated remotely

without the need of a data-taking crew onsite. During more than tree years of operation of FACT, G-APDs have proven to be very reliable. Despite operating them regularly also under very strong moonlight conditions, the G-APDs show no change in their properties or any indication for ageing. This allows FACT to have a successful monitoring program of the brightest TeV blazars in the northern hemisphere and several flare-alerts per year have been sent to the community.

This presentation will describe the status of FACT and report the lessons learned about the usage of SiPM in a Cherenkov telescope from the construction and operation of FACT.

Collaboration:

FACT

Registration number following "ICRC2015-I":

871

Parallel DM 04 / 46

Prospects for Indirect Dark Matter Searches with the Cherenkov Telescope Array (CTA)

Author: John Carr¹

Co-authors: Aldo Morselli²; Christian Farnier³; Csaba Balazs⁴; Emmanuel Moulin⁵; Gabrijela Zaharijas⁶; German Arturo Gomez Vargas⁷; Hannes Zechlin⁸; Javier Rico⁹; Jennifer Gaskins¹⁰; Mark Wilkinson¹¹; Masaaki Hayashida¹²; Matthew Wood¹³; Mattia Fornasa¹⁴; Michele Doro¹⁵; Miquel Sánchez-Conde¹⁶; Nestor Morselli¹⁷; Takauki Saito¹⁸; Torsten Bringmann¹⁹; Trygve Buanes²⁰; Valentin Lefranc²¹

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The existence of dark matter (DM) as the dominant contribution to the gravitational mass of the Universe is by now well established but the corpuscular nature of DM is at present unknown. Multiple hypotheses endure as to the character of DM and for the most popular DM models the CTA has a unique chance of discovery.

The principal target for DM searches with CTA is the Galactic Centre (GC) halo. The best strategy is to perform CTA observations within a few degrees of the GC, with the Galactic Centre itself and the most intense diffuse emission regions removed from the analysis. Assuming a cuspy DM density profile for the Milky Way, 500 hours of observations in this region provide sensitivities to and below the thermal cross-section of DM annihilations, for masses between a few hundred GeV and a few tens of TeV, and give a significant chance of discovery in some models for Weakly Interacting Massive Particles (WIMPs). Since the DM density in the Milky Way is far from certain, other targets are also proposed for observation, like ultra-faint dwarf galaxies such as Segue 1 with 100 hours per year proposed. Beyond these two observational targets, further alternatives, such as galactic dark clumps, will be considered closer to the actual date of CTA operations.

The presentation will give the sensitivity predictions for DM searches on the various targets taking into account the latest instrument response functions expected for CTA together with estimations on the systematic uncertainties from the backgrounds.

Collaboration:

CTA

Registration number following "ICRC2015-I":

58

Parallel CR12 Radio / 502

The Tunka Radio Extension: two years of air-shower measurements

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Since its commissioning in autumn 2012, Tunka-Rex, the radio extension of the air-Cherenkov detector Tunka-133, performed two years of air shower measurements. Currently the detector consists of 44 antennas, each connected to air-Cherenkov and scintillator detectors, respectively, placed in the Tunka valley, Siberia. Triggered by these detectors, Tunka-Rex measures the radio signal of EeV-scale air-showers. This configuration provides a unique possibility for cross-calibration between air-Cherenkov, radio and particle techniques. We present reconstruction methods developed with CoREAS simulations, which allow for a precision competitive with the air-Cherenkov technique. We apply these methods to data acquired by Tunka-Rex and compare the results with the Tunka-133 reconstruction of the energy and the shower maximum.

Collaboration:

Tunka-Rex

Registration number following "ICRC2015-I":

458

Parallel GA11 Instruments / Prospects / 579**Performance of the MAGIC telescopes after the major upgrade****Author:** Julian Sitarek¹**Co-authors:** Daniel Mazin²; Diego Tescaro ; Emiliano Carmona³; Pierre Colin⁴¹ *University of Łódź*² *IFAE*³ *CIEMAT*⁴ *MPI fuer Physik***Corresponding Author:** jsitarek@uni.lodz.pl

MAGIC is a system of two Imaging Atmospheric Cherenkov Telescopes located in the Canary island of La Palma, Spain. During summer 2011 and 2012 it underwent a major upgrade. The main subsystems upgraded were the MAGIC-I camera and its trigger system and the readout system of both telescopes. We use observations of the Crab Nebula taken at low and medium zenith angles to assess the key performance parameters of the MAGIC stereo system. For low zenith angle observations, the standard trigger threshold of the MAGIC telescopes is about 50 GeV. The integral sensitivity for point-like sources with Crab Nebula-like spectrum above 220 GeV is $(0.66 \pm 0.03)\%$ of Crab Nebula flux in 50 h of observations. The angular resolution, defined as the sigma of a 2-dimensional Gaussian distribution, at energies of a few hundred GeV is below 0.07 degree, while the energy resolution is around 16%. We investigate the effect of the systematic uncertainty on the data taken with the MAGIC telescopes after the upgrade. We estimate that the systematic uncertainties can be divided in the following components: < 15% in energy scale, 11-18% in flux normalization and ± 0.15 for the slope of the energy spectrum.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

500

Parallel DM 04 / 402**First Limits on the Dark Matter Cross-Section with the HAWC Observatory****Authors:** Brenda Dingus¹; Megan Longo Proper²**Co-authors:** J. Patrick Harding³; Kirsten Anne Tollefson⁴¹ *Los Alamos National Lab*² *Colorado State University (US)*³ *Los Alamos National Laboratory*⁴ *Michigan State University (US)*

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The High Altitude Water Cherenkov (HAWC) gamma-ray observatory is a wide field-of-view observatory sensitive to 100 GeV –100 TeV gamma-rays and cosmic-rays. The HAWC observatory is also sensitive to diverse indirect searches for dark matter annihilation, including annihilation from extended dark matter sources, the diffuse gamma-ray emission from dark matter annihilation, and gamma-ray emission from non-luminous dark matter subhalos. Among the most promising classes of objects for the indirect detection of dark matter are dwarf spheroidal galaxies. These objects are expected to have few astrophysical sources of gamma-rays, but high dark matter content, making them ideal candidates for indirect dark matter detection with gamma-rays. Here we present independent limits on the annihilation cross section for 14 dwarf spheroidal galaxies within the HAWC field-of-view, as well as a combined limit using all 14 candidates. These are the first limits on the annihilation cross section using data collected with HAWC. Other dark matter results and studies with the HAWC observatory will also be discussed.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

1159

Parallel GA12 EGAL / 162

4.5-year simultaneous multi-wavelength observation of Mrk 421 in ARGO-YBJ and Fermi overlap era

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As one of the most active blazars, Mrk421 is an excellent candidate for the study of the physical processes within the jets of AGN. Here we report on the extensive multi-wavelength observations of Mrk 421 over 4.5 years, from 2008 August to 2013 February. This source was simultaneously monitored by several experiments at different wavelengths: the ARGO-YBJ detector at gamma-ray energies above 0.3 TeV, Fermi-LAT at 0.1-300 GeV, Swift-BAT in hard X-rays, RXTE-ASM, MAXI and Swift-XRT in soft X-rays, and Swift-UVOT in the ultraviolet and optical ranges. According to the observed light curves, ten states (including seven large flares, two quiescent phases and one outburst) were selected. For the first time, the multi-wavelength spectral evolutions of Mrk 421 during different states were systematically analyzed. The one-zone synchrotron self-Compton model was adopted to investigate the intrinsic mechanisms.

Registration number following "ICRC2015-I/":

207

Parallel SH 04 STEREO / 1115

Multi-spacecraft observations and transport modeling of energetic electron for a series of solar particle events in August 2010

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During August 2010 a series of solar particle events was observed by the two STEREO spacecraft as well as by near-Earth spacecraft. The events, occurring at the 7th, 14th and 18th of August, were originating from active regions 11093 and 11099. We combine in-situ and remote-sensing observations with predictions from our model of three-dimensional anisotropic particle propagation in order to investigate the physical processes which cause the large angular spreads of the energetic particles during these events. In particular, we address the effects of lateral transport of the electrons in the solar corona as well as due to diffusion perpendicular to the average magnetic field in the interplanetary medium. We also study the influence of two CMEs and associated shock waves on the electron propagation, and a possible time variation of the transport conditions during the above period. For the 18th August event we additionally utilize electron observations from the Messenger spacecraft at a distance of 0.31 AU from the Sun for an attempt to separate between radial and longitudinal dependences in the transport process.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

891

Parallel CR13 EX EAS / 218

Combined fit of spectrum and composition data as measured by the Pierre Auger Observatory

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We present a combined fit of both flux and composition of ultra-high energy cosmic rays as measured by the Pierre Auger Observatory. The fit has been performed for energies above 5×10^{18} eV, the region of the all-particle spectrum above the so-called "ankle" feature. A simple astrophysical model has been adopted, consisting of identical sources, injecting nuclei with a rigidity dependent mechanism and uniformly distributed in a comoving volume. The solutions that have been found suggest a source model characterized by relatively low maximum injection energies and hard spectral indices. The impact of different sources of systematic uncertainties in the above result is discussed.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I/":

237

Parallel CR14 Hadr Int / 1091

Extension of the measurement of the proton-air cross section with the Pierre Auger Observatory

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With hybrid data of the Pierre Auger Observatory it is possible to measure the cross section of proton-air collisions at energies far beyond the reach of the LHC. Since the first measurement by the Pierre Auger Collaboration the event statistics has increased significantly. The proton-air cross section is now estimated in the two energy intervals in $\lg(E/\text{eV})$ from 17.8 to 18.0 and from 18.0 to 18.5. These energies are chosen so that they maximise the available event statistics and at the same time lie in the region most compatible with a significant primary proton fraction. Of these data, only the 20% of most proton-like events are considered for the measurement. Furthermore, with a new generation of hadronic interaction models which have been tuned to LHC data, the model-dependent uncertainties of the measurement are re-visited.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I/":

887

Parallel NU 04 / 634

Search for point-like neutrino sources over the Southern Hemisphere with the ANTARES and IceCube neutrino telescopes

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A search for cosmic neutrino point-like sources using the ANTARES and IceCube neutrino telescopes over the Southern Hemisphere is presented. The ANTARES data was collected between January 2007 and December 2012, whereas the IceCube data ranges from April 2008 to May 2011. Clusters of muon neutrinos over the diffusely distributed background have been looked for by means of an unbinned maximum likelihood maximisation. This method is used to search for an excess of events over the whole Southern Hemisphere assuming an E^{-2} source spectrum. A search over a pre-selected list of candidate sources has also been carried out for different source assumptions: spectral indices of 2.0 and 2.5, and energy cutoffs of 1 PeV, 300 TeV and 100 TeV. No significant excess over the expected background has been found, and upper limits for the candidate sources are presented compared to the individual experiments.

Collaboration:

ANTARES

Registration number following "ICRC2015-I/":

558

Parallel GA13 Future / 465

Second large scale Monte Carlo study for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) represents the next generation of ground based instruments for Very High Energy gamma-ray astronomy. It is expected to improve on the sensitivity of current instruments by an order of magnitude and provide energy coverage from 20 GeV to more than 200 TeV. In order to achieve these ambitious goals Monte Carlo (MC) simulations play a crucial role, guiding the design of CTA. An overview of CTA second large-scale MC production will be given and the main conclusions concerning the influence of telescope layouts, altitude, night sky background levels and geomagnetic field will be discussed.

Collaboration:

CTA

Registration number following "ICRC2015-I":

416

Parallel SH05 GLEs & FDs / 260

The time structure of cosmic-ray ground-level enhancements

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Seventy-one ground-level enhancements (GLEs) in the counting rates of cosmic-ray detectors, due to outbursts of solar energetic particles, have been observed since 1942.

It is well-known that these events are associated with solar flares and coronal mass ejections (CMEs), and that they originate primarily from western longitudes on the surface of the sun. In addition, studies of the time structure of these events generally classify them as “prompt” or “gradual”. The spectral shape and anisotropy of these events provide signatures of the acceleration mechanism and the subsequent propagation conditions.

McCracken et al., *ApJ*, 761:101, (2012) described a data base of all these 71 events, including observations of all the detectors that recorded them. These observations are used in this paper to study the time structure of the GLE pulses in greater detail than before. For each event we record the maximum increase, the time-to-maximum, the time to decay to 50% from the maximum, and the longitude of the inferred origin of the event. We then interpret these properties in terms of a simple diffusive model. The results indicate that there is a continuous range of pulses ranging from prompt to gradual, that the most prompt ones come from the latitude range 30 to 60 degrees west solar longitude, that the relationship between rise and decay time of the pulses confirms their diffusive propagation, and that reasonable estimates of the cosmic-ray diffusion mean free path between the sun and earth can be derived from this.

The details of the diffusive model indicate that the injection phase makes up a significant fraction of the duration of the events, and that they cannot be described as simple point-explosions.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

66

Parallel NU 04 / 1217

Overview of the Third Flight of the ANITA Long-duration Balloon Payload

Author: Peter Gorham¹

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¹ *University of Hawaii, for the ANITA collaboration*

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We present an overview of the third flight of the NASA-sponsored long-duration balloon payload known as the Antarctic Impulsive Transient Antenna (ANITA). ANITA-III was launched on December

17, 2014, and terminated January 8, 2015, after about 22 days of successful observations at float.

ANITA’s primary goal is the search for ultra-high energy neutrinos, but ANITA is also sensitive to radio impulses from ultra-high energy cosmic ray air showers over Antarctica. We will summarize the

flight operations and data acquired, and present some preliminary highlights of the flight, as well as the outlook for the fourth ANITA flight, scheduled for late 2016.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

1217

Parallel GA13 Future / 1397

The small size telescope projects for the Cherenkov Telescope Array

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The small size telescopes (SSTs), spread over an area of several square km, dominate the CTA sensitivity in the photon energy range from a few TeV to over 100 TeV, enabling for the first time detailed exploration of the very high energy gamma-ray sky. The proposed telescopes are innovative designs providing a wide field of view. Two of them, ASTRI and GCT, are based on dual mirror Schwarzschild-Couder optics, with primary mirror diameters of 4 m. The third, SST-1M, is a Davies-Cotton design with a 4 m diameter mirror. Progress with the construction and testing of prototypes of these telescopes is presented. The SST cameras use silicon photomultipliers, with preamplifier and readout/trigger

electronics designed to optimize the performance of these sensors for imaging atmospheric Cherenkov light. The status of the camera developments is discussed. The SST sub-array will consist of about 70 telescopes at the CTA southern site. Current plans for the implementation of the array are presented.

Collaboration:

CTA

Registration number following "ICRC2015-I":

129

Parallel CR14 Hadr Int / 1095

First result of the proton-air cross section of the Telescope Array experiment.

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In this work we report on the measurement of the proton-air inelastic cross section $\sigma_{p\text{-air}}^{\text{inel}}$ using data collected by the Telescope Array (TA) detector. Based on the measurement of $\sigma_{p\text{-air}}^{\text{inel}}$, the proton-proton cross section $\sigma_{p\text{-p}}$ is subsequently inferred using the Glauber Formalism and the QCD-inspired fit of Block, Halzen and Stanev, at a center of mass energy of 95 TeV. The use of cosmic ray events at ultra high energies enables the measurement of this fundamental quantity at energies currently inaccessible with particle accelerators. The data used in this report was collected

over five years using hybrid events from the TA Middle Drum fluorescence detector as well as the TA surface detector array.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

1086

Parallel SH05 GLEs & FDs / 428

Observations and Monte Carlo Simulation of the Princess Sirindhorn Neutron Monitor at a Vertical Rigidity Cutoff of 16.8 GV

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Neutron monitors (NMs) are large ground-based instruments for precise time tracking of the variations in the Galactic cosmic ray (GCR) flux at the GeV-range. NMs count the secondary particles (mostly neutrons) issued from the interaction of the cosmic rays in the Earth's atmosphere. The sensitivity to GCR variations depends on the geomagnetic cutoff at the location of measurement as well as on the altitude of detection. Since late 2007, the Princess Sirindhorn Neutron Monitor (PSNM), at the summit of Doi Inthanon, Thailand's highest mountain (2565 m altitude), has recorded the flux of galactic cosmic rays with the world's highest vertical rigidity cutoff for a fixed station, 16.8 GV. We present here the observations of PSNM since the beginning of its operation. We have also developed Monte Carlo simulations of cosmic ray interactions in the atmosphere and in PSNM (with its surroundings), that includes the tracing of cosmic ray trajectories through Earth's magnetic field to model the cosmic ray suppression at low rigidity at the location of PSNM. The simulation shows a fairly good agreement with the data and the variations of the GCR spectrum, such as the solar modulation, are investigated for the first time with a fixed ground-based NM at a such high geomagnetic cutoff. That expands the range in energy of the worldwide NM network's sensitivity. Partially supported by a postdoctoral fellowship from Mahidol University and the Thailand Research Fund.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

399

Parallel CR13 EX EAS / 1346

Fluorescence Detection of Cosmic Ray Air Showers Between $10^{16.5}$

eV and $10^{18.5}$ eV with the Telescope Array Low Energy Extension (TALE)

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Abstract:

The TA Collaboration has completed construction of a low-energy extension to its Middle Drum telescope station. Ten new telescopes were added observing 31-59 degrees in elevation above the original telescopes. A graded array of scintillators with spacing 400-600-1200m is being installed in the space in front of the telescope station. With these upgrades, the physics threshold will be lowered below $10^{16.5}$ eV. The TA Low Energy Extension (TALE) will explore the regime corresponding to the LHC center-of-mass energy. This is also where the transition from galactic to extra-galactic cosmic ray flux is suspected to occur. A brief overview of the physics will be presented as well as a report on the progress toward measuring the cosmic ray spectrum between $10^{16.5}$ eV and $10^{18.5}$ eV.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

1001

Parallel CR14 Hadr Int / 797

Measurement of the muon content in air showers at the Pierre Auger Observatory

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The muon content of extensive air showers is an observable sensitive to the primary composition and to the hadronic interaction properties. We present here different methods which allow us to estimate the muon number at the ground level and the muon production depth by exploiting the measurement of the longitudinal, lateral and temporal distribution of particles in air showers recorded at the Pierre Auger Observatory. The results, obtained at about 10^{19} eV ($E_{\text{CM}} \sim 140$ TeV center-of-mass energy for proton primaries), are compared to the predictions of LHC-tuned hadronic interaction models with different primary masses and suggest a deficit in the muon content at the ground predicted by simulations. The Pierre Auger Observatory is the only hybrid detector sensitive to muons and the combination of these results with other independent mass composition analyses such as X_{max} provides additional constraints on hadronic interaction models.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

690

Parallel SH05 GLEs & FDs / 546

The mini neutron monitor programme

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Two small neutron monitors were built in 2002 to intercalibrate the approximately 40 stationary neutron monitors around the world, in order to study the modulation of cosmic rays derived from the resulting differential response functions. Due to electronic development during the past decade, the electronics heads were redesigned in 2011 and due to cheaper and more efficient counter tubes, the vision broadened to the concept of a mini neutron monitor, i.e. a permanent detector in its own right. Such instruments can attain counting rates similar to those of standard neutron monitors if they are placed at mountain locations of > 3 000 m. Currently, three such high-altitude mini neutron monitor are operational. One operates at sea level, and one is used on the research vessel Polarstern to measure the instrument's latitude response, from which its rigidity response can be calculated. Progress with these instruments is reported elsewhere in the conference.

This contribution describes the newest versions of the mini neutron monitors, i.e., the various counter tubes that are available commercially, different configurations of lead producers, and it investigates how a more efficient second-generation network of neutron monitors can be deployed at high-altitude locations in existing buildings, using their already-installed infrastructure.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0495

Parallel CR13 EX EAS / 572

Burst Shower Events Observed by the Telescope Array Surface Detector

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Co-authors: Akimichi Taketa²; Eiji Kido²; Hiroyuki Sagawa²; Hisao Tokuno²; John Belz³; Kazumasa Kawata²; Masahiro Takeda²; Masaki Fukushima²; Nobuyuki Sakurai⁴; Toshiyuki Nonaka²; William Hanlon³

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The Telescope Array (TA) Surface particle Detector (TASD) has observed short time bursts of air-shower like events. Correlations were found between these burst events and lightning data. We report on the observed bursts of air-shower like events and their correlation with lightning.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

518

Parallel NU 04 / 637

Neutrino point source search including cascade events with the ANTARES neutrino telescope

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ANTARES is the largest neutrino telescope in the Northern Hemisphere. It has been taking data since 2007. One of the prime objectives is the detection and identification of cosmic neutrino sources in the TeV to PeV energy regime. ANTARES has established excellent pointing resolution for muon neutrinos (0.4 deg). Recently, we achieved good pointing capabilities also for contained cascade events (~2 deg), which opens up the possibility for all-flavour cosmic point source searches. Together with its geographical location, this makes ANTARES an excellent/competing tool to test for the presence of cosmic sources in the Southern Hemisphere, including the area around the Galactic Centre, where IceCube reports a slight excess.

In this contribution, we briefly discuss the method to measure the shower energy and direction, which yields degree-level resolutions. We will also present the latest time-integrated point source search results, which incorporate cascade events alongside the muon-neutrinos, and the impact on the interpretation of the IceCube signal.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

561

Parallel GA13 Future / 318

Status of the Medium-Sized Telescopes for the Cherenkov Telescope Array

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CTA, the Cherenkov Telescope Array, is an international project for the next generation ground-based observatory for gamma-ray astronomy in the energy range from 20 GeV to 300 TeV. The sensitivity in the core energy range will be dominated by up to 40 Medium-Sized Telescopes (MSTs).

The MSTs, of Davies-Cotton type with a 12m diameter reflector are currently in the prototype phase. A full-size mechanical prototype has been constructed in Berlin. Different prototype mirrors have been developed, tested and are mounted on the prototype. A report concentrating on aspects of the design, commissioning and performance of the telescope structure, the drive and the optics of the MSTs will be given.

Collaboration:

CTA

Registration number following "ICRC2015-I":

0329

Parallel SH05 GLEs & FDs / 21

A New neutron monitor yield function computed for different altitudes: Application for a GLE analysis

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At present the world wide neutron monitor (NM) network provides continuous information about cosmic ray (CR) variations in the vicinity of Earth. In addition, analyses of ground level enhancements (GLEs) are also based on the NM data records. It is important to have precise information for the NM yield function for primary CRs, which is crucial for an analysis of GLEs. Here we present a newly computed yield function of the standard sea-level 6NM64 neutron monitor for primary proton and alpha CR nuclei. In addition, we present new computations for the altitudes of 3000 m and 5000 m above the sea level. The computations have been carried out with Planetocosmics and CORSIKA codes as standardized Monte-Carlo tools for atmospheric cascade simulations. The flux of secondary neutrons and protons was computed using the Planetocosmics code. A realistic curved atmospheric model was applied. An updated information concerning the NM registration efficiency for secondary neutrons and protons was used. The NM yield function is obtained by convolution of the secondary particle flux with the NM registration efficiency. The effect of the geometrical correction of the NM effective area is considered. The new computation allow us to consider all the NMs in a realistic way, leading to a precise estimation of the spectral and angular characteristics of GLE particles. The obtained results are compared with the previously obtained ones using the double attenuation method.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

17

Parallel CR14 Hadr Int / 1162

Combined analysis of accelerator and ultra-high energy cosmic ray data

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The complexity of the development of extensive air showers makes it extremely difficult to study the nature and the sources of cosmic rays at ultra-high energies. The largest uncertainties are related to the modelling of hadronic interactions in the air shower cascade. The sensitivity to the theoretical description is maximised when measurements in the forward phase-space at accelerators are combined with measurements based on cosmic ray data. So far, this method has never been applied to constrain interaction models. Here, we outline a strategy to find an optimal global description of the underlying physics, ultimately leading to a consistent understanding of astrophysics as well as hadronic interaction physics at ultra-high energies.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

345

Parallel CR13 EX EAS / 1185

Cosmic Rays Energy Spectrum observed by the TALE detector using Cerenkov light

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We report on a cosmic ray energy spectrum measurement by the Telescope Array Low-Energy extension (TALE) fluorescence detector (FD). The TALE FD is an air fluorescence detector which is also sensitive to the Cerenkov light produced by shower particles. Low energy cosmic rays, in the PeV energy range, are detectable by TALE as "Cerenkov Events". Using these events, we measure the energy spectrum from a low energy of ~ 4 PeV to an energy greater than 100 PeV. In this talk, we will describe the detector, explain the technique, and present results from a first measurement of the spectrum in this energy range.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

931

Parallel NU 04 / 1121

Updates on the neutrino and photon limits from the Pierre Auger Observatory

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Ultra-high energy neutrinos and photons, with energies above 1 EeV and 10 EeV respectively, can be detected with the Surface Detector array (SD) of the Pierre Auger Observatory. Downward-going neutrinos of all flavours interacting in the atmosphere at zenith angles larger than 60 degrees, as well as upward-going tau neutrinos ("Earth-skimming") can be identified through the broad time-structure of the signals expected to be induced in the SD stations. In the absence of candidates in data from January 2004 until June 2013, an updated and stringent limit to the diffuse flux of ultra-high energy (UHE) neutrinos is computed. The sensitivity is improved with respect to the latest published results due to the additional data, the combination of the Earth-Skimming and downward-going searches, and the improved calculation of the exposure to UHE neutrinos. The photon search analysis uses SD observables sensitive to the mass composition of the primary particle. Compared to the hadronic background, photon-induced showers show a steeper lateral distribution of secondary particles at ground level and a larger spread in their arrival times. Upper limits on the diffuse flux of UHE photons and neutrinos are set in the hypothesis of an E^{-2} spectrum.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

698

Parallel GA13 Future / 197

Status of the Cherenkov Telescope Array Large Size Telescopes

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The Cherenkov Telescope Array (CTA) observatory, will be deployed over two sites in the northern and southern hemispheres. Both sites will be equipped with four Large Size Telescopes (LSTs), which are crucial to achieve the science goals of CTA in the 20-200 GeV energy range. Each LST is equipped with a primary tessellated mirror dish of 23 m diameter, supported by a structure made mainly of carbon fibre reinforced plastic tubes and aluminum joints. This solution guarantees light weight (around 100 tons), essential for fast slewing to any position of the sky in <20 seconds. The camera is composed by 1855 PMTs and is integrated with the control, readout and trigger electronics. Detailed design is basically complete and production of the first LST, which will serve as a prototype for the remaining seven, is well underway. The first LST will be installed at the Roque de los Muchachos Observatory in the Canary island La Palma (Spain) in 2016. In this talk

we will outline the technical solutions adopted to fulfill the design requirements, present results of element prototyping and describe the installation and operation plans.

Collaboration:

CTA

Registration number following "ICRC2015-I":

867

Parallel NU 04 / 187

Results of neutrino point source searches with 2008-2014 IceCube data above 10 TeV

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The emphasis on point source searches for astrophysical neutrinos has recently been strengthened by the unambiguous detection of high-energy astrophysical neutrinos by IceCube. So far the limited statistics and angular resolution of the relevant analyses do not resolve more than an isotropic emission of astrophysical neutrinos. We present the results of searches for point source neutrino emission using six years of integrated IceCube livetime, of which three years use the completed IceCube detector. Focusing on track-like events induced by charged-current muon-neutrinos, we attain a large statistics sample of more than 650,000 event candidates on the full sky with median angular resolution from 1° down to 0.4°, improving with higher energy. For the Southern hemisphere, the main background consists of bundles of muons created in extensive air-showers, whereas the Northern Hemisphere is dominated by neutrinos created in extensive air showers. With the hard energy spectrum observed in the diffuse astrophysical flux, a possible signal can be identified at high neutrino energy. Using an unbinned likelihood maximisation search for local clustering, IceCube is sensitive to sources in the Northern sky substantially below $10^{-12} \text{TeV}^{-1} \text{cm}^{-2} \text{s}^{-1}$ for a benchmark E^{-2} -spectrum. We report about the status of these searches and the implications on the nature of the observed flux as well as single source candidates.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

1139

Parallel CR13 EX EAS / 254

The spectrum of cosmic rays in the energy range 10^{16} – 10^{18} eV according to the Small Cherenkov Array in Yakutsk

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The experimental data on the energy spectrum cosmic rays, obtained from Small Cherenkov Array in Yakutsk on the measurement of Cherenkov radiation in showers with energy 10^{15} – 10^{18} eV are discussed. The data were obtained by means of continuous array operation since 1994. Found that the spectrum of the all particle in this energy region has a complex shape and cannot be described by a simple exponential function with a single slope indicator g . After the first kink at energy $3 \cdot 10^{15}$ eV (knee), the spectrum becomes steeper at $Dg = 0.4$ to energy $< 2 \cdot 10^{16}$ eV, then part of the spectrum to $> 8 \cdot 10^{16}$ eV becomes flat, the slope of the spectrum is $g = 2.92 \pm 0.03$ and then again changes slope to $Dg = 0.32 \pm 0.05$, since about energy $\sim 2 \cdot 10^{17}$ eV. The second kink in the spectrum observed at the Yakutsk EAS array at $\sim 2 \cdot 10^{17}$ eV, or also called second knee is the significant result for space astrophysics of ultra-high cosmic rays. In this paper we discuss possible scenarios for spectrum formation of cosmic rays by the galactic sources to energies $< 10^{17}$ eV, mainly supernovae remnants SNR and Metagalactic origins in the energy range 10^{17} – 10^{18} eV. Most likely, that measurement of second knee is related with transitional region, galactic to extragalactic origin of cosmic rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

273

Parallel SH05 GLEs & FDs / 1038

Variations of the vertical cutoff rigidities for the world wide neutron monitor network over the period of continues monitoring of cosmic rays

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Vertical cutoff rigidities for the world wide neutron monitor network are obtained with one year resolution during the period of 1950-2015 by the method of trajectory calculations. The models of Definitive Geomagnetic Reference Field and International Geomagnetic Reference Field have been used for 1950-2010 and 2015 correspondingly. Besides, cutoff rigidities for the whole period were obtained using model by Tsyganenko Ts89 with involving yearly mean values of Kp index. In each case an estimation of penumbra contribution was made in approximation of flat and low spectra (0 and -1) of cosmic ray variations. The results testify total decrease of cut off rigidities practically in the all locations, which is apparently connected to the common decrease of magnetic field in a considered period.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0754

Parallel CR14 Hadr Int / 670

Testing hadronic interaction models with the attenuation length of muons in KASCADE-Grande

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Preliminary analyses of air-shower data from the KASCADE-Grande observatory have pointed out a possible discrepancy between the predicted and the measured values of the attenuation length of muons

with energy threshold of 230 MeV at ground level in air showers. In particular, the analyses suggest that the measured muon attenuation length, as reconstructed with the constant intensity cut method,

could be larger than the expected values from the QGSJET-II-2, QGSJET-II-04, SIBYLL 2.1 and EPOS 1.99 hadronic interaction models for showers with energies between $10^{16.3}$ and $10^{17.3}$ eV. In this contribution, we investigate the aforementioned anomaly using a more detailed analysis than in previous works. The study involves the identification and the calculation of the most relevant systematic uncertainties affecting both measurements and simulations. From the results of this analysis, we show that the predictions from the modern high-energy hadronic interaction models on the muon attenuation length are not statistically consistent with the measured value at KASCADE-Grande.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I/":

0402

Parallel SH05 GLEs & FDs / 1277

South Pole Neutron Monitor Sensitivity to Geomagnetic Field Variations

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Secular variation of the Earth's geomagnetic fields is well known to change the cutoff rigidity, and thereby the count rate of low latitude neutron monitors. Such changes are generally assumed to be

irrelevant to so called atmosphere limited neutron monitors at high latitudes. We have documented a secular change in the count rate of the neutron monitor at Amundsen –Scott Station, located at the geographic South Pole. This monitor is conventionally assumed to be atmosphere limited, but the combination of low cutoff and high altitude is unique within the worldwide network of monitors. We are constructing a more accurate model of secondary particle production in this environment. Using this model we present a new prediction of the sensitivity of the South Pole Neutron Monitor to changes in the geomagnetic field over a 40 year period.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

160

Parallel CR14 Hadr Int / 1233

Investigation of hadronic interaction models from *10TeV to 1 PeV with the Tibet AS-core data

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A hybrid experiment has been started by the Tibet ASy collaboration in Tibet, China, since May 2009. It consists of a burst-detector-grid (YAC : Yangbajing Air- shower Core-array) and the Tibet-III AS array. The Tibet-III array is used to measure the total energy and the arrival direction of air-showers, and YAC-I can observe high-energy shower particles in air-shower cores. By comparing the MC data with our experimental data, we examine hadronic interaction models currently used for AS simulation code CORSIKA(ver.7.3500) and the detector simulation code Geant4 (version 9.5). In this paper, the results on the check of interaction models from *10 TeV to 1 PeV energy region will be reported based on the data taken by YAC-I and Tibet-III during the period from May 2009 through February 2010.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

945

Parallel GA13 Future / 904

Design highlights and status of the LHAASO project

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The Large High Altitude Air Shower Observatory (LHAA-SO) project plans to build a hybrid extensive air shower (EAS) array with an area of 1 km^2 at an altitude of 4410 m asl in Sichuan province, China, aiming for very high energy gamma ray astronomy and cosmic ray physics around the spectrum knees. With a sensitivity of 1% Crab unit, the LHAA-SO will survey the entire northern sky for gamma ray sources with full duty cycle. The spectra of all sources in its field of view will be measured simultaneously over a wide energy range from 300 GeV to 1 PeV. This measurement will offer a great opportunity for identifying cosmic ray origins among the sources. The LHAASO is also equipped with Cherenkov/fluorescence telescopes and in-filled burst detector array, so it will serve as the most effective detector for energy spectral measurement of different mass groups of cosmic rays.

In this contribution, the design highlights and status of LHAASO project are presented.

Collaboration:

LHAASO

Registration number following "ICRC2015-I/":

768

Parallel NU 04 / 544

A Search for Astrophysical Tau Neutrinos in Three Years of Ice-Cube Data

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The IceCube Neutrino Observatory has reported a diffuse flux of TeV-PeV astrophysical neutrinos in three years of data. The observation of tau neutrinos in the astrophysical neutrino signal is of great interest in determining the nature of astrophysical neutrino oscillations. Tau neutrinos become distinguishable from other flavors in IceCube at energies above a few hundred TeV, when the particle shower from the initial charged current interaction can be separated from the cascade from the tau decay: the two cascades are called a "double bang" signature. An analysis is presented which uses the digitized signal from individual IceCube sensors to resolve the two showers, in order to be sensitive to taus at as low an energy as possible. This is the first IceCube search to be more sensitive to tau neutrinos than to any other flavor. No candidate events were observed in three years of completed IceCube data. The resulting limit and prospects for future high energy tau neutrino searches, including a search for higher energy double bangs, will be discussed.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

1102

Parallel CR13 EX EAS / 446

Two Decades of KASCADE and KASCADE-Grande Measurements: Some Achievements

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At a few PeV the energy spectrum of high-energy cosmic rays exhibits a sudden change of the spectral index, usually known as the knee of the spectrum. The origin of this knee is seen as key for the understanding of galactic cosmic rays. KASCADE-Grande investigated with a multi-detector installation (including LOPES for measuring the radio emission of air showers) the elemental composition of cosmic rays in the energy region of the knee in detail. The history of KASCADE, the most important results, as well as the implications of these results for the understanding of cosmic ray physics will be summarized in this contribution. In addition, lessons learnt from KASCADE for future experiments will be discussed.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

313

Parallel SH05 GLEs & FDs / 1199

Investigations of Forbush decreases by means of muon hodoscope

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Investigations of Forbush decreases in a muon flux have certain peculiarities. First, muons are sensitive to the higher energies (relative to neutrons) of primary cosmic rays (PCRs), opening up new possibilities for studying the heliospheric perturbations responsible for the modulation of high energy PCRs. Second, muons save the direction of the primary particle motion, allowing to obtain the spatial-angular characteristics of cosmic ray modulation using just one facility. Such investigations are now possible, due to the muon hodoscopes that detect the flux of cosmic ray muons on the Earth's surface simultaneously from different directions (hodoscope mode). It's allows study the energy, angular and spatial-temporal characteristics of variations of the cosmic ray muon flux during Forbush decrease (FD). For that, an especial research methodology was developed. The results of the analysis of the FDs registered by means of URAGAN in the period from 2006 to 2013 are presented. With the help of a single methodology, decrease the amplitudes of the intensity of the cosmic ray muon flux in dependence on the energy of the primary particles in the region above 10 GeV are obtained, and their changes at different phases of development of the FD are investigated. Based on the analysis of spatial and angular variations of the muon flux unique "muon snapshots", values of vector of the local anisotropy and correlations between its projections on the South and East are obtained.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

48

Parallel NU 04 / 1293

First cosmogenic neutrino limits from two full ARA detector stations at South Pole

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The Askaryan Radio Array (ARA) is an ultra-high energy (>100 PeV) cosmic neutrino detector which is in phased construction near the South Pole. ARA searches for radio Cherenkov-like emission from particle cascades induced by neutrino interactions in the ice using radio frequency antennas (~150-800 MHz) deployed at a design depth of 200m in the Antarctic ice. A prototype ARA Testbed station was deployed at ~30m depth in the 2010-2011 season and the first three full ARA stations were deployed in the 2011-2012 and 2012-2013 seasons. We present the first neutrino search with ARA using data taken in 2013 with the first full ARA stations along with the resulting constraints on the neutrino flux from 100 PeV to 100 EeV.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

979

Parallel CR13 EX EAS / 136

Status of the first phase of the Alborz Observatory Array: Alborz-I

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Alborz-I as the first phase of the Alborz Observatory Array supposed to study the cosmic ray spectrum around the knee at Sharif University of Technology, Tehran (1200 m a.s.l). In this paper theoretical results obtained from study of the design features, performance, technical characteristic and angular resolution of the Alborz-I consists of 20 scintillator detectors are described. Using a Monte Carlo simulations of showers, the rate of detected events per day and the trigger probability functions are presented for energies around the knee and zenith angles up to 60°. Moreover, the angular

resolution of the array in the energy of $\sim 3 \times 10^{14}$ eV, which contains the most rate of detected events, is estimated.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

149

Parallel CR14 Hadr Int / 363

Surface muons in IceTop

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IceTop, the surface component of the IceCube detector, has been used to measure the energy spectrum of cosmic rays from 1.6 PeV to 1.3 EeV. It was recently shown that the recorded data can also be used to measure the average density of GeV muons in the shower front at large radial distances (> 300 m) from the shower axis. The analysis is based on fitting the single muon peak in charge histograms build over many events. The single muon peak is theoretically well understood and stands out above the electromagnetic background at large distances. Since the analysis can be done in several radial intervals, we effectively extract the average muon lateral distribution function from data (μ -LDF). The amplitude of the μ -LDF is connected to the average mass of cosmic rays.

We will present the measurement of the μ -LDF for cosmic rays with energies from 1.6 PeV and to about 0.1 EeV and compare it to proton and iron simulations. By combining the μ -LDF with complementary mass-sensitive observables, we expect to significantly reduce systematic uncertainties in the inferred mass composition of cosmic rays due to theoretical uncertainties in hadronic interaction models.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

1044

Parallel GA13 Future / 121

MACHETE: A transit Imaging Atmospheric Cherenkov Telescope to survey half of the VHE gamma ray sky

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Current Cherenkov Telescopes for VHE gamma ray astrophysics are pointing instruments with a field of view up to a few tens of sq.deg. We propose to build an array of two non-steerable telescopes with a FOV of 5 x 60 sq.deg oriented along the meridian. Roughly half of the sky drifts through this FOV in a year. We have performed a MC simulation to estimate the performance of this instrument, which we dub MACHETE. The sensitivity that MACHETE would achieve after 5 years of operation for every source in this half of the sky is comparable to the sensitivity that a current IACT achieves for a specific source after a 50 h devoted observation. The analysis energy threshold would be ~150 GeV and the angular resolution ~0.1 deg. For astronomical objects that transit over MACHETE for a specific night, it would achieve an integral sensitivity of 8% of crab in a night. This makes MACHETE a powerful tool to trigger observations of variable sources at VHE or any other wavelengths.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

62

Parallel GA13 Future / 264

ROBAST: Development of a Non-sequential Ray-tracing Simulation Library and its Applications in the Cherenkov Telescope Array

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We have developed a non-sequential ray-tracing simulation library, ROot-BAsed Simulator for ray Tracing (ROBAST), which is aimed to be widely used in optical simulations of cosmic-ray and gamma-ray telescopes. The library is written in C++, and fully utilizes the geometry library of the ROOT analysis framework. In spite of the importance of optics simulations in cosmic-ray experiments, there has never existed any open-source software for ray-tracing simulations that can be widely used in the community. In order to reduce the dispensable effort needed to develop multiple ray-tracing simulators by different research groups we have successfully used ROBAST for many years to perform optics simulations for the Cherenkov Telescope Array (CTA). Among the proposed telescope designs for the CTA, ROBAST is currently used for 3 telescopes: the Schwarzschild-Couder Medium-Sized Telescope (SC-MST), the Schwarzschild-Couder Small-Sized Telescope (SC-SST), and the Large-Sized Telescope (LST). ROBAST is also used for simulations and development of hexagonal light concentrators proposed for the LST focal plane. Making full use of the ROOT geometry library with additional ROBAST classes, we are able to build complex optics geometries typically used in cosmic-ray experiments and ground-based gamma-ray telescopes. In this contribution we introduce ROBAST and its features developed for cosmic-ray experiments, and show several successful applications for the CTA.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

278

Parallel SH05 GLEs & FDs / 183

A study of Forbush Decreases with a 3-D cosmic ray modulation model

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We have constructed a 3-D numerical model for studying Forbush Decreases (FDs) in the heliosphere. It incorporates 3-D propagation barriers, with enhanced cooling inside, into a time-dependent Parker type modulation model using a Stochastic Differential Equation (SDE) approach. This numerical model simultaneously takes into account the effect of solar wind convection, regular drift plus current sheet drift, parallel and perpendicular diffusion and adiabatic energy changes. This state-of-art numerical model enables us to find and study some new 3-D features for FD type events: 1. The cosmic ray intensity at Earth varies depending on the relative location of the Earth to the current sheet, and is reflected also in the amplitude of the FDs. The local modulation conditions, at a given observational point, determine the total amplitude. 2. The radial, latitudinal and longitudinal extent of a diffusion barrier significantly affects the amplitude of a FD. 3. The recovery time of a FD, at a given observational location, is determined by the modulation conditions which the corresponding propagation barrier encounters as it moves outwards in the heliosphere.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

196

Parallel CR13 EX EAS / 214

LAGO: the Latin American Giant Observatory

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The Latin American Giant Observatory (LAGO) is an extended cosmic ray observatory composed by a network of water-Cherenkov detectors (WCDs) spanning over different sites located at significantly different altitudes (from sea level up to more than 5000\,m a.s.l.) and latitudes across Latin America, covering a huge range of geomagnetic rigidity cut-offs and atmospheric absorption/reaction levels. This detection network is designed to measure the temporal evolution of the radiation flux at ground level with extreme detail.

The LAGO project is mainly oriented to perform basic research in three branches: high energy phenomena, space weather and atmospheric radiation at ground level. LAGO is built and operated by the LAGO Collaboration, a non-centralized collaborative union of more than 30 institutions from ten countries, and is aiming at developing Astroparticle Physics in Latin America.

In this work, the several scientific and academic programs that are conducted within the LAGO framework, its present status and future perspectives will be described.

Collaboration:

LAGO

Registration number following "ICRC2015-I":

713

Parallel NU 04 / 734

Correlation between the UHECRs measured by the Pierre Auger Observatory and Telescope Array and neutrino candidate events from IceCube

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Co-authors: Esteban Roulet²; Geraldina Golup²; Hiroyuki Sagawa³; Julien Aublin⁴; Lorenzo Caccianiga⁴; Michael Unger⁵; Mohamed Rameez¹; Peter Tinyakov⁶; Piera Luisa Ghia⁴; Teresa Montaruli¹

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We present the results of three searches for correlations between UHECR events measured by Telescope Array and the Pierre Auger Observatory and high-energy neutrino candidate events from IceCube. Two cross-correlation analyses of UHECRs are done: one with 28 cascades from the IceCube high-energy starting events sample and the other one with 12 high-energy tracks. The angular separation between the arrival directions of neutrinos and UHECRs is scanned. The same events are also used in a separate search stacking the neutrino arrival directions and using a maximum likelihood approach. We assume UHECR magnetic deflections inversely proportional to the energy with values 3° , 6° and 9° at 100 EeV to account for the uncertainties on the magnetic fields and UHECR charges. A similar analysis is performed on stacked UHECR arrival directions and the IceCube 4-year sample of through-going muon-track events that was optimized for neutrino point source searches.

Collaboration:

IceCube & Pierre Auger & Telescope Array

Registration number following "ICRC2015-I":

346

Parallel CR14 Hadr Int / 980

A universal description of temporal and lateral distributions of ground particles in extensive air showers

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Extensive air showers are traditionally described with phenomenological models - often called Lateral Distribution Functions (LDFs) - of the density of particles at the ground and derived quantities. The concept of air shower universality aims at a deeper understanding of the shower development in the atmosphere by taking into account physical properties of different types of secondary particles. Our extended model is based on the well known universal behaviour of the electromagnetic as well as of the muonic component and of its accompanying electromagnetic halo. A fourth component of electromagnetic particles from pion decays close to the observation level is considered in addition. Eventually the model allows for a description of particle distributions at observation level as a function of a few macroscopic quantities: the total energy E , the depth of the shower maximum X_{\max} , the muon content N_{μ} and the geometry of the shower. The pure electromagnetic component is determined by E and X_{\max} while differences between hadronic interaction models and primary particles are absorbed in the muon scale, affecting the three remaining components. We will detail the basic concepts of the extended universal description of air showers and describe the application using the detector response of the water-Cherenkov detector array of the Pierre Auger Observatory as an example. Both, the signal response of particles and their time of arrival in the detectors are accounted for in the reconstruction. The universal parameterizations of the components allow us to estimate X_{\max} and N_{μ} event-by-event solely based on the measured footprint of the air shower at observation level. The shower maximum is reconstructed with a resolution of 30 – 50 g/cm² depending on energy and zenith angle of the shower. The applicability of the method, limitations and model dependence will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

330

High-Light Talks / 228

Connections between cosmic-ray physics, gamma-ray data analysis and Dark Matter detection

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In the first part, I present a detailed overview on recent results regarding modeling of cosmic-ray (CR) propagation in the Galaxy and in the Heliosphere.

In particular I focus on the necessity to go beyond the standard and simplified picture of uniform and homogeneous diffusion, showing that gamma-ray data point towards different propagation regimes in different regions of the Galaxy. I also sketch the impact of large-scale structure on CR observables. Concerning the propagation of the Heliosphere, I mention the necessity to consider a charge-dependent modulation scenario.

In the second part, I discuss several aspects regarding the recent claim of a gamma-ray excess in the Galactic center region, discussing in particular the interpretation in terms of Dark Matter, compared to other astrophysical interpretations.

I will emphasize the interplay between the non-trivial aspects of CR propagation discussed in the first part and the understanding of the GC excess origin. In particular, I will show in detail how the knowledge of the CR transport parameters and solar modulation is crucial to investigate the compatibility with other channels (namely antiprotons) and to provide alternative astrophysical interpretations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

245

High-Light Talks / 1374

Highlights from the Pierre Auger Observatory

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The Pierre Auger Observatory has been detecting ultra-high energy cosmic rays (UHECRs) for more than ten years. It presents the first “hybrid” observatory on the world’s largest scale, comprising a 3000 km² surface detector (SD) of 1600 water Cherenkov stations spaced 1500 m apart and four fluorescence detectors (FD) overlooking the array. It also now includes three high elevation fluorescence telescopes (HEAT) which overlook a 23.5 km² denser SD sub-array partly equipped with the AMIGA muon detectors, and a 17 km² array of 153 radio antennas (AERA), all of them aimed at extending the cosmic ray energy range down to 10¹⁷ eV. The analyses of data taken by these instruments (and their combination) have led to a multitude of results on UHECRs that will be highlighted. The updated high-precision measurement of the energy spectrum over more than three decades in energy is a good example of the power of using the combination of different detectors. The large accumulated exposure of more than 50000 km² sr yr and the large field of view have also allowed us to measure the flux in different regions of the sky for the first time. We have also measured the depth of the shower maximum down to 10¹⁷ eV for the first time, allowing us to extend by one decade in energy the mass composition sensitivity based on LHC-tuned shower models. The measured evolution of the flux and of the mass composition as a function of energy has permitted a detailed comparison of our data with a set of simple astrophysical models. While the depth of shower maximum as observed by the FD is the premier observable to infer the nature of the primaries, we have exploited observables with the SD as well. On the one hand, this has enabled us to search for UHE photons and neutrinos with unprecedented sensitivity. On the other hand, the study of observables such as the muon production depth, or the number of muons, or the asymmetry of the rise-time of the signals, has yielded a powerful probe of current air shower models at center-of-mass energies as high as 140 TeV, thus providing insights into hadronic interactions at these otherwise inaccessible energies. The new measurement of the proton-air cross-section, extended down to 10^{17.8} eV, is another example of the particle-physics capability of the Observatory. To complement the spectrum and mass measurements, we have studied the distribution of the arrival directions of the detected cosmic rays at different angular scales. By including in these studies for the first time cosmic rays with zenith angles up to 80°, the field of view has been extended to cover the declination range from -90° to +45°. At the highest energies, above 40 EeV, we have looked for small- to intermediate-scale anisotropies, both intrinsic ones and in correlation with potential astrophysical sources. We have also implemented different analyses to search for dipolar and quadrupolar large-scale anisotropies over four orders of magnitude in energy, above about 10¹⁶ eV.

The rich harvest of the first 10 years of operation has guided the Collaboration towards a plan for an upgrade of the Observatory. The rationale for this it and its status will also be presented.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

0000

High-Light Talks / 1184

On the connection of gamma rays from supernova remnants interacting with molecular clouds and cosmic ray ionization measured in the mm range

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Cosmic rays are an essential ingredient in the evolution of the interstellar medium, as they determine the ionisation level of the dense molecular gas where stars and planets form. In recent years, infrared and millimetre observations provided us with measurements of the cosmic ray ionisation rates in a number of molecular clouds. Such ionisation is mainly determined by cosmic rays in the MeV domain. Remarkably, in a handful of cases the clouds interact with supernova remnant shocks, and have also been detected in GeV and TeV gamma rays. The combination of these high and low-energy measurements will allow us to extract the spectrum of cosmic rays produced at the supernova remnant over an unprecedented energy range (more than six orders of magnitude!). This will constitute a crucial step towards the solution of the problem of the origin of cosmic rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

865

Public lecture / 1399

Victor Hess Lecture

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BlackHoleCam: The first image of a super massive black hole.

Gravity is successfully described by Einstein's theory of general relativity. One of its most fundamental predictions are black holes. Their defining, but as yet unproven, feature is the event horizon -

the point of no return where not even light can escape the grip of gravity. Supermassive black holes, with masses of millions to billions of suns, are suspected to lurk in the hearts of almost every major galaxy. They make themselves known as sources of intense radiation, ultra-fast plasma streams, and high-energy particles. The best place to study black holes is in the center of our own Milky Way. Due to its proximity of “only” 30.000 light years this is as close as we can get to a supermassive black hole. Using a global network of radio telescope it should be possible to image the shadow of the black hole’s event horizon for the first time ever. This would prove one of Einstein’s most fundamental predictions and shed light on what happens to matter falling into the abyss. This talk will take the audience on a trip into the center of the Milky Way, explain our current understanding of how black holes work, and describe the ongoing attempts to image them.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

hess

Invited Review Talks / 1383**Dark Matter Searches: Status and Prospects**

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Figuring out the nature of dark matter is one of the greatest questions in physics today. While we see its effect in a wide variety of astrophysical and cosmological measurements, a description of its composition and properties has remained elusive. The hunt for dark matter is taking place in three different and complimentary fronts: looking for the end products of potential dark matter annihilation, decay or other interactions with the standard model in the cosmos (indirect detection); looking for evidence of dark matter production at colliders, and looking for potential interactions between the local dark matter and laboratory detectors (direct detection). In this talk I will concentrate on direct detection. Our ignorance of the properties of dark matter imply that direct detection efforts must span a huge parameter space of dark matter mass and cross section. I will overview the current efforts to find dark matter, from extremely light axions to massive particles thousands of times heavier than the proton.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

1169

Invited Review Talks / 1385**Cosmic-ray acceleration and propagation**

Author: Damiano Caprioli¹

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The origin of cosmic rays (CRs) has puzzled scientists since the pioneering discovery by Victor Hess in 1912. In the last decade, however, modern supercomputers have opened a new window on the processes regulating astrophysical collisionless plasmas, allowing the study of CR acceleration via first-principles kinetic simulations; at the same time, new generations of X-ray and gamma-ray telescopes have been collecting evidence that Galactic CRs are accelerated in the blast waves of supernova remnants (SNRs).

I present state-of-the-art particle-in-cells simulations of non-relativistic shocks, in which ion and electron acceleration efficiency, and magnetic field amplification, are studied in detail as a function of the shock parameters. I then discuss the theoretical and observational counterparts of these findings, comparing them with predictions of diffusive shock acceleration theory, and with multi-wavelength observations of young SNRs; I especially outline some major open questions, such as the (possible) causes of the steep CR spectra inferred from gamma-ray observations of SNRs, and the origin of the knee in the Galactic CR spectrum. Finally, I put such a theoretical understanding in relation with CR propagation in the Galaxy, in order to bridge the gap between acceleration in sources and measurements of CRs at Earth.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1074

Parallel CR16 TH prop / 1105

Non-linear Cosmic Ray propagation close to the acceleration site

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Recent advances on gamma-ray observations from SuperNova Remnants and Molecular Clouds offer the possibility to study in detail the properties of the propagation of escaping Cosmic Rays (CR). However, a complete theory for CR transport outside the acceleration site has not been developed yet. Two physical processes are thought to be relevant to regulate the diffusion: the growth of waves caused by streaming instability, and possible wave damping mechanisms that reduce the growth of the turbulence. Only a few attempts have been made so far to incorporate these mechanisms in the theory. In this talk I present recent advances in this subject. In particular, I show results obtained by solving the coupled equations for the diffusion of CRs and the evolution of waves. I discuss the importance of streaming instabilities and wave damping in different ISM phases and for different CR energies.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

899

Parallel GA14 GAL / Bubbles etc / 379**Fermi Bubbles with HAWC****Authors:** C. Michelle Hui¹; Hugo Ayala¹; Petra Huentemeyer²¹ *Michigan Technological University*² *urn:Google***Corresponding Author:** hayalaso@mtu.edu

The Fermi Bubbles, which comprise two large and homogeneous regions of spectrally hard gamma-ray emission extending up to 55° above and below the Galactic Center, were first noticed in GeV gamma-ray data from the Fermi Telescope in 2010. The mechanism or mechanisms which produce the observed hard spectrum are not understood. Although both hadronic and leptonic models can describe the spectrum of the bubbles, the leptonic model can also explain similar structures observed in microwave data from the WMAP and Planck satellites. Recent publications show that the spectrum of the Fermi Bubbles is well described by a power law with an exponential cutoff in the energy range of 100MeV to 500GeV. For Example, observing the Fermi Bubbles at higher gamma-ray energies would help to constraint the spectrum of the bubbles. A steeper cutoff will favor a leptonic model. The High Altitude Water Cherenkov (HAWC) Observatory, located 4100m above sea level in Mexico, is designed to measure high-energy gamma rays between 100GeV to 100TeV. With a large field of view and good sensitivity to spatially extended sources, HAWC is the best observatory suited to look for extended regions like the Fermi Bubbles. We will present results from a preliminary analysis of the Fermi Bubble visible to HAWC in the Galactic Northern Hemisphere.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

359

Parallel CR15 Direct/Aniso / 621**MAGNETOSPHERIC EFFECTS ON HIGH-ENERGY SOLAR PARTICLES DURING THE 2012 May 17th EVENT MEASURED WITH THE PAMELA EXPERIMENT****Author:** Matteo Martucci¹¹ *Laboratori Nazionali di Frascati***Corresponding Author:** matteo.martucci@roma2.infn.it

The great challenge in constraining scenarios for solar energetic particle (SEP) acceleration is due to the fact that the signatures of acceleration itself are heavily modified by transport within interplanetary space. During transport, SEPs are subject to pitch angle scattering by the turbulent magnetic

field, adiabatic focusing, or reflections magnetic structures. Ground Level Enhancements (GLEs) provide an ideal way to study acceleration with minimal transport. Their different morphologies has led many to believe that two distinct acceleration processes are at work. PAMELA (Payload for Antimatter-Matter Exploration and Light-nuclei Astrophysics) offers unique possibilities to study the link between the highest energy GLEs and the low-energy in-situ observations. It bridges a critical gap in energy while also providing pitch angle measurements above several GeVs. This has led to constraining, for the first time, the effects of transport over a broad range in energy. In this work, we present a unique high-energy SEP observation from PAMELA of the 2012 May 17 GLE and interpret the observed pitch angle distributions as a result of scattering in the magnetosheath.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

433

Parallel SH 06 Cycle & AMS / 697

Ultimate Spectrum of Solar/Stellar Cosmic Rays

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We reconstruct an ultimate spectrum of solar/stellar cosmic rays (SCR) in a given point in the heliosphere (stellar sphere) basing on maximal value of magnetic field strenght in active region and its characteristic linear dimension. An accelerator of given dimensions and magnetic field strengh may accelerate to a finite energy for a given time (a maximal energy of SCR). We will use spectrum of SCR proposed by Syrovatsky (1961) for relativistic and non-relativistic energies normaliszing it to galactic cosmic ray (GCR) intensity at maximal SCR energy. Maximal values of SCR flux propagating in the heliosphere are determined by equilibrium between pressure of interplanetary magnrtic field and dynamic pressure of SCR (Frier&Webber, 1963). The obtained spectra would be applied to explain the extreme solar particle event occurred in about 775 AD basing on the tree-ring chronology (Miyake et al., 2012).

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

612

Parallel GA15 Future / IN / 1078

Extending Fermi LAT discoveries with ComPair: Following the Energy in MeV Gamma-ray Astronomy

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The MeV domain is one of the most underexplored windows on the Universe, mainly due to the challenging nature of the measurements. This is an energy range of transition in the Universe. Thermal sources dominate at lower energies, while non-thermal phenomena prevail at higher energies. In addition, observations at both gamma-ray and hard X-ray energies provide compelling evidence of astrophysical objects whose radiative output peaks in the MeV range. Equally crucial is the strong evidence that spectral features such as breaks, turnovers, cutoffs, and temporal behavior, which are critical discriminating factors between competing physical models, occur within this energy band. In this paper we analyze these phenomena and define the science objectives for a future MeV gamma-ray mission, ComPair, using both Compton scattering and Pair Production detection techniques.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

890

Parallel GA14 GAL / Bubbles etc / 792

Giant Shocks in the Fermi Bubbles and the Origin of the Microwave Haze

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Co-authors: Andrew Taylor²; Ettore Carretti³; Geoffrey Bicknell¹

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Analysis of γ -ray data provided by the Fermi-LAT has revealed giant, hard-spectrum γ -ray lobes emanating from the Galactic nucleus (and extending to $|b| \sim 50^\circ$). These Fermi Bubbles' have hard-spectrum, total-intensity microwave (~ 20 -40 GHz) counterparts in their lower reaches (the microwave-Haze' extending to $|b| \sim 35^\circ$) and, on large scales, are subsumed by steep spectrum, polarised radio (2-20 GHz) structures (the 'S-PASS Lobes' extending to $|b| \sim 60^\circ$). We present a unified model for these disparate, non-thermal phenomena in which the Bubbles are inflated by a wind driven by star formation in the central molecular zone of the Galactic Center. Giant reverse shocks located ~ 1 kpc above and below the nucleus in the interior of the Bubbles accelerate relativistic electrons, accounting for the microwave haze associated with them. The γ -rays are produced by hadronic emission through shock accelerated relativistic protons interacting with dense, thermally unstable clouds within the Bubbles but concentrated near their edges. The Bubbles are currently slowly expanding, with ages of a few $\times 100$ Myr. Lower energy, non-thermal electrons accelerated at the shocks reach the edges of the Bubbles and escape from their upper regions accounting for the steep spectrum, polarized radio emission covering the Bubbles and pluming out beyond them at high Galactic latitudes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

692

Parallel CR16 TH prop / 1124

Models for cosmic ray transport in the era of AMS-02

Authors: Iris Gebauer^{None}; Simon Michael Kunz¹¹ *KIT - Karlsruhe Institute of Technology (DE)***Corresponding Author:** simon.michael.kunz@cern.ch

Transport models for galactic cosmic rays depend on a large number of parameters which are poorly known and can be constrained only through derived quantities by comparison with the observed spectra of various cosmic ray species. Numerical models as implemented in the DRAGON or GALPROP code describe a multitude of observations. However, degenerate solutions limit the predictive power of these models when applied to other observables.

This might be improved with the more precise AMS-02 data.

We use Markov chain Monte Carlo methods to investigate wide ranges of transport parameters. Solutions to the transport equation are obtained numerically by using the DRAGON software. A total amount of 15 Mio. solutions was generated. The predictions are compared to measurements of cosmic ray protons and nuclei using data from PAMELA, ACE, CREAM, ISOMAXX and HEAO. More than 13,000 models were found to have a maximum deviation from the data of 1 sigma averaged over all data points.

We find that even in low dimensional models no definite solution exists. Instead, the predictions of a multitude of strongly differing parameter combinations are conform to current measurements. In a subsequent analysis, the more precise AMS-02 data have been included. We discuss the impact of the AMS-02 data on transport parameter limits and comment on the model uncertainties originating from numerics, the gas distribution and nuclei fragmentation cross sections.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

905

Parallel SH 06 Cycle & AMS / 778

Unusual structure of sunspot cycle 24

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Smooth sunspot numbers (SSNs) for cycle 24 increased since onset in December 2008, developing a shoulder in 2012, a plateau in 2013 and a peak in October 2014 followed by a decay phase well after the solar polar magnetic fields reversed; polar field reversals usually occur near SSN maxima

but the polarity in northern hemisphere reversed in June 2012 and again in February 2014 while that in southern hemisphere reversed in June 2013. Present status of cycle 24 is described in terms of both SSNs and 10.7 cm (2800 MHz) microwave flux (F10.7) from the Sun and its activity is compared to prior cycles (14-23) of the twentieth century and cycle 5 that led to the Dalton grand minimum; cycle 14 led to a shallow Gleissberg minimum. SSNs for cycle 24 declined at a faster rate than F10.7 starting near cycle 21 minimum and F10.7 peak occurred two months after SSN peak. There is also a conspicuous excess of SSNs in southern hemisphere for cycle 24. Decay phase for both has now set in. The physical cause(es) for these differences are not known calling into question several assumptions how a typical sunspot cycle may develop. The physical significance of our findings is discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

94

Parallel GA15 Future / IN / 386

PANGU: A High Resolution Gamma-Ray Space Telescope

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PANGU (the PAir-production N Gamma-ray Unit) is a small astrophysics mission with wide field of view optimized for spectro-imaging, timing and polarisation studies. It will map the gamma-ray sky from 10 MeV to a few GeV with unprecedented spatial resolution. This window on the Universe is unique to detect photons emitted directly by relativistic particles, via the decay of neutral pions, or the annihilation or decay light from anti-matter and the putative light dark matter candidates. A wealth of questions can be probed among the most important themes of modern physics and astrophysics.

The PANGU instrument is a pair-conversion gamma-ray telescope based on an innovative design of a silicon strip tracker. It is light, compact and accurate. It consists of 100 layers of silicon micro-strip detector of 40 x 40 cm² in area, stacked to height of about 90 cm, and covered by a top anticoincidence detector. PANGU relies on multiple scattering effects for energy measurement, reaching an energy resolution between 30-50% for 10 MeV –1 GeV. The novel tracker will allow the first polarisation measurement and provide the best angular resolution ever obtained in the soft gamma ray and GeV band.

PANGU has been submitted as a candidate to the recent ESA-CAS Call for Joint Small Science Mission.

In this contribution, the key science objectives, the payload concept and the expected performance will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

362

Parallel CR15 Direct/Aniso / 1129

Study on CRE arrival distributions with PAMELA experiment

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From 2009, several experiments, like PAMELA, FERMI and AMS, have shown a rise in the fraction of positrons versus electrons+positrons. One of the most probable explanation is due to the presence of nearby sources, like SNRs or pulsars. PAMELA (Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics) is a balloon-borne experiment and is collecting data since 15 June 2006. Its quasi-polar orbit permits to perform a survey in each direction of the sky. The study of the arrival distribution of cosmic ray electrons and positrons from different regions allows the exploration of different origins for the excess.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

901

Parallel CR16 TH prop / 110

Escape model for Galactic cosmic rays

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We show that the cosmic ray (CR) knee can be entirely explained by energy-dependent CR leakage from the Milky Way, with an excellent fit to all existing data. We test this hypothesis calculating the trajectories of individual CRs in the Galactic magnetic field. We find that the CR escape time $t(E)$ exhibits a knee-like structure around $E/Z = \text{few} \times \text{PeV}$ for small coherence lengths and strengths of the turbulent magnetic field. The resulting intensities for different groups of nuclei are consistent with the ones determined by KASCADE and KASCADE-Grande, using simple power-laws as injection spectra, normalized to CREAM data. Thus the escape model describes successfully the data of individual groups of nuclei from $E/Z = \text{TeV}$ up to 0.1 EeV energies. The transition from Galactic to extragalactic CRs is terminated at $\approx 2 \text{ EeV}$, while extragalactic CRs contribute sizeable to the subdominant proton flux already for $> 20 \text{ PeV}$. The escape model provides a good fit to $\ln(A)$ data; it predicts that the phase of the CR dipole varies strongly in the energy range between 0.1 EeV and 3 EeV, in agreement with determinations of the phase by Auger. Our estimate for the dipole magnitude is consistent with observations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

623

Parallel SH 06 Cycle & AMS / 958

AMS-02 Monthly Proton Flux: Solar Modulation Effect and Short Time Scale Phenomena

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The Alpha Magnetic Spectrometer (AMS-02) is a high-energy particle detector designed to perform fundamental physics research in space. It was installed on the International Space Station (ISS) on May 19, 2011. During the first 30 months of operations, AMS-02 collected 41 billion events of primary cosmic rays between 1 GV and 1.8 TV.

In this work, we analyze the detailed time variation of the proton flux with a monthly time-based integration. While at high energy the spectra remains stable versus time, the low-energy range exhibits a decreasing general trend, strongly reflecting the increase of the solar activity that recently reached its maximum. The monthly AMS-02 proton flux, below 10 GV, shows fluctuations related to strong Coronal Mass Ejections. This short time scale variation is consistent with the one measured by GOES-13.

Collaboration:

AMS

Registration number following "ICRC2015-I":

808

Parallel CR15 Direct/Aniso / 1102

Direction and time dependent fluxes with AMS-02

Authors: Carmen Maria Merx¹; Iris Gebauer¹; Karen Grace Andeen¹; Nikolay Nikonov¹; Stefan Zeissler¹; Valerio Vagelli¹

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The Alpha Magnetic Spectrometer (AMS-02) is a state-of-the-art particle detector designed to operate as an external module on the International Space Station (ISS). In this unique space environment cosmic particles can be measured with high precision over an energy range from GeV up to a few TeV. In 2014, the AMS collaboration provided precise measurements of the electron and

positron fluxes, which indicate an additional source of positrons among the various cosmic particles. The arrival directions of energetic e^\pm in the range of hundreds of GeVs convey fundamental information on their origin, whereas low energy e^\pm in the MeV to tens of GeV range are subject to time dependent solar modulations.

We evaluate the AMS-02 detector acceptance as a function of incoming angle in the detector frame. Using the detector pointing information over the entire AMS-02 data taking period, we build time dependent skymaps in galactic coordinates of the e^\pm incoming directions, as well as time dependent reference maps. The latter simulate the expected AMS-02 measurement of isotropic fluxes. Our maps allow us to study possible anisotropies in the arrival directions of energetic e^\pm , as well as time and direction dependent effects at low energies due to the influence of the solar wind. This technique can be applied to protons and other cosmic ray species. We demonstrate the performance of the method using AMS-02 data.

Collaboration:

AMS

Registration number following "ICRC2015-I":

717

Parallel GA14 GAL / Bubbles etc / 825

Evidence for a hadronic origin of the Fermi Bubbles, formed by outflows from star-forming regions

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The Fermi-LAT 6-year data provide a detailed map of the diffuse gamma-ray sky for which the main contributions originate from neutral pion decay, bremsstrahlung and inverse Compton scattering. The energy spectra of these contributions are known from laboratory experiments and can be used as templates to fit the energy spectra of the Fermi data in each direction, thus providing the normalization, and hence the fluxes, for the various contributions in each direction. These contributions describe the data well, except for the regions of the Fermi Bubbles, the Galactic Bar and the spiral arms. In these regions one needs an additional component corresponding to the decay of neutral pions produced by CR nuclei with a spectral index of E^{-2} , which can be attributed to source cosmic rays (SCR), i.e. cosmic rays (CR) trapped inside the source and producing mainly pions in the enhanced gas density of the shock wave.

The hard E^{-2} spectrum is the hardest imaginable CR spectrum, predicted only for diffuse shock wave acceleration in supernova remnants (SNRs). The SCR interpretation is supported by the fact that i) the energetics of this contribution is consistent with a SNR rate of 3 per century and ii) the spatial distributions of this hard component coincides with the spatial distribution of 1.8 MeV gamma rays from ²⁶Al, a radioactive nucleus produced in SNRs as well. The morphology of the hard Fermi component and 1.8 MeV gamma rays shows in both cases clearly the imprint from the Galactic Bar and the tangent point of the nearest spiral arm.

The Fermi Bubbles have the same hard E^{-2} spectrum, suggesting that they are outflows from star-forming regions near the Galactic center with the CRs trapped inside this plasma. In this case the CR spectra are not softened by diffusion.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1096

Parallel GA15 Future / IN / 991

Balloon-Borne Experiment for Deep Sky Survey of MeV Gamma Rays using an Electron-Tracking Compton Camera

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Co-authors: Atsushi Takada¹; Dai Tomono¹; Hidetoshi Kubo¹; Joseph Parker¹; Kazuki Ueno¹; Kentaro Miuchi²; Kiseki Nakamura¹; Makoto Oda¹; Satoru Iwaki¹; Shinya Sonoda¹; Shogo Nakamura¹; Shohei Miyamoto¹; Shunsuke Kurosawa³; Taito Takemura¹; Tatuya Sawano¹; Tetsuro Kishimoto¹; Tetsuya Mizumoto¹; Toru Tanimori¹; Yoshihiro Matsuoka⁴; Yoshitaka Mizumura¹

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The observation of MeV celestial gamma rays provide us much information about various high energy phenomena. However, the sufficient observation has not yet been achieved due to the large radiation backgrounds and unclearness of Compton gamma-ray image.

To advance the MeV gamma-ray astronomy, we have developed an Electron-Tracking Compton Camera (ETCC) which consists of a gaseous Time Projection Chamber and pixel scintillator arrays. By measuring a three dimensional track of Compton recoil electron, we restrict the arrival direction of each incident photon to an arc segment. In addition, the energy loss rate of each track enables us to separate the Compton recoil electrons from background particles including neutrons efficiently. By these features, our ETCC has attained the higher-quality imaging and quite stronger background rejection than conventional MeV gamma-ray telescopes. Especially, the SPD angle, which is measured only from the direction of recoil electrons, reveals an excellent improvement of the contrast of image by a factor of >5. Thus, ETCC has resolved the above two obstacles for MeV astronomy.

To certificate the performance of an ETCC, we have carried out the balloon-borne experiments, "Sub-MeV gamma-ray Imaging Loaded-on-balloon Experiment"(SMILE) since 2006, and plan to observe the Crab and CygX-1 in 2016. The flight model of 30 cm-cubic ETCC was already completed, and several tests including the operation under the intense radiation condition by accelerator beams have been done. With the obtained results, the ETCC is expected to detect Crab Nebula with a significance of ~ 8 sigma level in several hours. By using the pressured CF4 based gas (3 atm), its detection efficiency will be increased one order, and we consider the long duration observation at the polar region for deep sky survey with a several times better sensitivity than COMPTEL.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

Parallel GA15 Future / IN / 775

POLAR: Gamma-Ray Burst Polarimetry onboard the Chinese Space-lab

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Co-authors: Aleksandra RUTCZYNSKA²; Ania Zwolinska²; B.B. Wu³; Catherine LECHANOINE-LELUC¹; Divic Rapin⁴; Dominik Rybka⁵; H.H. Xu³; H.L. Shi³; H.L. Xiao³; Ignacio Cernuda⁶; Ilia Britvitch⁷; J.C. Sun³; J.T. Liu³; J.Y. Ch³; Jacek Szabelski⁸; L.Y. Zhang³; Li Zhang³; Lu Li⁹; M.N. Kong⁹; Martin Pohl⁴; Neal Gauvin¹⁰; Nicolas Produit¹¹; R.J. Wang³; Radoslaw MARCINKOWSKI⁵; S.N. Zhang³; Silvio Orsi⁴; T.W. Bao³; Tadeusz Batsch²; Tancredi Bernasconi⁴; Wojtek Hajdas¹²; X. Liu³; X. Wen³; Y.J. Zhang³; Y.W. Dong³

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Polarimetry is a powerful tool to study the emission processes involved in high energy astrophysical events such as Gamma-Ray Bursts (GRBs). Despite the wealth of information which can be extracted from polarimetry measurements few have been performed successfully thus far. POLAR is a novel space-borne Compton polarimeter foreseen to be launched in 2016 on the Chinese spacelab TG-2. The instrument is designed for dedicated measurements of the hard X-ray polarisation of the prompt emission of GRBs in the energy range 50–500 keV. The polarisation degree and angle of a photon flux can be extracted by measuring the Compton scattering angles when the photons interact in a detector. The Compton scattering angles of the incoming photons are measured in POLAR using a finely segmented plastic scintillator array consisting of 1600 bars. The bars have a surface area of 6 by 6 mm and a length of 176 mm and are read out in groups of 64 by 25 flat-panel multi-anode photomultipliers. Due to its large granularity POLAR can measure the photon interaction locations, and therefore the scattering angles, with a high precision resulting in a relatively high modulation factor. The instrument furthermore has a relatively large effective area and a field of view of 1/3 of the sky thereby optimising it for studying GRBs. The instrument was shown through Geant4 simulations to be capable of performing measurements with a minimum detectable polarization below 10% for several GRBs per year. The flight model has recently been constructed and was tested extensively in recent months. The results from the instrument calibration measurements, performed using both radioactive sources and synchrotron facilities, and the results from the flight qualification tests will be presented along with the future prospects.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

Parallel SH 06 Cycle & AMS / 952

Trajectory reconstruction in the Earth Magnetosphere using TS05 model and evaluation of geomagnetic cutoff in AMS-02 data

Author: Davide Grandi¹

Co-authors: Bruna Bertucci²; Cecilia Pizzolotto²; Davide Rozza¹; Domenico D'Urso²; Emanuele Fiandrini²; Federico Donnini³; Francesco Nozzoli²; Giuseppe La Vacca¹; Mario Zannoni¹; Marta Crispoltoni²; Massimo Ger-vasi¹; Matteo Boschini⁴; Matteo Duranti²; Maura Graziani³; Mauro Tacconi¹; Pier-Giorgio Rancoita¹; Simonetta Pensotti⁵; Stefano Della Torre¹; Vincenzo Vitale²

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Our backtracing code (Geomagsphere), for Cosmic Rays trajectory reconstruction in the Earth Magnetosphere, has been developed using the latest models of Internal (IGRF-11) and External (Tsyganenko 1996 and 2005) field components. Backtracing technique was applied to AMS-02 data to separate Primary Cosmic Rays Particles from Secondary particles. We tested the accuracy of Magnetic Field models (with and without the external field component) comparing them with data from satellite (GOES, 1998 and CLUSTER, 2004). In both periods TS05 reproduces the magnetic field strength with good accuracy. Moreover the specificity of the TS05 model, designed for solar storms, was tested comparing it with data taken by CLUSTER during the last solar active period (from 2011 to 2013). We found a relevant difference on the fraction of AMS-02 cosmic rays identified as trapped and secondary particles, especially during Solar Flare periods (i.e. those occurred in March and May 2012). Finally the backtracing of a wide sample, more than 70 days, of AMS-02 proton data was used to get the real geomagnetic cutoff. We found an increased counting rate of primary particles at high latitudes with respect to the IGRF model. Besides we built a procedure to extract from data the rate of secondary particles.

Collaboration:

AMS

Registration number following "ICRC2015-I":

529

Parallel CR16 TH prop / 345

Diffuse gamma-ray and neutrino emissions of the Galaxy with spatial dependent cosmic-ray transport

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As recently shown, Fermi-LAT measurements of the diffuse gamma-ray emission of the Galaxy favor the presence of a smooth softening of the primary cosmic-ray spectrum with the Galactocentric distance. This result can be interpreted in terms of a spatial dependent rigidity scaling of the diffusion coefficient. The DRAGON code has been used to build a model which implements such feature reproducing latest Fermi-LAT results as well as local cosmic-ray measurements including PAMELA, AMS-02 and CREAM ones.

Here we show that if extrapolated at larger energies the model grasps the gamma-ray flux measured by MILAGRO at 15 TeV from the inner Galactic plane region as well as that measured by H.E.S.S. from the Galactic ridge. Furthermore, considering the presence of a large reservoir of gas in a very extended halo around the Galaxy, recently inferred from X-ray observations, we show as our model also predicts a neutrino emission which may account for a significant fraction, as well as for the spectral shape, of the astrophysical flux measured by IceCube above 25 TeV.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

343

Parallel GA14 GAL / Bubbles etc / 323

HAWC Observation of Supernova Remnants and Pulsar Wind Nebulae

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The majority of Galactic TeV gamma-ray sources are pulsar wind nebulae (PWNe) and supernova remnants (SNRs), and the most common association for unidentified sources is PWN. Many of these sources were discovered in TeV by imaging air Cherenkov telescopes using overlapping pointed observations over sections of the Galactic plane. The HAWC observatory is a survey type instrument in the Northern hemisphere with an energy range of 100 GeV to 100 TeV. Preliminary analysis of the HAWC partial array data taken since 2013 shows extended detections that are coincident with known TeV SNRs and PWNe. The full array of HAWC became operational in early 2015 and has been steadily surveying the Northern sky since. I will discuss detections in HAWC data taken since 2013 associated with PWNe and SNRs.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

331

Parallel CR15 Direct/Aniso / 1110

Methods for cosmic ray anisotropy searches with AMS-02

Authors: Carmen Maria Merx¹; Iris Gebauer¹; Karen Grace Andeen¹; Nikolay Nikonov¹; Stefan Zeissler¹; Valerio Vagelli¹

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The Alpha Magnetic Spectrometer (AMS-02) is a state-of-the-art particle detector designed to operate as an external module on the International Space Station (ISS). In the absence of atmospheric disturbance, cosmic ray fluxes between 0.5 GeV and a few TeV can be measured with high precision.

In 2014, the AMS collaboration provided precise measurements of the electron and positron fluxes, which indicate an additional source of positrons among the various cosmic particles.

Possible candidates for this source are local pulsars, a local source of positrons produced in proton-gas interactions or the annihilation of dark matter. In the first two cases a possible anisotropy in the e^\pm incoming direction at Earth, caused by the finite extension of the production site, might be detectable.

To determine the level of isotropy in the AMS-02 data it is necessary to compare the measured e^\pm arrival directions to reference maps, which simulate the AMS-02 measurement of an isotropic sky. A common choice of reference maps are proton count maps, assuming that a possible anisotropy in proton arrival directions is significantly lower than that for e^\pm . We present a method to determine the upper limits on an anisotropy in proton arrival directions. Two different methods to search for anisotropies in the e^\pm fluxes, an expansion into multipoles and a direct bin-to-bin comparison, will be presented. We demonstrate the performance of the method using AMS-02 data.

Collaboration:

AMS

Registration number following "ICRC2015-I/":

717

Parallel GA14 GAL / Bubbles etc / 1092

The Galactic Center region imaged with MAGIC and variability searches during the G2 pericenter passage

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We present the results from the Major Atmospheric Gamma Imaging Cherenkov (MAGIC) telescope of the search for TeV variability in the very high energy (VHE) gamma ray regime performed during the pericenter passage of the G2 gas cloud. This gas cloud orbits the Galactic Center (GC) on a highly eccentric trajectory with a pericenter distance of only a few thousand Schwarzschild radii. The GC has been monitored by MAGIC for over three years. Due to its location in the northern hemisphere, MAGIC observes the GC at large zenith angles (58-70 deg), resulting in a higher energy threshold, but an enhanced effective collection area at multi-TeV energies.

No variability was detected in the TeV regime, but these observations also gave us the opportunity to study the overall morphology of the TeV sources in the vicinity of the GC in great detail. We will discuss possible source counterparts in other wavelengths and various scenarios for the production of VHE emission in this complex region.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

678

Parallel CR15 Direct/Aniso / 569

The large-scale anisotropy in the PAMELA experiment.

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The large-scale anisotropy (or the so-called star-diurnal wave) has been studied in the frame of research carrying out in space with the PAMELA instrument. It was studied during the time period covering 2006-2014 for the Southern and Northern hemispheres simultaneously. The cosmic ray intensity distribution was constructed in the equatorial coordinate system and anisotropy was obtained. For dipole approximation its amplitude and phase have been measured for cosmic ray particles with energies 1-20 TeV/n. This result well known from ground based measurements has been obtained in space for the first time.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

67

Parallel GA15 Future / IN / 1062

GAMMA-400 gamma-ray observatory

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The GAMMA-400 is designed to measure fluxes of gamma rays and the electron-positron cosmic-ray component possibly associated with annihilation or decay of dark matter particles; and to search for and study in detail Galactic Center, discrete and extended gamma-ray sources, to measure the energy spectra of Galactic and extragalactic diffuse gamma rays, and to study gamma-ray bursts and gamma rays from the active Sun. The energy range for measuring gamma rays and electrons (positrons) is from about 100 MeV to several TeV.

For 100 GeV gamma rays, the gamma-ray telescope has an angular resolution of $\sim 0.01^\circ$, an energy resolution of $\sim 1\%$, and a proton rejection factor of $\sim 5 \times 10^5$. The GAMMA-400 will be installed onboard the Russian Space Observatory.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

859

Parallel CR16 TH prop / 740

COSMIC RAY TRANSPORT IN THE PRESENCE OF A CR-DRIVEN GALACTIC WIND

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The transport of cosmic rays (CRs) in the Galaxy is known to be affected by the presence of winds launched from the Galactic disc. When these winds are pre-assigned, it is easy to check that the effects on transport are limited to energies below ~ 10 GeV. Moreover a boundary condition needs to be imposed at large distances (above and below the disc) to ensure the stationarity of the problem. However, a Galactic wind can be driven by the gradient in the CR pressure, and the hydrodynamics of such winds has been studied in the past. We discuss a semi-analytical kinetic calculation of CR transport in a CR driven wind, that allows one to determine the CR spectrum and spatial distribution in the Galaxy, as well as the characteristics of the wind itself. In this highly non-linear approach, diffusion is due to scattering on self-generated Alfvén waves and both diffusion coefficients and slope of the B/C ratio are outputs of the problem. Moreover, no artificial boundary condition at spatial infinity is needed. We discuss the implications of this physical model for the following observables: 1) CR spatial distribution in the disc of the Galaxy; 2) CR anisotropy; 3) Spatial profile of the diffuse radiation due to CR interactions. We also discuss preliminary results of the case in which neutral hydrogen in the circum-disc region is transported by the wind due to charge exchange reactions.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

656

Parallel SH 06 Cycle & AMS / 1114

Fermi Large Area Telescope observations of high-energy gamma-ray emission from behind-the-limb solar flares

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Fermi LAT >30 MeV observations of the active Sun have increased the number of detected solar flares by almost a factor of 10 with respect to previous space observations. These sample both the impulsive and long duration phases of GOES M and X class flares. Of particular interest are the recent detections of two solar flares whose position behind the limb was confirmed by the STEREO-B satellite. While gamma-ray emission up to tens of MeV resulting from proton interactions has been detected before from occulted solar flares, the significance of these particular events lies in the fact that these are the first detections of >100 MeV gamma-ray emission from footpoint-occulted flares. We will present the Fermi-LAT, RHESSI and STEREO observations of these flares and discuss the various emission scenarios for these sources.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

1141

Parallel SH 06 Cycle & AMS / 160

An estimation of the diffusion coefficient of galactic cosmic rays in the heliosphere near the Earth.

Author: Hiroshi Kojima^{None}

Co-authors: Akitoshi Oshima¹; Atul Jain²; B.S Rao²; H.M Antia²; Hisanori Takamaru¹; Isao Morishita³; Katsuya Yamazaki⁴; Koichi Tanaka⁵; Munetoshi Tokumaru⁶; Nobuo Ito⁴; P.K Mohanty²; S.K Gupta²; S.R Dugad²; Saburo Kawakami⁴; Shoichi Ogio⁴; Shoichi Shibata¹; Toru Nakamura⁷; Toshio Matsuyama⁴; Toshiyuki Nonaka⁸; Yoshio Hayashi⁴

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From the density gradient of galactic cosmic rays derived from the Swinson flow and the regression coefficients between the intensity variations of cosmic rays and the solar wind velocity, we have derived the diffusion coefficient and the scattering mean free path of galactic cosmic rays in the heliosphere near the Earth. In this analysis we have used the data obtained by the large area muon tracking detectors of GRAPES-3 and assumed the simplified diffusion-convection equation of cosmic rays in the heliosphere. We will explain the method we have adopted in the estimation of the diffusion coefficient and the scattering mean free path of galactic cosmic rays in this paper.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

170

Parallel CR15 Direct/Aniso / 219

Small-scale anisotropies of cosmic rays from relative diffusion

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Co-author: Markus Ahlers

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The arrival directions of multi-TeV cosmic rays show significant anisotropies at small angular scales. It has been argued that this small scale structure is the reflection of the local, turbulent magnetic field in the presence of a global dipole anisotropy in cosmic rays as determined by diffusion. This effect is analogous to weak gravitational lensing of temperature fluctuations of the cosmic microwave background. We show that the non-trivial power spectrum in this setup can be related to the properties of relative diffusion. A rigorous mathematical treatment of the generation of small scale anisotropies will help in unraveling the structure of the local magnetic field through cosmic ray anisotropies.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

N/A

Parallel CR16 TH prop / 268

Cosmic Ray propagation in magneto-hydrodynamic turbulence

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Co-author: Romain Cohet ¹

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During their journey in the Galaxy, Cosmic Rays (CRs) are scattered by magnetic perturbations that can be well described by the magneto-hydrodynamic (MHD) theory. The very nature of the interaction still however remains largely unknown. In this work we investigate by the mean of direct numerical calculations the CR propagation in large scale driven turbulence. The MHD fluctuations are generated using the MHD code RAMSES over a periodic 3 dimensionnal box. We discuss the CR mean free path obtained with respect to the CR energy, the turbulence level and the geometry of the forcing.

Registration number following "ICRC2015-I":

282

Collaboration:

– not specified –

Parallel GA14 GAL / Bubbles etc / 726

Towards a Detection of the Geminga Supernova Remnant with VERITAS

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Geminga was first detected as a gamma-ray point source by the SAS-2 gamma-ray satellite observatory and the COS-B X-ray satellite observatory. Subsequent observations have identified Geminga as a heavily obscured radio-quiet pulsar associated with a nearby (250 pc) late Sedov phase (300,000 year) supernova remnant. The Geminga pulsar is the second brightest source detected by the Large Area Telescope aboard the Fermi gamma-ray satellite (Fermi-LAT) and has been frequently advanced as a source of the anomalous excess of cosmic ray positrons reported by PAMELA, Fermi-LAT, and AMS-2. It is surrounded by a compact X-ray pulsar wind nebula. Observations above 10 TeV by the water Cherenkov observatory MILAGRO have detected a diffuse gamma-ray halo around Geminga extending over several square degrees. The VERITAS IACT observatory has performed observations of Geminga and the surrounding halo region since 2007. However, the standard methods of source detection in VERITAS data have insufficient sensitivity to reveal a source on the scale of the Milagro detection. In this talk, we describe two approaches being developed to search for angularly extended VHE gamma-ray emission surrounding the Geminga pulsar.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

643

Parallel GA15 Future / IN / 727

Gamma-Ray Observations with CALET: Exposure Map, Response Functions, and Simulated Results

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The CALorimetric Electron Telescope (CALET) is a space-borne cosmic ray calorimeter system planned for installation on the JEM-EF platform on the International Space Station (ISS) in 2015. The CALET collaboration is a Japan-led team collaborating with researchers in Italy and the U.S. In addition to precise measurement of the cosmic ray electron and nuclei spectra, the CALET calorimeter will be capable of gamma-ray observations in the energy range 10 GeV – 10 TeV. This paper presents a study of the expected gamma-ray signal measured by CALET in the first year on orbit. The ISS zenith pointing is simulated at a time resolution of 1 second in order to precisely estimate the exposure map on the sky. The instrument response functions and simulated results of gamma-ray/electron separation for the calorimeter are discussed and used to estimate the point source and galactic diffuse signals in the energy range 10 GeV - 500 GeV based on known positional fluxes measured by Fermi-LAT.

Collaboration:

CALET

Registration number following "ICRC2015-I/":

648

Parallel CR17 EAS spec / 916

Recent Results on Cosmic Ray Physics with the IceCube Observatory

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Registration number following "ICRC2015-I/":

337

Parallel NU 05 / 903

High-Fluence Blazars as Possible Sources of the IceCube PeV Neutrinos

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The IceCube collaboration has detected an extraterrestrial neutrino flux with the most significant signal in the southern sky at PeV energies. In spite of its smaller volume, the ANTARES telescope provides comparable sensitivity and superior angular resolution at the given southern declinations and energies below ~ 100 TeV and is thus the ideal instrument to constrain the neutrino spectrum of candidate sources.

We report on an analysis of the spectral energy distributions of a sample of blazars in positional agreement with PeV neutrinos detected by IceCube. Within the framework of the TANAMI program, we showed that the integrated calorimetric output of these blazars is high enough to explain a neutrino fluence in agreement with the observed IceCube events. For the two blazars with the highest predicted neutrino fluence in the fields of the IC14 and IC20 PeV neutrino events, Swift J1656.3-3302 and TXS 1714-336, ANTARES detects two signal-like TeV neutrino events, in agreement both with the blazar-origin hypothesis and with an atmospheric origin. In the absence of any signal-like neutrino events, ANTARES constrains the possible neutrino spectra of four other candidate sources to spectral indices flatter than -2.4 . TANAMI and ANTARES studies of the blazars in the field of the third PeV neutrino event, IC35, are ongoing.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

771

Parallel SH 07 Modulation I / 97

The total solar modulation of low energy electrons in the heliosphere

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Modeling and the subsequent understanding of the processes responsible for the solar modulation of Jovian and galactic electrons require that a source function for Jovian electrons and a heliopause spectrum (HPS) for galactic electron as an input spectrum be specified at the heliopause (assumed to be the solar modulation boundary). Using a comprehensive three-dimensional numerical model based on solving Parker's transport equation, both a new Jovian source function and HPS are used to compute the total modulation of electrons over an energy range from 1 MeV to 50 GeV. The modulation of low energy electrons is a particular handy tool to construct a suitable diffusion tensor to assure compatibility between model computations and observations from different spacecraft and balloon flights relevant to electrons in the heliosphere. Energy spectra and radial intensity profiles of galactic and Jovian electrons are compared to previous and recent observations. Studying the radial profile of 12 MeV electrons enables us to compute the differential intensity of galactic electrons at this energy at the Earth.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

112

Parallel GA16 H.E.S.S. / 627**The H.E.S.S. Galactic plane survey****Author:** Christoph Deil¹**Co-authors:** Axel Donath ¹; Francois Brun ²; Henning Gast ³; Regis Terrier ⁴; Ryan Chaves ⁵; Svenja Carrigan ⁶; Vincent Marandon ¹¹ *MPI for Nuclear Physics, Heidelberg*² *CEA-Saclay*³ *I. Physikalisches Institut B, RWTH Aachen*⁴ *APC, Paris*⁵ *CNRS / LUPM*⁶ *Uni Kaiserslautern***Corresponding Author:** deil.christoph@gmail.com

The H.E.S.S. Galactic plane survey (HGPS) was performed with the H.E.S.S. I Cherenkov telescope array in Namibia from 2004 to 2013. Roughly ~2800 hours of high-quality observations of the Galactic disk are available in the Galactic longitude range 250 to 65 degrees and Galactic latitude range $|b| < 3.5$ degrees. This is the first high-resolution (~0.1 deg) and sensitive (~2% Crab nebula point-source sensitivity) survey of the Milky Way in TeV gamma-rays. A diverse population of cosmic accelerators was discovered and, using the full dataset, we have compiled a catalog of ~70 sources.

In this presentation, we will show the latest survey maps and describe the source catalog construction method and results from the HGPS paper. Source population statistics and the associations of H.E.S.S. sources with pulsars, pulsar wind nebulae and supernova remnants as well as GeV sources discovered by the Fermi LAT will be discussed, along with a few new discoveries.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

552

Parallel CR18 TH prop / 281**Cosmic-ray diffusive reacceleration: a critical look****Author:** Luke Drury¹**Co-author:** Andrew Strong ²¹ *DIAS*

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Cosmic-ray scattering on magnetic turbulence leads to spatial diffusive propagation; if the scattering medium is moving, this will inevitably also cause changes in the momentum of the particles, so-called diffusive reacceleration. This can be described as diffusion in momentum space. Diffusive reacceleration has often been invoked to explain the peak observed in secondary-to-primary ratios at a few GeV, in particular Boron-to-Carbon. This avoids the necessity to postulate an ad-hoc break in the spatial diffusive coefficient, and has become almost a standard in modelling cosmic-ray spectra. However, at the levels invoked, the process implies a significant input of energy from the interstellar medium into cosmic rays, so that in such models interstellar space competes with the usual accelerators like supernova remnants. The questions arise: is reacceleration really occurring at the high level required to explain secondary-to-primary ratios? and are the energy requirements physically plausible? We address this issue using both analytical and numerical models of cosmic-ray propagation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0291

Parallel CR18 TH prop / 398

GALPROP Code for Galactic Cosmic Ray Propagation and Associated Photon Emissions

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Co-authors: Andrew Strong ²; Andrey Vladimirov ³; Elena Orlando ¹; Guðlaugur Jóhannesson ⁴; Troy Porter ¹

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Recent years are marked with many breakthroughs in astrophysics of cosmic rays (CRs), and more are expected in the nearest future. Their proper interpretation is impossible without a well-developed propagation code. The GALPROP project celebrates its 19th anniversary this year. This project is devoted to the development of a self-consistent model for CR propagation in the Galaxy and associated diffuse emissions (radio, microwave, X-rays, gamma-rays). The project stimulated independent studies of the interstellar radiation field, distribution of the interstellar gas (H₂, H I, H II), synchrotron emission and the Galactic magnetic field, and a new study of the isotopic production cross sections. These studies provide necessary and unique input datasets for the GALPROP model. The code is optimized and parallelized and accessible as a standalone executable or library that can be linked to other codes enabling many other studies, such as Markov Chain Monte Carlo, MultiNest, SuperBayeS, and DarkSUSY. The new version of the code has many updates that improve its accuracy and capabilities. As always, the latest release of the code is available through the WebRun, a service to the scientific community enabling easy use of the GALPROP code via web browsers.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

382

Parallel SH 07 Modulation I / 333

Solar modulation of galactic cosmic rays electrons and positrons over the 23rd solar minimum with the PAMELA experiment.

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Co-authors: Etienne Vos²; Marthinus Potgieter³

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The satellite-borne PAMELA experiment was launched in June 2006 from the Baikonur cosmodrome and since then it has been taking data.

The apparatus design is particularly suited for particle and antiparticle identification. At this conference we present

the half-yearly galactic cosmic ray electron and positron spectra measured down to 70 MeV and from July 2006 to December 2009.

The most recent period of solar minimum activity and the consequent minimum modulation conditions for cosmic rays were unusual. This period

of prolonged solar minimum activity is well suited to study the modulation processes. Hence, these fluxes

provide important information about the cosmic rays propagation mechanism inside the heliosphere. Moreover, a direct comparison of electron and positron spectra allows a detailed study of charge-sign dependent solar modulation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

336

Parallel GA16 H.E.S.S. / 1254

On the origin of the very-high energy gamma-ray emission of the Galactic Center region

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The Galactic Centre region has been observed by the H.E.S.S. I array of ground-based Cherenkov telescopes since 2004 leading to the detection of the very-high-energy (VHE, $E > 100$ GeV) gamma-ray source HESS J1745-290 spatially coincident with the supermassive black hole Sgr A*. Diffuse TeV gamma-ray emission has been detected along the Galactic ridge, most likely due to cosmic-ray interactions with dense gas of the Central Molecular Zone. We report here the results of a detailed spectral study of the inner 50 pc of the Galactic Centre region based on the full data set of 2004-2013 observations. The new results allow us to make a strong statement regarding the location and origin of the accelerator of the parent ultrarelativistic particles. We will discuss possible implications of the observed emission, in particular, in the context of the origin of Galactic cosmic-rays.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

965

Parallel NU 05 / 1208

High energy astrophysical neutrino flux characteristics for neutrino-induced cascades using IC79 and IC86-string IceCube configurations

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We have performed a new measurement of the all-sky diffuse flux of high energy, $E > 10$ TeV, extraterrestrial neutrino induced showers (cascades) based on IceCube data collected during 641 days in 2010–2012. Cascades arise predominantly in electron and tau neutrino interactions and have good energy resolution, so that they are well-suited for the spectral characterization of the extraterrestrial flux. For the first time, we have included also high-energy cascades with vertices in near proximity to the detector, thereby enlarging the event sample by up to a factor of two for $E > 100$ TeV. A total of 172 cascades with energies ranging from 10 TeV to 1 PeV have been observed, of which approximately 60% (75% above 100 TeV) have not previously been reported by IceCube. Based on Monte Carlo simulations we estimate the neutrino purity to be 95%. The dominant extra-terrestrial component is well described by a smooth and featureless power-law. The result is in agreement with previous IceCube results and is preferred over a background-only hypothesis with a significance of more than 4 sigma. Additionally we will present a comparison between the results obtained when upward oriented and downward oriented showers are considered separately, showing that the extraterrestrial neutrino fluxes originating from the Northern and Southern hemispheres are consistent.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

938

Parallel CR17 EAS spec / 795

Latest Results on Cosmic Ray Spectrum and Composition from Three Years of IceTop and IceCube

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With the IceTop detector at the South Pole, a spectrum of cosmic ray air shower size S_{125} can be unfolded into an energy spectrum of primary cosmic rays. When the IceTop data is analyzed in coincidence with high-energy muon energy loss information from the deep IceCube detector, both the spectrum and mass composition of primary cosmic rays can be extracted using a neural network. Both of these analyses have been applied to three years of IceTop and IceCube data: from mid-2010 to mid-2013, using the 73-station/79-string and 81-station/86-string detectors. Both analyses are now sensitive to energies of up to 500 PeV. The performance and relative advantages of the two analyses will be discussed, and both all-particle spectra as well as individual spectra for elemental groups will be presented.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

386

Parallel NU 05 / 306

Search for an enhanced emission of neutrinos from the Southern Sky with the ANTARES telescope

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Compelling evidence of the existence of cosmic neutrinos has been reported by the IceCube collaboration. Some features of this signal could be explained by a Northern/Southern sky asymmetry of the flux. This possible asymmetry would be related to the presence of the bulk of our Galaxy in the Southern sky.

The ANTARES neutrino telescope, located in the Mediterranean Sea, consists of a three dimensional array of 885 10-inch photomultiplier tubes distributed along twelve vertical lines. Its effective area and its good exposure to the Southern Sky would allow to constrain an enhanced muon neutrino emission from extended sources.

A signal region around the largest accumulation of events from the IceCube HESE is defined; the background from atmospheric events is estimated looking at data from off-zones for which ANTARES has the same exposure as for the signal region. The ANTARES sensitivity to such a flux has been computed. The results of the analysis after unblinding will be presented.

Collaboration:

ANTARES

Registration number following "ICRC2015-I/":

Parallel SH 07 Modulation I / 528**Modulation of galactic helium in the heliosphere****Author:** Godfrey sibusiso Nkosi¹**Co-author:** Marthinus Potgieter ²¹ *Vaal University of technology*² *North-West University***Corresponding Author:** sibusiso@vut.ac.za

Several space missions have improved our knowledge of the solar modulation of galactic cosmic rays in the heliosphere during the past 40 years (e.g. Pioneer 10 & 11, Voyager 1 & 2, IMP 8, Ulysses, PAMELA and more). These data sets are from solar minimum to solar maximum activity with clear differences in the energy spectra of the positive and negative magnetic polarity cycles. The modulation of galactic helium is studied with a 3D numerical model which includes all major modulation mechanisms (convection, diffusion, drifts, energy changes, etc.) as well as a heliosheath. We use a new heliopause spectrum for helium and compute spectra from the heliopause to the Earth. We are able to obtain a set of diffusion coefficients and a drift coefficient which are applicable from the inner to the outer heliosphere. We also find that the heliosheath plays an important role to establish the total level of modulation for helium, the lower the energy, the more important it becomes, with drifts playing a minor role in the outer heliosphere.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

473

Parallel GA16 H.E.S.S. / 596**H.E.S.S. precision measurements of the SNR RX J1713.7-3946****Author:** Peter Eger¹**Co-authors:** David Berge ²; Felix Aharonian ³; Mark Bryan ⁴; R. D. Parsons ¹; Stefan Funk ⁵; Victor Zabalza ⁶; Yasunobu Uchiyama ⁷¹ *MPIK Heidelberg*² *NIKHEF (NL)*³ *MPIK Heidelberg, DIAS*⁴ *GRAPPA, Univ. of Amsterdam*⁵ *Stanford University and SLAC*⁶ *University of Leicester*⁷ *Rikkyo University*

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The shell-type supernova remnant (SNR) RX J1713.7-3946 is one of the brightest TeV gamma-ray sources in the Galaxy detected by the High Energy Stereoscopic System (H.E.S.S.). Despite extensive multi-wavelength coverage in gamma-rays, X-rays and lower energy regimes, the nature of the underlying gamma-ray radiation mechanisms is still under debate.

Here, we present new precision measurements, based on 150 hours of observations performed with the H.E.S.S. array in its 4-telescope configuration, and make use of new superior analysis techniques. The new results feature an improvement in the exposure by factors of 2 (sky images) to 4 (spectra) over previous measurements. These data allow for spectral and morphological studies at unprecedented precision, yielding the most detailed TeV gamma-ray analysis of any extended object in the sky. The angular resolution of better than 0.05 deg allows us to perform for the first time a detailed investigation of morphological differences between TeV gamma rays and X-rays.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

527

Parallel CR18 TH prop / 1237

A fresh view on cosmic rays and magnetic fields in halos of spiral galaxies

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First results from a new radiocontinuum study of edge-on galaxies are presented. The study is based on data from the CHANG-ES (Continuum HALos in Nearby Galaxies - an EVLA Survey; PI J. Irwin) project which has observed 35 edge-on galaxies with the Karl G. Jansky Very Large Array (JVLA) in two frequency bands (L- and C-band) and in three array configurations (D, C, B). This survey benefits significantly from the new multi-channel capability of the upgraded facility.

The results presented here are based on the D-array data only. From the total power maps a "mean" radiocontinuum halo has been derived and the polarization information provides information on the magnetic field structure in the halos.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

763

Parallel NU 05 / 344

Search for Supernova Neutrino Bursts with the Large Volume Detector

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The Large Volume Detector (LVD) in the INFN Gran Sasso National Laboratory, Italy, is a 1 kton liquid scintillator neutrino observatory mainly designed to study low energy neutrinos from gravitational stellar collapses. LVD is sensitive to core-collapse supernovae via neutrino burst detection with 100% efficiency over our own entire Galaxy. The result of the search of neutrino bursts from gravitational stellar collapses in the period from June 1992 to June 2015 is presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

293

Parallel GA16 H.E.S.S. / 1053

H.E.S.S. Observations of the Large Magellanic Cloud

Authors: Chia-Chun Lu¹; Jacco Vink²; Matthieu Renaud³; Michael Mayer⁴; Nukri Komin⁵; Stefan Ohm⁶

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The Large Magellanic Cloud (LMC) is an irregular satellite galaxy of the Milky Way, which has been observed extensively at Very-High-Energy (VHE) gamma-rays with the H.E.S.S. telescopes, obtaining a deep exposure of 210 hours. In this talk we will present the results of this campaign.

Besides the already known PWN N 157B, these observations establish significant VHE gamma-ray emission from the super-bubble 30 Dor C and show evidence for emission from the supernova remnant N 132D. It is the first unambiguous detection of gamma rays from a super-bubble and for the first time individual cosmic-ray accelerators are identified in an external galaxy. Contrary to theoretical expectations, VHE gamma-ray emission is not detected from SN 1987A.

We will discuss these three objects, representing the high-energy tip of the VHE gamma-ray source population in the LMC, as possible cosmic-ray accelerators, and compare them with similar systems

in our Galaxy. Further discoveries can be expected with more sensitive surveys of the LMC in gamma-rays, for instance with the Cherenkov Telescope Array.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

870

Parallel CR17 EAS spec / 380

The flux of ultra-high energy cosmic rays after ten years of operation of the Pierre Auger Observatory

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The flux of cosmic rays has been measured with unprecedented precision and statistics at the Pierre Auger Observatory. We report an update of the all-sky flux of cosmic rays above 3×10^{17} eV obtained by combining four independent data sets. These measurements are based on data from the surface detector (divided into two sets according to the shower zenith angle), from a nested denser detector array, and hybrid events measured simultaneously with both the fluorescence detector and the surface detector. The spectral features are presented in detail and the systematic uncertainties are addressed. The huge amount of data collected to date, with a total exposure exceeding 50,000 km² sr yr, together with the wide range of sky observed (in declination from -90° to 45°) also allow us to measure the energy spectrum from different regions of the sky. We present the results of the search for a dependence of the measured flux on the declination of the incoming directions.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

0279

Parallel SH 07 Modulation I / 967

The solar modulation potential derived by spacecraft measurements modified to describe GCRs at energies below neutron monitors and above

Author: Jan Gieseler¹

Co-authors: Bernd Heber¹; Konstantin Herbst¹

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Galactic Cosmic Rays (GCRs) are modulated by various effects as they propagate through the heliosphere before they are detected at Earth. This transport can be described by the Parker equation (Parker, 1965). It calculates the phase space distribution of GCRs depending on the main modulation processes: convection, drifts, diffusion and adiabatic energy changes. A first order approximation of this equation is the force field approach, reducing it to a one-parameter dependency, the solar modulation potential. Utilizing this approach, Usoskin et al. (2005; 2011) reconstructed the solar modulation potential between 1936 and 2010, which by now is commonly used in many fields. However, it has been shown previously e.g. by Herbst et al. (2010) that the solar modulation potential depends not only on the Local Interstellar Spectrum (LIS) but also on the energy range of interest. Using the LIS by Usoskin et al. (2005) together with published proton intensity spectra obtained by PAMELA, heavier nuclei measurements from IMP8 and ACE/CRIS as well as neutron monitors, we have investigated this energy dependence further. We will present the results that show as expected severe limitations at lower energies including a strong dependence on the solar magnetic epoch. Based on these findings, we will outline a tool to describe GCR proton spectra in the energy range from a few hundred MeV to tens of GeV over the last solar cycles.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0818

Parallel CR18 TH prop / 754

A study of the energy spectrum and composition of cosmic rays up to the highest energies

Author: Satyendra Thoudam¹

Co-authors: Abraham Achterberg²; Heino Falcke²; Jörg Hörandel³; Jörg Rachen²

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Motivated by the recent high-precision measurements of the cosmic-ray energy spectrum and composition by several new-generation experiments, a detailed study to understand the observed properties of cosmic rays up to the highest energies is being conducted. The study involves building a cosmic-ray propagation model in the Galaxy that explains the observed spectra of different cosmic-ray elements at GeV-TeV energies measured by balloon and satellite borne experiments. The contribution of Galactic cosmic rays to the all-particle cosmic-ray spectrum at higher energies measured by air-shower experiments is determined by extrapolating the spectra of different elements obtained from the Galactic propagation model to energies above the "knee" ($\sim 3 \times 10^{15}$ eV). Only the maximum energy of protons accelerated by the Galactic sources is taken as the model parameter. In addition, the contribution of extra-galactic cosmic rays is calculated by taking a reasonable assumption for the source distribution and the nature of cosmic-ray propagation in the intergalactic magnetic fields. Preliminary results indicate the requirement of an extra component of Galactic cosmic rays in order to explain the observed all-particle energy spectrum between $\sim 10^{16}$ and 10^{18} eV. Details about the comparison of the model predictions with the observed all-particle energy spectrum and composition up to energies $\sim 10^{20}$ eV will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

666

Parallel CR18 TH prop / 293

USINE propagation code and associated tools

Author: David Alain Maurin¹¹ *Centre National de la Recherche Scientifique (FR)***Corresponding Author:** dmaurin@lpsc.in2p3.fr

I present the first public release of the USINE code for charged galactic cosmic-ray (GCR) propagation. USINE is a C++ toolbox handling GCR ingredients and several semi-analytic propagation models (1D and 2D). Non-public versions of this code were used in the last 10 years to fit the transport parameters, study radioactive nuclei, antinuclei and possible DM contributions, etc. The complementary of USINE with existing fully numerical models is that: (i) a typical model run is fast, so that the many user interfaces and plots provided in USINE make it a very pedagogical tool to better understand CR propagation; (ii) USINE is interfaced with an MCMC engine that enables fits of CR data in a few hours of laptop CPU; (iii) users who wish to develop their own semi-analytic model benefit from having a lot of tools and ingredients at their disposal; (iv) users who wish to provide new inputs (cross sections, etc.) can quickly see their impact on propagation. USINE, as well as CRDB, and a web interface to get solar modulation values for any time period are all part of a suite of public tools provided to ease GCR studies.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

296

Parallel GA16 H.E.S.S. / 1046

Observations of the Crab Nebula with H.E.S.S. phase II

Authors: Christopher van Eldik¹; David Berge²**Co-author:** Markus Holler³¹ *University of Erlangen-Nuremberg*² *NIKHEF (NL)*³ *LLR - Ecole Polytechnique***Corresponding Author:** holler@llr.in2p3.fr**Registration number following "ICRC2015-I/":**

1107

Parallel SH 07 Modulation I / 1354

Role of solar wind and interplanetary magnetic field in cosmic ray modulation.

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Galactic cosmic rays are modulated through their propagation in interplanetary medium by the effect of large scale disturbances in sun related interplanetary medium. Often the interplanetary parameters used in modulation are solar wind velocity V and interplanetary magnetic field B . For this study, we have used the monthly, quarterly, half yearly and yearly mean values of solar wind velocity and IMF B for the period of 1996 to 2011, covering the solar cycle 23 and ascending phase of solar cycle 24. The analysis brings out the long-term characteristics of changes in galactic cosmic rays. A negative and normal correlation exists between cosmic rays and solar wind velocity on long-term basis. Correlative analysis has been done for these two data series (CRI and V_{sw}) for different phases of solar activity cycle. All the epochs of solar activity cycles show normal and negative correlation. Product values of $B.V$ for different periods show better correlation than for only for solar wind velocity or IMF alone. It is also investigated that product $B.V$ is more important in producing enhancement in geomagnetic field variations. Analysis indicates a significant role of IMF B along with solar wind velocity in cosmic ray modulation process. It is suggested that electric drift is the basic cause of the observed solar modulation of cosmic rays on long-term basis.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

361

Parallel NU 05 / 642

A measurement of the diffuse astrophysical muon neutrino flux using multiple years of IceCube data

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The IceCube Collaboration measured an all-flavor, high-energy astrophysical neutrino flux. In order to identify the sources of this flux, high-energy muon neutrinos are ideal messenger particles because of their excellent angular resolution. However, the first step is to confirm the observed flux in the muon neutrino channel using IceCube data from 2009 through 2014. The main background for this search are cosmic-ray-induced atmospheric muon neutrinos. High-purity neutrino event samples have been analyzed using a two-dimensional likelihood approach, taking full advantage of the information of neutrino energies and arrival directions with a consistent treatment of systematic uncertainties. The results of this analysis initially using IceCube data from 2009 through 2012 will be presented.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

544

Parallel CR17 EAS spec / 847

TA Spectrum Summary

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The Telescope Array (TA) covers an energy range from 4 PeV to over 100 EeV. TA is a hybrid detector that uses air fluorescence detectors (FD) combined with a ground array. In May 2015, TA will have collected 7 years of data. The TA low energy extension (TALE), which sees cosmic rays down to 4 PeV, consists of additional fluorescence telescopes at one of the TA FD stations. An infill array of 400m spaced counters is being deployed. TALE has collected 1 year of data. We will present (1) the energy spectrum measured by TA surface detector, which provides the largest statistics measurement at the highest energies; (2) the TA FD mono and hybrid spectra which cover intermediate energies; and (3) we will show the first results of TALE, which include TALE monocular fluorescence and Cherenkov measurements and cover the lowest energies in the experiment.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

732

Parallel CR17 EAS spec / 299

Interpretation of the energy spectrum observed with the Telescope Array surface detectors

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We present the latest energy spectrum of ultra-high-energy cosmic rays (UHECRs) with energy $E > 10^{18.2}$ eV observed by the surface detectors of the Telescope Array experiment. The broken power law to the spectrum contains two break points, a flattening known as the "ankle" or "dip" at $E = 10^{18.70}$ eV, and a steepening at $E = 10^{19.75}$ eV. These spectral features are related to the distribution of cosmic-ray sources, their injection spectra, and energy loss processes during the propagation of UHECRs in inter-galactic space. In this talk, we consider a phenomenological model of proton sources distributed either uniformly or following the large-scale structure distribution. We show that in both cases it is possible to produce satisfactory fits assuming a power law injection spectrum and strong evolution of the source density with redshift. We also discuss constraints on the source model parameters, e.g. the injection power law and cosmological evolution and average distance between sources.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

303

Parallel GA16 H.E.S.S. / 1013

Pulsations from the Vela pulsar down to 30 GeV with H.E.S.S. II

Author: Michael Gajdus¹

Co-authors: Arache Djannati-Atai²; Bronek Rudak³; Christo Venter⁴; Gianluca Giavitto⁵; Markus Holler⁶; Mathieu Chrétien⁷; Thomas Tavernier⁸

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The Vela pulsar (PSR J0835-4510) is the brightest persistent source in the high-energy γ -ray sky. It is a relatively near, young and energetic rotation-powered pulsar. Vela was a key target for the High Energy Stereoscopic System phase II array (H.E.S.S. II). Observations were carried out following a hint of pulsed emission above 20 GeV seen using Fermi-LAT data. In this talk we present detailed results from the analysis of data only from the new 28 m telescope in monoscopic mode on the Vela pulsar. A high-significance pulsed emission is detected. The low-energy performance of the H.E.S.S. II instrument in monoscopic mode is clearly demonstrated given a distinct pulsed excess down to energies of 30 GeV. The H.E.S.S. II data provide a thorough insight into the general phase profile of the Vela pulsar and reveal the specific pulse shape at these energies.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

847

Parallel NU 05 / 490

Combined Analysis of the High-Energy Cosmic Neutrino Flux at the IceCube Detector

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With the discovery of a high-energy astrophysical neutrino flux, the IceCube Neutrino Observatory, located at the geographical South Pole, has opened the field of neutrino astronomy. While evidence for extraterrestrial neutrinos has been found in multiple searches, it was not yet possible to identify their sources; they appear as an isotropic excess. Nevertheless, it is possible to constrain the properties of the sources by measuring the energy spectrum and the flavor composition of the flux, which has been done in several analyses. Typically, these analyses concentrate on specific event classes, such as events with interaction vertices inside the instrumented volume or throughgoing, ν_μ -induced tracks from the Northern hemisphere. Here, we present the latest results from a global analysis, combining the event samples of multiple individual searches, thus covering all detection channels. We derive the energy spectrum and flavor composition of the astrophysical neutrino flux. In addition, we show projected constraints on the astrophysical flux that can be obtained with 10 years of IceCube data.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

445

Parallel SH 07 Modulation I / 117

North-south anisotropy of galactic cosmic rays observed with the Global Muon Detector Network (GMDN)

Author: Kazuoki Munakata¹

Co-authors: Alisson Dal Lago ²; Chihiro Kato ¹; Hala K. Al Jassar ³; Ismail Sabbah ⁴; John E. Humble ⁵; John W. Bieber ⁶; Madan M. Sharma ³; Marcus L. Duldig ⁵; Marlos Rockenbach ⁷; Masayoshi Kozai ¹; Munetoshi Tokumaru ⁸; Nelson Jorge Schuch ⁷; Paul Evenson ⁶; Takao Kuwabara ⁹

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We analyze the north-south anisotropy (NSA) of galactic cosmic rays (GCRs) observed with the GMDN on hourly basis in the "toward"(T) and "away"(A) IMF sectors separately. From the monthly mean and its standard error of NSA in each of T and A sectors, we deduce the "T/A separation" and its temporal variation during a period between 2006 and 2014. We also examine the "success rate" which is a ratio of the number of hours when the sign of the observed NSA is positive (negative) in T (A) IMF sector to the total number of hours and is introduced as a parameter indicating to what extent we can infer the IMF sector polarity from the sign of the observed NSA. The temporal variations of "T/A separation" and "success rate" will be discussed in relation to the solar modulation of GCRs in the Solar Cycle 24.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

126

Parallel CR18 TH prop / 146

Parametrization of gamma-ray production cross-sections for pp interactions in a broad proton energy range from the kinematic threshold to PeV energies

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Co-authors: Andrew Taylor²; Felix Aharonian³; Gabriela Vila⁴

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Using publicly available Monte Carlo codes as well as compilation of published data on pp interactions for proton kinetic energy below 2 GeV, we parametrize the energy spectra and production rates of γ -rays by simple but quite accurate ($\leq 20\%$) analytical expressions in a broad range from the kinematic threshold to PeV energies.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

162

Parallel NU 05 / 349

Search for a neutrino flux from the Fermi Bubbles with the ANTARES telescope

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The Fermi Bubbles are two giant lobes of γ -ray emission above and below the Galactic Center. Whereas the origin of the observed γ -ray flux remains obscure, the measurement of a neutrino flux from the Fermi Bubbles could distinguish between leptonic and hadronic emission scenarios. Such a search for a neutrino signal from the Fermi Bubbles has been performed with the ANTARES neutrino telescope in the Mediterranean Sea using four years of data. The search has aimed for charged current muon neutrino interactions, which produce muons with long tracks in the detector and therefore have an angular resolution of well below one degree. Thanks to their vast extension the Fermi Bubbles are also an excellent target for shower-like neutrino interaction channels with limited

angular resolution. The results obtained from the track analysis will be presented together with an outlook on the sensitivity that can be achieved with a combined analysis of track- and shower-like events using six years of ANTARES data.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

0214

Parallel SH 07 Modulation I / 131

Average features of the interplanetary shock observed with the Global Muon Detector Network (GMDN)

Author: Masayoshi Kozai¹

Co-authors: Alisson Dal Lago²; Chihiro Kato¹; Hala. K. Al Jassar³; Ismail Sabbah⁴; John E. Humble⁵; John W. Bieber⁶; Kazuoki Munakata¹; Madan M. Sharma³; Marcus L. Duldig⁵; Marlos Rockenbach⁷; Munetoshi Tokumaru⁸; Nelson J. Schuch⁷; Paul Evenson⁶; Takao Kuwabara⁹

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Galactic cosmic ray (GCR) depleted regions behind the interplanetary shocks or disturbances cause the Forbush decreases (Fds), short term decreases of the GCR isotropic intensity (or GCR density) at the Earth. We can deduce the geometries of the depleted regions from three-dimensional GCR anisotropy associated with Fds, because the first order anisotropy reflects the spatial gradient of GCR density. Deriving the dynamic variation of GCR anisotropy using a single detector, however, has been difficult because the traditional analyses based on the diurnal variation of GCR intensity provide only the daily mean equatorial anisotropy. The present GMDN consisting of four multi-directional muon detectors in Nagoya (Japan), Hobart (Australia), São Martinho da Serra (Brazil) and Kuwait city (Kuwait) started operation in 2006 and successfully observed dynamic variations of GCR anisotropy associated with major Fd events. In this presentation, we analyze the average features of GCR anisotropy and density gradient associated with shocks identified by the geomagnetic storm sudden commencement (SSC) during a period between 2006 and 2014. We analyze about 120 SSC events classified into two groups associated with coronal mass ejections (CMEs) and corotating interaction regions (CIRs). From the first order anisotropy corrected for the solar wind convection and Compton-Getting effect arising from Earth's orbital motion around the sun, we deduce the three-dimensional density gradient on hourly basis for each SSC event. We then derive the average temporal variations of the anisotropy and density gradient by superposing variations at the SSC onset timing. In the CME event, the anisotropy vector shifts sunward before the SSC onset, implying the flow of GCRs reflected by the shock. We also confirm that the density gradient components are clearly enhanced in the both of CME and CIR events, indicating the geometry of the GCR depleted region. We discuss the physical implications of the obtained geometries.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0143

Parallel CR17 EAS spec / 382**Ultra-high-energy cosmic ray flux and energy measurement with ANITA****Author:** Harm Schoorlemmer¹**Co-authors:** Collaboration ANITA¹; Daniel García Fernández²; Enrique Zas²; Jaime Alvarez-Muñiz²; Washington R. Carvalho Jr²¹ *University of Hawaii*² *Universidade de Santiago de Compostela***Corresponding Author:** harmscho@science.ru.nl

The first flight of the Antarctic Impulse Transient Antenna (ANITA) experiment recorded 16 radio signals that were emitted by cosmic ray induced air showers. Recent developments in simulation packages made it possible to estimate the cosmic ray energy from these observations. In this talk we introduce a novel method to estimate the cosmic ray energy and apply it to the observations. We present, for the first time, a cosmic ray flux measurement from radio observations only and show that it is agreement with observations made elsewhere. In addition, we find good agreement between our observations and a full Monte Carlo simulation of the ANITA flight. The result of this study shows that observations in the 300-1000 MHz frequency band, which is an unique feature of ANITA, can be used to measure cosmic ray energy and they have the potential to provide accurate measurements of air shower properties in future applications.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

366

Parallel GA16 H.E.S.S. / 938**Sgr A* Observations with H.E.S.S. II****Author:** Robert Parsons¹**Co-authors:** Aion Viana²; Cyril Trichard³; Emmanuel Moulin⁴; Helen Poon⁵; Johannes King¹; Johannes Veh⁶; Karl Kosack⁷; Markus Holler⁸; Mathieu de Naurois⁹; Raphaël Chalmé-Calvet¹⁰; Valentin lefranc⁴¹ *Max Planck Institute for Nuclear Physics*² *M*³ *LAPP*⁴ *CEA*⁵ *urn:Facebook*

⁶ *University of Erlangen*

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The Galactic Centre has been studied with the H.E.S.S. array for over 10 years, revealing a bright, complex gamma-ray morphology above 100 GeV. Besides a strong point-like very-high-energy gamma-ray source coincident with the supermassive black hole Sgr A*, previous analyses also revealed a diffuse ridge of gamma-ray emission, indicative of a powerful cosmic-ray accelerator in this region.

The addition of a fifth telescope with 600 m² mirror area to the centre of the H.E.S.S. array has significantly increased the energy range accessible, allowing observations to take place below 100 GeV. This wider energy range allows an important overlap in observations with satellite instruments such as the Fermi-LAT gamma-ray telescope. We will present the results of new H.E.S.S. observations of the Galactic Centre region and show a detailed analysis of the central source, including comparisons to results at other wavelengths.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

559

Parallel CR18 TH prop / 200

IIn supernovae as the sources of high energy neutrinos

Author: Vladimir Zirakashvili¹

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It is shown that astrophysical neutrinos observed by IceCube can be produced by protons accelerated at IIn supernova remnant shocks propagating in the dense circumstellar medium. The nonlinear diffusive shock acceleration model is used for description of particle acceleration. We calculate the neutrino flux produced by a single IIn supernova remnant and the neutrino background produced by all IIn supernovae in the Universe.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0220

Parallel SH 07 Modulation I / 159**RELEVANCE OF LONG TERM TIME –SERIES OF ATMOSPHERIC PARAMETERS AT A MOUNTAIN OBSERVATORY TO MODELS FOR CLIMATE CHANGE****Author:** Mária Kancírová¹**Co-authors:** Anatoly D. Erlykin²; Arnold W. Wolfendale³; Karel Kudela⁴¹ *1Department of Mathematics and Physics, The University of Security Management, Kukučínova 17, 04001 Košice, Slovakia 2Faculty of Science, P. J. Šafárik University, Šrobárova 2, 04108 Košice, Slovakia*² *4Department of Physics, Durham University, Durham, UK 5Permanent address: P N Lebedev Institute, Moscow, Russia*³ *Department of Physics, Durham University, Durham, UK*⁴ *IEP SAS, Watsonova 47, 04001 Košice, Slovakia***Corresponding Author:** kkudela@saske.sk

A detailed analysis has been made of annual meteorological, and cosmic ray, data from the Lomnický štít mountain observatory (2634 masl), from the standpoint of looking for possible solar cycle (including cosmic ray) manifestations. Interestingly, it is found that taking the two 'recent' Solar Cycle periods (SC 22 and 23), the measured 'cloud cover' is nearly linearly proportional to the satellite – measured mean Global Low Cloud Cover (LCC), but with different coefficients. The linearity allows us to check the assertion that the Global LCC is dependent on the cosmic ray intensity; the reason for the difference in the coefficients will be considered elsewhere.

Apart from the Pressure, Sunspot number correlation, we find no significant Solar Cycle dependence (i.e. difference from one Cycle to the next) of the relationship between local temperature and pressure, cloud cover and pressure, cloud cover and Sunspot Number, and cloud cover and cosmic rays, corrected for atmospheric pressure, or not, in contrast with the results of others for the cloud cover, cosmic ray intensity correlation. The apparent rise in cloud cover with increasing cosmic ray intensity is smaller than found by others and is, in our view, due at least in part to atmospheric pressure effects.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0173

Parallel CR17 EAS spec / 654**The origin of the ankle in the UHECR spectrum, and of the extragalactic protons below it****Author:** Glennys Farrar¹**Co-authors:** Luis Anchordoqui²; Michael Unger³¹ *New York University*² *Lehman College and CUNY*³ *NYU and KIT***Corresponding Author:** gf25@nyu.edu

The sharp change in slope of the ultra-high energy cosmic ray spectrum around $10^{18.6}$ eV (the ankle), combined with evidence of a light but extragalactic component near and below the ankle and

intermediate composition above, has proved exceedingly challenging to understand theoretically. We propose a mechanism whereby photo-disintegration of ultra-high energy nuclei in the region surrounding a UHECR accelerator naturally accounts for the observed spectrum and inferred composition at Earth. We discuss the conditions required to reproduce the spectrum above $10^{17.5}$ eV and the composition, which – in our model – consists below the ankle of extragalactic protons and the high energy tail of Galactic Cosmic Rays, and above the ankle of surviving nuclei from the extended source. Predictions for the spectrum and flavors of neutrinos resulting from this process will be presented, and also implications for candidate sources.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

388

Parallel GA16 H.E.S.S. / 780

AGN observations with a 100 GeV threshold using H.E.S.S. II

Author: Dmitry Zaborov¹

Co-authors: Andrew Taylor²; Carlo Romoli²; Daniel Parsons³; David Sanchez⁴; Jean-Philippe Lenain⁵; Olivier Hervet⁶

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The recent addition of the 28 m Cherenkov telescope (CT5) to the H.E.S.S. array extended the experiment's sensitivity towards low energies. The lowest energy threshold is obtained using monoscopic observations with CT5, providing access to gamma-ray energies below 100 GeV. This is particularly beneficial for studies of Active Galactic Nuclei (AGN) with soft spectra and located at redshifts $\gtrsim 0.5$. We report on the first analysis employing the CT5 data for AGN observations with a < 100 GeV threshold. In particular, the spectra of PKS 2155-304 and PG 1553+113 are presented.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

307

Parallel CR18 TH prop / 69

Fermi-LAT observations of the Sagittarius B complex

Author: Yang Ruizhi^{None}

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We use 5 years of Fermi-LAT data towards the Galactic centre giant molecular cloud complex, Sagittarius B, to test questions of how well-mixed the Galactic component of cosmic rays are and the level of the cosmic-ray sea in different parts of the Galaxy. We use dust-opacity maps from the Planck satellite to obtain independent methods for background subtraction, and an estimate for the mass of the region. We then present high-quality spectrum of γ -ray emission from 0.3 to 30 GeV, and obtain an estimate of the cosmic-ray spectrum from the region. We obtain an estimate of the mass of the region of $1.5 \pm 0.2 \times 10^7 M_{\odot}$ using the Planck data, which agrees well with molecular-line derived estimates for the same region. We find the the γ -ray flux from this region is well-fit with a cosmic-ray spectrum the same as that observed locally, with evidence of a small over-density at intermediate (1–10 GeV) energies. We conclude that the γ -ray and cosmic-ray spectrum in the region can be well-fit using a local cosmic-ray spectrum.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

92

Poster 3 CR - Board: 138 / 661

Ground Calibration of MAPMT and SiPM for JEM-EUSO

Author: Michael Karus¹

Co-authors: Andreas Ebersoldt ¹; Andreas Haungs ¹; Andreas Weindl ¹; Francesca Bisconti ¹; Harald Schieler ¹; Thomas Huber ¹

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In order to unveil the mystery of ultra-high energy cosmic rays (UHECRs), JEM-EUSO (Extreme Universe Space Observatory on-board Japanese Experiment Module) will observe extensive air showers induced by UHECRs from the International Space Station (ISS) orbit with a huge acceptance. The telescope will consist of Fresnel optics and a focal surface detector with 5,000 multi-anode photomultiplier tubes (MAPMTs) - 300,000 channels in total. In order to discuss the origin of UHECRs precisely with the observed results, it is essential to calibrate the detector pre-flight with utmost precision.

With several pathfinder missions the technical readiness level of JEM-EUSO is demonstrated, e.g. EUSO-Balloon, EUSO-TA and Mini-EUSO. These pathfinder missions also provide the perfect environment to investigate the capability of new state of the art photosensors based on Geiger mode avalanche photo diodes (G-APDs), so called silicon photomultipliers (SiPMs).

In order to absolutely calibrate and characterize different types of photosensors, an universal calibration and test setup was built at the Karlsruhe Institute of Technology (KIT). It consists of a photon shielding dark box (1.5m x 1m x 1m), a diffuse uniform light source with a calibrated optical output and several readout electronics for MAPMTs and SiPMs. The light source can be used in single-photon mode (pulsed light) and other modes, ranging from a few tens of photons to continuous light. The spectral output is around 377 ± 6 nm. Further wavelengths will be implemented with respect to the emission lines of the nitrogen fluorescence spectrum.

Former measurements with SiPMs have shown a temperature dependence of dark count and gain. Therefore, a temperature control has been implemented into the setup. With this the photo detection efficiency of various photosensors can be measured for different wavelengths and temperatures. The present status of the calibration and test setup will be reported.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

468

Poster 3 CR - Board: 156 / 854

EUSO-TA, a ground precursor to JEM-EUSO telescope at the Telescope Array site

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Co-author: Marco Ricci¹

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Registration number following "ICRC2015-I":

434

Poster 3 CR - Board: 144 / 767

The JEM-EUSO global light system laser station prototype

Author: Patrick Hunt¹

Co-authors: Andrew Osieczanek¹; Anna Evans¹; Austin Cain¹; Austin Cummings¹; Casey Baron¹; Christine Geier¹; Colton Bigler¹; Darek Bruzgo¹; David Hirsch¹; Iain Smith¹; Johannes Eser¹; John Fruit¹; Jonathan Gossman¹; Kristina Gallmeyer¹; Lawrence Wiencke¹; Martin Burg¹; Mike Mantz¹; Randy Bachman¹; Ryan Hanley¹; Thomas Wills¹; William Finch¹

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We describe the design and fabrication of a prototype Global Light System (GLS) laser ground station for the JEM-EUSO project. The GLS will be a network of ground-based UV LEDs and steered lasers to monitor and calibrate the JEM-EUSO cosmic ray detector planned for the International Space Station. The GLS units will generate optical signatures in the atmosphere that are comparable to tracks from cosmic ray extensive air showers (EASs). Unlike the EASs, the number, time, energy, location and direction (for lasers) of GLS events can be specified as JEM-EUSO passes 400 km overhead.

Laser tracks from the GLS prototype will be recorded by prototype detectors in ground-to-ground tests. Distant tracks with low angular speed are of particular interest because these are the types of EAS tracks that will be measured by JEM-EUSO. To do this ground-to-ground tests, the prototype detectors will need to measure the laser through the atmosphere at low elevation viewing angles. The beam energy can be adjusted from 1 to 90 mJ to compensate for this additional atmospheric attenuation. The frequency tripled YAG laser produces 355nm (7 ns pulse) light. This wavelength is

near the center of the UV EAS fluorescence spectrum. The system is housed in a utility trailer that can be pulled by a small truck for domestic campaigns or rolled into an industry standard 20 foot container for global deployment. In operation mode, the laser platform inside the trailer is isolated mechanically to maintain beam pointing accuracy. A retractable two stage steering head can point in any direction above the horizon. A slip ring eliminates cable wrap problems. The GLS prototype will be used to test the EUSO-TA detector and will also be used in preflight tests of the EUSO-balloon payload planned for a super pressure balloon mission.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

661

Poster 3 GA - Board: 109 / 1101

A Medium Sized Schwarzschild-Couder Cherenkov Telescope Design Proposed for the Cherenkov Telescope Array

Authors: Karen Byrum¹; Scott Wakely²; Victor Guarino³

Co-authors: Akira Okumura⁴; Daniel Nieto Castano⁵; David Kieda⁶; Dirk Naumann⁷; Emmet Roache⁸; Huyue Zhao¹; Julien Rousselle⁹; Manel Errando¹⁰; Philip Kaaret¹¹; Reshmi Mukherjee¹⁰; Richard Northrop²; Rob Cameron¹²; Ronny Sternberger⁷; Stefan Schlenstedt⁷; Steve Criswell⁸; T.Brian Humensky⁵; Vladimir Vassiliev¹³; Wystan Benbow¹⁴

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The Cherenkov Telescope Array (CTA) is an international next-generation ground-based gamma-ray observatory. CTA will be implemented as one or more arrays of tens of small, medium and large-sized imaging Cherenkov telescopes with the goal of improving the sensitivity of the current-generation experiments by an order of magnitude. CTA will provide energy coverage from ~20 GeV to more than 300 TeV. The Schwarzschild-Couder (SC) medium size (9.5m) telescopes will feature a novel aplanatic two-mirror optical design capable of accommodating a wide field-of-view with significantly improved imaging angular resolution as compared to the traditional Davis-Cotton optical design. A full-scale prototype SC medium size telescope structure has been designed and will be constructed at the Fred Lawrence Whipple Observatory in southern Arizona during the late summer of 2015. A report concentrating on the novel features of the design will be given.

Collaboration:

CTA

Registration number following "ICRC2015-I":

1167

Poster 3 GA - Board: 80 / 1167

Cosmic Ray Diffusion in the W44 Region with the MAGIC Telescopes

Authors: Diego Torres¹; Emma de Oña Wilhelmi¹; Giovanna Pedalletti²; Julian Krause³; Pierre Colin³; Roberta Zanin⁴; Sara Rebecca Gozzini²; Yoshitaka Hanabata⁵

Co-authors: Di Venere Leonardo⁶; Giordano Francesco⁶; Sano Hidetoshi⁷; Yasuo Fukui⁷; Yoshiike Satoshi⁷

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The W44 region includes the supernova remnant SNR G34.7-0.4 and two additional surrounding GeV sources, revealed with Fermi Large Area Telescope (LAT); the whole system is embedded in the giant molecular cloud G34.8-0.6.

In the hypothesis that hadrons are accelerated at the SNR shock, the geometry of the system suggests a possible signature of their diffusion and interaction with the cloud away from the acceleration site, resulting in gamma-ray emission offset from the radio SNR shell.

In order to test the diffusion scenario, the GeV source with the harder spectrum (W44 SRC1) has been observed in very-high energy gamma rays with the MAGIC Telescopes.

No significant very-high energy signal has been found from W44 SRC1 in about 100 hours of data. Upper limits on the integral flux of this region have been computed at energies above 50 GeV. The source extension will be derived by the GeV emission provided by Fermi-LAT.

The surrounding molecular cloud has been studied based on HI and CO maps provided by the NAN-TEN collaboration.

We used these data to constrain the cosmic ray diffusion coefficient in the region.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

206

Poster 3 DM and NU - Board: 285 / 1077

Search for magnetic monopoles with the ANTARES neutrino telescope

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Magnetic monopoles are hypothetical particles predicted to be created in the early Universe in the framework of Grand Unified Theories (GUTs). The signature of the passage of magnetic monopoles in a Cherenkov telescope like ANTARES (Astronomy with a Neutrino Telescope and Abyss environmental RESearch) is expected to be evident and unambiguous, because of the large amount of light emitted compared to that from muons.

A first study has been carried out in ANTARES using a limited data set of 116 days; first upper limits on the magnetic monopoles flux were established between $1.3 \cdot 10^{-17} \text{ cm}^{-2} \cdot \text{s}^{-1} \cdot \text{sr}^{-1}$ and $8.9 \cdot 10^{-17} \text{ cm}^{-2} \cdot \text{s}^{-1} \cdot \text{sr}^{-1}$ for relativistic monopoles with $\beta \geq 0.625$.

We present here an update of the analysis, using an enlarged data set (data collected from January 2008 to December 2013) and considering a wider range of values for β . No monopoles have been observed, and new improved upper limits have been set, for monopoles with $\beta \geq 0.572$.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

338

Poster 3 CR - Board: 162 / 1025

The Data Processor System of EUSO Balloon: in flight performance.

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The EUSO-Balloon experiment is a pathfinder mission for JEM-EUSO which has as its main objective an end-to-end test of all the key technologies and instrumentation of JEM-EUSO detectors.

The instrument is a telescope of smaller dimension with respect to the one designed for the ISS, it is mounted in an unpressurized gondola of a stratospheric balloon. It was launched during the CNES flight campaign in August 2014 from the Timmins (Ontario) base. The flight lasted about five hours and the payload reached a float altitude of about 40 km.

In this paper we will present the Data Processor (DP) of EUSO-Balloon. The DP is the component of the electronics system which performs the data handling and, through the interface with the telemetry system, allows the controlling and the monitoring of the instrument from ground. We will describe the main components of the system and their performance during the flight.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

546

Poster 3 SH - Board: 40 / 782

Cosmic ray hard sphere scattering in solar wind and heliospheric modulation parameters: 1963-2013

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At high rigidities (≥ 10 GV) galactic cosmic ray (GCR) particle density gradients and mean free paths (λ) in turbulent interplanetary magnetic field (B) at 1 a.u. can only be computed from the solar diurnal anisotropy (SDA) data. Long-term changes of SDA components recorded by the global network of neutron monitors (NMs) with long track records are used to compute the annual mean values of the heliospheric modulation parameters for 1963-2013 using the concept of galactic cosmic ray isotropic hard sphere scattering in the solar wind plasma. The computations of coefficient $\alpha (= \lambda_{\perp} / \lambda_{\parallel})$ at 1 a.u. were reported at the 40th COSPAR Scientific Assembly held in Moscow in 2014. In this paper we present the computed values of the product of the cyclotron frequency (ω) and mean time between diffusive collisions (τ) as well as mean free path parallel to mean B (λ_{\parallel}), radial density gradient (Gr) and asymmetric density gradient ($G\theta_a$) with respect to heliospheric current sheet (HCS) and discuss their dependence on GCR rigidity, positive (p-) and negative (n-) polarity intervals of B and sunspot activity.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1028

Poster 3 CR - Board: 160 / 560

Mini-EUSO: a pathfinder for JEM-EUSO to measure Earth's UV background from the ISS.

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For any experiment aiming at the observation of Ultra High Energy Cosmic Rays (UHECR's) from space, one key measurement is related to the UV background produced in Earth atmosphere. In view of the planned missions (KLYPVE/K-EUSO, JEM-EUSO) at the International Space Station (ISS), a small, compact UV telescope, Mini-EUSO, is being developed by the JEM-EUSO International Collaboration to be placed at the transparent, nadir looking UV window of the Russian module of the ISS. Mini-EUSO is a mission approved by the Italian Space Agency (ASI) and, under the name "UV atmosphere", by the Russian Space Agency Roscosmos. Scientific, technical and programmatic aspects of this project will be described.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

0434

Poster 3 CR - Board: 182 / 188

Determination of source spectra of ultrahigh energy cosmic rays

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The energy spectra and composition of ultra-high energy cosmic rays are changing in a course of propagation in the expanding Universe filled with background radiation. We use a numerical code for solution of inverse problem for cosmic-ray transport equations that enables the determination of average source spectra of different nuclei from the cosmic ray spectra observed at the Earth. The source spectrum is calculated without ad hoc assumptions about its' shape. The injection spectra of a few groups of nuclei in extragalactic sources are found. The effects of cosmological source evolution and the finite distance to the nearest source are studied. The data from the Auger experiment and the combined data from the Telescope Array + HiRes experiments are used to illustrate the method.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0195

Poster 3 SH - Board: 22 / 22

11 Year variation in third harmonics of cosmic ray intensity on quiet days

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The aim of this work is to study the long term variation in third harmonics of cosmic ray intensity on sixty quietest days in a year using the data of high latitude and low latitude neutron monitoring stations during the solar cycle 20-22. It has been observed that in spite of the abrupt change in the amplitude and phase of third harmonic of cosmic ray intensity, the amplitude of third harmonics is relatively larger during the solar cycle 21 as it is observed during the declining phase of earlier solar cycle 20. Therefore this enhancement explicitly points out 11 year periodicity in third harmonics of cosmic ray intensity at equatorial neutron monitoring stations. Further, the phase shift to later hours during the year 1990 showing the dependence on the polarity of solar magnetic field, which is attributed to drift effect at high latitude neutron monitoring station

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

25

Poster 3 DM and NU - Board: 284 / 636

Limits on point-like sources with different spectral indexes around the Galactic center using the ANTARES neutrino telescope

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Motivated by an accumulation of events close to the Galactic center in the High Energy Starting Events (HESE) reported by the IceCube Collaboration, a search for point-like sources up to an extension of a few degrees in a wide region around the Galactic center has been performed using the ANTARES neutrino telescope. Different spectral indexes for the energy spectra of the sources, in addition to the default value of $\gamma = 2.0$, have been tested. Upper limits on the flux normalization as a function γ have been set.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

558

Poster 3 GA - Board: 112 / 957

HARPO, TPC as a gamma telescope and polarimeter: First measurement in a polarised photon beam between 1.7 and 74 MeV

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Gamma-ray astronomy allows us to explore the non-thermal emissions and magnetic field configuration of objects such as Active Galactic Nuclei (AGN), Gamma Ray Bursts (GRB) and pulsars.

Presently, there is a sensitivity gap for gamma rays between 1 MeV and 100 MeV.

Additionally, there is no polarisation measurement above 1 MeV, although such a measurement could shed light on emission processes.

A gaseous detector can achieve a much better angular resolution in the MeV-GeV range than the current/past telescopes that use tungsten converters, thanks to the reduced multiple scattering of the electrons and positrons from conversion.

This translates to a greatly improved point source sensitivity and also gives access to the linear polarisation of the photons through the azimuthal angle of the electron-positron pair.

The HARPO Time Projection Chamber (TPC) has been designed as a high angular resolution telescope for gamma-ray polarimetry.

It was set up in a polarised gamma-ray beam at the NewSUBARU accelerator in Japan in November 2014.

Data were taken at different photon energies from 1.7 MeV to 74 MeV, and with different polarisation configurations.

The full experimental setup of the TPC and the photon beam will be described.

The first results from the beam campaign will be shown.

The future projects toward a space telescope will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1196

Poster 3 CR - Board: 218 / 1259

On the Combined Analysis of Muon Shower Size and Depth of Shower Maximum

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The mass composition of ultra-high energy cosmic rays can be studied from the distributions of the depth of shower maximum and/or of the muon shower size. We study the dependence of the mean muon shower size on the depth of shower maximum in more details. Air showers induced by four different primaries were simulated with two models of hadronic interactions already tuned with LHC data. The generated air showers were combined to obtain various types of mass composition of the primary beam. We investigate the shape of functional dependence of the mean muon shower size on the depth of shower maximum and its dependency on the composition mixture and resolution of the measurement.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

963

Poster 3 CR - Board: 174 / 1364

A Cockcroft-Walton High-Voltage Power Supply for the EUSO Instruments

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The future JEM-EUSO instrument is a UV telescope to be installed on the International Space Station (ISS) with the goal of observing Extensive Air Showers (EAS) created by Ultra-High Energy Cosmic Rays (UHECRs). EUSO-balloon is a pathfinder mission for JEM-EUSO which flew in a stratospheric balloon from Timmins, Canada in August 2014. Due to its placement on the ISS, two major specifications of the JEM-EUSO instrument are that: i) the power allocated for the entire instrument should be no more than 1000 W; requiring that the power allocated to polarize the Photomultiplier Tubes (PMTs) should be less than ~50 W (using normal resistive voltage dividers requires nearly 2 kW), and ii) the light intensity reaching JEM-EUSO has a dynamic range larger than 1E6, going from the background illumination (about one photoelectron per pixel per 2.5 μ s) up to Transient Luminous Events (TLE). Our solution for i) is to use a Cockcroft Walton circuit to effectively create a separate power supply for each dynode, regrouping identical dynodes at the same power supply. These groups will be at the level of the Elementary Cell (EC) (4 PMTs). The required dynamic range, ii), will be provided by a switching circuit, giving an overall dynamic range of 1E6 in steps of 100 and in a time of several microseconds. Here we present the Cockcroft-Walton high voltage power supply design used in EUSO-Balloon. This design resulted in a power consumption of 630 mW to polarize the entire EUSO-Balloon focal surface (36 PMT), and the switching circuit was capable of reducing the focal surface collection efficiency within 2.5 μ s.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

560

Poster 3 CR - Board: 226 / 1189

On the primary model to explain the relation between a rigidity-dependent spectral hardening of proton and helium spectra and a sharp knee of the all-particle spectrum.

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CR spectrum may be not expressed by a simple power law in a certain energy region. Recently, PAMELA, ATIC and CREAM presented a rigidity dependent spectral breaks and remarkable hardening after the breaks in the rigidity region above about 100 GV. On the other hand, the all-particle energy spectrum of primary cosmic rays observed in a wide range from 10^{14} to 10^{17} eV with the Tibet-III AS array clearly shows a sharp knee at around 4 PeV. In order to explain the both data, we propose a phenomenological model in which extra nearby CR sources are responsible for creating a sharp knee. In this paper, we discuss some details of our model and also show that this model can well explain both the data by PAMELA and others in the lower energy region and that by the Tibet-III AS gamma experiment simultaneously. This model also predicts a dominance of cosmic-ray nuclei heavier than helium at the knee.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

920

Poster 3 CR - Board: 168 / 1155

Analysis of EUSO-Balloon data with Offline

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EUSO-Balloon is a balloon-borne experiment, conceived as a pathfinder for JEM-EUSO experiment which is the first experiment measuring the highest energy cosmic rays from space.

EUSO-Balloon is equipped with an optical system made by two Fresnel lenses and one photo detection module (PDM), representing a complete prototype for the JEM-EUSO experiment. On 24th August 2014 EUSO-Balloon was launched from Timmins Balloon base in Ontario (Canada) in collaboration with the French Space Agency CNES. The flight lasted about 5 hours with a float altitude of about 38 km, observing regions with different background light. The instrument has been also tested with laser shots emitted from an helicopter flown under the balloon for about 2 hours. A procedure to analyze these data and compare them with simulation is developed into the Offline framework. The results are reported in the following contribution.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

901

Poster 3 GA - Board: 65 / 1135

FACT-Tools: Streamed Real-Time Data Analysis

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The First G-APD Cherenkov telescope (FACT) is dedicated to monitor bright TeV blazars on the northern sky. The use of silicon photon detectors allows for a larger duty cycle, which results in a huge amount of allocated data (~800 GB/night). In order to satisfy its monitoring purpose, changes in the flux of the observed sources have to be registered without delay. This requires a data analysis chain that provides physical results at a rate that is comparable to the trigger rate of ~60Hz.

The recently developed data analysis software *FACT-Tools* aims to accomplish these requirements in real-time. It is implemented based on the data-flow framework *Streams*, which was developed at Dortmund's collaborative research center for resource-constrained data analysis (SFB 876). *Streams* provides an easy-to-use abstraction layer to design analysis processes by use of human readable XML files, aiming at modularity and guaranteed reproducibility. Multi-source processes (e.g. data from several telescopes) and multi-core processes (parallelization) are already included in *Streams*. In addition, a compatibility layer to Big Data software infrastructures (e.g. Hadoop, Apache Storm) is already supported. Therefore, *Streams* is an ideal framework for use in gamma-ray astronomy.

The *FACT-Tools* are an extension library that encapsulate analysis methods for Cherenkov telescopes. The collection of methods is ranging from RAW data handling and calibration up to image parameter extraction and Gamma-Hadron separation. The latter is performed by an online application of a random forest classifier, which in turn, allows for an adaptation in other tasks e.g. image cleaning or online estimation of the energy spectrum.

In this contribution we present the features of *FACT-Tools* and *Streams* alongside with their performance measured on the data from the FACT Cherenkov telescope.

Collaboration:

FACT

Registration number following "ICRC2015-I":

910

Poster 3 CR - Board: 141 / 1008

Performance of the Spanish Infrared Camera onboard the EUSO-BALLOON (CNES) flight on August 24, 2014.

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The EUSO-balloon, pathfinder for the JEM-EUSO Space Mission, was launched during the night of August 24, 2014. The main aim of the flight was to test all the technologies developed for JEM-EUSO under very severe operating conditions (Stratosphere ~ 40 km altitude), partly representative of the working conditions in ISS. The IR camera onboard EUSO-Balloon is used to obtain the Cloud Top Height (CTH) and cloud coverage in the Field of View (FOV) by using two Long Wave InfraRed (LWIR) bands centered at 10.8 μm and at 12 μm . In order to achieve these objectives a precise control of all the components during the flight is mandatory. The present work is devoted to the evaluation of the spectral and angular response of the microbolometer and filters and a geometrical description of all the components of the IR camera to achieve the proper performances. Once the theoretical study is done, it has to be checked experimentally, determining the involved parameters that have to be taken into account. After this work, we will be able to calculate the CTH of all the clouds in the FOV of the IR camera.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

800

Poster 3 CR - Board: 180 / 144

The new horizon disclosed by the measurements of the chemical composition of the cosmic radiation above the ankle energy

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The measurements of the chemical composition of the cosmic radiation in the last years above the ankle energy have modified the foundation of Cosmic Ray Physics and have simple, compelling, unambiguous interpretation: (1) high energy cosmic rays in the band $3 \times 10^{18} - 3 \times 10^{20}$ eV do not have an extragalactic origin; (2) the cosmic nuclei above the ankle are not dominated by protons but they have a mixed composition with a rising fraction of Iron up to highest observed energies $\approx 2 \times 10^{20}$ eV where the Iron abundance dominates; (3) the cutoff of the spectrum observed at the incipient energy of $2.5-3 \times 10^{19}$ eV is not due to the collisions of the extragalactic cosmic protons

with the ubiquitous cosmic photons of $\approx 5 \times 10^{-4}$ eV but to a galactic process.

The consistency of the experimental data on the chemical composition of various experiments are presented and shortly discussed. The focus of the presentation is on the severe and illuminating constraints implied by these measurements on the quest for the mechanism accelerating cosmic rays in the Galaxy which is presently unknown.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

153

Poster 3 GA - Board: 57 / 1070

Observing the Cosmic Ray Moon Shadow with VERITAS

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The Earth is subjected to an isotropic flux of very-high-energy cosmic rays (VHE, $E > 100$ GeV) unless they are obscured by an object, such as the Moon. The Moon creates a deficit in the uniform flux and, since cosmic rays are charged, this deficit is deflected by the Earth's magnetic field, enabling the rigidity of the obstructed cosmic rays to be determined. Measurement of the relative deficits of different species enables the positron fraction and the antiproton ratio to be measured. The April 15, 2014 lunar eclipse was visible with the VERITAS Cherenkov telescopes, which allowed (with special UV bandpass filters installed) 74 minutes of direct observations of the Moon and the associated deficit in the cosmic-ray flux. The results of this observation will be presented. Additionally VERITAS has been conducting a series of observations by pointing close to a partially illuminated Moon and observing with a reduced high voltage applied to the photo-multiplier-tubes and also using UV bandpass filters. We present the technique developed for these observations and their current status.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

884

Poster 3 GA - Board: 114 / 773

Development of an optical system for the SST-1M telescope of the Cherenkov Telescope Array observatory

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The prototype of a Davies-Cotton small size telescope (SST-1M) has been designed and developed by a consortium of Polish and Swiss institutions and proposed for the Cherenkov Telescope Array (CTA) observatory. The main purpose of the optical subsystem is to focus the Cherenkov light emitted by extensive air showers in the atmosphere onto the focal plane detectors. The main component of the subsystem is a dish consisting of 18 hexagonal mirrors with a total effective collection area of 6.47 m² (including the shadowing and estimated mirror reflectivity). Such a solution was chosen taking into account the analysis of the Cherenkov light propagation and based on optical simulations. The proper curvature and stability of the dish is ensured by the mirror alignment system and the isostatic interface to the telescope structure. Here we present the design of the optical subsystem together with the performance measurements of its components.

Collaboration:

CTA

Registration number following "ICRC2015-I":

98

Poster 3 SH - Board: 32 / 437

GCR intensity during the sunspot maximum phase and the inversion of the heliospheric magnetic field

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Recently the maximum phase of the current solar cycle (SC) 24, in many relations anomalous when compared with solar cycles of the second half of the 20-th century, came to the end. The corresponding phase in the GCR intensity cycle is also in progress.

In this paper we study different aspects of the sunspot and GCR behavior around this phase. First, the amplitudes of the SC 24 in the solar activity and GCR intensity are considered with respect to the previous sunspot cycles. Beside the different well-known prediction techniques, the values for maximum phase are estimated from the correlation between characteristics in the maximum and in the inflection points (few years before maximum) for the previous solar cycles. Second, the GCR-effects specific for the maximum phase - Gnevyshev Gap effect, quasi-biennial oscillations and the energy hysteresis – are studied and correlated with QBO in the strength of the heliospheric magnetic field (HMF) and with the inversion of the HMF polarity.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

215

Poster 3 CR - Board: 200 / 753

An Additional Component Blurring the Transition between Galactic and Extragalactic Cosmic Rays?

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Recent KASCADE-Grande and Auger results between 10^{17} eV and $5 \cdot 10^{18}$ eV have revealed complex features in the energy spectrum, be it in the all-particle one or in the composition-sensitive ones. They have also revealed that the mass composition is dominated by iron nuclei around 10^{17} eV, and by light and intermediate-nuclei elements above 10^{18} eV. In this contribution, we argue that these results can be interpreted in a coherent way as the manifestation of an additional component of a different origin from the one responsible for the bulk of Galactic cosmic rays. This component, sub-dominant below 10^{17} eV, appears dominant together with the extragalactic one once the standard Galactic component is extinguished above few 10^{17} eV, and is responsible for the ankle feature through its rapid suppression above 10^{18} eV. Possible signatures left in the large-scale structure of arrival directions are discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

607

Poster 3 GA - Board: 88 / 1183

Statistical biases of spectral analysis with the ON-OFF likelihood statistic

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Spectral extraction in the VHE range is usually performed using the ON-OFF likelihood statistics which is based on the profile likelihood technique. The latter is known to lead to inconsistent estimators in some situations. We present here a systematic MC study of the distribution of fitted spectral parameters for typical observations with the HESS observatory and show that, in some conditions, spectral extraction yields inconsistent estimators. We discuss some techniques to alleviate this effect and the impact on the search for spectral cutoffs in the very low statistic regime.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

842

Poster 3 GA - Board: 55 / 665

Observer Access to the Cherenkov Telescope Array Gamma-Ray Observatory

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The Cherenkov Telescope Array (CTA), a ground-based facility for very-high-energy (VHE) gamma-ray astronomy, will operate as an open observatory serving a wide scientific community to explore and to study the non-thermal universe. Open community access is a novelty in this domain, putting a challenge on the implementation of services that make VHE gamma-ray astronomy as accessible as any other waveband. We will present here the design of the CTA Observer Access system that comprises support of scientific users, dissemination of data and software, tools for scientific analysis, and the system to submit observing proposals. We will illustrate typical scientific user workflows and provide a glance on future CTA science analysis based on recent software developments.

Collaboration:

CTA

Registration number following "ICRC2015-I":

552

Poster 3 DM and NU - Board: 283 / 1090

Unfolding measurement of the Atmospheric Neutrino Spectrum using IceCube-79/86

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IceCube is a cubic kilometer neutrino telescope located at the geographic South Pole. Although primarily designed for the detection of cosmic neutrinos, the detector is well suited for measurements of the atmospheric muon neutrino energy spectrum. We present the first measurement of the atmospheric neutrino energy spectrum obtained in its full 86-string configuration. The analysis was carried out using dedicated machine learning algorithms for the selection of neutrino candidates. The spectrum was obtained by applying regularized unfolding as implemented in the unfolding software TRUUE. An additional component due a diffuse flux of high energy astrophysical neutrinos has been observed in addition to the flux of atmospheric neutrinos.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

888

Poster 3 CR - Board: 205 / 1005

Do Ultrahigh Energy Cosmic Rays Originate in our Galaxy?

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The possibilities are considered that ultrahigh energy cosmic rays, even at the highest energy, originate a) in our Galaxy and b) specifically at the Fermi bubble.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

835

Poster 3 DM and NU - Board: 289 / 969

Follow-up of high energy neutrinos detected by the ANTARES telescope

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The ANTARES telescope is well suited to detect neutrinos produced in astrophysical transient sources as it can observe a full hemisphere of the sky with a high duty cycle. Potential neutrino sources are gamma-ray bursts, core-collapse supernovae and flaring active galactic nuclei. To enhance the sensitivity of ANTARES to such sources, a detection method based on follow-up observations from the neutrino direction has been developed. This program, denoted as TAToO, includes a network of robotic optical telescopes (TAROT, Zadko and MASTER) and the Swift-XRT telescope which are triggered when an “interesting” neutrino is detected by ANTARES.

A follow-up of special events, such as neutrino doublets in time/space coincidence or single neutrino having a very high energy or in the specific directions of local galaxies, significantly improves the perspective for the detection of transient sources. As images can be taken within 20 seconds after the neutrino trigger and as observations are also made up to two months after the alert, the search for fast transient sources such as gamma-ray burst afterglows or slowly rising sources such as core-collapse supernovae becomes possible.

Recently, the follow-up has been extended with a search for correlations between neutrinos and individual high energy photons detected by Fermi-LAT.

The analysis of follow-up observations, as well as the search for ν/γ correlations have been done and the results covering optical, X-ray and gamma-ray data, will be presented.

Collaboration:

ANTARES

Registration number following “ICRC2015-I”:

812

Poster 3 SH - Board: 39 / 776

North-south excess of hemispheric sunspot numbers and cosmic ray modulation

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The timeline of solar activity is discussed with data for the annual mean north-south excess (NSE) of hemispheric sunspot numbers (SSNs) for 1945-2014, covering five SSN cycles (18-23) and the rising phase of cycle 24. We report the results of our study of the relation between NSE and galactic cosmic ray (GCR) modulation at 1 a.u. The significance of our results is discussed.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

94

Poster 3 DM and NU - Board: 266 / 1296

Dark Matter Annihilation and Decay Searches with the High Altitude Water Cherenkov (HAWC) Observatory

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In order to observe annihilation and decay of dark matter, several types of potential sources should be considered. Some sources, such as dwarf galaxies, are expected to have very low astrophysical backgrounds but fairly small dark matter densities. Other sources, like the Galactic center, are expected to have larger densities of dark matter but also have more complicated backgrounds from other astrophysical sources. To search for these signatures of dark matter, the large field-of-view of the HAWC detector, covering 2 sr at a time, particularly enables searches from sources of dark matter annihilation and decay, which are extended over several degrees on the sky. With a sensitivity over 2/3 of the sky, HAWC has the ability to probe a large fraction of the sky for the signals of TeV-mass dark matter. In particular, HAWC should be the most sensitive experiment to signals coming from dark matter with masses greater than 10-100 TeV. We present the HAWC sensitivity to annihilating and decaying dark matter signals for several likely sources of these signals.

Registration number following "ICRC2015-I":

1159

Poster 3 CR - Board: 185 / 226

PCR energy spectrum and composition above the knee: new approach to experimental data interpretation

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EAS investigation is the only way to obtain information about PCR energy spectrum and composition above the knee. Usually it is assumed that primary particle energy is equal to EAS energy, which is evaluated from measured EAS parameters. At that, it is also assumed that interaction model at such energies is known as a continuation of models verified at accelerator energies. Therefore it is supposed that all changes of EAS characteristics in dependence on energy are results of PCR energy spectrum and composition changes only (cosmophysical approach).

In this talk another approach (nuclear-physical one) is considered. It is supposed that interaction model at energies above the knee is drastically changed. The reasons of consideration of such approach are the following: the difficulties in explanation of behavior of the energy spectrum and especially mass composition in dependence on energy in the frame cosmophysical approach; unusual behavior of some EAS parameters: excess of muons compared to simulations at limiting suppositions about composition (pure iron) and interaction model (with maximum muon yield); observations of unusual events in various experiments (halo, alignment, penetrating cascades, long-flying component, Centauros and AntiCentauros, excess of muons with energy above 100 TeV), which cannot be explained in the frame of existing interaction models.

The proposed approach based on the production of blobs of quark-gluon matter (plasma) with a large orbital momentum allows explain behavior of PCR energy spectrum and mass composition and all observed above the knee events and phenomena from a single point of view. Experiments for checking of new interpretation models are discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

50

Poster 3 CR - Board: 169 / 1292

Implementation in OFFline of the reconstruction code of the Infrared Camera of the JEM-EUSO Space Mission.

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The JEM-EUSO Atmospheric Monitoring System (AMS) consists of a bi-spectral Infrared Camera and a LIDAR device that are being fully designed under space qualification to fulfil the scientific requirements of this space mission. An understanding of the atmospheric conditions in the Field of View (FoV) of the telescope is mandatory for a space-based mission which aims to detect Ultra-High Energy Cosmic Rays (UHECR) and Extremely-High Energy Cosmic Rays (EHECR) from Space using the Earth's atmosphere as calorimeter. In this work the steps of the simulation and reconstruction processes in the Offline framework are explained. The relevant modules developed for the calibration, simulation and reconstruction tasks of the images from the Infrared camera including its configuration options are discussed. This presentation represents the status of the JEM-EUSO Infrared camera modules as implemented in Offline.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

958

Poster 3 GA - Board: 81 / 1032

A Monte Carlo template-based analysis for very high definition imaging atmospheric Cherenkov telescopes as applied to the VERITAS telescope array

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VERITAS is an imaging atmospheric Cherenkov telescope array that is sensitive to very-high energy gamma-rays from 85 GeV to 30 TeV. We present a high-performance shower-image analysis. The algorithm is based on the likelihood fitting of the charge amplitude in the camera pixels to an expected image template. The templates are generated by performing Monte-Carlo simulations of a large number of air showers for a given event parameter set, followed by ray-tracing of the telescope optics. A maximum likelihood fit is performed to find the best-fit shower parameters. A related reconstruction algorithm has already been shown to provide significant improvements over traditional reconstruction for both the CAT and H.E.S.S. experiments.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

225

Poster 3 GA - Board: 54 / 666

The H.E.S.S. Galactic plane survey poster

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We will present a high-resolution image of the H.E.S.S. Galactic plane survey with interesting sources and features highlighted. This poster is complementary to the talk "The H.E.S.S. Galactic plane survey". Come talk to us about sources of interest to you or any questions you might have how to properly use the HESS survey significance, flux and upper limit maps and source catalog in FITS format which are distributed along with the HGPS paper.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

572

Poster 3 CR - Board: 203 / 934

On galaxies as accelerators of cosmic rays

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One of the hypotheses about nature of ultra-high energetic tails of cosmic ray (CR) spectrum assumes extragalactic origin. Intergalactic CRs includes particles both emitted and reflected by galaxies. The particles entering and leaving galaxies undergo additional acceleration depending on the time spent there. One can assume, that such particles participate, at least partially, in forming the energy spectrum in the ankle region. To estimate characteristics of this process, we consider a simple version, when a charged particle falls on a plane layer of ISM and is reflected from it. As is known, the diffusion approximation fails to get the time and path distributions, so we apply more proper tools for calculations. The time distribution is obtained via the analytical solution of the linearized Boltzmann equation [1], and the acceleration process is calculated by solving the integral reacceleration equation [2]. In addition, our analysis takes a fractal (turbulent) properties of ISM into account in frame of the nonlocal CR transport theory [3]. Results of numerical calculations show that the hypothesized effect really exists, but very sensitive to parameters of turbulent heterogeneity.

This work is supported by Russian Foundation for Basic Research (grant 13-01-00585).

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Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1134

Poster 3 SH - Board: 31 / 408

Long-term scaler and histogram analysis

Author: Jimmy J. Masías-Meza¹

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The low energy modes of the Surface Detector array of the Pierre Auger Observatory record variations in the flux of low energy secondary particles with extreme detail. In these modes, the rate of signals above a very low threshold (scalers) and the calibration charge histograms of the individual pulses detected by each water-Cherenkov detector are used. Previous work has studied the flux of galactic cosmic rays on short and intermediate time scales (i.e. from minutes to weeks) using these low energy modes. In this work, after including a long-term correction to the response of the detectors, we present the first long-term analysis of the flux of cosmic rays using scalers and the

calibration histograms. We show its sensitivity to the solar cycle variation and its relation to the solar modulation of cosmic rays for a 9-year period of the last solar cycle.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

713

Poster 3 DM and NU - Board: 261 / 125

A search for Dark Matter in the centre of the Earth with the Ice-Cube neutrino detector.

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Many models predict new particles that have the properties of a Weakly Interacting Massive Particle (WIMP) and could explain the dark matter observed in the universe. Heavy celestial bodies, such as the Earth, could capture these WIMPs and accumulate them. Over time the WIMPs will self-annihilate and may produce standard model particles, including neutrinos. Large scale neutrino telescopes, such as the cubic kilometre IceCube Neutrino Observatory located at the South Pole, can be used to search for such neutrino fluxes.

The dark matter annihilation rate in the centre of the Earth, and thus the resulting neutrino flux depend on the local Dark Matter density and the mass of the Dark Matter particle. This flux could be within reach of a large neutrino detector like IceCube.

We present the status of the first search for Earth WIMPs with the IceCube detector.

Registration number following "ICRC2015-I":

137

Poster 3 SH - Board: 37 / 593

A new approach to modeling the effects of the wavy current sheet on cosmic rays in the heliosphere

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The study of the modulation of cosmic rays in the heliosphere has recently been done by using increasingly the stochastic differential equation (SDE) approach to solving the well-known transport equation. This approach, which is now well-established and published, allows for an in depth study of the modulation effects of the wavy heliospheric current sheet (HCS), in particular as its waviness increases with increasing solar activity up to extreme solar maximum conditions. This can be done because these pseudo-particles can be traced so that insightful trajectories of how they respond to the wavy HCS can be computed and displayed. The results of this numerical modeling study will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1100

Poster 3 GA - Board: 104 / 739

The Calibration System of the HAWC Gamma-Ray Observatory

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The HAWC collaboration has recently completed the construction of a gamma-ray observatory at an altitude of 4100 meters on the slope of the Sierra Negra volcano in the state of Puebla, Mexico. In order to achieve an optimal angular resolution, energy reconstruction, and cosmic-ray background suppression for the air showers observed by HAWC, it is crucial to obtain good timing and charge calibrations of the photosensors in the detector. The HAWC calibration is based on a laser system which is able to deliver short light pulses to all the tanks in the array. The light intensity can range over 5 orders of magnitude, broad enough to cover all the dynamic range of the PMT readout electronics. In this contribution we will present the HAWC calibration system, together with the methods used to calibrate the detector.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

332

Poster 3 DM and NU - Board: 271 / 592

Search for signal emission from unresolved point sources with the ANTARES neutrino telescope

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We use a two point correlation analysis to look for inhomogeneities in the arrival directions of the high energy muon neutrino candidates detected by the ANTARES neutrino telescope. This approach is complementary to a point source likelihood-based search, which is mainly sensitive to one bright point like source and not to collective effects. We present the results of a search based on this two-point correlation method performed on ANTARES 2007-2012 data, providing constraints on models of a population of point sources too faint to be detected by the likelihood-based method.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

526

Poster 3 DM and NU - Board: 251 / 819

Antiquark nuggets as dark matter: Detection prospects with the ANITA3 experiment

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Regions of parameter space for a nearly forty year old hypothesis explaining dark matter with the existence of heavy composite quark objects remain unexplored. The Antarctic Impulsive Transient Antenna (ANITA) experiment, a NASA-sponsored long duration balloon payload, is in a unique position to test this exotic dark matter candidate by exploiting the sensitivity of an on-board monitoring subsystem. We present estimates of the experimental sensitivity of ANITA to these dark matter candidates, and preliminary results for the three flights of the payload to date.

Registration number following "ICRC2015-I":

716

Poster 3 CR - Board: 201 / 811

Magnetic field amplification by high Alfvén Mach number shocks in partially ionized plasmas

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The interstellar medium and ejecta of supernova are not always completely ionized. Such partially ionized plasmas are thought to be unsuitable for cosmic ray acceleration. In order to study shock structures of collisionless shocks in partially ionized plasmas, we perform two-dimensional hybrid simulations. We find that large density fluctuations and large magnetic fields fluctuations are generated both in the upstream and downstream regions for high Alfvén Mach number shocks. For the shock velocity $V_s = 1333 \text{ km/s} = 57 V_a$, the strong turbulence is generated in the downstream region by the upstream density fluctuations and the downstream magnetic field is amplified over 30 times the initial upstream magnetic fields. In addition, we find that the velocity distribution of downstream hydrogen atoms has three components for $V_s = 1333 \text{ km/s}$. Observed shock structures suggest that diffusive shock acceleration can operate at perpendicular shocks propagating into partially ionized plasmas in real three-dimensional systems. If possible, we will present results of three-dimensional simulations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

708

Poster 3 CR - Board: 165 / 816

EUSO-Balloon mission to record extensive air showers from near space

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The first Balloon-EUSO stratospheric flight launched from Timmins Ontario by the French Space Agency (CNES) recorded artificial tracks and pulses from a laser and optical flashers flown in helicopter (NASA) under the balloon. To make the first measurements of high energy cosmic ray extensive air showers from near space, preparations are underway for a super pressure balloon flight of several weeks duration. The proposed launch site is Wanaka New Zealand. We describe the parameters of this mission, the updated instrument, and the expected rates of extensive air shower events produced by cosmic primaries in the energy range of $\sim 5 \times 10^{17}$ to $\sim 2 \times 10^{19}$ eV. A precursor short duration flight from Aire sur l'Adour France is also envisioned to test improvements to the instrument.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

1018

Poster 3 GA - Board: 94 / 719

Feasibility of VHE gamma ray detection by an array of Imaging Atmospheric Cherenkov Telescopes using the fluorescence technique

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The last 20 years have seen the development of new techniques in Astroparticle Physics providing access to the highest end of the electromagnetic spectrum. It has been shown that some sources emit photons up to energies close to 100 TeV. Yet the fluxes of these photons are incredibly low and to go higher in energy new detection techniques are needed.

A new technique that would use the new generation of Cherenkov Telescopes, i.e., the Cherenkov Telescope Array (CTA), is proposed to push further the energy frontier. It is based on the detection of the fluorescence radiation emitted in Extensive Air Showers (EAS), a successful method used in ultra-high-energy cosmic ray experiments, like the Pierre Auger Observatory. It would require minor modifications of the hardware currently being developed for the CTA and would not imply significant extra cost during its planned operation.

We study an array of Cherenkov Telescopes of 12 meters diameter, with characteristics similar to some of the proposed components of CTA, making some basic assumptions on its behavior. Using a toy model for the development and detection of gamma-ray induced EAS we compute the approximated effective areas and exposures at trigger level for different energies and incidence angles. The results show that at trigger level the fluorescence technique might be competitive at the highest energies. It remains to be proved if an efficient gamma/hadron separation can be achieved under those conditions.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

333

Poster 3 CR - Board: 143 / 717

Performance of the EUSO-BALLOON optics

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EUSO-BALLOON is a prototype of the JEM-EUSO detector, to perform an end-to-end test of the subsystems and components, and to prove the entire detection chain and measure the atmospheric

and terrestrial UV background. In August 2014, the instrument was launched in collaboration with the French Space Agency CNES for its maiden flight.

This article describes the optics of EUSO-BALLOON, consisted of two large (1 m²) Fresnel lenses made from PMMA. We also present the methods used for the alignment and characterization of the optics. The alignment of the optics was obtained with the use of a laser tracker and the tests were performed using a one-meter collimator and UV light sources. We present the performance of the optical system, i.e. the point spread function, and the global efficiency as a function of UV wavelength and incidence angle.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

636

Poster 3 CR - Board: 198 / 711

Cosmic Ray Acceleration at Supernovae Occurring in Structured Environments

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Progenitors of some supernovae (especially Type II_n) are expected to explode in circumstellar environments containing clumps, or shells from previous eruptions. We show that supernovae occurring in such structured environments must be able to accelerate cosmic rays (CR) to high or very-high energies.

In this work, we present a detailed study of the maximum CR energy that can be reached in such systems, and we calculate the amount of energy (per supernova) that can be channelled into CRs. We study the dependence of our results on the parameters of the progenitor star, and on the parameters of the structures in the circumstellar medium.

These high-energy CRs interact with the dense circumstellar gas and produce secondary high-energy neutrinos and gamma-rays. We compute the fluxes of gamma-rays and neutrinos that should be produced by supernovae exploding in such environments.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

623

Poster 3 GA - Board: 71 / 710

Sensitivity of HAWC to Primordial Black Hole Bursts

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Primordial Black Holes (PBHs) are gravitationally collapsed objects that may have been created in the early universe and could have arbitrarily small masses down to the Planck scale. Due to quantum gravitational effects, it is believed that a black hole has a temperature inversely proportional to its mass and will emit all species of fundamental particles thermally. PBHs with initial masses of $\sim 5.0 \times 10^{14}$ g should be expiring in the present epoch with bursts of high-energy particles, including gamma radiation in the GeV/TeV energy range. The HAWC (High Altitude Water Cherenkov) high energy observatory is sensitive to the high end of the PBH evaporation gamma-ray spectrum. Due to its large field of view, duty cycle above 90 % and sensitivity up to 100 TeV, the HAWC observatory is well suited to perform a search for PBH bursts. In this work, we show that if the PBH explodes within 0.25 light years from Earth and within 26 degrees of zenith, HAWC will have a 95% probability of detecting the PBH burst at 5 sigma level. On the other hand a null detection from HAWC for a >2 year search will set PBH upper limits which are significantly better than any other upper limits set by any previous PBH search.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

1279

Poster 3 CR - Board: 195 / 606

Monte Carlo simulations of proton acceleration in colliding wind binaries

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Particles accelerated at the shocks forming at the wind collision region of a binary system of massive stars are expected to produce γ -rays dominantly either through inverse Compton scattering of electrons in the stellar radiation fields, or through the decay of neutral pions produced in proton-proton collisions.

Up to now, the only colliding wind binary (CWB) associated with γ -ray emission is η Carinae, where two components seem to be present. So far, there is no evidence for γ -ray emission from other binary massive star systems, such as WR 140 or WR 147, which were expected to be detected with comparable or even higher fluxes.

We investigate injection and acceleration of protons in a typical CWB system by means of Monte Carlo simulations with a test-particle approach. We rely on hydrodynamic simulations for determining the background conditions in the wind collision region. Both shocks on either side of the contact discontinuity are considered, looking for different accelerated particle populations, that could result

in different components of the γ -ray spectrum. Such studies may contribute to understand the lack of detection of γ -rays from most of these CWB systems up to now.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

541

Poster 3 DM and NU - Board: 290 / 1063

Recent improvements in the detection of supernovae with the Ice-Cube observatory

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With a lattice of 5160 photomultiplier tubes, IceCube monitors one cubic kilometer of deep Antarctic ice in order to detect neutrinos via the Cherenkov photons emitted by charged secondaries arising from their interactions in matter. Due to subfreezing ice temperatures, the photomultipliers' dark noise rates are particularly low. Therefore a collective rate enhancement introduced by interacting neutrinos in all photomultipliers can be used to search for the signal of galactic core collapse supernovae, providing excellent sensitivity for those of galactic origin. A detailed understanding of the characteristics and temporal changes of the dark rate background has been achieved and cosmic ray muons, responsible for the majority of fake supernova candidate triggers, are rejected in real time. An addition to the standard data acquisition allows us to buffer all registered photons in the detector in case of a serious alert. By analyzing these data, a precision determination of the burst onset time and

the characteristics of rapidly varying fluxes, as well as estimates of the average neutrino energies and - for supernovae ending in a black hole - of the burst direction may be obtained. Such data are also crucial to characterize details of the noise behavior and of the atmospheric muon background.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

844

Poster 3 DM and NU - Board: 252 / 1064

A Search for Dark Matter from Dwarf Galaxies using VERITAS

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In the cosmological paradigm, cold dark matter (DM) dominates the mass content of the Universe and is present at every scale. Candidates for DM include many extensions of the standard model, with weakly interacting massive particles (WIMPs) in the mass range from ~ 10 GeV to greater than 10 TeV. The self-annihilation or decay of WIMPs in astrophysical regions of high DM density can produce secondary particles including very high energy (VHE) gamma rays with energy up to the DM particle mass. VERITAS, an array of atmospheric Cherenkov telescopes, sensitive to VHE gamma rays in the 85 GeV-30 TeV energy range, has been utilized for the search of indirect detection of DM. The astrophysical objects considered to be candidates for indirect DM detection by VERITAS are dwarf spheroidal galaxies (dSphs) of the Local Group, the Galactic Center among others. This presentation reports on the observations of five dSphs, and the results from a joint DM search from these objects.

Registration number following "ICRC2015-I":

882

Poster 3 DM and NU - Board: 279 / 194

Evaluation of expected solar flare neutrino events in the IceCube observatory

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Since the end of the eighties and in response to an increase in the total neutrino flux in the Home-stake experiment in coincidence with a solar flare, solar neutrino detectors have searched for solar flare signals. Neutrinos from the decay of mesons, which are themselves produced in collisions of accelerated protons with the solar atmosphere, would provide a novel window on the underlying physics of the acceleration process.

For our studies we focus on the IceCube Neutrino Observatory, a cubic kilometer neutrino detector located at the geographical South Pole. Due to its Supernova data acquisition system and its DeepCore component, dedicated to low energy neutrinos, IceCube may be sensitive to solar flare neutrinos and thus permit either a measurement of the signal or the establishment of more stringent upper limits on the solar flare neutrino flux. We will present an approach for a time profile analysis based on a stacking method and an evaluation of a possible solar flare signal in IceCube using the Geant4 toolkit.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 3 DM and NU - Board: 273 / 1122

Search for Neutrino Induced Double Tracks as an Exotic Physics Signature in IceCube

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Physics theories beyond the Standard Model like Supersymmetry and models with extra dimensions often invoke \mathbb{Z}_2 -symmetries in order to avoid new couplings that lead to unobserved new physics like unnaturally fast proton decay. This gives rise to the possibility of heavy, new particles being produced in pairs with the lightest of them being (meta-) stable. Thus, under favorable conditions, neutrinos in the PeV range - like those observed by IceCube - can produce pairs of exotic, charged particles that can be seen in a km³-sized detector as two parallel, muon-like tracks with a track separation a few hundred meters.

We discuss the methods of reconstructing double tracks and how to separate them from other air shower or neutrino-induced (coincident) muon events in a model independent way. The results of the first search for such events with the IceCube

detector in its 79-string configuration and how to interpret them in the context of more explicit beyond the Standard Model frameworks, like Supersymmetry, is shown.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

896

Poster 3 CR - Board: 208 / 1359

Cosmic rays: extragalactic and Galactic

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From the analysis of the flux of high energy particles, $E > 3 \cdot 10^{18} eV$, it is shown that the distribution of the power density

of extragalactic rays over energy is of the power law, $\bar{q}(E) \propto E^{-2.7}$, with the same index of 2.7 that has the

distribution of Galactic cosmic rays before so called 'knee',

$E < 3 \cdot 10^{15} eV$. However, the average power of extragalactic

sources, which is of $calE \simeq 10^{43} erg s^{-1}$, at

least two orders exceeds the power emitted by the Galaxy in cosmic rays, assuming that the density of galaxies is estimated as

$N_g \simeq 1 Mpc^{-3}$. Considering that such power can be

provided by relativistic jets from active galactic nuclei with the

power $calE \simeq 10^{45} - 10^{46} erg s^{-1}$, we

estimate the density of extragalactic sources of cosmic rays as

$N_g \simeq 10^{-2} - 10^{-3} Mpc^{-3}$. Assuming the same nature

of Galactic and extragalactic rays, we conclude that the Galactic

rays were produced by a relativistic jet emitted from the Galactic center during the period of its activity in the past. The remnants of

a bipolar jet are now observed in the form of bubbles of

relativistic gas above and below the Galactic plane. The break, observed in the spectrum of Galactic rays ('knee'), is explained by fast escape of energetic particle, $E > 3 \cdot 10^{15} eV$, from the Galaxy because of the dependence of the coefficient of diffusion of cosmic rays on energy, $D \propto E^{0.7}$. The obtained index of the density distribution of particles over energy, $N(E) \propto E^{-2.7-0.7/2} = E^{-3.05}$, for $E > 3 \cdot 10^{15} eV$ agrees well with the observed one, $N(E) \propto E^{-3.1}$. Estimated time of termination of the jet in the Galaxy is $4.2 \cdot 10^4$ years ago.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1010

Poster 3 CR - Board: 194 / 526

A production scenario of Galactic strangelets and an estimation of their possible flux in solar neighborhood

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Finite lumps of strange quark matter in the form of strangelets, theorized absolute ground state of QCD containing a bound state of approximately equal numbers of up, down and strange quarks, are supposed to be more stable than ^{56}Fe nuclei. Recent simulation studies suggest that a major source of strangelets in the Galaxy may be the fragmentation of tidally released bulk strange matter during the merger of strange stars in compact binary stellar systems. Here, we determine a plausible baryon number (or mass) distribution of such strangelets by invoking a statistical disassembly model often used in nuclear multifragmentation problems. The produced strangelets are likely to be accelerated by the shock front generated in the stellar merger itself thereby gaining power law energy spectrum with spectral index close to -2 . We estimate the fluxes of such accelerated strangelets of different masses in the neighborhood of the Sun considering diffusive propagation of strangelets from the sources in the stochastic magnetic field of the interstellar medium which is found to be consistent with the null results of PAMELA experiment. The reported limit of sensitivity of the AMS-02 experiment suggests that the experiment should be able to detect strangelet events as per the prediction of the proposed model and thereby may finally vindicate the strange matter hypothesis.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 3 CR - Board: 151 / 1016

Absolute calibration of the photon detector module of the EUSO-Balloon experiment and improvements for future missions

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EUSO-Balloon is a balloon borne mission operated by CNES during a one-night flight in August 2014 over the Ontario forest, in Canada, at 38 km altitude. The payload is a technological demonstrator for the Extreme Universe Space Observatory (JEM-EUSO) aiming at the detection of Extensive Air Showers (EAS) induced by Ultra High Energy Cosmic Rays (UHECR) from the International Space Station (ISS). The photon detection module of EUSO-Balloon consists in a square assembly of 36 Multi-Anodes Photomultiplier Tubes for a total of 2,304 pixels. The characterization at the single photoelectron level in laboratory has been processed before flight in a dedicated black box. After-flight calibration to check possible decrease of gain and efficiency of PMTs has been also carried out. Finally we discuss the upgrade of the detector module to improve the gain and the signal to noise ratio as well as the dynamic range of the readout electronics. The significant progresses made on these aspects represent a first milestone for the R&D of future EUSO-like missions.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

832

Poster 3 CR - Board: 236 / 1012

Studies on Time Profiles of EAS Particles Observed with the Telescope Array Surface Detectors

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The arrival time distributions of extensive air shower (EAS) secondary particles have been studied in an energy region, $E > 10^{18} \text{eV}$ with the data collected by the Telescope Array scintillator detector array. We present the average shapes of time profiles in ranges of primary particle energy, zenith angle, and core distance. This is a phenomenological study of extensive air shower longitudinal structures in the ultra high energy regime. In addition, “rise time” parameters from the time profiles are used to evaluate the stage of EAS development. In this report, the characteristics of time profiles of EAS in the energy region of $10^{18.4} \text{eV} - 10^{19.4} \text{eV}$ are studied in both the data and simulation.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

0837

Poster 3 CR - Board: 217 / 1235

Simulation study on the detection of high energy electrons and gamma rays with the newly upgraded Tibet ASgamma experiment

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The rapidly declining electron flux with the power index of ~ 3.3 makes it difficult to measure directly with instruments on board balloons and satellites at high energies higher than about 1 TeV. However, the large-area and wide-field EAS arrays could be used to extend cosmic-ray electron spectrum ($e^+ + e^-$) measurements up to about 10 TeV or more. The newly upgraded Tibet hybrid AS experiment (Tibet-III+MD) may become one of the world’s most sensitive observatories of gamma rays or maybe electrons above 10 TeV due to its high gamma/hadron separation ability. In this paper, using a Monte Carlo simulation, we examine its ability for measuring CR electron spectrum in the high Galactic latitude area.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

945

Poster 3 CR - Board: 190 / 440

Weibel instability in anisotropically inhomogeneous plasmas

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The Weibel instability is thought to be important for particle acceleration and generation of magnetic fields in relativistic shocks. However, the magnetic field produced by the Weibel instability cannot occupy large regions because of the rapid decay. Non-linear evolution of the Weibel instability has been investigated in uniform plasmas or shocks propagating into uniform plasmas so far. In order to study non-linear evolution of the Weibel instability in inhomogeneous background plasmas, we perform two-dimensional particle in cell simulations. We find that spatially anisotropic density structures produce anisotropic velocity distributions, so that the magnetic field fluctuations are excited by the Weibel instability. Relativistic shocks propagating into inhomogeneous plasmas are expected to produce such anisotropic density structures in the downstream region. Therefore, magnetic fields generated by the Weibel instability could occupy regions larger than previously thought. If so, the maximum energy of accelerated particles would become larger than previously thought.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

408

Poster 3 SH - Board: 14 / 1231

27-day Variation of the Three Dimensional Solar Anisotropy of Galactic Cosmic Ray: 1965-2014.

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The temporal evaluation of the 27-day variation of the three dimensional (3D) galactic cosmic ray (GCR) anisotropy has been studied for 1965-2014. 3D anisotropy vector was obtained based on the neutron monitors and Nagoya muon telescopes data. We analyze the 27-day variation of the (1) two dimensional (2D) GCR anisotropy in the ecliptic plane, and (2) North-South anisotropy (ANS) normal to the ecliptic plane. Studying the time line of the 27-day variation of the 2D GCR anisotropy,

we confirm that the average amplitude in the minimum epoch of solar activity is polarity dependent, as it is expected from the drift theory. The amplitude in the negative polarity epochs is less as we had shown before. The feeble 11-year variation connected with solar cycle and strong 22-year pattern connected with solar magnetic cycle is visible in the 27-day variation of the 2D anisotropy for 1965-2014. We show that the 27-day variation of the GG index (being a measure of the north-south asymmetry) varies in accordance to solar cycle with a period of 11-years, being in good agreement with the 27-day variation of the component of the GCR anisotropy calculated by the IZMIRAN group.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

946

Poster 3 SH - Board: 5 / 39

A new method for determining atmospheric pressure coefficient by using fast Fourier transform for muons in the GRAPES-3 experiment

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A large area (560~m^2) tracking muon detector operating in the GRAPES-3 experiment at Ooty in India has been recording cosmic ray muons at a rate of $1.7 \times 10^8 \text{ h}^{-1}$ since 2000. The high statistics data have enabled sensitive measurement of several solar phenomena to be made including the solar and sidereal anisotropy and Forbush decreases following coronal mass ejections. Prior to studies of any of these phenomena, an important task is to correct the variation in measured muon rates due to atmospheric pressure. Unfortunately, the pressure coefficient usually deduced from the observed data is not very reliable due to the presence of various solar phenomena listed above. Here, we present an alternative method which avoids complications arising from solar effects. Since the pressure at Ooty displays a 12 h periodicity, using which we could separate its contribution from other effects in the muon data through a power spectrum analysis using fast Fourier transform technique. The method yielded a clear dependence of muon rate on

pressure providing an accurate estimate of the pressure coefficient almost independent of the solar modulation effects.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

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Poster 3 SH - Board: 4 / 38

Forbush decrease precursors observed using GRAPES-3

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Earth-directed Coronal mass ejections (CMEs) emanating from the Sun and the shock associated with it are the primary drivers of space weather disturbances. Forbush decrease precursors are advance warning of these upcoming magnetic field disturbances. GRAPES-3 tracking muon telescope which is a part of GRAPES-3 experiment located in Ooty, India, provides high statistics measurement of the muon flux with good temporal resolution. In this study we are using data from GRAPES-3 muon telescope and making use of its multidirectional observations to study the Forbush decrease precursors in greater detail. We have identified few Forbush decrease precursor signatures in muon flux well before the arrival of the actual shock. We use these Forbush decrease precursors to study the characteristics of magnetic field compression associated with the upcoming CME shock-sheath system.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

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Poster 3 SH - Board: 3 / 37

Relation of Forbush decrease with interplanetary magnetic fields.

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The relation between the Forbush decreases (FDs) and near-Earth interplanetary magnetic field (IMF) enhancements associated with the solar coronal mass ejections (CMEs) is studied. We have used data from GRAPES-3 tracking muon telescope to identify the Forbush decrease events. We have chosen events that are having a reasonably clean profile, and magnitude $> 0.25\%$. We have used IMF data from ACE/WIND spacecrafts to investigate how closely the FD profile follow the IMF enhancements. We found that the enhancement of magnetic field responsible for the FD takes place mainly in the sheath region and also the MHD turbulence level get enhanced in this region. We found that the FD profile looks remarkably similar to that of IMF enhancement, yielding good correlation with a time lag. The FD profile lags behind the IMF by few hours. This observed lag corresponds to the time taken by high energy protons to diffuse into the magnetic field enhancement through cross-field diffusion.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

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Poster 3 SH - Board: 2 / 36

Measurements of solar diurnal anisotropy with GRAPES-3 experiment

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Harmonics in the cosmic ray solar diurnal anisotropy up to third have been experimentally observed. Very high statistics is required to investigate

higher harmonics because of exceedingly small amplitudes. The GRAPES-3 experiment located in Ooty, India contains a large area (560~m^2) tracking muon telescope that provides a high statistical record of the muon flux ($\sim 4 \times 10^9$ per day). This allows measurement of tiny variations in cosmic ray intensity (0.01%) caused by various solar phenomena. After making appropriate corrections for the efficiency of the detector and atmospheric pressure variations, a continuous stream of one year data was used to investigate the diurnal anisotropy. A fast Fourier transform based analysis revealed clear presence of the first three harmonics as well as the fourth harmonic for the first time. Further, a clear rigidity dependence of each of the four harmonics was also obtained. These results will be presented during the conference.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 3 SH - Board: 9 / 643

Results from the observations of Forbush decreases by the Extreme Energy Events experiment

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The monitoring of galactic cosmic ray flux decreases is of interest for the understanding of phenomena that occur on the solar corona, as well as on other observable stars. As it is known, they are related to the emission of mass from the star corona and often related to solar flares, even if such relation is not completely understood.

The effect on the solar wind directly affects the measured galactic cosmic ray flux on Earth, giving typical flux fluctuations of a few percent on a few days basis. The phenomenon is therefore observable by any apparatus surveying the cosmic ray radiation with a comparable overall accuracy.

The Extreme Energy Events telescope array is an array of 47 tracing detector (growing), each made of three MRPC planes, spread over more than 10 degrees in latitude and 11 in longitude, organized in clusters and single telescope stations. The overall acceptance of the EEE stations allows for a flux rate measurement within the 15-50 particle/s, depending on the set-up, while the timing within different station is driven by the GPS time resolution and it is better than 50 ns.

On November 10, 2015, a flux decrease was observed at the same time by six stations, covering almost the whole latitude and longitude range. Even if the s/n ratio by a single station was between 1 and 3, the averaged observation on the whole set of telescopes gave a s/n 4, better than what was obtained by OULU monitor. This observation came after other flux decreases observed by EEE.

The observation is promising, in view of the construction of a solar surface phenomena survey, with both high accuracy and low systematics and wide longitude/latitude coverage features.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

568

Poster 3 CR - Board: 232 / 1245

Consistent description of leptonic and hadronic spectra in cosmic rays

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The AMS Collaboration has recently released data on cosmic ray (CR) leptons and hadrons that can shed light on two exciting problems in CR physics: on one side, the origin of the rise of the CR positron fraction above 10 GeV of energy, on the other side, the nature of the spectral features observed in CR protons and helium at \sim TeV energies. In this work, the AMS data are described using a two-component scenario, where the total CR flux is provided by a mixture of fluxes accelerated by sources with different properties. Within this picture, the role of secondary CR production inside nearby supernova remnants is discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

960

Poster 3 SH - Board: 33 / 439

On the mechanisms of the quasi-biennial oscillations in the GCR intensity

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Quasi-biennial oscillation (QBO) is a well-known quasi-periodical variation with characteristic time 0.5-4 years in different solar, heliospheric and cosmic ray characteristics. Recently it has been shown that there is rather high anticorrelation between the QBOs in GCR intensity near the Earth and in the strength of the heliospheric magnetic field. Besides, it was suggested that both step-like changes of the GCR intensity and Gnevyshev Gap effect (a temporal damping of the solar modulation around the sunspot maxima) could be viewed as the manifestations of QBO.

In this paper we add some features to the phenomenological study of the QBOs and then, using rather simple numerical models, consider the mechanisms of their formation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 3 SH - Board: 15 / 1249

THE ROLE OF DRIFT ON DIURNAL ANISOTROPY OF GALACTIC COSMIC RAYS IN DIFFERENT PERIODS OF SOLAR MAGNETIC CYCLE

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The hourly neutron monitor data have been used to study the role of drift effect in the temporal changes of the diurnal anisotropy. In order to thoroughly separate sectors of the Interplanetary Magnetic Field (IMF) and its influence on the anisotropy of Galactic Cosmic Rays (GCRs) for positive ($A>0$) and negative ($A<0$) polarities of solar magnetic cycle, two periods (1995-1997 ($A>0$) and 2007-2009 ($A<0$)) have been considered.

We study drift effects in diurnal anisotropy of GCR caused by the gradient and curvature of the regular IMF, and due to the heliospheric neutral sheet. We use the harmonic analyses method to calculate radial A_r and tangential A_ϕ components of the ecliptic diurnal anisotropy of GCR based on data of NM for cut of rigidities less than 5 GV. It is shown that there are differences between the diurnal anisotropy of GCR found in the reliably established various sectors (duration of each sectors is ≥ 4 days) of IMF. An interpretation of obtained results are provided based on the present modern theory of GCR propagation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

801

Poster 3 CR - Board: 152 / 432

Calibration of the TA-EUSO Prototype Instrument

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The Extreme Universe Space Observatory (EUSO) instrument is being developed for deployment on the International Space Station (ISS). Looking down from its berth on the ISS, EUSO will take high speed UV video of Extensive Air Showers (EAS) caused by cosmic rays. Using these videos, the energy and arrival direction of each cosmic ray will be reconstructed. In order to reconstruct the energy, the absolute sensitivity of EUSO must be known. To test the EUSO instrument concept a prototype of EUSO (TA-EUSO) has been deployed on the Telescope Array site in Utah, USA in order to take advantage of the calibration facilities available on the site and to make simultaneous observations of extensive air showers recorded by the Telescope Array's fluorescent detectors. In this

paper we describe the use of calibrated LEDs to calibrate the TA-EUSO instrument. These calibrated LEDs will also be used for pre-flight calibration of the EUSO Balloon prototype.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

403

Poster 3 DM and NU - Board: 288 / 334

Medium-energy (few TeV - 100 TeV) neutrino point source searches in the Southern sky with IceCube

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Many Galactic sources of gamma rays, like supernova remnants, are suspected to also produce high-energy neutrinos with a typical high-energy cutoff below 100 TeV. For the IceCube Neutrino Observatory, located at the South Pole, this is challenging due to the very large background of atmospheric muons at these energies in the southern hemisphere which covers the inner part of the Galactic plane including the Galactic Center. Using both the outer part of the detector as veto region and the topology of events as identifier it is possible to reduce this background significantly. The event selection, optimized for neutrino energies between a few TeV and 100 TeV, together with the results for a southern sky point source scan and the investigation of selected sources will be presented.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

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Poster 3 CR - Board: 202 / 856

Constraints on acceleration of ultra high-energy cosmic rays in Fermi gamma-ray sources

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The current experimental statistics of ultra high-energy cosmic rays (UHECRs) is not sufficient for identification of the sources, although a spatial correlation between the arrival directions of UHECRs and nearby active galactic nuclei (AGNs) has been discussed using the data of the Pierre Auger

Observatory and the Telescope Array.

Here, we focused on the Fermi Large Area Telescope gamma-ray sources to search candidates of accelerators of UHECRs because gamma rays would provide the direct evidence of the existence of high energy particles. We first investigated a spatial correlation between gamma-ray sources and the arrival directions of UHECRs. We selected gamma-ray sources with more than one UHECR within 4 degrees from them, taking into account that trajectories of UHECRs are deviated typically about 4 degrees from the directions of acceleration sites mainly due to the Galactic magnetic field. After that, we excluded sources whose redshifts are larger than 0.1 when considering the energy loss of cosmic rays due to the interaction with the cosmic microwave background photons. Finally, we selected five AGNs as candidates of accelerators of UHECRs.

We analyzed their spectrum energy distributions by using multi-wavelength archival observational data (Radio, IR, Optical, X-ray and Gamma ray). Pe'er & Loeb (2012) derived constraints on the ability of AGN to produce UHECRs by using observational quantities which are synchrotron peak luminosity and the ratio of inverse Compton to synchrotron peaks. By introducing the constraints, we evaluate the physical conditions in the acceleration regions of these five AGNs and discuss whether they can accelerate to UHECRs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

735

Poster 3 DM and NU - Board: 272 / 749

Studies of intrinsic resolution of low energy electron and muon neutrino events with neutrino telescopes

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Existing large-volume neutrino telescopes such as ANTARES and IceCube, as well as the future KM3NeT/ORCA, investigate neutrinos at characteristic particle energies of 10TeV, whereas KM3NeT/ORCA and PINGU will operate around 10GeV to determine the neutrino mass hierarchy using atmospheric neutrinos propagated through the Earth. In this energy regime, intrinsic fluctuations in particle interactions become important.

These intrinsic fluctuations have been investigated to answer two basic questions. Firstly: How do intrinsic fluctuations limit the reconstruction accuracy of an ideal detector, i.e. if every single photon is detected? While this requires making some basic assumptions about the methods used in the reconstruction, the answer to this question will indicate the optimum that could be achieved by any detector. Secondly: Given that only a finite number of photons will be detected, what is the best possible reconstruction accuracy in the case of a perfect use of the information carried by these photons? For this study the characteristics of the KM3NeT/ORCA detector have been used. This investigation separately considers muons, electromagnetic and hadronic showers. Taking the kinematics of the neutrino interactions into account, limits on the best possible reconstruction accuracy in energy and direction for the initial neutrinos achievable with an ORCA-type detector are derived. The poster will summarise the analysis methods and results.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

424

Poster 3 SH - Board: 25 / 99

The effects of particle drifts on the modulation of galactic electrons in the global heliosphere

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The fundamental process of global curvature, gradient and current sheet drifts in the heliosphere is still not fully understood, especially how solar wind and magnetic field turbulence could affect the magnitude of drifts on a global scale. General consensus is that the so-called weak scattering drifts is giving too large modulation effects as follows from the application of numerical drift models to solar modulation, when compared to observations from the Earth to the outer heliosphere. The effects of drifts on the global modulation of electrons are revisited by studying different modulation scenarios using a three-dimensional steady state numerical model for solar minimum conditions, for both magnetic polarity epochs. A straight forward approach is followed to illustrate how reducing drifts can affect the modulation of galactic electrons on such a global scale.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

112

Poster 3 SH - Board: 24 / 98

Modelling of the solar modulation of Jovian electrons in the inner heliosphere

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The challenge regarding the modeling of the solar modulation of Jovian electrons lies in determining a reasonable source function which on its part influences the energy range where these particles dominate in the heliosphere. Another controversial issue is what the spectral index of these electrons should be, from the lowest to the highest energies of relevance to solar modulation. If this can

be reasonably determined, it becomes possible to compute what the intensity of galactic electrons is at these rather low energies at the Earth. In this study the spectral shape and the value of the Jovian electron source function is revisited and investigated, using a large set of observations and a 3D numerical modulation model. Comparing the modeling with these observations, a new source function is determined, and when used in the model, indicates that Jovian electrons can dominate electron intensities in the inner heliosphere only up to about 25 MeV above which the contribution from galactic electrons becomes progressively larger. This is based on using a new very local interstellar spectrum for galactic electrons.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

112

Poster 3 SH - Board: 47 / 90

Flux of solar energetic particles in the distant past: Data from lunar rocks

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The era of direct measurements of solar energetic particle (SEP) fluxes is limited to the last few decades and largely overlaps the Modern grand maximum of solar activity with unusually high solar activity. However, for many purposes it is important to know the fluxes of SEPs on much longer time scale. This can be made only using indirect proxies. Terrestrial proxy archives, such as the isotopes C-14 and Be-10, may potentially resolve strongest SEP events but cannot evaluate the average SEP flux. On the other hand, lunar rock samples, collected during the Apollo missions and measured later at Earth, may provide information on the average fluxes of SEPs throughout millennia and millions of years in the past. This option had been explored earlier, and here we revisit the approach, using the newly calculated yield functions of cosmogenic isotope production in lunar rocks and re-analyzing the published results of measurements of lunar rocks. As a result, a new improved estimate of the averaged SEP flux in the past is obtained and compared with the present day values.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

65

Poster 3 SH - Board: 48 / 92

Use of cosmogenic radionuclides ¹⁴C and ¹⁰Be to verify empirically reconstructed cosmic ray modulation since 1616

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Here we present a new semi-empirical model describing modulation of galactic cosmic rays in the heliosphere. The model is an update of the previous similar model by Alanko-Huotari et al. (2006) and considers such heliospheric parameters as open solar magnetic flux, heliospheric current sheet tilt angle and the large scale solar magnetic field polarity. The model has been tested and calibrated for the period 1976 - 2013 including the very weak solar activity minimum in 2008-2010. Based on this model, and on different reconstructions of the open solar flux, the heliospheric modulation potential is reconstructed since 1610, and subsequently used to compute the production and distribution of cosmogenic radionuclides, such as ¹⁰Be and ¹⁴C. The modelled values are compared with archives from ice cores and tree rings confirming the validity of our model.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

73

Poster 3 DM and NU - Board: 286 / 1219

Joint search for gravitational waves and high energy neutrinos with the VIRGO-LIGO and ANTARES detectors

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Cataclysmic cosmic events can be plausible sources of both gravitational waves (GW) and high energy neutrinos (HEN), alternative cosmic messengers carrying information from the innermost regions of the astrophysical engines. Possible sources include long and short gamma-ray bursts (GRBs) but also low-luminosity or choked GRBs, with no or low gamma-ray emissions.

The ANTARES Neutrino Telescope can determine accurately the time and direction of high energy neutrino events, and the Virgo/LIGO network of gravitational wave interferometers can provide timing/directional information for gravitational wave bursts. Combining these informations through GW+HEN coincidences provides a novel way of constraining the processes at play in the sources, and also enables to improve the sensitivity of both channels relying on the independence of backgrounds of each experiment.

We will describe the joint GW+HEN searches performed using data taken with the ANTARES telescope both in 2007 (while Antares was half its final size) and in 2009-2010 (with the full Antares

detector) combined with data from the Virgo/LIGO interferometers during the VSR1/S5 and VSR2-3/S6 (with improved sensitivities) science runs. The 2007 search has allowed to place the first upper limits on the density of joint GW+HEN emitters, and the 2009-2010 analysis will allow a significant improvement in sensitivity.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

0522

Poster 3 CR - Board: 227 / 1216

Spectral Intensities of Antiprotons and the Lifetime of Cosmic Rays in the Galaxy

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In this paper we note that the spectral intensities of antiprotons observed in Galactic cosmic rays in the energy range ~ 1 -100 GeV by BESS and PAMELA instruments display nearly the same spectral shape as that generated by primary cosmic rays through their interaction with matter in the interstellar medium, without any significant modifications. More importantly, a constant residence time of $\sim 2.5 \pm 0.7$ million years in the Galactic volume, independent of the energy of cosmic rays, matches the observed intensities. A small additional component of secondary antiprotons in the energy below 10 GeV, generated in cocoon-like regions surrounding the cosmic-ray sources, seems to be present. We discuss this result in the context of observations of other secondary components like positrons, beryllium and boron, and conclude with general remarks about the origins and propagation of cosmic rays.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

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Poster 3 CR - Board: 225 / 1098

Uncertainties on propagation parameters: impact on the interpretation of the positron fraction

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The positron fraction in cosmic rays has recently been measured with improved accuracy up to 500 GeV, and it was found to be a steadily increasing function of energy above ~ 10 GeV. This behaviour contrasts with standard astrophysical mechanisms, in which positrons are secondary particles, produced in the interactions of primary cosmic rays during their propagation in the interstellar medium. The observed anomaly in the positron fraction triggered a lot of excitement, as it could be interpreted as an indirect signature of the presence of dark matter species in the Galaxy, the so-called weakly interacting massive particles (WIMPs). Alternatively, it could be produced by nearby sources, such as pulsars. These hypotheses are probed in light of the latest AMS-02 positron fraction measurements. The cosmic ray positron transport in the Galaxy is described using a semi-analytic two-zone model. For consistency, the secondary and primary components of the positron flux are calculated together with the same propagation model. We show that the results inferred for both hypotheses crucially depend on the propagation parameters, estimated with the Boron-to-Carbon ratio. Their uncertainties turn out to be very significant, and overshadow even the statistical errors from the positron data.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

839

Poster 3 CR - Board: 199 / 744

Constraints of the entropic index of Tsallis statistics in the context of hadronic collisions at ultra high energies using measures of the depth of maximum of air showers

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Cosmic rays of ultra-high energy are one of the great puzzles of modern physics. So far their production mechanisms, sources, chemical composition and abundances as a function of energy are unknown. One can infer the primary mass composition from the depth of maximum, X_{\max} , of the longitudinal development of air showers induced by cosmic rays. Measurements of the evolution of this observable as a function of energy performed by the Pierre Auger Collaboration indicate the presence of a heavier component in the absence of new physics in the range of 100 TeV. These results are sensitive to the dynamics of the first interaction and depend on the validity

of the hadronic interaction models extrapolated from data at lower energies. Additionally, recent data from the Large Hadron Collider (LHC) at CERN, for p-p and A-A collisions at center of mass energy \sim TeV indicate a significant increase on the multiplicity of hadrons produced with respect to the multiplicity predicted by models generally used. This result, as well as the transverse momentum distribution of the particles produced in the collision are parameterized by the Tsallis distribution favoring a thermodynamic / statistical interpretation of the hadronization process. In this work we constrain the values of the entropic index q of the Tsallis model by comparing its X_{max} predictions with measurements performed by the Pierre Auger Collaboration, under the assumption of a proton primary composition.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

669

Poster 3 SH - Board: 35 / 551

Results of the recalculation of the cosmic-ray modulation parameters

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The propagation of cosmic rays through the heliosphere is subjected to modulation. This propagation can be described by the Parker Transport Equation. Two simple approximations of this equation are the convection-diffusion and the force-field approaches. The solutions of these equations contain the modulation parameter M and the modulation potential ϕ , respectively. Usoskin et al. (2011) used the force-field approach to calculate monthly values for ϕ for the period from 1936 to 2009. We recalculated the modulation parameters using revised, more accurate atmospheric yield functions for the production of secondary cosmic rays, as well as the most recent estimates of the LIS derived from Voyager observations. The results are reported.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0495

Poster 3 GA - Board: 84 / 1050

Improving the Fermi LAT Source Catalog

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The Fermi Large Area Telescope has been routinely gathering science data since August 2008, surveying the full sky every three hours. The current source catalog (3FGL, Acero et al. 2015, arxiv 1501.02003) is based on four years of data.

Besides a longer time interval, the next source catalog will be based on the new Pass 8 data, which introduces a number of improvements at all energies, and in particular enhanced response at low energy.

This opens the possibility of broadening the energy range to reach below 100 MeV, but it also introduces new challenges due to the larger number of low-energy photons in a range where the point-spread function is several degrees wide. In that regime the source-to-background ratio is small (at the percent level) so systematic errors on the background model are critical. The energy dispersion must also be accounted for.

We will describe how we plan to address those challenges in order to keep the catalog robust.

Finally the procedure for associating LAT sources with counterparts at other wavelengths is also expected to improve, in particular by entering spectral information explicitly in the process.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

869

Poster 3 CR - Board: 167 / 1198

The EUSO@TurLab project'

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JEM-EUSO is a space mission devoted to the investigation of Ultra-High Energy Cosmic Rays and Neutrinos ($E > 5 \times 10^{19}$ eV), using the atmosphere as a giant detector, which is also the source of the largest fraction of noise (nightsky background). The EUSO@TurLab project is an on-going activity aiming to reproduce atmospheric and luminous conditions that JEM-EUSO will encounter on its orbits around the Earth, once it will be installed to the International Space Station. The TurLab facility, part of the Department of Physics - University of Torino, is equipped with a rotating tank, used to perform fluid-dynamics studies. In EUSO@TurLab project the facility is used to simulate different surface conditions (with different optical characteristics, like snow, oceans, forests, glaciers, deserts, savanna) in a very dark and rotating environment in order to test the response of JEM-EUSO's sensors and its sensitivity. Moreover, it is possible to produce "replica" of other kind of glowing phenomena such as cosmic rays, meteors, city lights, lightnings, etc. by using artificially controlled luminous intensities. The detector is a simplified system consisting of a 25 pixel Multianode Photomultiplier, a lens and a read-out electronics using conventional modules. The experimental setup currently in operation has been used to check the potential of the TurLab facility for the above purposes, and the acquired data are used to test the concept of JEM-EUSO's trigger system. In this presentation we will report on the description of the EUSO@TurLab project, examples of the luminous conditions

produced so far, as well as the results of the tests of the JEM-EUSO first level trigger applied to the data taken at TurLab.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

914

Poster 3 GA - Board: 85 / 1056

The potential of the HAWC Observatory to observe violations of Lorentz Invariance

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The framework of relativistic quantum-field theories requires Lorentz Invariance, which among other things implies a constant velocity of light. Many theories of quantum gravity, on the other hand, include violations of Lorentz Invariance at small scales and high energies. This generates a log of interest in establishing limits on such effects, and, if possible, observe them directly. Gamma ray observatories provide a tool to probe parts of the parameter space of models of Lorentz Invariance Violation that is not accessible in terrestrial laboratories and man-made accelerators. Transients, especially gamma-ray bursts, are a particularly promising class of events to search for such phenomena. By combining cosmological distances with high energy emission and short duration, emitting photons up to 30 GeV in less than a second, one can measure the energy dependence of the speed of photons to one part in 10^{16} . We will discuss the potential of HAWC to detect effects of the violation of Lorentz Invariance and place its sensitivity in the context of existing limits.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

877

Poster 3 GA - Board: 110 / 1057

Development of Slow Control Boards for the Large Size Telescopes of the Cherenkov Telescope Array

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Development of Slow Control Boards for the Large Size Telescopes of the Cherenkov Telescope Array

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Abstract:

The camera of the Large Size Telescopes (LSTs) of the Cherenkov Telescope Array (CTA) consists of 265 photosensor modules, each of them containing 7 photomultiplier tubes (PMTs), a slow control board (SCB), a readout board, and a trigger logic. We have developed the SCB, which is installed between the 7 PMTs and the readout board. The main functions of SCBs consist of controlling the high voltages for the PMTs and monitoring their anode current. In addition, the SCB has a functionality to create test pulses that can be injected at the input of the PMT preamplifier in order to emulate a PMT signal without the need of setting high voltage, or even without the PMT itself. The test pulses have a very similar width as the PMT pulses (less than 3ns FWHM) and their amplitude can be adjusted in a wide dynamic range. These features allow us not only to test the functionality of the camera modules but also to fully characterize these. We report on the design and the functions of the SCB together with the results of test measurements.

Collaboration:

CTA

Registration number following "ICRC2015-I":

867

Poster 3 GA - Board: 120 / 1058

Studies towards an understanding of global array pointing for the Cherenkov Telescope Array

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Current arrays of Imaging Atmospheric Cherenkov Telescopes (IACTs) routinely achieve an astrometric point-source location accuracy of 20-30 seconds of arc (given large photon statistics), which is well below the angular resolution obtained for individual photons. The location accuracy is mainly limited by systematic uncertainties due to possible deformations of the telescopes' structures, causing a mis-orientation between the nominal optical axes of the telescopes and their actual pointing directions. Usually, only a subset of telescopes is triggered for a given gamma-ray event, and their mis-orientations enter the gamma-ray direction reconstruction in a combined manner. Hence, in

general, the average location accuracy for a set of gamma-ray observations depends in a complex way on the individual telescope accuracy and the geometry of the array, but also on the observing conditions, the energy spectrum of the source and the chosen event selection cuts.

For the proposed Cherenkov Telescope Array (CTA), a post-calibration point-source location accuracy of 3 seconds of arc is aimed for under favorable observing conditions and for gamma-ray energies exceeding 100 GeV. In this contribution, results of first studies on the location accuracy are presented. These studies are based on a toy Monte Carlo simulation of a typical CTA-South array layout, taking into account the expected trigger rates of the different CTA telescope types and the gamma-ray spectrum of the simulated source. With this simulation code it is possible to study the location accuracy as function of arbitrary telescope mis-orientations and for typical observing patterns on the sky. Results are presented for various scenarios, including one for which all individual telescopes are randomly mis-oriented within their specified limits. The study provides solid lower limits for the expected source location accuracy of CTA, and can be easily extended to include various other important effects like atmospheric refraction or partial cloud coverage.

Collaboration:

CTA

Registration number following "ICRC2015-I":

502

Poster 3 SH - Board: 43 / 1195

Galactic Cosmic Ray Modulation Near the Heliospheric Current Sheet

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Galactic cosmic ray (GCR) flux is modulated by the heliospheric magnetic field (HMF) over decadal time scales, due to long-term, global HMF variations, but also over time scales of a few hours due to structures crossing Earth such as coronal mass ejections or the heliospheric current sheet (HCS). The HCS separates the outward and inward polarities of magnetic field from the Sun and hence is a large scale feature which extends out through the heliosphere. Due to the close association between the HCS, the streamer belt, and the band of slow solar wind, HCS crossings are often associated with corotating interaction regions where fast solar wind catches up and compresses slow solar wind ahead of it. However, not all HCS crossings are associated with strong compressions. Therefore we present a catalogue of HCS crossings which are categorised in two ways: Firstly, using the change in magnetic polarity, as either away-to-toward or toward-to-away magnetic field directions relative to the Sun and, secondly, using the strength of the associated solar wind compression, which has not been studied previously. For strong-compression HCS crossings, a peak in neutron counts preceding the HCS crossing is observed, followed by a large drop after the crossing, attributable to the so-called 'snow-plough' effect. For weak-compression HCS crossings, where magnetic field polarity effects are more readily observable, we instead observe that the neutron counts have a tendency to peak in the away magnetic field sector. By splitting the data by the dominant polarity at each solar polar region, it is found that the increase in GCR flux prior to the HCS crossing is primarily from strong compressions in cycles with negative north polar fields due to drift effects.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0932

Poster 3 CR - Board: 229 / 619

Equations of anomalous diffusion of cosmic rays

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Classical description of diffusion process for scalar flux of particles of cosmic rays $u(\vec{r}, t, E)$ is based on equation

$$\frac{\partial u(\vec{r}, t, E)}{\partial t} = k(E)u(\vec{r}, t, E) + f(\vec{r}, t, E), \quad (1)$$

where E – energy of particles, $f(\vec{r}, t, E)$ is density distribution of source and $k(E)$ –

In the last years it is stated that energy spectrum of Galaxy cosmic rays falling to the Earth have a power type in wide diapason primary energy from $10^9 eV$ until $10^{17} eV$ with "knee" at energy $\sim 3 \cdot 10^{15} eV$ [1]. Phenomenon "knee" of spectrum it's beyond classical model of diffusion. In this relation we have to consider modified Fick's law which in its turn requires attraction of mathematical apparatus of fractional integro - differential calculations. Similar phenomenon is called an anomalous diffusion.

In this paper we consider fractional variant of equation (1)

$$D_t^\beta u(x, t, E) = \nabla^{\frac{\alpha}{2}} (k(x, t, E) \nabla^{\frac{\alpha}{2}} u(x, t, E)) + f_1(x, t, E), \quad x \in R^3, 0 < \beta \leq 2, 1 < \alpha \leq 2. \quad (2)$$

Here α - fractional order of Caputo partial derivative in $x_i, i = 1, 2, 3$, β - fractional order of Caputo derivative in t , ∇ - gradient of function u . In case $\alpha = 2, \beta = 1$ and k not depended on x we get classical diffusion equation (1).

Numerical method of solution of initial - boundary problem for equation (2) is proposed, which elucidate the phenomenon of "knee" of spectrum.

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Collaboration:

– not specified –

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13

Poster 3 CR - Board: 179 / 143

The Ankle, the Knee and the Principle of Constant Spectral Indices in Cosmic Ray Physics

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Measurements of the energy spectra of 11 nuclear species by the TRACER experiment in the energy band $10^{11} - 5 \times 10^{14}$ eV result in a constant, common spectral index of 2.67 ± 0.05 . A similar figure has been reported by the CREAM experiment for Helium and Proton spectra in the same energy band. This index is equal within error bars with that of the all-particle spectrum measured at very high energy, in the band $3 \times 10^{18} - 3 \times 10^{19}$ eV, by the TA, Auger, HiRes, Yakutsk, Akeno-Agasa and Haverah Park experiments. The adoption of this universal index and the calculation of the cosmic-ray trajectories in the Galaxy with adequate parameters (gas density, magnetic field, size of the Galaxy and nuclear cross sections) lead to the remarkable determination of the energy of the knee at 3×10^{15} eV and that of the ankle at 3.5×10^{18} eV along with the correct shapes of the energy spectra of individual ions in the range $10^{11} - 3 \times 10^{19}$ eV. This highly distinctive outcome is used to constrain the galactic mechanism that accelerates cosmic rays which is still unknown.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

153

Poster 3 CR - Board: 172 / 611

The JEM-EUSO energy and X_{max} reconstruction performances

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JEM-EUSO is an international collaboration committed to the development of space based ultra high energy cosmic ray observatories. In this framework we are carrying out an extensive simulation study in order to evaluate the performances of the mission. In this contribution we focus on the energy and X_{max} reconstruction performances. We therefore simulated several samples of cosmic ray events and we produced the detector response following a detailed simulation of the optics and of the detector. After the issue of a trigger flag we analyze the received data to extract the basic shower parameters like direction, energy and X_{max} . In this work we briefly

describe the algorithms to reconstruct the energy and X_{max} . We then present a study to assess the energy reconstruction performances in a set of fixed conditions and on the whole field of view. We also present preliminary results on the X_{max} reconstruction in the center of the field of view. We then evaluate the fraction of good quality events with respect to the triggered events.

Collaboration:

JEM-EUSO

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443

Poster 3 GA - Board: 90 / 616

Performance of the VERITAS experiment

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VERITAS is a ground-based gamma-ray instrument operating at the Fred Lawrence Whipple Observatory in southern Arizona. With an array of four imaging atmospheric Cherenkov technique (IACT) telescopes, VERITAS is designed to measure gamma rays between ~ 85 GeV and ~ 30 TeV with a sensitivity to detect a point source with a flux of 1% of the Crab nebula flux within 25 hours. Since its first light observation in 2007, VERITAS has continued its successful mission for over seven years with two major upgrades : the relocation of telescope 1 in 2009 and a camera upgrade in 2012. We will present the performance of VERITAS and how it has improved with these upgrades.

Collaboration:

VERITAS

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548

Poster 3 CR - Board: 207 / 1286

Study of short-time X-ray variability of knots of Centaurus A jet

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We present the analysis of short-time periodic X-ray variability of knots in Centaurus A jet. The analysis is based on observational data from Chandra X-ray Observatory. The search for periodic variability was done using Lomb-Scargle periodogram method. We have found two knots with significant periodic signal. In order to improve signal to noise ratio we propose the procedure where

the photons are collected from regions with more significant periodic signal. We have developed a new procedure for searching the most probable signal to noise ratio for week periodic signals. The possible explanation of such short-time periodic variability is proposed.

Collaboration:

– not specified –

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528

Poster 3 SH - Board: 16 / 1281

Study of CME and Solar Flare parameters and their relations to Forbush decreases during 24 solar cycle.

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In the paper we statistically inspect Forbush decreases, CMEs, Solar Flares and geomagnetic variations during the solar cycle 24 and compare them with earlier cycles and discuss Sun-Earth system response to extreme solar events and space weather. Data from different spacecrafts, GOES X-ray and LASCO coronagraph images were used together with neutron monitor network recordings. The observed galactic cosmic ray modulation is modest compared to previous cycles.

Collaboration:

– not specified –

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971

Poster 3 CR - Board: 173 / 1283

The Atmospheric Science of JEM-EUSO

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An Atmospheric Monitoring System (AMS) is a mandatory and key device of a space-based mission which aims to detect Ultra-High Energy Cosmic Rays (UHECR) and Extremely-High Energy Cosmic Rays (EHECR) from Space. JEM-EUSO has a dedicated atmospheric monitoring system that plays a fundamental role in our understanding of the atmospheric conditions in the Field of View (FoV) of the space telescope. Our AMS consists of a very challenging space infrared camera, a LIDAR device and a Global Light System (GLS) Laser Stations, that are being fully designed with space qualification to fulfil the scientific requirements of this space mission. The AMS will provide information of the cloud cover in the FoV of JEM-EUSO, as well as measurements of the cloud top heights with an accuracy of 500 m and the optical depth profile of the atmosphere transmittance in the direction of each air shower with an accuracy of 0.15 degree and a resolution of 500 m. This will ensure that the energy of the primary UHECR and the depth of maximum development of the EAS (Extensive Air Shower) are measured with an accuracy better than 30% primary energy and 120 g/cm² depth of maximum development for EAS occurring either in clear sky or with the EAS depth of maximum development above optically thick cloud layers. Moreover a very novel radiometric retrieval algorithm considering the LIDAR shots as calibration points in the FoV of the Infrared Camera, that seems to be the most promising retrieval algorithm is under development to infer the Cloud Top Height (CTH) of all kind of clouds, thick and thin clouds in the FoV of the JEM-EUSO space telescope. Moreover all the Atmospheric Science developed for the JEM-EUSO collaboration will be reviewed as pattern recognition for different levels of UV background, the atmospheric effects on the calibration of GLS or even the capabilities of JEM-EUSO to contribute to the Space weather.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

958

Poster 3 GA - Board: 60 / 933

Long term variability of the blazar PKS 2155-304

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Time variability of the photon flux is a known feature of AGN and in particular of blazars. The high frequency peaked BL Lac object PKS 2155-304 is one of the brightest source in the TeV band and has been monitored regularly with different instruments and in particular with the H.E.S.S. experiment above 200 GeV for more than 11 years. These data together with the observations of other instruments/monitoring programs like SMARTs (optical), Swift/RXTE/XMM (X-ray) and Fermi-LAT (100 MeV < E < 300 GeV) are used to characterize the variability of this object over a wide energy range.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

1247

Poster 3 GA - Board: 119 / 941

A method to filter out high rate noises in air shower reconstruction for the LHAASO-WCDA project

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The Large High Altitude Air Shower Observatory (LHAASO) will be constructed at Mt. Haizi in Sichuan Province, China. Among several detector components of the LHAASO, the Water Cherenkov Detector Array (WCDA) is of great importance for low-to-middle energy gamma ray astronomy. The WCDA has an area of 90,000 m² in total, which is sub-divided into 3600 cells by curtains, with a PMT resided in each cell. As located at 4400 m a.s.l. and governing 25 m² water area, the single rate of a PMT can reach as high as 50 kHz, bringing a big trouble for the reconstruction of shower events. In this study, an initial reconstruction method aiming to deal with these high rate noises is developed. This method is tested with the Monte Carlo simulation data, showing a very good efficiency in filtering out noises, while most of the real shower signals are remained. This method is proposed to be applied for the future LHAASO-WCDA project, in a stage of the online processing. It can be generalized and used by other air shower experiments as well.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

39

Poster 3 GA - Board: 91 / 688

The search for short-term flares in 10 years of VHE Crab Nebula observations with the Whipple 10m Telescope

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In 1989, the Whipple 10m Telescope achieved the first indisputable detection of a TeV gamma-ray source, the Crab Nebula. Until its decommissioning in 2011, the Whipple Telescope took regular measurements of the nebula. With the recent discovery of GeV gamma-ray flaring activity in the Crab Nebula, it is an opportune time to return to the Whipple Telescope data set and search its extensive archive for evidence of TeV flares. A data set on the Crab Nebula spanning ten years, 2000 - 2010, is compiled and searched for day-scale flaring activity. Using two independent search methods, no evidence for significant flaring activity is found. Monte-Carlo simulations show that low levels of variation on short timescales are difficult to detect. Assuming a flare duration of seven days, 99% confidence level upper limits are calculated for the number of possible 5-fold, 2-fold and 1.5-fold flares in the data set. An upper limit of 0.02 flares per year in the 10-year period is found for the 5-fold flare, and a limit of 0.27 flares per year is placed on the 2-fold flare.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

316

Poster 3 SH - Board: 27 / 157

The modulation of galactic protons in the inner heliosphere during the recent unusual solar minimum period

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Proton observations from the PAMELA mission and a comprehensive modulation model, including a new Stochastic Differential Equation (SDE) model, are used to study the details of the modulation of cosmic rays in the inner heliosphere. Recent theoretical advances in determining the diffusion coefficients are used to compute cosmic ray intensities over the unusual last solar minimum activity

period. We present proton spectra observed between 2006 and 2009 in comparison with the mentioned numerical models. The time-dependence of the magnitude of the solar magnetic field and the corresponding wavy current sheet are used, relating their time-dependence to that of the relevant diffusion coefficients and drift coefficient. The approach is further enhanced by introducing a time-dependence in the rigidity dependence of the transport coefficients as required to reproduce these observations. It will be illustrated that the model can reproduce the monthly spectra observed during the mentioned period. This makes it possible to identify the dominant modulation mechanisms for the unusual solar minimum up to 2009 and to establish why drift effects appear to be of lesser importance than during previous solar minimum cycles.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

172

Poster 3 SH - Board: 12 / 1059

FEATURES OF THE INTERPLANETARY MAGNETIC FIELD TURBULENCES IN DIFFERENT EPOCHS OF SOLAR ACTIVITY

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Data of Bx, By, Bz components of the Interplanetary Magnetic Field (IMF) have been used to study a features of the IMF turbulences for two positive ($A > 0$) and two negative ($A < 0$) polarity epochs of solar magnetic cycles (1969-2011).

We found that the changes of the exponents ν_y , ν_z , ν_x of the Power Spectral Density (PSD) of the By, Bz, Bx components of the IMF show a radical alternation of the large-scale structure of the IMF turbulence in period 1969-2011.

We found a distinction between the temporal changes of the exponents ν_y , ν_z , ν_x for the $A > 0$ and the $A < 0$ polarity epochs of solar magnetic cycles, especially in minima and near minima epochs of solar activity.

We suppose that the changes of the turbulence in the range of frequencies $[10^{(-6)}-10^{(-5)}]$ Hz (responsible for the scattering of the GCR particles of the energy 5-50 GeV) and the module B of the IMF versus solar activity can be considered as the general reasons of the long period variations of the GCR intensity.

Collaboration:

– not specified –

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Poster 3 GA - Board: 121 / 684

Construction of a medium-sized Schwarzschild-Couder telescope as a candidate for the Cherenkov Telescope Array: development of the optical alignment system

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The Cherenkov Telescope Array (CTA) is an international project for a next-generation ground-based gamma-ray observatory. CTA, conceived as an array of tens of imaging atmospheric Cherenkov telescopes, comprising small, medium and large-size telescopes, is aiming to improve on the sensitivity of current-generation experiments by an order of magnitude and provide energy coverage from 20 GeV to more than 300 TeV. The Schwarzschild-Couder (SC) medium-size candidate telescope model features a novel aplanatic two-mirror optical design capable of a wide field-of-view with significantly improved imaging resolution as compared to the traditional Davis-Cotton optics design. Achieving this imaging resolution imposes strict alignment requirements to be accomplished by a dedicated alignment system. In this contribution we present the status of the development of the SC optical alignment system, soon to be materialized in a full-scale prototype SC medium-size telescope at the Fred Lawrence Whipple Observatory in southern Arizona.

Collaboration:

CTA

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592

Poster 3 GA - Board: 63 / 708

Observational Characteristics of the Final Stages of Evaporating Primordial Black Holes

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Many early universe theories predict the creation of Primordial Black Holes (PBHs). PBHs could have masses ranging from the Planck mass to 10^5 solar masses or higher depending on the size of

the universe at formation. Due to quantum-gravitational effects, a black hole is expected to have a temperature which is inversely proportional to its mass. Hence a sufficiently small black hole will quasithermally radiate particles at an ever-increasing rate as emission lowers its mass and raises its temperature. The final moments of this evaporation phase should be explosive. In this work, we investigate the final few seconds of black hole evaporation using the Standard Model of particle physics and calculate energy dependent PBH burst time profiles in GeV/TeV range. We use HAWC (High Altitude Water Cherenkov) observatory as a case study and calculate PBH burst light curves observed by HAWC. Moreover, we explore PBH burst search methods and potentially unique observational signatures of PBH bursts.

Collaboration:

HAWC

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1279

Poster 3 CR - Board: 175 / 682

Evaluation of scientific performance of JEM-EUSO mission with Space-X Dragon option

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The Extreme Universe Space Observatory on-board the Japanese Experiment Module (JEM-EUSO) is a mission devoted to the observation of ultra-high energy cosmic rays (UHECRs) around and above the so-called Greisen-Zatsepin-Kuzimin energy at $\sim 5 \times 10^{19}$ eV. The origin of these enigmatically energetic cosmic rays remain an open question since their discovery more than 50 years ago. Very high statistics observations of UHECRs are essential to provide key information to answer this question. Very large exposure are indeed necessary to overcome their extremely low fluxes of an order of a few events per square kilometer per century. JEM-EUSO is designed to measure the extensive air showers induced by UHECRs using an super-wide field-of-view ultra-violet fluorescence telescope pointed downwards nighttime atmosphere. Orbiting onboard the International Space Station (ISS), JEM-EUSO rather uniformly covers the entire celestial sphere, allowing a thorough analysis of UHECR arrival direction distributions. In the present work, we introduce the current design of the JEM-EUSO telescope using the Space-X Falcon 9 as launcher and the Dragon as transport vehicle to the ISS. We then discuss the expected performances, and in particular the science of the search for the UHECR origin. Assuming the detector configuration based on the full-scale JEM-EUSO, the expected exposure and quality of arrival direction distribution analysis during the assumed mission

lifetime are evaluated by simulation studies. We also preliminarily investigate an advanced scenario based on the use of silicon photomultipliers as focal surface detectors. Eventually we report the expected efficiency of UHECRs observation for these options including the expected sky map UHECRs.

Collaboration:

JEM-EUSO

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531

Poster 3 GA - Board: 52 / 1300

A 3-Meter Atmospheric Cherenkov Telescope as a Test Bench for Very High Energy Gamma-Ray Astrophysics Projects

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We have been setting up a 3-meter diameter atmospheric Cherenkov telescope in Akeno, Japan, for various R & D studies mainly on very high energy gamma-ray astrophysics. This Davies-Cotton type telescope (Akeno telescope, hereafter) was manufactured in 1998 and has been recommissioned at low cost. A low power consumption imaging camera system has been developed for a future gamma-ray astrophysics observatory with "mobile" imaging atmospheric Cherenkov telescopes, which can flexibly change the array configuration for a number of science targets, and has been installed to the Akeno telescope for test observations. We present performances of the optics and the drive system of the Akeno telescope, as well as the status of the imaging camera system. Some other R & D plans including test observations using a prototype imaging camera for CTA and simultaneous observations of the optical and radio Crab pulsar are also presented.

Collaboration:

– not specified –

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Poster 3 SH - Board: 44 / 1301

Experimental and Theoretical study of the long period

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In order to create a two dimensional time dependent relatively realistic model of galactic cosmic ray transport we have found delay time between changes of the galactic cosmic ray (GCR) intensity, on the one hand, and various parameters determined conditions in heliosphere- sunspot numbers SN, magnitude B of the interplanetary magnetic field (IMF), solar wind velocity U, variance of the B, and an index of the rigidity dependence of the GCR intensity long period variations, on the other. We show that delay time dynamically changes between different pairs of parameters throughout from one 11-year cycle to another and by the same token being a natural obstacle in choice of optimal length of the modelling time interval. We consider two models (1) in which we are installing different parameters with regard delay times and (2) without delay times and results compare with experimental data of neutron monitors. In spite of an inclusion of delay times in modelling is not the straightforward exercises, it is worth to perform, because we obtain an additional information about the modulation of cosmic rays from large distances from the earth's orbit.

We show that an acceptable compatibility with the experimental data of neutron monitors is kept for the period of 1976-1987 (solar cycle #21), when the minimum of the expected temporal changes of the GCR particles density is shifted for 18 months with respect to the minimum of the temporal changes of the smoothed experimental data of the GCR intensity

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

801

Poster 3 CR - Board: 136 / 1302

Night time measurement of the UV background by EUSO-Balloon

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Precise characterization of the Earth night side UV background is essential for observation of the ultra-high-energy cosmic ray induced extensive air showers (EAS) from the space. We have analyzed data from the flight of EUSO-Balloon pathfinder mission that took place near Timmins (Canada) in the moonless night from 24th to 25th August 2014. The EUSO-balloon telescope imaged the UV background in the wavelength range 290–430 nm from the altitude \sim 38 km with a 1 m² refractor telescope with 11.5° field-of-view pointed in nadir direction. The UV data were complemented by the data of the Infrared (IR) camera onboard EUSO-balloon, which operated in the wavelength ranges 10.37–11.22 μ m and 11.57–12.42 μ m. We have combined the UV and IR images to study the upward UV radiance from the Earth surface and Earth atmosphere. This allowed us to estimate UV background in clear atmosphere conditions without man-made lights and also to investigate influence of clouds on the UV background values. The obtained UV intensity for clear atmosphere conditions is in a good agreement with previous BaBy and NIGHTGLOW balloon measurements. Comparison of the UV and IR images reveals a strong dependence of the upward UV radiance on the atmospheric conditions, so we discuss the possibility to use the UV albedo effect for characterization of the clouds. For estimating the observation efficiency of EAS from space by EUSO like detectors, it is important to determine the time variation of average UV background intensity, cloud distribution and local man-made light. Using available data, we also discuss these key factors that determine the observable time and area for EAS observation.

Collaboration:

JEM-EUSO

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Poster 3 CR - Board: 137 / 1309

The Spanish Infrared Camera onboard the EUSO-Balloon (CNES) flight on August 24, 2014.

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The Spanish bi-spectral & waterproof Infrared Camera onboard the EUSO-BALLOON (CNES) flight on August 24, 2014 from Timmins (Canada) will be reviewed in this paper. This infrared camera is aimed to obtain the cloud coverage and the cloud top height in the whole Field of View (FoV). The Infrared Camera is a stand-alone device of 0.4m x 0.4m x 0.4m with two filters centered at 10.8 μm and 12 μm and a wide optical system which provided a total FoV of 45°. The operation mode ranged from -30 °C to 55 °C. It took 753 infrared images, 350 before landing on water. Nevertheless, the Camera was completely waterproof and therefore all the infrared camera data were successfully recovered.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

958

Poster 3 SH - Board: 23 / 23

Effect of solar Poloidal magnetic field reversal on tri-diurnal anisotropy of cosmic ray intensity on quiet days.

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The tri-diurnal and quart diurnal anisotropy of cosmic ray intensity have been investigated during the solar cycle 21-22 using the neutron monitor data recorded at different latitudes on sixty geomagnetically quiet days in a year. It has been observed that in spite of the abrupt changes in the amplitude and phase of tri-diurnal and quart diurnal anisotropy in cosmic ray intensity, the phase of tri-diurnal anisotropy shifted to earlier / later hours during the reversal period 1990-91 and 1979-80 showing the dependence on the polarity of solar magnetic field, which is attributed to drift effect at mid latitude neutron monitoring stations. Further, no systematic change have been noticed in the amplitude and phase of quart-diurnal anisotropy of daily variation in quiet days.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

25

Poster 3 GA - Board: 61 / 931

Xeff analysis method optimization to enhance IACTs performances

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The identification of gamma-rays against the dominant background of hadronic cosmic rays is very challenging for Imaging Air Shower Telescopes such as H.E.S.S. Xeff is a multivariate particle classification approach successfully applied to the H.E.S.S. data analysis enabling a significant gain in sensitivity. It is based on the combination of three shower reconstruction methods currently under use : Hillas parameters, semi-analytical analysis (model), and the so called "3D-model". Recently the rejection power of the Xeff method has been increased by introducing the improved model++ reconstruction, refining the set of combined discriminating variables and the classification following observation conditions. The efficiency of this analysis method will be presented by comparing Monte Carlo simulations and real data from a set of published results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1248

Poster 3 SH - Board: 19 / 1347

Study of ground level electric field response to Forbush decreases

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Energetic charged particles of galactic cosmic rays (GCR) and in a extent stronger energetic solar particles penetrate more or less deep into lower atmosphere ionizing the air and affect onto the value and distribution of electric conductivity, the electric field and other atmospheric electric parameters. The response of the atmospheric electric field (AEF) at ground level to the GCR changes and the solar particle events (SPEs) is difficult to distinguish due to large amount of factors affecting the measured vertical component of AEF E_z . In spite of such situation, the effects of Forbush decreases (FEs) in GCR and SPEs in the AEF and air-earth current density in short time scale (hours and days) have been examined and reported in numerous papers. Recently, the interest in such results has increased in a view of the possible physical links between the effects of solar wind on the atmospheric electricity and the changes of weather and climate. A selection of data using a bit larger statistics (March, 1997) enabled a lowering of the E_z values during and after the Forbush decreases. In the present report a preliminary examination of the energetic particle flux changes on the E_z at Swider Observatory is presented using a part of atmospheric electricity recordings continued there since 1954. Only the geomagnetically quiet days with the fair weather condition have been taken into account in our analysis. The preliminary results show the near the ground level potential gradient increase during a 2-4 days after FE.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

999

Poster 3 DM and NU - Board: 281 / 1279

KM3NeT/ARCA sensitivity to neutrino point sources

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KM3NeT is a large research infrastructure that will consist of a network of deep-sea neutrino telescopes in the Mediterranean Sea, of which the ARCA detector installed in the CapoPassero site (Italy) is optimised for studying high-energy neutrinos of cosmic origin. Thanks to its geographical location on the Northern hemisphere, KM3NeT can observe most of the Galactic Plane, including the galactic centre. Prime targets of KM3NeT/ARCA are therefore neutrino sources in our Galaxy. While extragalactic candidate neutrino sources are numerous, the estimates of their neutrino fluxes have large uncertainties due to model assumptions and to the intergalactic absorption of VHE gamma-rays that strongly modifies the gamma-ray spectra measured at Earth. On the other hand, under the hypothesis of hadronic gamma emission and transparent sources, models for galactic neutrino sources are well constrained by TeV gamma-ray observations and allow to obtain realistic expectations on the detection perspectives. We report the ARCA sensitivities for galactic sources such as the supernova remnant RXJ1713.7-3946 and the pulsar wind nebula Vela Jr, and also the discovery potential for generic point sources with an E^{-2} spectrum. Analysis methods and results will be presented both for the track and cascade channels.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

558

Poster 3 DM and NU - Board: 282 / 1175

KM3NeT/ARCA sensitivity to a diffuse flux of cosmic neutrinos

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KM3NeT is a future research infrastructure hosting the next-generation underwater neutrino observatory in the Mediterranean Sea. Within KM3NeT, the ARCA detector will be devoted to the observation of high-energy cosmic neutrinos both in diffuse and point source mode. A major objective of KM3NeT/ARCA is to establish all-flavour neutrino astronomy. The observation of cosmic neutrinos has been reported by the IceCube collaboration in high energy analyses, exceeding significantly the expectations from atmospheric backgrounds. This observation is compatible with an isotropic cosmic flux, equally distributed in the three neutrino flavours. The sensitivity of the planned ARCA detector, with an instrumented volume of about one Gton, has been investigated in an all-flavour analysis and the results will be reported in this presentation. In particular, KM3NeT/ARCA will be able to detect an IceCube-like neutrino flux within less than one year of operation with the complete detector.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

1021

Poster 3 CR - Board: 148 / 393

A new design for simulation and reconstruction software for the JEM-EUSO mission

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The Extreme Universe Space Observatory (JEM-EUSO) is designed to detect the highest energy particles in the Universe by observing the fluorescence and (reflected) Cherenkov light produced when these ultrahigh energy cosmic rays (UHECR) traverse the Earth's atmosphere. Unlike existing cosmic ray observatories, JEM-EUSO will view the atmosphere from above, as the instrument will be attached to the International Space Station. Here we describe a new general-purpose software framework to facilitate detailed simulation and reconstruction of UHECR events observed by JEM-EUSO. This new software is based on open-source codes developed over roughly a decade by a collaborative effort of several particle astrophysics and high energy physics experiments, and is particularly suited to the needs of large collaborations. We explain the machinery used to manage user contributions, organize an abundance of configuration files, facilitate multi-format file handling, and provide access to time-dependent information on detector and atmospheric properties. We also discuss the strategies employed to ensure stability and maintainability in the face of a large number of user contributions. Finally, we show analyses of data from the recent JEM-EUSO stratospheric balloon test flight using this new software package.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

375

Poster 3 SH - Board: 30 / 392

NASA galactic cosmic radiation environment model: Badhwar-O'Neill (2014)

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The Badhwar-O'Neill (BON) Galactic Cosmic Ray (GCR) flux model is used by NASA to certify micro-electronic systems and in the analysis of radiation health risks for human space flight missions. Of special interest to NASA is the kinetic energy region below 4.0 GeV/n due to the fact that exposure from GCR behind shielding (e.g. inside a space vehicle) is heavily influenced by the GCR particles from this energy domain. The BON model numerically solves the Fokker-Planck differential equation to account for particle transport in the heliosphere due to diffusion, convection, and adiabatic deceleration under the assumption of a spherically symmetric heliosphere. The model utilizes a GCR measurements database from various particle detectors to determine the boundary conditions. By using an updated GCR database and improved model fit parameters, the new BON model (BON14) is significantly improved over the previous BON models for describing the GCR radiation environment of interest to human space flight.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

537

Poster 3 CR - Board: 224 / 396

Effect of the regular galactic magnetic field on the propagation of galactic cosmic rays in the Galaxy

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Supernova remnants (SNRs) are believed to be the sources of galactic cosmic rays (GCRs). Occurrences of supernovae are obviously discrete in both space and time. Hence we have to take into account this discreteness of the SN occurrences when we investigate the propagation process of GCRs from parent SNRs to the solar system. Recently, we proposed a new and fully three-dimensional numerical method with stochastic differential equations to calculate the age distribution and the path length distribution (PLD) of GCRs reflecting the discreteness of the SN occurrences (Miyake, Muraishi, and Yanagita, *A&A*, 573, 2015). The resultant age and the energy dependence of B/C calculated from the obtained PLD by the weighted slab model are consistent with recent observations. These findings were obtained under a simplified assumption of an isotropic diffusion model for the

propagation of GCR neglecting the effects anticipated from an anisotropic diffusion under the interstellar magnetic field (ISMF). It may be interesting to see the effects of the ISMF on the propagation processes of GCR.

In this study, we have investigated numerically the propagation process of GCRs in the Galaxy with the regular ISMF proposed by Jansson and Farrar (*ApJ*, 757, 2012). Here we assume the spatial diffusion process is anisotropic with respect to the direction of the regular ISMF. We also assume the spatial diffusion coefficient is inversely proportional to the strengths of the ISMF. We found that significantly larger values of the diffusion coefficient depending on the degree of anisotropy were required to reproduce the observed energy dependence of the B/C ratio. The expected energy dependence of the age and the PLD are also affected by the changes in values of the anisotropic diffusion coefficients. The details of these results will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

380

Poster 3 SH - Board: 45 / 1362

Spectral coherence analysis between the cosmic ray anisotropy and the interplanetary medium

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It is well known that cosmic rays with energies below 100 GeV are significantly modulated by solar wind structures populating the heliosphere, which originate at the Sun. We apply a cross wavelet transform and wavelet coherence for examining relationships in time frequency space between isotropic and anisotropic components of cosmic rays data from the Global Muons Detectors Network (GMDN) and solar wind plasma and magnetic field time series. The GMDN is composed of four muon detectors installed, in chronological order, in Nagoya, Japan (1969), Hobart, Australia (1992), São Martinho da Serra, Brazil (2001) and Kuwait, Kuwait (2006). With this spectral coherence analysis we can identify, from 2007 to 2012, periods of greater coherence between the anisotropy of cosmic ray data and the interplanetary medium parameters (magnetic field and solar wind). We identify periods in which cosmic ray modulation is enhanced due to particular solar structures.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

988

Poster 3 SH - Board: 8 / 586

Spectral index of the recurrent variation of the galactic cosmic rays during the Solar Cycle No. 24.

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We study temporal changes of a behaviour of the power-law rigidity spectrum of the first three harmonics of the 27-day variation of the galactic cosmic rays (GCR) intensity during the solar cycle (SC) no. 24 and compare with other 11-year cycles of solar activity. We show that our recent finding - a hard spectrum of the amplitudes of the 27-day variation of the GCR intensity in maximum epochs and soft one in the minimum epochs during solar cycles no. 20 - no. 23 is generally kept, with some peculiarity in SC no. 24. Particularly, while the rigidity spectrum of amplitudes of the first harmonic of 27-day variation of the GCR intensity practically behaves as for previous periods, the second and the third harmonics demonstrate a valuable softening of a rigidity spectrum of their amplitudes needing a future study.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

108

Poster 3 DM and NU - Board: 255 / 587

Searching for neutrinos from dark matter annihilations in (dwarf) galaxies and clusters with IceCube

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In many models, the self-annihilation of dark matter particles will create neutrinos which can be detected on Earth. An excess flux of these neutrinos is expected from regions of increased dark matter density, like (dwarf) galaxies and galaxy clusters. The IceCube neutrino observatory, a cubic-kilometer neutrino detector at the South Pole, is capable of detecting neutrinos down to energies of the order of 10 GeV and is therefore able to constrain the self-annihilation cross section as a function of the mass of the dark matter particle. This work will present the analysis method and results obtained from the first search for dark matter annihilations in (dwarf) galaxies and galaxy clusters with the complete IceCube detector.

Registration number following "ICRC2015-I":

520

Poster 3 CR - Board: 178 / 1133

Constraints on the extragalactic magnetic fields from the NVSS Faraday rotation measures

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Extragalactic magnetic fields remain extremely elusive. Non-observation of cascade gamma-rays from VHE sources imply that there is a lower bound on their strength $B_{min} \sim 10^{-17}$ G. The upper bound could be larger than 10^{-8} G. Magnetic fields of such strength could considerably alter the process of UHECR propagation, increasing deflection of proton UHECRs and even introducing so-called 'magnetic horizons' for heavier nuclei.

In this work we have used rotation measures of the sources with known redshift from the NVSS catalogue. Redshift evolution of their intrinsic RMs could have been caused by extragalactic fields. Absence of any clear-cut evolution thus allowed us to constrain strength of the extragalactic magnetic fields at several nGs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

798

Poster 3 GA - Board: 67 / 614

AP Librae: The extended jet as the source of VHE emission?

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The LBL AP Librae is a fascinating blazar, since its spectrum contains a few peculiarities, which are not easy to explain. First, the H.E.S.S. collaboration has announced the detection of VHE γ -ray emission from AP Librae. This results in an unusually broad inverse Compton component, since the X-rays are also inverse Compton dominated. Coupled with the narrow synchrotron component, the standard one-zone model fails to reproduce the spectrum.

Secondly, Chandra has detected X-ray emission from the extended jet, which closely follows the radio morphology. Due to the slope of the X-ray spectrum, one can conclude that the X-ray jet is of inverse Compton origin. Interestingly, an extrapolation of the Chandra jet spectrum to γ -ray energies intersects the Fermi-LAT spectrum exactly at the point of a strong break in the Fermi spectrum. This implies that the VHE spectrum measured by H.E.S.S. could be due to inverse Compton emission of the jet instead of the core, which would be an incredible result.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

538

Poster 3 SH - Board: 41 / 1006

Coronal holes in the long-term cosmic rays modulation

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The present study of galactic CR modulation in the heliosphere through the 21-24 cycles continues the series of works, where long-term CR modulation was described using the multi-parametric model, including the solar activity (SA) characteristics. Initial data for modeling of CR variations are long-term observations of CR intensity, the characteristics of the solar global magnetic field and the short-time characteristic of SA (solar x-rays flares). Data of the CR intensity were obtained from the ground network of NM and stratospheric sounding.

In order to improve the simulation of long-term CR variations we introduced into the model the characteristic of the regions with the open magnetic field –the coronal holes (CH). Location (latitude), the area and the magnetic flux of CHs were used. Modeling modulation is carried out for all period and separately for the periods with the same polarity of the global field of the Sun, taking into account the delay CR variations regarding changes of CA characteristics.

The quality of the long-term variations description has been improved by including in the model the CH characteristics.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0754

Poster 3 CR - Board: 193 / 515

Cosmic ray PeVatrons: where are they?

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We discuss what types of supernova remnants can be the sources of PeV cosmic rays and of the corresponding gamma-ray emission.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

0220

Poster 3 CR - Board: 158 / 979

CLOUD TOP HEIGHT ESTIMATION FROM WRF MODEL: APPLICATION TO THE INFRARED CAMERA ONBOARD EUSO-BALLOON (CNES)

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EUSO-BALLOON (CNES) was launched on August 24, 2014 from Timmins (Canada) with a biespectral Infrared Camera onboard intended to measure the cloud coverage during the flight. Clouds at mid and upper levels of the Troposphere are crucial for a proper reconstruction of the main parameters of the Ultra-High Energy Cosmic Rays (UHECR). Therefore, determining Cloud Top Height (CTH) with high accuracy is crucial to estimate the effect of clouds on these measurements. With this aim, we have developed a method to extract CTH parameters via vertical profiles predicted by the WRF model. Moreover, we have evaluated model's ability to represent temperature and humidity profiles in different climatic regions of the globe.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

800

Poster 3 DM and NU - Board: 256 / 1002

All-flavor searches for dark matter with the IceCube neutrino observatory

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Dark matter particles can be trapped in massive celestial bodies, such as the Sun or the Earth. Their self-annihilations may produce standard model particles, including neutrinos of all flavors. Recent developments of reconstruction tools have allowed us to reconstruct electron and tau neutrino interactions with adequate angle and energy resolutions and to estimate the corresponding uncertainties. IceCube's in-fill array DeepCore, when using the outer IceCube detector as a veto, permits us to extend such studies to energies well below neutrino energies of 100 GeV. This is particularly important for the search of Weakly Interacting Massive Particles (WIMPs) that accumulate in the center of the Earth, as their annihilation rate is expected to be enhanced for WIMP masses around 50 GeV/c². All-flavor neutrino searches, in principle, enhance IceCube's sensitivity with respect to previous searches based solely on muon neutrinos.

Registration number following "ICRC2015-I/":

1214

Poster 3 CR - Board: 196 / 628

Adventures in Inflation And Cosmic Microwave Background - The future of the cosmos.

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The radiation present today as a 2.7 K thermal background originated when the universe was denser by a factor of 109 and younger by a factor of around 5×10^4 . The radiation provides the most distant direct image of the universe we can hope to see, at least until gravitational radiation becomes a useful astronomical data source. The microwave background radiation is extremely uniform, varying in temperature by only a few parts in 10⁵ over the sky (apart from an overall dipole variation arising from our peculiar motion through the microwave background's rest frame); its departure from a perfect blackbody spectrum has yet to be detected.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

553

Poster 3 CR - Board: 153 / 625

Determination of the sensitivity and the detection performances of the UV camera pixels of the EUSO-BALLOON instrument

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Recently, the EUSO-BALLOON instrument, the pathfinder for future space telescopes of the JEM-EUSO family, has been flown during one night in the stratosphere by CNES.

The recording of light intensity emitted from earth or its atmosphere by its fast and high-resolution pixel UV camera was one of the main goals of this mission.

We present an analysis on the in-flight UV camera calibration data.

These data allow the extraction of the signal and background components in the recorded photoelectron count spectrum for each pixel, under the assumption of a parameterised multi-component statistical model describing the experimental setup.

We assess the detection performances such as the detection sensitivity, the signal to noise ratio.

We discuss as well the implication of this calibration in the estimation of the statistical and systematic errors on the photoelectron rates measurement.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

0542

Poster 3 DM and NU - Board: 258 / 170

Limits to dark matter properties from a combined analysis of MAGIC and Fermi-LAT results

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The existence of a non-baryonic, neutral and weakly-interacting dark matter component in the Universe is supported by an overwhelming body of experimental evidence. A promising way to try and identify the dark matter particle, and to measure its properties, is to search for the gamma rays produced by annihilation and/or decay in dark matter overdensities in the local Universe. Gamma-ray instruments like the Fermi-LAT (in space) and the MAGIC telescopes (on the ground) are sensitive to overlapping and complementary ranges of dark matter particle mass (from ~ 100 MeV to ~ 100 TeV), and have dedicated programs to look for such signals coming from, e.g., the Galactic center, galaxy clusters, and dwarf satellite galaxies.

The universality of dark matter properties allows the combination of results from different experiments and/or observational targets into a global, more sensitive search. For a given dark matter particle model, a joint likelihood function can be defined as the product of the particular likelihood functions for each of the measurements/instruments. Using such an approach has the advantage that the details of each experiment do not need to be combined or averaged. We have implemented this analysis framework and applied it to combine the results recently published by the MAGIC and Fermi-LAT Collaborations on observations of dwarf satellite galaxies. In this talk, we present the analysis method and the obtained results. The applied approach is completely general and could be used in the future to merge our results with those from other instruments (H.E.S.S., VERITAS, CTA and/or HAWK), sensitive to the same region of the dark matter parameter space.

Registration number following "ICRC2015-I":

1183

Poster 3 GA - Board: 72 / 973

Evidence for a spectral turnover in the broadband gamma-ray emission from SNR Puppis A revealed by H.E.S.S. observations

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The 4 kyr-old supernova remnant (SNR) Puppis A shows strong evidence of interaction between the forward shock and a molecular cloud. The results from Fermi-LAT indicate extended HE gamma-ray emission with a 0.2-100 GeV spectrum that does not significantly deviate from a power law, in contrast to most of the GeV-bright SNRs known to be interacting with molecular clouds. In order to characterize the position of this spectral feature at higher energies, very-high-energy (VHE, $E > 0.1$ TeV) gamma-ray observations of Puppis A were carried out with the H.E.S.S. telescope array. The analysis of the H.E.S.S. data did not reveal any significant emission towards Puppis A. The upper limits on the differential photon flux imply that its broadband gamma-ray spectrum must exhibit a spectral break, estimated to be below 280 GeV, or alternatively a cutoff below ~ 450 GeV or ~ 280 GeV when assuming exponential or sub-exponential cutoff in the power law spectrum, respectively. These results provide insights into our understanding of the processes accelerating particles in the shock front of Puppis A.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

310

Poster 3 CR - Board: 157 / 971

Search for significant background fluctuations in the EUSO-Balloon data

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The balloon borne experiment, EUSO-Balloon, recorded data to measure the UV background during a moonless night, from an altitude of ~ 40 km in the nadir direction, with a field of view of ± 6 deg. In this paper, we investigate the sensitivity of the instrument to coherent fluctuations of this background over areas from $\sim 1 \text{ km}^2$ up to the entire field of view, on timescales ranging from a few microseconds to a few seconds. We present the results of a systematic search for significant variations in the data recorded during the stratospheric flight of August 2014.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

824

Poster 3 GA - Board: 73 / 978

HAP-Fr, a pipeline of data analysis for the HESS-II experiment

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The H.E.S.S. (High Energy Stereoscopic System) experiment is dedicated to the observation of very high energy gamma-rays using the Imaging Atmospheric Cherenkov Technique. Since 2012, the array of 4 telescopes of 12m diameter (CT1-4) is functioning with a fifth telescope, CT5, of 23m

diameter. The full array allows now to observe gamma-rays down to few tens of GeV. With this hybrid array of telescopes, several observations modes are possible, in 'stereo' with only the 12m-class telescopes, in 'hybrid' with all telescopes and in 'mono' with only CT5. The pipelines of data analysis have then been evolved to deal with this first hybrid array of Cherenkov telescopes.

Here is presented the HAP-Fr (HESS Analysis Package-France) pipeline allowing to treat the data of these different observation modes whatever the calibration chains and the different Monte-Carlo simulations packages. This analysis chain aims to process raw data in order to reduce them, reconstruct the shower properties with different algorithms for the mono mode (CT5), stereo mode (CT1-4) and hybrid mode (CT1-5), reduce the cosmic-rays background with advanced multivariate analysis and derive high-level products by controlling finely their statistical properties.

In this communication, the main algorithms of HAP-Fr are introduced and the analysis performance are given with the three instrument configurations.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

816

Poster 3 GA - Board: 103 / 652

Imaging Camera and Hardware of TAIGA-IACT Project

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The key advantage of the TAIGA gamma-ray observatory is a hybrid operation of wide-angle and narrow-angle detectors of the Tunka-HiSCORE and Tunka-IACT. The first IACT telescope of TAIGA project is under construction. The reflector of the telescope will have area of 10 m² and a focus of 4.75 m. Imaging camera consists of about 540 PMT-based pixels with 0.36 degree field of view. Total FOV is 10x10 degrees. We describe construction of the camera and hardware of this telescope. For processing of signals from camera PMTs, the 64-channel board based on ASIC MACOC-3 was developed. The structure and basic characteristics of the MAROC3 chip are discussed. This 64-channel chip was designed to collect output signals from the 64-pixel multianode PMT. It contains a 12-bit Wilkinson ADC and provides production of a shaped signal proportional to the input charge, and 64 trigger outputs. Extension of the dynamic range of the camera read-out channels is ensured using two channels of MAROC3 chip for one PMT. The system includes local nodes for generating local trigger signals, control of analog-digital conversion, loading of MAROC3 chip configuration and an interface of an upper level system. The features of application of the system for atmospheric Cherenkov telescope are highlighted. Design of the TAIGA-IACT camera related with its operation in the hard Siberian winter conditions is presented and discussed as well.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

53

Poster 3 DM and NU - Board: 275 / 1126

First cosmogenic neutrino limits from the ARA Testbed station at South Pole

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The Askaryan Radio Array (ARA) is an ultra-high energy (UHE) cosmic neutrino detector located at the South Pole. The cosmic ray flux cut off above primary energies of $10^{19.5}$ eV leads us to expect a UHE neutrino flux due to the Greisen-Zatsepin-Kuzmin (GZK) effect. The detection of these UHE cosmic neutrinos will add to the understanding of the sources and physics of UHE cosmic rays. The radio Cherenkov technique is the most promising technique for a long term program to investigate the UHE cosmic neutrino flux. ARA uses this radio Cherenkov technique by deploying radio frequency antennas at a depth of 200m in the Antarctic ice. A prototype ARA TestBed station was deployed in the 2010-2011 season and the first three ARA stations were deployed in the 2011-2012 and 2012-2013 seasons. We present the results of the first neutrino search with ARA, using data taken from 2011-2012 with the ARA TestBed station.

Collaboration:

ARA

Registration number following "ICRC2015-I":

348

Poster 3 GA - Board: 98 / 1088

Enhanced HESS-II low energies performance thanks to the focus system

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For the current generation of Imaging Atmospheric Cherenkov Telescopes (IACTs), with their large mirrors and their cameras with fine segmentation of photodetectors, the focusing capability is a relevant issue. The optical system of an IACT has a limited depth of field. Therefore, focusing the telescopes close to the shower maximum in the atmosphere has a significant impact on the data acquisition and analysis. As the distance of the shower maximum to the telescope depends (among others) on the zenith angle, an adjustable focus would be desirable. The fifth Cherenkov telescope of the H.E.S.S. II array is equipped with a focus system which allows to adjust the position of the camera along the optical axis, possibly during data taking. This impact has been studied on gamma-ray Monte Carlo simulations, and the results in terms of gamma-ray trigger rate, energy reconstruction

and gamma-ray effective area will be shown. The impact on mono mode analysis of the first H.E.S.S. II data will be presented as well.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

1248

Poster 3 GA - Board: 108 / 862

Development of the photomultiplier tube readout system for the first Large-Sized Telescope of the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) is the next generation ground-based very high energy gamma-ray observatory. The Large-Sized Telescope (LST) of CTA targets 20 GeV –1 TeV gamma rays and has 1855 photomultiplier tubes (PMTs) installed in the focal plane camera. With the 23 m mirror dish, the night sky background rate amounts to ~200 MHz per pixel. In order to record clean images of gamma-ray showers with minimal NSB contamination, a fast sampling of the signal waveform is required so that the signal integration time can be as short as the Cherenkov light flash duration (a few ns). We have developed a readout board which samples waveforms of seven PMTs per board at a GHz rate. Since a GHz FADC has a high power consumption, leading to large heat dissipation, we adopted the analog memory ASIC "DRS4". The sampler has 1024 capacitors per channel and can sample the waveform at a GHz rate. Four channels of a chip are cascaded to obtain deeper sampling depth with 4096 capacitors. After a trigger is generated in a mezzanine on the board, the waveform stored in the capacitor array is subsequently digitized with a low speed (33 MHz) ADC and transferred via the FPGA-based Gigabit Ethernet to a data acquisition system. Both a low power consumption (2.7 W per channel) and high speed sampling with a bandwidth of >300 MHz have been achieved. In addition, in order to increase the dynamic range of the readout we adopted a two gain system achieving up to 2000 photoelectrons in total. We finalized the board design for the first LST

and proceeded to mass production. Performance of produced boards are being checked with a series of quality control (QC) tests. We report the readout board specifications and QC results.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

744

Poster 3 GA - Board: 78 / 867

Prospects for Measuring the Isotropic Diffuse Gamma-Ray Emission in HAWC above 1 TeV

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Isotropic diffuse gamma-ray emission above 100 GeV is produced by unresolved extragalactic objects such as active galactic nuclei, as well as source of truly diffuse emission such as the electromagnetic cascades produced by very high energy gamma rays and cosmic rays. Isotropic diffuse gamma-ray emission has been observed up to nearly 1 TeV. An Observation or limit above this energy can substantially constrain the origin of the astrophysical neutrino signal observed in IceCube. The High Altitude Water Cherenkov (HAWC) observatory, with superior sensitivity to gamma rays between 100 GeV and 100 TeV, continuously observes the overhead sky and will measure or constrain isotropic emission above 1 TeV. The measurement is challenging because the background estimation typically employed fails in the presence of a truly isotropic signal. This paper will use the current HAWC performance on known gamma-ray sources to estimate HAWC's sensitivity to the IDGE.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

748

Poster 3 GA - Board: 79 / 881

Limits on the isotropic diffuse gamma-rays at ultra high energies measured with KASCADE

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Diffuse ultra-high energy gamma radiation can arise from a variety of astrophysical sources. Using the data collected by the KASCADE air shower array, the 90% C.L. upper limit to the flux of ultra-high energy gamma-rays in the primary cosmic-ray flux is determined from 200 TeV up to 20 PeV. The upper limit on the fraction of gamma-rays to cosmic-rays in energy range 1.5 and 3.7 PeV is the best up to now, which might set some constraints on the model about the origin of the IceCube neutrino excess.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I":

755

Poster 3 CR - Board: 222 / 885

Cloud Monitoring using Nitrogen Laser for LHAASO Experiment

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Abstract:

Atmospheric monitoring is the key for experiments using the air Cherenkov/fluorescence techniques. In particular cloud monitoring is of great importance to evaluate "clearness" of night skies which affects to shower images obtained by the Wide Field of view Cherenkov/Fluorescence Telescope Array(WFCTA). A nitrogen laser has been installed at the ARGO-YBJ site for the cloud monitoring during WFCTA observations. The testing system has been in operation since January 2012. In this paper, we describe the nitrogen laser system and the analysis method of the cloud monitoring data. As a cross check, the star light data also be analyzed.

Collaboration:

LHAASO

Registration number following "ICRC2015-I":

757

Poster 3 CR - Board: 219 / 1289

Transient luminous events registered with a ground pinhole

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The near UV background level at the atmosphere has several sources, such as transient luminous events, trace of micro-meteorites and human activities by example. In order to evaluate the possibility to detect ultra high energy cosmic ray fluorescence signals from the space, it is necessary to measure and monitor this UV background level. Nature of the UV atmospheric transient events is not well known yet and more experimental data are needed. By that, we constructed a fast imaging detector, a pinhole camera. The pinhole camera design fulfills the requirements of FOV, compactness, reliability, and attached to a fast position sensitive detector PSD will allow us to obtain 2d-images, as proposed in the near future space mission TUS (tracking ultraviolet system). In this work we present the shape and energy of some TLEs recorded in the Sierra Negra Volcano near Puebla, Mexico (4300 m.a.s.l).

Collaboration:

LAGO

Registration number following "ICRC2015-I":

614

Poster 3 CR - Board: 166 / 889

The Weather Research and Forecasting (WRF) model contribution to the atmospheric conditions estimation during the EUSO-Balloon experiment

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EUSO-Balloon is a first prototype of the spaced-based JEM-EUSO telescope. Built on a stratospheric balloon, the telescope flew for eight hours, the night of August 25, 2014, above Canada. Interactions of light

with clouds might impact the signal received by JEM-EUSO & EUSO-Balloon from cosmic-ray events. Reliable informations on cloud properties, such as the cloud-top-height (CTH), are thus crucial to properly reconstruct air showers. For that purpose, atmospheric vertical profiles are needed to convert the cloud-toptemperature (CTT), measured by the InfraRed (IR) camera onboard the telescope, to the CTH. When real profiles from radiosoundings are not available, real-time vertical profiles simulated by Numerical Weather Prediction (NWP) models can be used.

In this preliminary work, the mesoscal Weather Research and Forecasting (WRF) model is applied to the EUSO-Balloon scene to check its reliability in evaluating atmospheric vertical profiles. We first test WRF simulated profiles by comparing with real radiosounding observations. Then, we consider EUSO-balloon scene observations from the very accurate satellite sensor MODIS.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

314

Poster 3 CR - Board: 216 / 1225

Shower reconstruction performance of the new Tibet hybrid experiment consisting of YAC-II, Tibet-III and MD arrays

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A new hybrid detector system has been constructed by the Tibet ASgamma collaboration in Tibet, China, since 2014 to measure the chemical composition of cosmic rays in the wide energy range including the knee. The new detector system consists of an AS-core detector-grid (YAC-II) to detect a bundle of high-energy shower particles, the Tibet-III AS array and a MD cluster (large underground water-Cherenkov Muon-Detector cluster). Its goal is to reconstruct the primary energy and composition of cosmic rays at the energies between 50 TeV to 10^{16} eV thereby allowing a detailed investigation of the expected proton-knee, helium-knee and iron-knee. In this paper, we present the accuracy of the shower reconstruction methods based on full Monte Carlo simulations. Implications to the discrimination power of the obtained parameters with respect to the nature of the primary particles will be considered.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

945

Poster 3 GA - Board: 64 / 701

Detecting extended gamma-ray emission with the next generation Cherenkov telescopes

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Very high energy (VHE > 100 GeV) gamma rays coming from blazars can produce pairs when interacting with the Extragalactic Background Light (EBL), initiating an electromagnetic cascade. For a non-null Intergalactic Magnetic Field (IGMF), this cascade may result in an extended isotropic emission of photons around the source (halo), or in a broadening of the emission beam, depending on the IGMF intensity. The detection of these effects may lead to important constraints on both the IGMF intensity and the EBL density, quantities of great relevance in astrophysics and cosmology.

Since the gamma ray extended emission was proposed, several groups have tried unsuccessfully to observe it using different approaches [1-5]. The next generation of Cherenkov telescope systems, with an order of magnitude more sensitivity and better angular resolution, might be able to distinguish this effect.

Using a Monte Carlo program, we simulate electromagnetic cascades coming from a blazar at redshift $z=0.14$, which is in principle an ideal distance for potentially observing the effect [6]. We have previously reported a calculation for a monochromatic source [7]. In this work the spectrum of the gamma ray source 1ES 0229+200 (hard spectrum) is used as the input photon distribution, which is injected to space within a 6 degree cone to simulate a blazar jet scenario. We study the possible detection of this gamma ray flux considering a generic future Cherenkov telescope system whose sensitivity, effective collection area, and angular resolution are characterized by a simplified analytical model [8]. Combining the properties of this detector, we calculate the telescope system point spread function (PSF). We simulate the angular distribution of the gamma rays detected under two situations (null and non-null IGMF intensity) and convolve them with the PSF to simulate the observed angular photon distribution. Finally we develop a method for testing the statistical feasibility of detecting the extended gamma ray emission effect by comparing these two distributions.

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Collaboration:

– not specified –

Registration number following "ICRC2015-I":

140

Poster 3 CR - Board: 186 / 325

On the gravitational quantum states of helium atoms in the gravitational field of a cold neutron star

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A study of gravitational properties of matter and a precision test of Weak Equivalence Principle (WEP) presents a fundamental interest. We have shown the possibility of investigation of quantum gravitational states of matter by the example of helium atom. We examined the capability of the existence of helium quantum states in the gravitational field of a cold neutron star. Observation of such states was done with the help of rotating neutron star's magnetic field. Periodically changing magnetic field induced transitions between gravitational states of helium atom and led to the appearance of gravitational transitions' spectral lines in gigahertz frequency range.

We consider a quite cold old neutron star surrounded by a cloud of cold helium gas. Helium atoms in the gravitational field of the star are localized in long-lived quantum states, similar to the states

of neutrons and antihydrogen atoms in the gravitational field of the Earth. Experimental test of the existence of such states for antihydrogen by methods of induction of resonance transitions between quantum levels in temporally oscillating gradient magnetic field is planned. In case of dealing with helium atoms near the neutron star's surface we can use neutron star's own oscillating magnetic field to observe gravitational states of atoms. The main effect that makes these observations difficult is the thermal motion of helium atoms. Helium atoms were chosen because the distance between gravitational levels of helium is larger than the same for hydrogen, that's why the thermal motion's effects are not so drastic for helium. It will be shown that temperature about 0.4 K will make observation of spectral lines consistent with gravitational transitions possible. Temperature about 0.4 K cannot be achieved if we consider a case of weak anisotropy of cosmic microwave background (TCMB ~ 2.7 K). On the other hand if we manage to register gravitational states' spectral lines, we can speak about the existence of the Universe's areas with sufficiently lower temperatures ($T \ll$ TCMB)

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

116

Poster 3 CR - Board: 187 / 328

The dominance of secondary nuclei in the cosmic radiation and the modulation of the nuclear species at the injection of the galactic accelerator

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The cosmic-ray abundances are compared to those of the quiescent matter referred to as galactic or solar abundances. Cosmic-ray and Galactic abundances are normalized to Iron.

The comparison takes advantage of the recent data of the energy spectra of the cosmic nuclei in the interval $3 \times 10^{10} - 5 \times 10^{14}$ eV and the observation of a constant spectral index of 2.67 ± 0.05 . The ratio of cosmic-ray to galactic abundances conforms to a remarkable regularity (or rule): the odd nucleus has a greater ratio than the adjacent even nucleus for the 14 nuclear species in the range, $5 \leq Z \leq 28$ where Z is the atomic number of the nucleus. Since many decades this rule is explained by the production of secondary nuclei by spallation reactions of primary nuclei in the interstellar medium. From this regularity it is inferred that the mechanism accelerating cosmic rays (galactic accelerator) does not alter galactic abundances of primary cosmic nuclei within about an order of magnitude, relative to Iron in the range $5 \leq Z \leq 28$.

From similar empirical arguments it is argued that primary proton and primary Helium in cosmic rays are highly depleted at the injection stage of the galactic accelerator. The depletion of H and He cosmic nuclei relative to Iron amounts to suppression factors higher than $10^4 - 10^5$ which outnumber those previously reported in the past and recent literature.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

153

Poster 3 DM and NU - Board: 265 / 759

GAPS - Dark matter search with low-energy cosmic ray antideuterons and antiprotons

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The GAPS experiment is foreseen to carry out a dark matter search by measuring low-energy cosmic ray antideuterons and antiprotons with a novel detection approach. It will provide a new avenue to access a wide range of different dark matter models and masses from about 10GeV to 1TeV.

The theoretically predicted antideuteron flux resulting from secondary interactions of primary cosmic rays is very low. Well-motivated theories beyond the Standard Model contain viable dark matter candidates, which could lead to a significant enhancement of the antideuteron flux due to annihilation or decay of dark matter particles. This flux contribution is believed to be especially large at low energies, which leads to a high discovery potential for GAPS. The GAPS low-energy antiproton search will provide some of the most stringent constraints on ~ 10 GeV dark matter, will provide the best limits on primordial black hole evaporation on galactic length scales, and explore new discovery space in cosmic ray physics.

GAPS is designed to achieve its goals via long duration balloon flights at high altitude in Antarctica. The detector itself will consist of 10 planes of Si(Li) solid state detectors and a surrounding time-of-flight system. Antideuterons and antiprotons will be slowed down in the Si(Li) material, replace a shell electron and form an excited exotic atom. The atom will be deexcited by characteristic X-ray transitions and will end its life by the formation of an annihilation pion/proton star. This unique event structure will deliver a nearly background free detection possibility. In June 2012, a successful prototype balloon flight from the balloon base in Taiki, Japan was carried out.

The presentation will motivate low-energy cosmic ray antideuteron and antiproton searches as well as specifically discuss the current status of the GAPS experiment and the design of the payload.

Registration number following "ICRC2015-I":

675

Poster 3 CR - Board: 183 / 201

Are inclined air showers from cosmic rays the most suitable to radio detection?

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Abstract: There are many discussions about the best possible type of air showers to radio detections. Two types of air showers are under considerations, Vertical and Inclined. In this study based on CORSIKA and CoREAS simulations, we are going to investigate the best type of aforementioned air showers especially for experimental purposes. We compare raw radio pulses and filtered peak radio amplitude patterns of different electrical field components in the 32 to 64 MHz frequency band using a specifically designed computer code for a series of vertical and inclined air showers

initiating from proton primary particle with 10^{17} eV initial energy. It is found that despite having smaller values in a very specific distance from shower core, the inclined air showers provide more expanded and consistent peak radio amplitudes throughout the entire radio detection area which is very important in real experiments. From vertical to 15° , 30° , 45° and 60° zenith angles we investigate a variety of different effective shower properties on radio signals from raw radio pulses to emerging patterns.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

91

Poster 3 GA - Board: 86 / 774

Search for Pulsed Emission in Archival VERITAS Data

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Since the 2011 VERITAS discovery of very high energy emission (VHE; $E > 100$ GeV) from the Crab pulsar, there has been concerted effort by the gamma-ray astrophysics community to detect other pulsars in the VHE band in order to place better constraints on emission models. Pulsar modeling demonstrates that much of the magnetosphere is opaque to very high energy photons, limiting emission regions to the outer magnetosphere or beyond the light cylinder. The locations of 19 known pulsars have been observed by VERITAS since full VERITAS observations began in 2007 with 11 locations having more than 20 hours of observations. Observations of VHE emission from more sources could provide key data to help constrain current models of emission location and mechanisms. We present on the ongoing VERITAS program searching for pulsed emission in archival pulsar data.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

680

Poster 3 CR - Board: 177 / 76

Phenomenological description of young massive star clusters

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The most massive stars appear grouped in giant molecular clouds. Their strong wind activity generates large structures known as super bubbles and induces collective effects which could accelerate particles up to the high energy and produce gamma-rays. The best objects to observe these effects are young massive star clusters in which no supernova explosion has occurred yet. Such star associations are typically still embedded in their parent molecular cloud, which can be traced by the emission due to ionization by the stellar light (HII region). Considering this region as a spherical leaky-box surrounding a central cosmic ray source, a phenomenological model has been developed to estimate cosmic-rays and gamma-rays production for several clusters. The expected gamma-ray flux have been finally compared to the present and future gamma-ray telescopes sensitivities.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1249

Poster 3 SH - Board: 42 / 1047

The chemical composition of galactic cosmic rays during solar minimum of solar cycle 20/21 - Helios E6 results

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Helios 1 and 2 were launched in December 1974 and January 1976, respectively. They both explored the inner heliosphere to distances of less than 0.3 AU from the Sun. The University of Kiel experiment on board the solar probe Helios measured high energy charged cosmic ray particles of solar, planetary and galactic origin. The cosmic ray telescope consists out of five semiconductor detectors, one Cerenkov and one scintillation counter. Electrons with energies between 0.3 and 4 MeV, protons and heavier nuclei up to neon with energies of more than 1.3 MeV/nucleon can be separated. Here we present the chemical composition of galactic cosmic rays during the minimum period of solar cycle 20 and 21 from launch in 1974 to the end of 1977.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1165

Poster 3 GA - Board: 51 / 1141

Gamma-ray halo around the M31 galaxy as seen by the Fermi LAT

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Theories of galaxy formation predict the existence of extended gas halo around spiral galaxies. If there are 10-100 nG magnetic fields at several ten kpc distances from the galaxies, extended galactic cosmic ray (CR) haloes could also exist. Galactic CRs could interact with the tenuous hot halo gas to produce observable γ -rays. In this paper we have performed search for such a halo around the M31 galaxy – the closest large spiral galaxy. Our analysis of 5.5 years of the Fermi LAT data revealed the presence of a spatially extended emission excess around M31. The data can be fitted using the simplest morphology of a uniformly bright circle. The best fit gave a 4.4σ significance for a 3° (40 kpc) halo with photon flux of $\sim (1.9 \pm 1.1) \times 10^{-9} \text{ cm}^{-2} \text{ s}^{-1}$ and luminosity $(8.4 \pm 4.6) \times 10^{38} \text{ erg s}^{-1}$ in the energy range 0.3–100 GeV. The presence of such a halo compellingly shows that a 10-100 nG magnetic field should extend around M31 up to a 40 kpc distance.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

798

Poster 3 GA - Board: 101 / 1341

The Multi-Mission Maximum Likelihood framework

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Astrophysical sources are now observed by many different instruments at different wavelengths, from radio to high-energy gamma-rays, with an unprecedented quality. Putting all these data together to form a coherent view, however, is a very difficult task. Each instrument has its own data format, software and analysis procedure, which are difficult to combine. It is for example very challenging to perform a broadband fit of the energy spectrum of the source.

The Multi-Mission Maximum Likelihood framework (3ML) aim to solve this issue, providing a common framework which allows for a coherent modeling of sources using all the available data, no matter their origin. At the same time, thanks to its architecture based on plug-ins, 3ML uses the existing official software of each instrument for the corresponding data in a way which is transparent to the user.

3ML is based on the likelihood formalism, in which a model summarizing our knowledge about a particular region of the sky is convolved with the instrument response and compared to the corresponding data. The user can choose between a frequentist analysis, and a Bayesian analysis. In the former, parameters of the model are optimized in order to obtain the best match to the data (i.e., the maximum of the likelihood). In the latter, the priors specified by the user will be used to build the posterior distribution, which will be then sampled with Markov Chain Monte Carlo or Multi-nest. Our implementation of this idea is very flexible, allowing the study of point sources as well as extended sources with arbitrary spectra.

We will review the architecture of the software, as well as preliminary results based on the plug-ins already developed for the Fermi Gamma-ray space telescope and other instruments.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

257

Poster 3 CR - Board: 210 / 1146

Analysis of Background Cosmic Ray Rate in the 2010-2012 Period from the LAGO-Chacaltaya Detectors

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The Latin American Giant Observatory (LAGO) is an extended Cosmic Rays observatory composed by a network of Water Cherenkov Detectors (WCDs) spread over Latin America. This work will report the analysis of three years of data from three LAGO WCD located in Cerro Chacaltaya, Bolivia, at 5200 m a.s.l. Background cosmic ray rate from these detectors is checked for DAQ issues and inconsistencies, and corrected for atmospheric effects. An analysis for short transients up to the minute timescale is performed, in search for coincidence with transients observed by satellites. Sidereal and solar long term epoch data analysis are also presented.

Collaboration:

LAGO

Registration number following "ICRC2015-I":

881

Poster 3 GA - Board: 53 / 1263

The X-Ray Counterpart of the Gamma-Ray Sky

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All-sky exploration by Fermi-LAT has revolutionized our view of the gamma-ray Universe. While its ongoing all-sky survey counts thousands of sources, essential issues related to the nature of unassociated sources call for more sensitive all-sky surveys at hard X-ray energies that allow for their identification. This latter energy band encodes the hard-tail of the thermal emission and the soft-tail of non-thermal emission thereby bridging the non-thermal and thermal emission mechanisms of gamma-ray sources.

All-sky surveys at hard X-rays are best performed by current coded-mask telescopes Swift/BAT and INTEGRAL/IBIS. To boost the hard X-ray all-sky sensitivity, we have developed an ad hoc technique by combining photons from independent observations of BAT and IBIS. The resulting Swift-INTEGRAL X-ray (SIX) survey has an improved source-number density. This improvement is essential to enhance the positive hard X-ray –gamma-ray source matches. We present the results from the scientific link between the neighboring gamma-ray and hard X-ray bands in the context of galactic and extragalactic source classes of the second catalog Fermi Gamma-ray LAT (2FGL).

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

751

Poster 3 GA - Board: 93 / 692

New method for Gamma/Hadron separation in HAWC using neural networks

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The High Altitude Water Cherenkov (HAWC) gamma-ray observatory is located at an altitude of 4100 meters in Sierra Negra, Puebla, Mexico. HAWC is an air shower array of 300 water Cherenkov detectors (WCDs), each with 4 photomultiplier tubes (PMTs). Because the observatory is sensitive to air showers produced by cosmic rays and gamma rays, one of the main tasks in the analysis of gamma-ray sources is gamma/hadron separation for the suppression of the cosmic-ray background. Currently, HAWC has a method called Compactness for the separation, but this method divides the data into 10 bins that depend on the number of PMTs in each event, and each bin has its own value cut. In this work, we present a new method that has only one bin, and therefore one cut for gamma/hadron separation. The method uses a Multilayer Perceptron net (MLP) that is fed with 5 features of the air shower to create one output value. We used simulated cosmic-ray and gamma-ray events and did an analysis to find the optimal cut and then applied the technique to data from the Crab Nebula. We found that the MLP method has superior gamma/hadron discrimination power when compared to Compactness, resulting in a 17% increase in the maximum significance of the excess of gamma rays from the Crab Nebula.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

610

Poster 3 DM and NU - Board: 260 / 690

Hunting for dark matter subhalos among the Fermi-LAT sources with VERITAS

Author: Daniel Nieto Castano¹¹ *Columbia University***Corresponding Author:** nieto@nevis.columbia.edu

The distribution of dark matter in the Galaxy, according to state-of-the-art simulations, shows not only a smooth halo component but also a rich substructure where a hierarchy of dark matter subhalos of different masses is found. We present a search for potential dark matter subhalos in our Galaxy exploiting the high (HE, 100 MeV – 100 GeV) and very-high-energy (VHE, >100 GeV) gamma-ray bands. We assume a scenario where the dark matter is composed of weakly interacting massive particles of mass over 100 GeV, and is capable of self-annihilation into standard model products. Under such a hypothesis, most of the photons created by the annihilation of dark matter particles are predicted to lay in the HE gamma-ray band, where the Fermi-Large Area Telescope is the most sensitive instrument to date. However, the distinctive spectral cut-off located at the dark matter particle mass is expected in the VHE gamma-ray band, thus making imaging atmospheric Cherenkov telescopes like VERITAS the best suited instruments for follow-up observations and the characterization of a potential dark matter signature. We report on the ongoing VERITAS program to hunt for these dark matter subhalos, particularly focusing on two promising dark matter subhalo candidates selected among the Fermi-LAT Second Source Catalog unassociated high-energy gamma-ray sources.

Registration number following "ICRC2015-I/":

592

Poster 3 GA - Board: 69 / 695

Gammapy: An open-source Python package for gamma-ray astronomy

Author: Axel Donath¹**Co-authors:** Christoph Deil ¹; Ellis Owen ²; Joachim Hahn ¹; Manuel Paz Arribas ³; Ramin Marx ¹; Regis Terrier ⁴; Rolf Buehler ⁵¹ *MPI for Nuclear Physics, Heidelberg*² *MSSL-UCL Astrophysics*³ *KIPAC, Stanford*⁴ *C*⁵ *DESY Zeuthen*

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In the past decade imaging atmospheric Cherenkov telescope arrays such as H.E.S.S., MAGIC, VERITAS, as well as the Fermi-LAT space telescope have provided us with detailed images and spectra of the gamma-ray universe for the first time. Currently the gamma-ray community is preparing to build the next-generation Cherenkov Telescope Array (CTA), which will be operated as an open observatory.

Gammapy (available at <https://github.com/gammapy/gammapy> under the open-source BSD license) is a new in-development Astropy affiliated package for high-level analysis and simulation of astronomical gamma-ray data. It is built on the scientific Python stack (Numpy, Scipy, matplotlib and scikit-image) and makes use of other open-source astronomy packages such as Astropy, Sherpa, gammalib and Naima to provide a flexible set of tools for gamma-ray astronomers. We present an overview of the current Gammapy features and example analyses on real as well as simulated gamma-ray datasets. We would like Gammapy to become a community-developed project and a place of collaboration between scientists interested in gamma-ray astronomy with Python. Contributions welcome!

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

572

Poster 3 GA - Board: 99 / 1338

Time Synchronization with White Rabbit - Experience from Tunka-HiSCORE

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Upcoming Gamma-Ray and Cosmic-Ray experiments require relative time calibration of all detector components with (sub-)nanosecond precision.

White Rabbit, an established technology for time- and frequency transfer, can be applied here.

We describe a White Rabbit (WR) based design for Tunka-HiSCORE - a timing array for Gamma-Ray astronomy now under construction.

Sub-nsec synchronization results from cosmic ray data, in-situ calibrations and laboratory tests taken over several years are presented. A WR-based online array-trigger and shower reconstruction concept is outlined, aiming at improved physics sensitivity.

We conclude that excellent field performance, design flexibility, cost-efficiency and its open source approach make WhiteRabbit advantageous over custom-made solutions for large, long-term projects.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

991

Poster 3 GA - Board: 117 / 1319

FlashCam: a fully-digital camera for the medium-sized telescopes of the Cherenkov Telescope Array

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The FlashCam group is currently preparing photomultiplier-tube based cameras proposed for the medium-sized telescopes (MST) of the Cherenkov Telescope Array (CTA). The cameras are designed around the FlashCam readout concept which is the first fully-digital readout system for Cherenkov cameras, based on commercial FADCs and FPGAs as key components for the front-end electronics modules and a high performance camera server as back-end. This contribution describes the progress of the full-scale FlashCam camera prototype currently under construction, as well as performance results also obtained with earlier demonstrator setups. Plans towards the production and implementation of FlashCams on site are also briefly presented.

Collaboration:

CTA

Registration number following "ICRC2015-I":

1212

Poster 3 GA - Board: 62 / 928

H.E.S.S. II Data Analysis with IMPACT

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The H.E.S.S. VHE gamma-ray telescope has added a fifth telescope of 600 m² mirror area to the centre of the 4 existing telescopes, lowering its energy threshold to the sub-100 GeV range and becoming the first operational IACT array using multiple telescope designs. In order to properly access this low energy range however, some adaptation must be made to the existing event analysis.

We therefore present an adaptation of the high-performance event reconstruction algorithm, Image Pixel-wise fit for Atmospheric Cherenkov Telescopes (ImPACT), for performing mono and stereo event reconstruction with the H.E.S.S. II array. The reconstruction algorithm is based around the likelihood fitting of camera pixel amplitudes to an expected image template, directly generated from Monte Carlo simulations. This advanced reconstruction is combined with a multi variate analysis based background rejection scheme to provide a sensitive and stable analysis scheme in the sub-100 GeV gamma-ray energy range.

We will present the latest results of the ImPACT analysis on both simulated and real H.E.S.S. II data, demonstrating the behaviour of the ImPACT analysis at the lowest energies.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

559

Poster 3 CR - Board: 146 / 925

Tests of JEM–EUSO 1st level trigger using EUSO–Balloon data

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EUSO–Balloon successfully flew on August 2014 from Timmins (Ontario, Canada). Its focal surface was an array of 36 MAPMTs, 64 pixels each, for a total of 2304 channels. During its 5 hours flight at float altitude of about 40 km it routinely recorded sequences of 128 consecutive 2.5 μ s long snapshots (GTUs) of the luminous conditions in its field of view ($\sim 64 \text{ km}^2$) with a spatial resolution of $\sim 175 \times 175 \text{ m}^2$. In total about 4×10^7 GTUs were acquired imaging nightglow background from forests, lakes and clouds, as well as city light conditions and artificial air showers tracks generated by means of a laser installed on a helicopter flying underneath EUSO–Balloon. EUSO–Balloon data have been processed a posteriori using the algorithm foreseen for the 1st level trigger of JEM–EUSO. This contribution will report on the results of such analysis.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

443

Poster 3 CR - Board: 192 / 496

Vela-X as main contributor to the electron and positron spectra at energy above 100 GeV

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The precise measurements of the electron, positron and electron plus positron spectra, in the energy range from 0.5 GeV up to 700 GeV, 500 GeV and 1 TeV respectively, were published by the AMS-02 collaboration. We focus the attention above 10 GeV where the solar modulation effects are negligible. The differences between these data and the “classical” Local Interstellar Spectra, obtained using optimized GALPROP parameters, show an extra contribution suggesting an equal amount for both electrons and positrons. Thus, they would be produced by a pair production process from the same source. We studied the contribution from Vela-X Pulsar Wind Nebula starting from the photon spectrum (due to synchrotron and inverse Compton processes) detected by gamma-ray telescopes. A diffusion model is applied from the source up to the Solar System and the propagated spectra are compared with the AMS-02 data. Above 100 GeV, Vela-X is the main candidate to contribute to the observed excess.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

448

Poster 3 GA - Board: 66 / 1134

Time-resolved multiwavelength observations of the blazar VER J0521+211 from radio to gamma-ray energies

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VER J0521+211 (RGB J0521.8+211) is one of the brightest and most powerful blazars detected in the TeV gamma-ray regime. It is located at a redshift of $z=0.108$ and since its discovery in 2009, VER J0521+211 has exhibited an average TeV flux exceeding 0.1 times that of the Crab Nebula, corresponding to an isotropic luminosity of $3e44$ erg s⁻¹. We present data from a comprehensive multi-wavelength campaign on this object extending between November 2012 and February 2014, including single-dish radio observations, optical photometry and polarimetry, UV, X-ray, GeV and TeV

gamma-ray data (VERITAS, MAGIC). Significant flux variability was observed at all wavelengths, including a long-lasting high state at gamma-ray energies in Fall 2013. Nighly-resolved spectra at X-ray and TeV energies will be presented, and emission mechanisms explaining the observed flux and spectral variability will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

601

Poster 3 CR - Board: 149 / 836

K-EUSO: An improved optical system for KLYPVE Ultra-High Energy cosmic ray space telescope

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KLYPVE is a Russian science mission to detect ultra-high energy cosmic rays (UHECRs) above 5 10¹⁹ eV. It will be attached to the Russian MRM-1 module onboard International Space Station. The K-EUSO project is a result of the joint efforts of the JEM-EUSO collaboration to improve performance of the KLYPVE mission, by employing the technologies (a corrector Fresnel lens, the Focal surface detector, and a laser head) developed for the JEM-EUSO mission. The baseline design of KLYPVE/K-EUSO uses a 3.4m primary mirror, allowing large photon collection efficiency. Light from the mirror is focused by a 1.7m diameter, double sided Fresnel lens on the focal surface. The lens enlarges the field of view to $\pm 14^\circ$, reduces aberrations thus improving the effective area by more than a factor 7. We will describe the details of the baseline optical system for KLYPVE/K-EUSO.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

1161

Poster 3 DM and NU - Board: 262 / 366

Constraining Secluded Dark Matter models with the ANTARES neutrino telescope

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In this work we describe the search for Secluded Dark Matter (SDM) annihilation from the Sun with ANTARES. SDM is a special scenario where DM, which would gravitationally accumulate in astrophysical objects like the Sun, is annihilated into a pair of non-Standard Model mediators, which subsequently decay into SM particles. It was suggested to explain some experimental observations, such as the positron-electron ratio observed by satellite detectors. Three different cases are studied: a) direct detection of di-muons from the mediator decay, or neutrino detection from: b) the mediator that decays into di-muons and, in turn, into neutrinos, and c) the mediator that directly decays into neutrinos. The ANTARES results obtained for SDM models –the first experimental limits established directly in neutrino telescopes–are presented. The limits imposed to these models are much more restrictive than those derived in direct detection searches for the case of spin-dependent interaction for a wide range of lifetimes of the meta-stable mediator.

Registration number following "ICRC2015-I/":

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Poster 3 DM and NU - Board: 263 / 361

Pull-validation: A resampling method to improve the usage of low-statistics datasets

Authors: Anna Obertacke¹; Florian Scheriau²; Jan Kunnen³; Jan Luenemann³¹ *Universität Wuppertal*² *Technische Universität Dortmund*³ *Vrije Universiteit Brussel***Corresponding Author:** jan.lunemann@vub.ac.be

In high energy physics many background dominated analyses suffer from limited statistics in simulation: With increasing efficiency of the event selection the simulated samples are reduced so that in many cases the event number at final analysis level is very low. Due to limited computational resources the production of more simulation is not always feasible. In this cases it is helpful to extract more information from the available simulated data sets. One way to deal with this issue in multivariate analyses (MVA) can be achieved by using resampling methods: The MVA is trained many times on small subsets that are randomly resampled from the complete dataset. The variation of the MVA output between the trainings can be interpreted as probability density function (PDF) for each event. This PDF can be used to calculate a weight that is applied to each event instead of making a binary cut decision. With this procedure events that were normally removed by the event selection can still contribute to the final dataset with a small weight. Another advantage is that pull-validation also provides an estimator for the uncertainty of the multivariate method. As an example of how the method can be used, we present a case-scenario from searches for physics beyond the Standard Model with IceCube.

Registration number following "ICRC2015-I/":

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Poster 3 SH - Board: 10 / 861

Analysis of the solar and interplanetary phenomena causing Forbush decreases in cosmic rays.

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We developed a catalog of Forbush decreases (Fd), in the period 2007-2013. To analyze the Fd's, we used data from three neutron monitors representing low, medium and high cut-off: Oulu (Finland), Moscow (Russia) and Mexico City. We selected the 9 most energetic events in the period to analyze them further. With the available data (interplanetary data from OMNI) we identified that 8 events are associated with Interplanetary Coronal Mass Ejections (ICME) and the last one is a complex event. We found that, instead of a single or many parameters from the ICME's, it's a mixture of the geometry of the impact, size and some parameters within the ICME. A general overview for the interplanetary (IP) causes, and the actual analysis for the events, is shown. Images of the catalog contains plots of the cosmic ray intensity in the three stations mentioned, solar wind data plots (magnetic field and plasma data), and behavior of Earth's magnetic field via the Dst index.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

728

Poster 3 SH - Board: 6 / 387

Forbush decreases detected by the Muonca muon telescopes on 13 September and 22 December 2014

Author: Anderson Fauth¹

Co-authors: Carlos Enrique Navia²; Debora N. B. Vasconcelos¹; Edmilson J. T. Manganote¹; Evandro A. Rosa¹; Filipe A. Nero¹; Henrique V. Souza¹; Luiz Augusto Stuani Pereira³

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Muon rate variations during Forbush decreases registered by the Muonca muon detector have been studied. We discuss the Forbush events which occurred on 13 September and 22 December 2014. Since April 2014, muon telescopes located at State University of Campinas, Brazil, inside the South Atlantic Anomaly, has been recording the flux of single muons. The Muonca experiment consists of four modular detectors arranged in mode to register the flux of vertical and 45 degrees inclined muons from East and West. The modular detector uses a slab of plastic scintillator and a 127 mm diameter photocathode photomultiplier inside a truncated trapezoidal box. Its measured muon counting efficiency is 96.8%. We present the experiment setup, its calibration and a comparative analysis with neutron monitor data and the New Tupi muon monitor. The data of the Muonca help to extend the knowledge about Forbush decreases to energies beyond the neutron monitor region.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

369

Poster 3 GA - Board: 82 / 788

Search for gamma-ray point sources with KASCADE

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Extensive air showers with primary energies around 300 TeV were measured with a large detector array and a muon tracking detector of KASCADE. Using all events in the full KASCADE data set, a search of a pointlike source of high-energy cosmic rays for the northern hemisphere are performed. In addition, a subset of muonless events, i.e., extensive air showers which are more similar to gamma ray induced showers, are analyzed. The equi-zenith method has been used for the background estimation. No significant excess for a pointlike source has been observed in a region around Galactic plane. In this contribution, the preliminary analysis results and an upper limit for a steady point source will be presented.

Collaboration:

KASCADE-Grande

Registration number following "ICRC2015-I/":

292

Poster 3 GA - Board: 83 / 789

High-energy follow-up studies of gravitational wave transient events

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Second-generation gravitational interferometers, such as Advanced LIGO and Advanced Virgo, will soon reach sensitivities sufficient to detect gravitational waves directly for the first time and open a new era in the multi-messenger investigations of the cosmos. The most violent and energetic astrophysical phenomena, including the mergers of compact objects or the core collapse of massive stars, are promising sources of gravitational waves, and are thought to be connected with transient phenomena such as Gamma Ray Bursts and supernovae. Combined observations of gravitational and electromagnetic signals from these events will thus provide a unique opportunity to unveil their progenitors and study the physics of compact objects. In particular, gamma-ray ground-based and space observatories such as Fermi or the Air Cherenkov Telescopes will be crucial to observe the high-energy electromagnetic counterparts of transient gravitational wave signals and provide a robust identification based on a precise sky localization. We will report on our studies of possible joint observation strategies carried on by gravitational interferometers and gamma-ray telescopes, with particular attention on the high-energy follow-up of Gamma Ray Bursts.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

688

Poster 3 CR - Board: 164 / 860

EUSO-Balloon: Observation and Measurement of Tracks from a Laser in a Helicopter

Author: Johannes Eser¹

Co-authors: Aera JUNG²; Beatrice Panico³; Camille Catalano⁴; Camille Moretto¹; Camille Moretto; Claudio Fornaro⁵; Donatella Campana⁶; Evgeny Kuznetsov⁷; Fausto Guarino⁸; Francesco Cafagna⁹; Francesco Perfetto⁸; Giuseppe Osteria³; Gregorio Suino¹⁰; Guillaume Prevot¹¹; Jim Adams¹²; Julio Arturo Rabanal Reina¹³; Jurgen Sawatzki⁷; Lawrence Wiencke¹; Mario Bertaina¹⁰; Mark Christl¹⁴; Matthew Rodencal⁷; Mourad Fouka¹⁵; Peter von Ballmoos⁴; Pierre Andreas Barrillon¹⁶; Reda Attallah¹⁷; Simon Bacholle¹⁸; Sylvie Dagoret-Campagne¹³; Valentina Scotti⁸; William Painter¹; Zouleikha Sahnoun¹⁹

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EUSO-Balloon is a prototype detector of the Extreme Universe Space Observatory on the Japanese Experiment Module (JEM-EUSO). EUSO-Balloon was flown successfully as a balloon payload from the Timmins Stratospheric Balloon Launch Facility in Ontario, Canada on 2014 August 24-25 at an altitude of 38 km. To simulate the optical signatures of UV fluorescence photons emitted from cosmic ray air showers generated in the atmosphere, a pulsed UV laser and two UV flashers (LED and Xe). These sources were fired in the instrument field of view for about 2 hours from a helicopter that circled at an altitude of 3 km under the balloon. UV signals were effectively detected, including 270 laser track events. We describe the helicopter laser system and the geometric reconstruction of the laser events that were generated by this system. We report here on the reconstruction of the laser events starting from the information contained in the observed tracks. We note that this work represents the first observation and measurement of aircraft based laser tracks by an optical fluorescence detector flown at near space altitudes.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

659

Poster 3 DM and NU - Board: 291 / 924

Search for neutrino emission from extended sources with the IceCube detector

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The IceCube Neutrino Observatory, a cubic kilometer telescope located in the Antarctic ice, offers unique opportunities to study high energy neutrino emission from galactic and extragalactic sources. The Galactic plane is the brightest source of gamma rays in the sky, and it is believed to be also one of the brightest very high energy neutrino sources. The first discovery of an astrophysical neutrino flux has recently been announced by the IceCube collaboration and although no clear sources have been found so far, it is reasonable to investigate whether a Galactic component might be contributing to the observed flux. However, as indicated by the HESS gamma-ray survey and by Milagro as well, many of the sources populating the Galactic plane are in fact extended sources. We will present the sensitivity and discovery potential of IceCube for neutrinos coming from extended regions with special focus on the Galactic plane.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

211

Poster 3 SH - Board: 26 / 114

Time-dependent modeling of the solar modulation of cosmic rays

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The stochastic approach to solving the Parker transport equation has relatively recently become a popular means of furthering the numerical study of cosmic ray modulation. This is in part due to the fact that this approach allows for three-dimensional, time-dependent simulations over a range of energies that could not be performed using earlier finite difference techniques. We present here preliminary results from one such study, showing galactic cosmic ray proton intensities computed using a time-dependent stochastic modulation code, employing observationally motivated solar cycle-dependent expressions for the heliospheric magnetic field, tilt angle, and solar wind speed. Qualitative comparisons with spacecraft observations of cosmic ray intensities will also be made.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

117

Poster 3 CR - Board: 154 / 570

JEM-EUSO observational capabilities for different UHE primaries.

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Co-authors: Angela V Olinto²; Elias Iwotschkin³; Francesco Fenu⁴; Gustavo Medina Tanco⁵; Jörg Bayer¹; Kenji Shinozaki¹; Lawrence Wiencke⁶; Mario Edoardo Bertaina⁴; Thomas Mernik¹

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Cosmic rays with energies exceeding 10^{18} eV, usually defined as Ultra High Energy Cosmic Rays (UHECRs), allow the possibility to study physics at energies well beyond man made accelerators. State of the art UHECR detectors have reached unprecedented exposures and have pioneered the field of Extreme Energy Cosmic Rays (EECR), cosmic rays with energies exceeding 5×10^{19} eV. The EECR flux is extremely small, of the order of 1 particle per square kilometer per century. The next generation of UHECR and EECR detectors are therefore expected to increase the exposure by at least one order of magnitude. The JEM-EUSO mission, currently designed to be hosted onboard the JEM module of the ISS, consists of a ultra wide field of view UV-telescope orbiting the earth at an altitude

of about 400 km. JEM-EUSO will look for fluorescent UV track produced by Extensive Air Showers (EAS) on the night side of the earth. According to the most recent studies, the JEM-EUSO mission, can be accommodated on the ISS by using the SpaceX's Dragon spacecraft. In this work we present preliminary studies on the triggering and angular reconstruction performances for different types of primaries (protons, iron nuclei and gamma rays). We show how the use of the Dragon configuration indeed improves the performance of the mission.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

0507

Poster 3 CR - Board: 155 / 577

The Angular Resolution of the JEM-EUSO Mission: an updated view

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The Extreme Universe Observatory onboard the Japanese Experiment Module (JEM-EUSO) is a mission being developed to observe ultra high energy cosmic rays (UHECRs) from space.

JEM-EUSO consists of a wide field of view UV-telescope, assisted by an atmospheric monitoring system, designed to be mounted onboard the International Space Station.

JEM-EUSO will observe the extensive air showers (EAS) induced by UHE cosmic particles with energies above 10^{19} eV by using the earth's atmosphere as a large detector.

Due to the amount of monitored target volume JEM-EUSO is expected to reach an effective aperture of approx. $2 \cdot 10^5$ km² sr.

During its lifetime, the mission will measure about 1000 events with $E > 5 \cdot 10^{19}$ eV significantly improving the statistics of the most energetic part of the spectrum above the observed cut-off.

In the context of the JEM-EUSO Collaboration different mission profiles are being explored.

A configuration actively investigated is a telescope, mainly based on the same technologies already employed in the baseline instrument, which can be launched with Space X Falcon 9 and tr\$ This new mission configuration allows a circular design of the optics which improves the performances.

In this paper we present a detailed study of the expected angular resolution of this new configuration.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

506

Poster 3 GA - Board: 105 / 900

Performance of the SST-1M telescope of the Cherenkov Telescope Array observatory

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The single mirror small-size telescope (SST-1M) is one of the telescope projects being proposed for the Cherenkov Telescope Array (CTA) observatory by a sub-consortium of Polish and Swiss institutions. The SST-1M prototype structure is currently being constructed at the Institute of Nuclear Physics in Cracow, Poland, while the camera will be assembled at the University of Geneva, Switzerland. This prototype enables measurements of parameters having a decisive influence on the telescope performance. We present results of numerical simulations of the SST-1M performance based on such measurements. The telescope effective area, the expected trigger rates and the optical point spread function are calculated together with an estimate of the performance of an array of SST-1M telescopes.

Collaboration:

CTA

Registration number following "ICRC2015-I":

631

Poster 3 DM and NU - Board: 277 / 255

Search for Gravitino Dark Matter Decay with IceCube

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Most searches for Dark Matter primarily focus on the WIMP paradigm, which predicts dark matter masses in the GeV - 10 TeV range. However, these relatively low energy searches continue to produce null results, possibly suggesting that dark matter is something other than WIMPs. Gravitinos, on the other hand, can satisfy the cosmological constraints on dark matter, and decay with a lifetime orders

of magnitude longer than the age of the universe, producing extremely high energy neutrinos. The IceCube Neutrino Observatory has already had success detecting EHE extragalactic neutrinos, and is well suited to search for dark matter in this high energy regime. I present the status of a search for a gravitino decay signal using the IceCube Neutrino Observatory.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

270

Poster 3 CR - Board: 159 / 632

EUSO-Balloon trigger efficiency in preparation of a long duration flight

Author: Simon Bacholle¹**Co-authors:** Aera JUNG²; Alejandro Guzman³; Etienne Parizot⁴; Francesco Fenu⁵; Mario Bertaina⁶¹ APC- Paris Diderot university² Université Paris Diderot-Paris 7³ Institute of Astronomy and Astrophysics, University of Tübingen⁴ Université Paris Diderot / APC⁵ Dipartimento di Fisica, Università di Torino⁶ Univ. & INFN Torino**Corresponding Author:** bacholle@apc.in2p3.fr

EUSO-Balloon is a pathfinder of the JEM-EUSO experiment that is devoted to the observation of UHECRs from space. It operates under a stratospheric balloon at an altitude of ~ 40 km. A first flight took place in August 2014, and gathered information about the UV background in the nadir direction below the flight altitude. Based on these measurements, we investigate the acceptance of a new version of the instrument in view of a forthcoming long duration flight. To this end, we use the ESAF simulation code, adapted to the EUSO-Balloon design, to determine the trigger efficiency as a function of energy, for different assumptions regarding the photo-detection efficiency, the performance of the optical system and the level of the background light. Finally, we convolve with the cosmic-ray spectrum and derive the number of events to be expected in the range 10^{17} and 10^{19} eV. We conclude that EUSO-Balloon is well-designed to be the first fluorescence telescope to detect cosmic-ray showers from above.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

560

Poster 3 DM and NU - Board: 278 / 730

Observation of Astrophysical Neutrinos in Four Years of IceCube Data

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The spectrum of cosmic rays includes the most energetic particles ever observed. The mechanism of their acceleration and their sources are, however, still mostly unknown. Observing astrophysical neutrinos can help solve this problem. Because neutrinos are produced in hadronic interactions and are neither absorbed nor deflected, they will point directly back to their source. This contribution will cover continued studies of the high-energy astrophysical neutrinos flux observed at the IceCube neutrino observatory, extending them from three to four years of data with a focus on energies above 60 TeV. The spectrum and spatial/temporal clustering of the observed neutrinos will be discussed.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

234

Poster 3 CR - Board: 215 / 1212

EAS spectrum in thermal neutrons measured with PRISMA-32

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Results on EAS study with a novel type of detector array PRISMA-32 sensitive to accompanying EAS thermal neutron is presented. The array is running in MEPhI (Moscow, Russia) since February, 2012. Comparison with a full-scale Monte Carlo simulation of the experiment using GEANT4 and CORSIKA codes is also shown. It is demonstrated that absolute number of recorded thermal neutrons is in a good agreement with expectations and that the EAS size spectrum in thermal neutrons within experimental errors can be well fitted with a pure power law function.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

50

Poster 3 GA - Board: 75 / 631

Improving H.E.S.S. cosmic-ray background rejection by means of a new Gamma-Ray Air Shower Parametrisation (GRASP)

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Co-authors: Francois Brun²; Robert Parsons¹

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Imaging Atmospheric Cherenkov Telescopes (IACTs), with their high sensitivity and large field-of-views, are ideal instruments to study the universe in VHE γ -rays. IACTs image Cherenkov light emitted by γ -rays from induced particle cascades, developing in the atmosphere. The sensitivity of the IACTs depends critically on their capability to reduce the background caused by the much more numerous hadronic air showers, induced from the hadronic component of the cosmic rays.

In this work we apply a new image analysis method using an advanced Gamma Ray Air Shower Parametrisation (GRASP)

to data from the High Energy Stereoscopic System (H.E.S.S. Phase I).

The new method provides additional classifying variables for a decision tree based learning algorithm to differentiate γ -ray induced air showers from hadronic ones. When combined with a (recently developed) γ -ray reconstruction method that uses an Image Pixel-wise fit for Atmospheric Cherenkov Telescopes (ImPACT), a significant improvement in sensitivity is observed compared to the H.E.S.S. Standard Analysis.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

562

Poster 3 GA - Board: 102 / 1210

Extending Fermi LAT discoveries: Compton-Pair Production Space Telescope (ComPair) for MeV Gamma-ray Astronomy

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The gamma-ray energy range from a few hundred keV to a few hundred MeV has remained largely unexplored, mainly due to the challenging nature of the measurements, since the pioneering, but limited, observations by COMPTEL on the Compton Gamma-Ray Observatory (1991-2000). This energy range is a transition region between thermal and nonthermal processes, and accurate measurements are critical for answering a broad range of astrophysical questions. We are developing a MIDEX-scale wide-aperture discovery mission, ComPair (Compton-Pair Production Space Telescope), to investigate the energy range from 200 keV to > 500 MeV with high energy and angular resolution and with sensitivity approaching a factor of 100 better than COMPTEL. This instrument will be equally capable to detect both Compton-scattering events at lower energy and pair-production events at higher energy. ComPair will build on the heritage of successful space missions including Fermi LAT, AGILE, AMS and PAMELA, and will utilize well-developed space-qualified detector technologies including Si-strip and CdZnTe-strip detectors, heavy inorganic scintillators, and plastic scintillators.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

941

Poster 3 DM and NU - Board: 276 / 1211**Indirect search for dark matter towards the centre of the earth with the ANTARES neutrino telescope****Author:** Andreas Gleixner¹**Co-author:** Christoph Tönnis²¹ *Friedrich-Alexander-Universitaet Erlangen/ECAP*² *Universitat de Valencia***Corresponding Author:** ctoennis@ific.uv.es

The ANTARES neutrino telescope is a water Cherenkov detector and currently the largest operating neutrino telescope in the Northern Hemisphere. One of the main scientific goals of ANTARES is the indirect search for dark matter, as the Weakly Interacting Massive Particle (WIMP). WIMPs could scatter on normal matter and therefore be gravitational bound in massive astronomical objects like the Earth. Therefore an indirect search for dark matter can be performed by looking for an excess of the neutrino flux from the Earth's core. The exact spectrum of the neutrino flux from the Earth would depend on the WIMP mass, the annihilation channel, the spin independent scattering cross section and the thermally averaged annihilation cross section of the WIMPs. Such a search has been done with the data taken by ANTARES from 2007 to 2012. First limits from this search will be presented.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

258

Poster 3 CR - Board: 161 / 639**The Simulation of cosmic rays in EUSO-Balloon: performances of the direction and energy reconstruction****Author:** Francesco Fenu¹**Co-authors:** Aera Jung²; Alejandro Guzman³; Andrea Santangelo³; Etienne Parizot⁴; Joerg Bayer³; Kenji Shinozaki³; Mario Bertaina¹; Naoto Sakaki⁵; Simon Bacholle²; Thomas Mernik³¹ *University of Torino - INFN Torino*² *University Paris Diderot, Paris 7*³ *University of Tuebingen*⁴ *University Paris Diderot*⁵ *Osaka City University*

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The EUSO–Balloon experiment is being developed as a pathfinder for the JEM–EUSO mission. In this framework we are developing a series of balloon flights, with a rescaled version of the JEM–EUSO detector, to be deployed at 40 km height. In view of a long duration flight, we estimate the feasibility of detecting real cosmic ray events. In this contribution we evaluate the energy and direction reconstruction performances for the EUSO–Balloon mission. We simulate several samples of EeV cosmic ray events, including the detector, and we apply the algorithms to reconstruct their energy and direction. We therefore show results on the energy and direction resolution and give an estimate of the fraction of good quality events with respect to the triggered events.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

443

Poster 3 SH - Board: 20 / 1357

Anomalous annual variation of cosmic rays in 24th solar cycle

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Analysis of data of world network neutron monitor (NM) has revealed the considerable annual variation of cosmic ray (CR) flux in 2011-2014. The variation observed at all stations: circumpolar, mid-latitude and subequatorial. It is present in the CR density changes obtained by the global survey. Annual variation is observed from 2011 to 2014. Phase variation is the same for all NM with a maximum in December - January and a minimum in June-July. Amplitude of a variation makes more than 1 percent. Variation absent all preceding years up to the seventies, where analysis also showed an annual variation in the period 1973-76. It is shown that in the same period of 2011-14 the quasi-annual variations of the interplanetary magnetic field (module IMF), the other parameters of the interplanetary medium (the speed, dynamic pressure solar wind) and the parameters of the solar magnetic field are observed. These variations are in good agreement with the identified CR variations. As the two possible causes are assumed: the features solar activity or asymmetry of a heliosphere.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

861

Poster 3 DM and NU - Board: 287 / 463

A search for extremely high energy neutrinos in 6 years of IceCube data

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Observations of extremely high energy neutrinos are expected to probe the origin of the highest energy cosmic rays with energies up to and above 10^{20} eV. Cosmogenic neutrinos are associated with the interaction of those most energetic cosmic rays with cosmic microwave background photons (GZK effect) and considered a guaranteed astrophysical neutrino signal. The cosmogenic neutrinos have been searched with the partially completed and completed IceCube detector. The previous cosmogenic neutrino search with approximately 2 years of the complete IceCube data has placed the stringent limit on cosmogenic neutrino models and shown that astrophysical objects with populations following a strong cosmological evolution such as Fanaroff-Riley type II radio galaxies are unlikely the highest energy cosmic-ray sources. We present the updated results of the extremely high energy neutrinos search above $\sim 10^6$ GeV in the total of 6 years of IceCube sample with 3 years of partially completed IceCube data taken in 2008-2011 and 3 years of completed IceCube data in 2011-2014. With expected improvements of more than a factor of two from the previous study, we are able to further constrain or prove the highest energy cosmic-ray origin with the IceCube neutrino observatory.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

0421

Poster 3 SH - Board: 29 / 163

Rigidity dependence of the intensity variations of galactic cosmic rays

Author: Hiroshi Kojima¹

Co-authors: Akitoshi Oshima²; Atul Jain³; B.S Rao³; H.M Antia³; Hisanori Takamaru²; Isao Morishita⁴; Katsuya Yamazaki⁵; Koichi Tanaka⁶; Munetoshi Tokumaru⁷; Nobuo Ito⁵; P.K Mohanty³; S.K Gupta³; S.R Dugad³; Saburo Kawakami⁵; Shoichi Ogo⁵; Shoichi Shibata²; Toru Nakamura⁸; Toshio Matsuyama⁵; Toshiyuki Nonaka⁹; Yoshio Hayashi⁵

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For the investigation of the interactions of galactic cosmic rays with the solar wind plasma and/or interplanetary magnetic field, it is important to know the rigidity dependence of the intensity variations of galactic cosmic rays in detail. In this paper, we have divided the data into two durations of

active and calm by a criteria which is based on the data of neutron monitor of the lowest geomagnetic cut-off rigidity on the Earth.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

171

Poster 3 GA - Board: 107 / 962

The Mirror Alignment and Control System for CT5 of the H.E.S.S. experiment

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The High Energy Stereoscopic System (H.E.S.S.) experiment is one of the leading observatories for gamma-ray astronomy. It consists of four telescopes with a reflecting dish diameter of 12 m (CT1-4) and a newer large telescope (CT5) with a reflecting dish diameter of 28 m. On CT5 876 mirror facets are mounted, all of them equipped with a computerised system for their alignment. The design of the mirror alignment and control system and the performance of the hardware installed to the telescope are presented. Furthermore the achieved point spread function of the telescope over the full operational elevation range as well as the stability of the alignment over an extended period of time are shown.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

578

Poster 3 CR - Board: 140 / 1075

Photoelectron counting rate measurements in the UV camera during the EUSO-BALLOON night flight

Author: Julio Arturo Rabanal Reina¹

Co-authors: Aera JUNG ²; Camille Moretto ; Guillaume Prévôt ³; Hiroko Miyamoto ⁴; Philippe Gorodetzky ⁵; Pierre Andreas Barrillon ⁶; Simon Bacholle ⁷; Sylvie Blin ⁸; Sylvie Dagoret-Campagne ¹

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JEM-EUSO-Balloon is a prototype for the future space telescope JEM-EUSO aiming to detect UV emissions in the Earth's atmosphere (cosmic air showers, meteorites, airglow, etc). It successfully completed its first flight operated by the CNES over Ontario, Canada, in August 2014. One of the main goals is to measure the photoelectron rate performed by its UV camera. These measurements, corrected from noise contamination, are presented including their time variation. A particular emphasis is put on the determination of the statistical and systematic errors using the relative calibration that was made for all the 2304 pixels. Possible improvements of these performances are discussed in the perspective of future flights.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

843

Poster 3 GA - Board: 77 / 963

HESS J1641-463, a very hard spectrum TeV gamma-ray source in the Galactic plane

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HESS J1641-463 is a unique source discovered by the H.E.S.S. telescope array in the very-high energy (VHE, $E \geq 0.1$ TeV) domain. The source had been previously hidden in the extended tail of emission from the bright nearby source HESS J1640-465. However, the analysis of the VHE data from the region at energies above 4 TeV revealed this new source at a significance level of 8.5 sigma. HESS J1641-463 showed a moderate flux level $F(E > 1 \text{ TeV}) = (3.64 \pm 0.44_{\text{stat}} \pm 0.73_{\text{sys}}) \times 10^{-13} \text{ cm}^{-2} \text{ s}^{-1}$, corresponding to 1.8% of the Crab Nebula flux above the same energy, and a hard spectrum with a photon index $\Gamma = 2.07 \pm 0.11_{\text{stat}} \pm 0.20_{\text{sys}}$. The light curve was investigated for evidence of variability, but none was found on both short (28-min observation) timescales and long (yearly) timescales. HESS J1641-463 is positionally coincident with the radio supernova remnant SNR G338.5+0.1. There is no clear X-ray counterpart of the SNR, although Chandra and XMM-Newton data reveal some weak emission that may be associated. If the emission from HESS J1641-463 is produced by cosmic ray protons colliding with the ambient gas, then the proton spectrum extends up to at least 0.1 PeV (99% confidence limit). If this is the case, then HESS J1641-463 may be a member of a larger source population contributing to the Galactic cosmic-ray flux around the knee.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I/":

310

Poster 3 GA - Board: 106 / 1153

DAQ system of Tunka –HiSCORE prototype array

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DAQ and time synchronization system for the Tunka-HiSCORE array has been developed. The system consists of 8-channel optical station board (OSB) for digitization of anode and dynode signals of 4 PMTs of the optical station and synchronization boards (SB) placed in the DAQ center. All boards are designed on the basis of DRS-4 chip and FPGA Xilinx Spartan-6. The OSB and SB boards are connected via single-mode optical fibers. An accuracy of time synchronization is < 1 ns. Time step of digitization may be changed from 0.2 to 1 ns. The dead time of OSB is less than 0.5 ms.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

784

Poster 3 CR - Board: 211 / 1158

Constant Intensity Method in IceTop

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The Constant Intensity method is used to study how signals in IceTop, the surface component of the IceCube Neutrino Observatory, are attenuated by the atmosphere as a function of zenith angle and primary energy. IceTop analyses so far have only used data with zenith angles less than 40° . A goal of this analysis is to extend the standard IceTop reconstruction to larger zenith angles. Showers are classified by the signal strength at 125 m from the shower core, determined from the fitted lateral distribution. The resulting signal distributions are corrected for attenuation using the constant intensity method and projected to a reference angle of 27° . Finally, a Gaisser-Hillas type function is used to fit the attenuation curve. The shower maximum parameter, X_{max} , from this fit is compared with results from other detectors.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

919

Poster 3 GA - Board: 111 / 874

Testing a novel self-assembling data paradigm in the context of IACT data

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The process of gathering and associating data from multiple sensors or sub-detectors due to a common physical event (the process of event-building) is used in many fields, including high-energy physics and gamma-ray astronomy. The problem of fault tolerance in event-building is a difficult one, and one that becomes increasingly difficult with higher data throughput rates and increasing numbers of sub-detectors. We draw on biological self-assembly models in the development of a novel event-building paradigm that treats each packet of data from an individual sensor or sub-detector as if it were a molecule in solution. Just as molecules are capable of forming chemical bonds, “bonds” can be defined between data packets using metadata-based discriminants. A database—which plays the role of a beaker of solution—continually selects pairs of assemblies at random to test for bonds, which allows single tiles and small assemblies to aggregate into larger assemblies. During this process higher-quality associations supersede spurious ones. The database thereby becomes fluid, dynamic, and self-annealing rather than static. We will describe tests of the self-assembly paradigm using our first fluid database prototype and data from the VERITAS gamma-ray observatory.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

750

Poster 3 GA - Board: 113 / 674

Developments of a new mirror technology proposed for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) very high-energy gamma-ray observatory will consist of about a hundred of imaging atmospheric Cherenkov telescopes (IACTs) of different sizes, with a

total reflective area of about 10,000 m². Here we present a novel technology for the production of IACT mirrors that has been developed in the Institute of Nuclear Physics PAS in Krakow, Poland. The mirrors are made by cold-slumping of both the front, reflective aluminium-coated panel and the rear panel, which are then interspaced with aluminium spacers. Each panel is built of two glass panels laminated with a layer of a fiberglass tissue in between for reinforcement of the structure against mechanical damage. The mirror structure is open and does not require the perfect seal needed in closed-type designs. This design prevents the trapping of water inside the structure and enables proper ventilation of the mirror. Full-size hexagonal prototype mirrors produced for the medium-sized CTA telescopes will be presented, together with the results of recent comprehensive optical and durability tests. Their design will be compared to the earlier technology developed at INP PAS that used a rigid flat open support structure with a reflective layer made by cold-slumping of the coated glass panel to the cast-in-mould spherical epoxy resin layer.

Collaboration:

CTA

Registration number following "ICRC2015-I":

598

Poster 3 SH - Board: 1 / 9

Study of the Forbush Decrease Event of October- November 2003 observed with High Cutoff Rigidity Muon Detector at Riyadh, Saudi Arabia

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Forbush decreases are one of the most important cosmic ray time variations observed by ground level monitors and on board space detectors. They mainly occur during the active phases of the solar cycle, and associated with geomagnetic storms caused by solar flares or coronal mass ejections. Experimental studies of Forbush decreases have shown distinct properties. These properties are important and playing a significant role in our understanding of the interplanetary medium and heliospheric structures.

On October 28, 2003 an Earthward-directed coronal mass ejection (CME) was observed in conjunction with an X17 solar flare. Data from KACST, a one square meter single channel scintillator detector which detects secondary muons, are presented during the time of this Forbush decrease. The presented data are compared to that of other cosmic ray monitors. Interplanetary data were used to characterize the solar and interplanetary conditions causing this event.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

16

Poster 3 CR - Board: 231 / 1244

Inhomogeneous diffusion model for recent data on high-energy cosmic rays

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The AMS Collaboration has recently released precision data on cosmic ray (CR) leptons and protons at high energies. Interesting progresses have also been made on the measurement of CR nuclei, such as the boron-to-carbon ratio or the lithium spectrum, up to \sim TeV/nucleon energies. In order to provide a description these data, I consider a diffusion model of CR propagation which allows for latitudinal variations of the CR diffusion properties in the Galactic halo. I discuss the role of high-precision data on light CR nuclei in resolutely testing this model and the key propagation parameters.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

960

Poster 3 CR - Board: 170 / 890

Preliminary results from the first EUSO-Balloon flight

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EUSO-Balloon is a pathfinder mission for JEM-EUSO with main objective to perform a full scale end-to-end test of all the key technologies and instrumentation of JEM-EUSO detectors, as well as a detailed and precise measurement of the UV background in different atmospheric and ground conditions, and a first measurement of air shower tracks from the edge of space. For its first flight, EUSO-Balloon was launched by the French Space Agency CNES from Timmins (Ontario, Canada) on the moonless night of August 24, 2014. After reaching the floating altitude of about 38 km, EUSO-Balloon imaged the UV background in the wavelength range 290 - 430 nm for more than 5 hours.

The spatial and temporal resolutions of the detector were \sim 200 m and 2.5 μ s, respectively, and a full field of view in nadir mode of about 12 degrees. The UV data were complemented by Infrared (IR) images taken by an IR camera on board EUSO-Balloon.

During part of the flight, a helicopter circled under the balloon operating UV laser and flashers to simulate the optical signals from extreme energy cosmic rays, calibrate the apparatus, and characterize the optical atmospheric conditions.

EUSO-Balloon took more than 2.5 million images in flight that are being analysed to infer different informations:

- a) performance of the different parts of the detector;
- b) response of the detector to the UV flasher and laser events;
- c) UV radiance from the Earth atmosphere and ground in different conditions: clear and cloudy atmosphere, grass, forests, lakes, as well as city lights.

In parallel the data of the IR camera are used to localize clouds and estimate their cloud-top. This contribution will summarize the preliminary results obtained concerning all the above aspects.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

314

Poster 3 CR - Board: 171 / 897

Towards a SiPM based fluorescence camera for JEM-EUSO

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The steady development of semiconductor devices in the last years lead to highly improved photon detectors (called SiPM) and with that its applicability for astroparticle physics experiments. Here, we discuss particularly the application at cosmic ray air-shower fluorescence telescopes in space (JEM-EUSO telescope). For this, improvements of the newest generation of SiPM are needed concerning the dark current rate, pixel cross-talks, and afterpulse rate. In addition, to be applicable for large-scale experiments in space like JEM-EUSO, temperature stability, operation temperature, the fluorescence light sensitivity, as well as the capability of arrays of SiPM to cover large areas need to be rigorously tested. The JEM-EUSO collaboration started a comprehensive R&D program for the development of a focal surface based on SiPMs optimized for measurements of the fluorescence emission of extensive air showers from space.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

313

Poster 3 GA - Board: 70 / 1087

Symmetric variability of gamma-ray emitting blazars

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Symmetric and triangle-shaped flux variability in X-ray and gamma-ray light curves has been observed in many blazars. A statistical study of X-ray and gamma-ray variability in blazars suggests that the rise time of flares are nearly equal to the decay time on the average. It is usually believed that the X-ray emission of many blazars arises as synchrotron emission of electrons accelerated at a

shock front moving down a jet, and that the gamma-ray emission is due to inverse Compton scattering by the electrons. However, there are no conclusive models which represent the characteristic X-ray and gamma-ray variability with the rise time nearly equal to the decay time. In this paper, we present the results of exploration of the variability characteristics of gamma-ray emitting blazars by using the X-ray and gamma-ray archive data. We also discuss a comprehensible model to give a description of the characteristic X-ray and gamma-ray variability.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

523

Poster 3 GA - Board: 89 / 646

H.E.S.S. data analysis with open source science tools

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Collaborations managing Cherenkov telescope arrays (presently H.E.S.S., VERITAS, and MAGIC) own their data and software in private servers, only accessible to their members. However, the upcoming Cherenkov Telescope Array (CTA) will operate as an observatory, calling for powerful high-level science tools usable by the whole astronomical community.

We report on the efforts within the H.E.S.S. collaboration to export our data and instrument response functions to the standard astronomical FITS format and to use and contribute to open-source gamma-ray astronomy data analysis packages (Gammalib and ctools, Astropy and Gammapy, Sherpa) as well as spectral energy distribution modeling codes (GamERa, Naima).

We present a few examples of H.E.S.S. data analysis with these open source tools, as well as a summary of our experience with the FITS data formats and open source tools, comparing them to the HESS-internal data formats and tools.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

552

Poster 3 CR - Board: 235 / 1138

Hadronic interactions of primary cosmic rays with the FLUKA code

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The measured fluxes of secondary particles produced by the interactions of cosmic rays with the astronomical environment are often used to infer some of their properties. In this work we investigate the production of secondary particles in inelastic hadronic interactions between several cosmic rays species of projectiles and different target nuclei of the interstellar medium. The yields of secondary particles have been calculated with the FLUKA simulation package, that provides with very good accuracy

the energy distributions of secondary products in a large energy range. An application to the propagation and production of secondaries in the Galaxy is presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

913

Poster 3 SH - Board: 38 / 648

RANDOM BALLISTIC INTERPRETATION OF THE NONLINEAR GUIDING CENTER THEORY OF PERPENDICULAR TRANSPORT

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Nonlinear guiding center (NLGC) theory has been used to explain the asymptotic perpendicular diffusion coefficient

κ_{\perp} of energetic charged particles in a turbulent magnetic field, which can be applied to better understand cosmic ray transport. Here we re-derive NLGC, replacing the assumption of diffusive decorrelation with random ballistic decorrelation (RBD), which yields an explicit formula for κ_{\perp} . We note that scattering processes can cause a reversal

of the guiding center motion along the field line, i.e., “backtracking,” leading to partial cancellation of contributions to κ_{\perp} , especially for low-wavenumber components of the magnetic turbulence. We therefore include a heuristic backtracking correction (BC) that can be used in combination with RBD. In comparison with computer simulation results for various cases and two different magnetic field models (2D+slab and noisy RMHD), NLGC with RBD and BC provides a substantially improved characterization of the perpendicular diffusion coefficient for a fluctuation amplitude less than or equal to the large-scale magnetic field. Partially supported by the Thailand Research Fund, the Development and Promotion of Science and Technology Talents Project of the Royal Thai Government, the U.S. NSF (AGS-1063439 and SHINE AGS-1156094), NASA (Heliophysics Theory NNX11AJ4G), the Solar Probe Plus/ISIS project, and Thailand’s Ministry of Education.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

262

Poster 3 GA - Board: 118 / 673

Construction of a Medium-Sized Schwarzschild-Couder Telescope for the Cherenkov Telescope Array: Implementation of the Cherenkov-Camera Data Acquisition System

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A medium-sized Schwarzschild-Couder Telescope (SCT) is being developed as a possible extension for the Cherenkov Telescope Array (CTA). The Cherenkov camera of the telescope is designed to have 11328 silicon photomultiplier pixels capable of capturing high-resolution images of air showers in the atmosphere. The combination of the large number of pixels and the high trigger rate (> 5 kHz) expected for this telescope results in a multi-Gbps data throughput. This sets challenging requirements on the design and performance of a data acquisition system for processing and storing this data.

A prototype SCT (pSCT) with a partial camera containing 1600 pixels, covering a field of view of 2.5 x 2.5 square degrees, is being assembled at the F.L. Whipple Observatory. We present the design and current status of the SCT data acquisition system with an emphasis on its software component.

Collaboration:

CTA

Registration number following “ICRC2015-I”:

534

Poster 3 CR - Board: 188 / 359

Transport of magnetic turbulence in supernova remnants

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Supernova remnants are known as sources of galactic cosmic rays by their nonthermal emission of radio waves, X rays, and gamma rays. However, many theoretical models fail to reproduce the observed soft spectra and the spectral breaks. We model cosmic-ray acceleration in a time-dependent and self-consistent way by simultaneously solving the CR transport equation and a transport equation for isotropic Alfvénic turbulence. The CR transport equation is solved in a test-particle approach combined with 1-D hydrodynamical simulations of the remnant evolution, as described in Telezhinsky et al. (2012). In the transport equation for scattering turbulence we only consider upstream and downstream moving Alfvén waves, and their spectral power density determines the spatial diffusion coefficient of cosmic rays. Our shock centered, expanding grid extends upstream to several shock radii. Thus we are not limited by a free escape boundary and are able to self-consistently study the escape of CR from the acceleration side. We demonstrate that the system is typically not in a steady state. In fact, even after several thousand years of evolution, no equilibrium situation is reached. The resulting time-dependent particle spectra calculated by us differ strongly from those derived assuming a steady state. Our results further indicate that the escape of particles is crucial for the formation of soft spectra and spectral breaks, as observed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1092

Poster 3 GA - Board: 59 / 763

Deconvolution of very high-energy-gamma-ray image with the Richardson-Lucy algorithm

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The number of very high-energy-gamma-ray (VHE; > 100 GeV) sources has increased steadily in the last decades. The majority of these sources are extended and exhibit detailed structures. These structures and especially their correlations with data from different wavelengths may unveil the processes responsible for the gamma-ray emission.

Multi wavelength studies, however, are hampered by the angular resolution of the measurements in the VHE gamma-ray regime which is roughly a factor of 10 worse compared to most of the other wavelength ranges.

To unveil the true morphology of VHE gamma-ray sources we apply the Richardson-Lucy deconvolution algorithm (RLA) to VHE gamma-ray images, and thus increase the angular resolution. We present detailed systematic studies on the deconvolution of simulated VHE gamma-ray data which show that deconvolution makes it possible to study structural details well below the angular resolution of the very high-energy gamma-ray experiment.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

674

Poster 3 CR - Board: 139 / 1074

Pattern recognition study for different levels of UV background in JEM-EUSO experiment

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JEM-EUSO experiment will observe UV light created by extensive air showers initiated by ultra high energy cosmic rays (UHECR). Reconstruction of UHECR particle direction from detected signal depends also on the level of signal background, which can vary in time and with location.

We developed an alternative pattern recognition (PR) method based on Hough transformation besides

to existing PR methods in JEM-EUSO software framework. The results of them, namely of PWISE method and Hough method were compared for the nominal UV background 500 ph/(m² ns sr). Hough method was used to evaluate UHECR direction reconstruction ability for higher level of the UV backgrounds on the Earth's night side. The study what impact on fake trigger events rate come from varying background levels was performed, too.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

567

Poster 3 CR - Board: 213 / 1169

A CORSIKA study on the influence of muon detector thresholds on the separability of primary cosmic rays at highest energies

Authors: Markus Roth¹; Sarah Mueller¹¹ *KIT***Corresponding Author:** sarah.mueller2@kit.edu

The precise determination of the number of muons in extensive air showers is a key issue for being able to separate showers that have been initiated by different primary particles. In the context of the planned upgrade of the Pierre Auger Observatory to improve muon detection capabilities, we have analyzed CORSIKA shower simulations at energies above 10^{18} eV to quantify expectations on the separability of primary particles. We find that an improved separation power, described in terms of the “merit factor”, is achieved if muons at lowest energies are rejected, i.e. the detector energy threshold is set to ~ 1 GeV. In order to gain insight into the underlying physics of this surprising result, we have investigated shower-to-shower fluctuations and Poisson statistics driving the separability. Further, we have studied the characteristics of the particles preceding the muons in the shower development.

Collaboration:

– not specified –

Registration number following “ICRC2015-I”:

926

Poster 3 GA - Board: 56 / 1073

Raster Scanning the Crab Nebula to Produce an Extended VHE Calibration Source

Author: Ralph Bird¹¹ *UCD Dublin***Corresponding Author:** ralph.bird@ucdconnect.ie

The Crab Nebula has long been the standard reference point source for very-high-energy (VHE, $E > 100$ GeV) gamma-ray observatories such as VERITAS. It has enabled testing and improvement of analysis methods, validation of techniques, and has served as a calibration source. No comparable extended source is known with a high, constant flux and well understood morphology. In order to artificially generate such a source, VERITAS has performed raster scans across the Crab Nebula. By displacing the source within the field-of-view in a known pattern, it is possible to generate an extended calibration source for verification of extended source analysis techniques. The method and results of this novel technique are presented.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

884

Poster 3 GA - Board: 58 / 1071

The H.E.S.S. II GRB Observation Program

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Gamma-ray bursts (GRBs) are some of the most energetic and exotic events in the Universe, however their behaviour at the highest energies (>10 GeV) is largely unknown. Although the Fermi-LAT space telescope has detected several GRBs in this energy range, it is limited by the relatively small collection area of the instrument. The H.E.S.S. experiment has now entered its second phase by adding a fifth telescope of 600 m² mirror area to the centre of the array. This new telescope increases the energy range of the array, allowing it to probe the sub-100 GeV range while maintaining the large collection area of ground based gamma-ray observatories, essential to probing short-term variability at these energies.

We will present a description of the GRB observation scheme used by the H.E.S.S. experiment, summarising the behaviour and performance of the rapid GRB repointing system, the conditions under which potential GRB repointings are made and the data analysis scheme used for these observations.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

559

Poster 3 DM and NU - Board: 292 / 483

Search for a diffuse cosmic neutrino flux with ANTARES using track and cascade events

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The ANTARES neutrino telescope, taking data in its final configuration since 2008 at the bottom of the Mediterranean Sea, has since then contributed to the searches for high-energy neutrino sources. ANTARES has also been able to set constraints on the cosmic neutrino flux.

The ANTARES sensitivity for a diffuse neutrino flux with six years of data taking is close to the level of the cosmic flux measured by the IceCube observatory.

In this work, prior ANTARES searches for the diffuse events from track-like charged-current muon neutrinos as well as cascade-like interaction from all neutrino flavours are integrated into a new comprehensive all-flavour search. The method employs a multivariate analysis approach on six years of ANTARES data.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

214

Poster 3 CR - Board: 142 / 939

Expected acceptance of the KLYPVE/K-EUSO space-based mission for the observation of ultra-high energy cosmic rays

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The energy spectrum of ultra-high energy cosmic rays (UHECRs) extends up to $\sim 10^{20}$ eV, but their sources have not been identified yet.

One of the reasons is the small statistics of UHECRs observed with the present ground based experiments,

Pierre Auger Observatory and Telescope Array Project.

Several projects with larger acceptance are planned to find the sources, among them JEM-EUSO and KLYPVE.

Both projects are space based missions under development. The idea is to launch onto the International Space Station a telescope to observe tracks of fluorescence and Cherenkov light in near ultra-violet band from extensive air showers of UHECRs with large acceptance.

The optics of KLYPVE consists of a mirror with 3.6 m diameter. However, it became clear that the performance of the KLYPVE optics would have improved considerably by utilizing the Fresnel lens

technology developed for JEM-EUSO. A collaborative work between KLYPVE and JEM-EUSO has started in 2013.

The baseline optics of the KLYPVE/K-EUSO consists of a mirror of 3.4 m diameter, and a double-sided Fresnel lens with a diffractive surface. The focal surface consists of ~ 1800 multi-anode photomultiplier tubes with 64 pixels each.

The total number of pixels are $\sim 100,000$. The data acquisition system works in photon counting mode with intelligent trigger to discriminate shower tracks.

A dedicated raytracing code of the KLYPVE/K-EUSO has been developed and has been implemented into the Euso Simulation and Analysis Framework (ESAF).

The performance of the optics and trigger aperture for UHECR observation of KLYPVE/K-EUSO will be reported in this paper.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

450

Poster 3 GA - Board: 100 / 1003

Development of a balloon-style pressure vessel for GRAINE balloon-borne experiment in 2015

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Gamma-Ray Astro-Imager with Nuclear Emulsion (GRAINE) is a project of cosmic gamma-ray observation using a balloon-borne emulsion detector. The angular resolution of the emulsion gamma-ray telescope (0.08° @ 1-2 GeV) is one order of magnitude better than that of the Fermi-LAT. In addition, it has the polarization sensitivity using the pair creation mode. GRAINE aims at high-resolution imaging of SNRs and point sources in the Galactic plane/center and the polarimetry in the unexplored subGeV/GeV region, by long duration balloon flights with large aperture area telescopes ($\sim 10 \text{ m}^2$). In 2015 May, GRAINE 2nd balloon-borne experiment is conducted in Australia to detect well-known bright gamma-ray source, Vela pulsar, and to demonstrate the performance of the emulsion telescope. The aperture area is 3600 cm^2 and the flight duration is ~ 24 hours.

We adopted and developed a balloon-style pressure vessel for GRAINE 2015. The entire emulsion telescope is contained in a pressure vessel pressurized to ~ 0.2 atm to maintain the vacuum-packed emulsion chamber at balloon altitudes. It consists of aluminum rings, two hemispherical rubber films, and shells made of plastic fabric, which reduces the absorbance of signals and the backgrounds caused secondary interaction at the surface of the vessel.

We present a balloon-style pressure vessel and the flight performance in GRAINE balloon-borne experiment in 2015.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

846

Poster 3 GA - Board: 116 / 1179

Software design for the control system for “Small-Size Telescopes with single-mirror” of the Cherenkov Telescope Array

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The Small-Size Telescopes with single-mirror (SST-1M) is 4 m Davies-Cotton telescope and is among the proposed designs for the Cherenkov Telescope Array (CTA). It is conceived to provide the high-energy (> few TeV) coverage. The SST-1M comprises proven technology for the telescope structure and innovative electronics and photosensors for the camera. Its design is meant to be simple, low-budget and easy-to-build industrially.

Each device of an SST-1M telescope is made visible to CTA through a dedicated OPC-UA server. The software is being developed in collaboration with the CTA Medium-Size Telescopes to ensure compatibility and uniformity of the array control. Early operations of the SST-1M prototype will be performed with a subset of the CTA central array control system based on the Alma Common Software (ACS). The triggered event data are time stamped, formatted and finally transmitted to the CTA data acquisition.

The software system developed to control the devices of an SST-1M telescope is described, as well as the interface between the telescope abstraction to the CTA central control and the data acquisition system.

Collaboration:

CTA

Registration number following "ICRC2015-I":

631

Poster 3 CR - Board: 212 / 1159

Intensity of Microwave Signals Expected from Molecular Bremsstrahlung Radiation in Extensive Air Showers

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A potential detection technique of ultra-high energy cosmic rays would be the use of the molecular Bremsstrahlung radiation emitted by low-energy electrons left after the passage of the showers in the atmosphere. The emission mechanism is expected from quasi-elastic collisions of electrons produced in the shower by the ionisation of the molecules in the atmosphere. Given the low energy of the ionisation electrons, GHz photons resulting from this emission mechanism are expected to be emitted isotropically. This would allow for mapping the ionisation content along the showers through the intensity of the microwave signals detected at ground, in the same way as done for the fluorescence technique. In this contribution, a detailed calculation of the spectral intensity of photons at ground level originating from the transitions between unquantised energy states of free ionisation electrons is presented. The obtained spectral intensity is shown to be $\simeq 4.0 \cdot 10^{-26} \text{ W m}^{-2} \text{ Hz}^{-1}$ at 10 km from the shower core for a vertical shower induced by a proton of $10^{17.5} \text{ eV}$. In addition, the contribution of the high-energy electrons of the showers to the GHz spectral intensity through Bremsstrahlung emission is shown to be of the same order or even dominant during the first nanoseconds at distances sufficiently close to the shower core. The detectability of the derived spectral intensities with the current experimental setups is discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

474

Poster 3 GA - Board: 68 / 672

All-sky sensitivity of HAWC to Gamma-Ray Bursts

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The High Altitude Water Cherenkov (HAWC) Observatory is a ground-based, TeV gamma-ray observatory in the state of Puebla, Mexico at an altitude of 4100m. Its 22,000 m² instrumented area, wide field of view ($\sim 2 \text{ sr}$), and $>95\%$ uptime make it an ideal instrument for discovering gamma-ray burst (GRB) emission at $\sim 100 \text{ GeV}$. Such a discovery would provide key information about the origins of prompt GRB emission as well as constraints on EBL models and the violation of Lorentz invariance. We will present prospects for discovering GRB emission at $\sim 100 \text{ GeV}$ with a simple, all-sky search algorithm using HAWC data that is most sensitive to short GRBs. The search algorithm presented here can also be used to detect other short transients with timescales and fluxes similar to short GRBs.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

1160

Poster 3 GA - Board: 95 / 265

Prototyping of Hexagonal Light Concentrators for the Large-Sized Telescopes of the Cherenkov Telescope Array

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Reflective light concentrators with hexagonal entrance and exit apertures are frequently used at the focal planes of gamma-ray telescopes in order to reduce their dead area caused by the geometries of the photodetectors, as well as to reduce stray light entering at large incident angles. The focal planes of the Large-Sized Telescopes (LSTs) of the Cherenkov Telescope Array (CTA) will also be covered by hexagonal light concentrators with an entrance diameter of 50 mm (flat-to-flat) so that we can maximize the active area and the photon collection efficiency to realize a very low energy threshold of 20 GeV. Compound parabolic cones (CPCs, also known as Winston cones) have been widely used in ground-based gamma-ray telescopes for this purpose, however, their shape is not optimized for hexagonal cone arrays in the 3-dimensional space but for 2D only. We proposed a cubic Bézier curve for the LST light concentrators instead of an inclined parabolic curve used in CPCs to achieve higher collection efficiency and a sharp cutoff simultaneously. We have confirmed that the use of a cubic Bézier curve in CTA outperforms normal CPCs by means of non-sequential ray-tracing simulations with the ROBAST software, in which the incident angle and position dependence of photocathode sensitivity were also simulated. In addition to the cone shape, the reflectance of the internal walls plays an important role to increase the collection efficiency. We have developed prototypes of LST light concentrators made of UV enhanced reflective mirror foils ($R > 95\%$) and plastic injection cones. We report ray-tracing simulation results and measured performance of our light concentrators.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

278

Poster 3 CR - Board: 176 / 60

Reacceleration of electrons in supernova remnants

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The radio spectra of many shell-type supernova remnants show deviations from those expected on theoretical grounds. In this paper we determine the effect of stochastic reacceleration on the spectra of electrons in the GeV band and at lower energies, and we investigate whether reacceleration can explain the observed variation in radio spectral indices. We explicitly calculated the momentum

diffusion coefficient for 3 types of turbulence expected downstream of the forward shock: fast-mode waves, small-scale non-resonant modes, and large-scale modes arising from turbulent dynamo activity. After noting that low-energy particles are efficiently coupled to the quasi-thermal plasma, a simplified cosmic-ray transport equation can be formulated and is numerically solved. Only fast-mode waves can provide momentum diffusion fast enough to significantly modify the spectra of particles. Using a synchrotron emissivity that accurately reflects a highly turbulent magnetic field, we calculated the radio spectral index and find that soft spectra with index $\alpha \leq -0.6$ can be maintained over more than 2 decades in radio frequency, even if the electrons experience reacceleration for only one acceleration time. A spectral hardening is possible but considerably more frequency-dependent. The spectral modification imposed by stochastic reacceleration downstream of the forward shock depends only weakly on the initial spectrum provided by, e.g., diffusive shock acceleration at the shock itself.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

82

Poster 3 CR - Board: 233 / 1246

Fragmentation cross-sections and model uncertainties in propagation of Galactic cosmic rays

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Abundances and energy spectra of cosmic ray nuclei are being measured with high accuracy by the AMS experiment. These observations can provide tight constraints to the propagation models of galactic cosmic rays. In the view of the release of these data, I present an evaluation of the model uncertainties associated to the cross-sections for secondary production of Li-Be-B nuclei in cosmic rays. I discuss the role of cross section uncertainties in the calculation of the boron-to-carbon and beryllium-to-boron ratios, as well as their impact in the determination of the cosmic-ray transport parameters.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

960

Poster 3 SH - Board: 18 / 1322

Exceptionally strong variation of galactic cosmic ray intensity at solar rotation period after the maximum of solar cycle 24

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After the reversal of solar polarity in 2014, the Sun is now in the early declining phase of cycle 24. Soon after the polarity reversal, the galactic cosmic ray intensity, as observed, e.g., by neutron monitors at several latitudes (cut-off rigidities) depict an exceptionally large variation at the solar rotation period. This recurrence started in mid-2014 and continues until now (the first half of March 2015). Several parameters characterizing solar activity, like sunspots and F10.7 radio flux, also depict similar enhanced variability, which started slightly earlier than in neutron monitors. Some solar wind properties also show this periodicity, although less systematically and for a shorter time. This excessively strong periodicity in GCR can be related to the rather rapid growth of an asymmetric polar coronal hole in the southern hemisphere, leading to a very asymmetric magnetic configuration at mid- to high heliospheric latitudes. This also leads to the fact that the tilt angle of the heliospheric current sheet is wavier during this cycle than at similar early declining phases of the previous solar cycles.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

108

Poster 3 GA - Board: 97 / 1324

Recent developments for testing of Cherenkov Telescope Array mirrors and actuators in Tuebingen

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The Cherenkov Telescope Array (CTA) is the next generation very high energy gamma-ray air-shower Cherenkov observatory. It will consist of a large number of segmented-mirror telescopes of three different diameters, placed in two locations, one in the northern and one in the southern hemisphere, thus covering the whole sky. The total number of mirror tiles will be of the order of 10.000, corresponding to a reflective area of $\sim 10^4 \text{ m}^2$. The Institute for Astronomy and Astrophysics in Tuebingen (IAAT) is currently developing mirror control alignment mechanics, electronics, and software optimised for the medium sized telescopes. In addition, IAAT is participating in the CTA mirror prototype testing. In this paper we present the status of the current developments, the main results of recent tests, and plans for the production phase of the mirror control system. We also briefly present the Tuebingen facility for mirror testing.

Collaboration:

CTA

Registration number following "ICRC2015-I/":

1117

Poster 3 DM and NU - Board: 274 / 986

Search for point-like neutrino sources above the horizon with the ANTARES Neutrino Telescope

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Installed in the Mediterranean Sea, at a depth of ~ 2.5 km, ANTARES is the largest undersea neutrino telescope currently operating. Point source searches with neutrino telescopes are normally limited to a fraction of the sky, due to the selection of events where the direction of the neutrino candidate has been reconstructed as coming from below the horizon, usually referred to as "up-going" events, in order to significantly reduce the atmospheric muons background. Here we demonstrate that the background can be effectively suppressed through an energy and direction dependent event selection so that a part of the region above the horizon can be included in the search. This approach provides sensitivity to the signal spectrum of sources in the EeV energy range, not accessible for up-going events due to the Earth absorption of neutrinos with energies above a PeV. The results from a binned scan of the entire sky and for a list of a few source candidates will be presented. In both cases an E^{-2} source spectrum is assumed.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

1245

Poster 3 CR - Board: 221 / 253

Study of Water Cherenkov muon detector parameters and performances for LHAASO

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Registration number following "ICRC2015-I":

768

Poster 3 CR - Board: 184 / 205

A new method to determine air shower propagation direction based on radio signal patterns

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Abstract: The propagation direction is one of the key parameter of an air shower. Many of current techniques are based on arrival time of an air shower. In this study we introduce a new and completely different approach to determine the propagation direction (and as a result the arrival direction) of an air shower based on filtered peak radio amplitudes which can shape radio signal patterns. For this purpose, a series of simulations have been done with CORSIKA and CoREAS. Simulated air showers initiate from Proton and Iron primary particles with 10^{17} eV initial energy and different zenith angles from vertical to 60° . Time based results are converted and analyzed using a specifically designed computer code to calculate the peak radio amplitudes of different electric field components (North, West and Vertical) in the 32-64 MHz frequency band. We investigate eight different shower propagation directions including North-South and East-West orientations in this paper. It is found that by investigating and comparing the orientations of the radio signal patterns from different electric fields components especially the North and Vertical ones, we'll be able to conclude an air shower propagation direction accurately. This new technique is especially useful for inclined air showers where the impact of an air shower propagation direction is very prominent on its radio signal patterns.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

91

Poster 3 GA - Board: 87 / 770

On the Spectral Shape of Gamma-ray Pulsars Above the Break Energy

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It is well known that, for bright gamma-ray pulsars with high statistics above a few GeV, the phase averaged spectral energy distribution (SED) is harder than a simple exponential cutoff above the break. We perform phase-resolved spectral analyses of bright gamma-ray pulsars and demonstrate that, even over narrow phase ranges, the SEDs of gamma-ray pulsars above the break energy are harder than a simple exponential cutoff. We argue within a radiation-reaction limited curvature framework that this is indicative of non-stationary emission or emission from multiple zones. Further, we address a common problem faced when fitting hard spectral tails with a power-law times a sub-exponential function. Namely, that the sub-exponent parameter does not describe any parameters of physical models of pulsar emission. We introduce a simple analytical fit function to solve this problem.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

679

Poster 3 CR - Board: 163 / 1024

Cloud Optical Depth obtained from the Infrared Camera data and the UV Flashers mounted on a helicopter flying under the EUSO-Balloon (CNES)

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The EUSO-Balloon (CNES) campaign was conducted during the summer of 2014. EUSO-Balloon was launched the night of August 24. A completely isolated Infrared Camera was mounted on the side of the gondola carrying the EUSO-Balloon instrument. During part of the balloon flight a helicopter with UV flashers was flown below the balloon. We have retrieved cloud coverage and Cloud Top Height (CTH) from the IR camera images during the same time that the flashers were operated under the balloon. The optical depth during times when the atmosphere was not clear will be inferred by comparing the luminosity of the flashers with the signal recorded by EUSO-Balloon both, in clear and not clear conditions.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

800

Poster 3 CR - Board: 150 / 429

The Calibration of EUSO Balloon using airborne light sources mounted to a Helicopter

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The Extreme Universe Space Observatory (EUSO) Balloon was launched from Timmins, Ontario, Canada on the moonless night of August 24, 2014. Before the balloon reached altitude, a helicopter carrying UV flashers and a UV laser took off from Timmins and flew to the balloon. For the next 2.5 hours the helicopter circled under the balloon operating the UV flashers and a UV laser to simulate the optical signals from extreme energy cosmic rays. Many of these signals were recorded onboard EUSO Balloon and have been used to calibrate this instrument as discussed in this and another paper in this conference. This paper will describe the helicopter operations, flashers carried on the helicopter and the calibration of EUSO Balloon made using the flashers.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

403

Poster 3 GA - Board: 76 / 844

Long-term VERITAS monitoring of LS I 61 +303 in conjunction with X-ray, and GeV observation campaigns

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One of the most enigmatic TeV binary systems, LS I +61 303 exhibits a high degree of modulation from optical to TeV over a single orbit of ~ 26.5 days. LS I +61 303 also exhibits a ~ 4.5 year modulation in radio, X-Ray and GeV emission which is yet to be seen in TeV gamma rays. LS I +61 303 has been observed by both VERITAS (85 GeV-30 TeV) and multi-wavelength partners (optical - GeV). The contemporaneous multi-wavelength dataset enables searches for correlations between emission in these three wavebands; these correlations can further elucidate the astrophysical properties of this system. The construction of a detailed keV-TeV spectral energy distribution from LS I +61 303 can also shed light on the population of accelerated particles producing this emission. The progress on analysis of recent and long-term VERITAS observations of LS I +61 303 in correlation with multi-wavelength observations by Swift (3-10 keV X-ray) and Fermi-LAT (0.3-300GeV γ -ray) will be presented.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

1144

Poster 3 CR - Board: 197 / 663

UHECR acceleration at GRB internal shocks

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Recent results from Auger suggest that there might be a significant heavy component in high energy cosmic rays. It is therefore interesting to explore the possibility to accelerate not only protons but also complex nuclei in relativistic jets. We developed a numerical tool inspired by the work done by Niemiec and Ostrowski (04) to compute the acceleration of particles at mildly relativistic shocks. This code includes energy losses of protons and nuclei and handles particle escape from the jet according to specific prescriptions, which can be adapted to different astrophysical environments and physical conditions. We first applied our code to the case of GRBs internal shocks. Physical quantities and their time evolution, relevant to cosmic-ray acceleration and energy losses, are estimated using the internal shock model of Daigne & Mochkovitch (98). We calculated the cosmic rays escaping from the jet environment but also secondary photons and neutrinos (produced both during the acceleration process and the UHECRs extragalactic propagation). The conditions for GRBs internal shocks to be the sources of UHECRs as well as the role of the key physical parameters are discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

573

Poster 3 CR - Board: 191 / 484

Spatial Evolution of Nonresonant Instabilities in the Precursors of Young Supernova Remnant Shocks

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The nonresonant cosmic-ray-current-driven instability that operates in the precursors of shocks in young supernova remnants may be responsible for magnetic-field amplification, quasithermal plasma heating, and hydrodynamical turbulence, all of which have impact on the shock properties and particle-acceleration processes. The temporal and spatial development of the instability is investigated here with Particle-In-Cell (PIC) simulations. Earlier PIC simulations used computational boxes with periodic boundary conditions which do not account for mass conservation in decelerating flows. Our current study for the first time uses a more realistic setup with open boundaries that permit inflow of plasma on one side of the simulation box and outflow at the other end. We demonstrate magnetic-field amplification as expected on the grounds of our earlier results. The effects of backreaction on CRs that slow down the initial relative drift velocity, limit further growth of the turbulence and lead to its saturation are also re-confirmed. We discuss a spatio-temporal structure

of the shock precursor, including the evolution of CR distribution and the details of the saturation processes.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

357

Poster 3 DM and NU - Board: 264 / 755

Search for Galactic dark matter substructures with Imaging Air Cherenkov Telescopes

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Weakly interacting, massive dark matter particles are expected to self-annihilate or decay into high-energy photons, which thereby establish the possibility for indirect detection by gamma-ray telescopes. For probing the dark matter annihilation products, accurate knowledge of the dark matter density distributions is crucial. However, major uncertainties exist in the density profiles of our Galaxy, neighboring spheroidal dwarf galaxies, and extragalactic targets.

The new public version of the semi-analytic code CLUMPY will be presented, which facilitates the fast calculation of astrophysical J-factors of arbitrary dark matter halos, including substructures. This code has been used for a careful study of the potential detection of Galactic dark matter substructures with present and future Imaging Air Cherenkov telescopes (IACT). In this presentation, two aspects will be considered in the light of recent constraints from other experiments: Firstly, a statement on the probability of finding single subhalos in IACT sky-surveys will be made. Secondly, the chance of detecting anisotropy patterns originating from dark matter substructures in the isotropic gamma-ray background will be examined. The impact of the different substructure models on these detection potentials will be discussed as well as the challenges for instrumental design and sensitivity.

Registration number following "ICRC2015-I/":

490

Poster 3 SH - Board: 36 / 562

A Time-dependent and Anisotropic Force Field Model For Galactic Cosmic Ray Flux

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Galactic cosmic ray flux calculated at 1au within the energy range (0.2-88) Ge V using the model is presented. The relationship between the calculated flux and solar wind is analyzed and presented. Short-time variation of the flux at a fixed energy range is also calculated, and this is used to predict galactic cosmic ray intensity variation at earth.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

481

Poster 3 CR - Board: 181 / 155

ELECTRON HEATING IN A RELATIVISTIC, WEIBEL-UNSTABLE PLASMA

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The dynamics of two initially unmagnetized relativistic counter-streaming homogeneous ion-electron plasma beams are simulated in two dimensions using the particle-in-cell (PIC) method. It is shown that current filaments, which form due to the Weibel instability, develop a large scale longitudinal electric field in the direction opposite to the current carried by the filaments as predicted by theory. This field, which is partially inductive and partially electrostatic, is identified as the main source of net electron acceleration, greatly exceeding that due to magnetic field decay at later stages. The transverse electric field, though larger than the longitudinal one, is shown to play a smaller role in heating electrons, contrary to previous claims. It is found that, in 1D, the electrons become strongly magnetized and are not accelerated beyond their initial kinetic energy. Rather, the heating of the electrons is enhanced by the bending and break-up of the filaments, which releases electrons that would otherwise be trapped within a single filament and slow the development of the Weibel instability (i.e. the magnetic field growth) via induction as per Lenz's law. In 2D simulations electrons are heated to about one quarter of the initial kinetic energy of ions. The magnetic energy at maximum is about 4 percent, decaying to less than 1 percent by the end of the simulation. The ions are found to gradually decelerate until the end of the simulation by which time they retain a residual anisotropy less than 10 percent.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

168

Poster 3 SH - Board: 28 / 158

Time-dependent modulation of galactic cosmic rays

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The time-dependent modulation of galactic cosmic rays in the heliosphere is studied over different polarity cycles by computing 2.5 GV proton intensities using a two-dimensional, time-dependent modulation model. By incorporating recent theoretical advances in the relevant transport parameters in the model we showed in previous work that this approach gave realistic computed intensities over a solar cycle. New in this work is that a refinement to this approach is proposed that would lead to an increase in compatibility between model results and spacecraft observations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

172

Poster 3 DM and NU - Board: 280 / 935

Sensitivity to the Neutrino Mass Hierarchy of KM3NeT/ORCA

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KM3NeT is the next generation underwater neutrino telescope being installed in the Mediterranean Sea. Its low-energy branch KM3NeT/ORCA will measure neutrinos in the energy range of several GeV, aiming to resolve the long-standing question whether the neutrino mass hierarchy is normal or inverted by measuring matter-induced oscillation effects in atmospheric neutrinos.

In the presentation, the expected sensitivity of KM3NeT/ORCA for a measurement of the mass hierarchy and other oscillation parameters is discussed, based on input from the latest MC simulations. A detailed overview is given of the sensitivity study, the various inputs and the log-likelihood ratio method employed. In particular, the various systematics taken into account in the study will be given attention.

Collaboration:

KM3NeT

Registration number following "ICRC2015-I":

796

Poster 3 CR - Board: 189 / 399

Probing Efficient Cosmic-Ray Acceleration in Young Supernovae

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Registration number following "ICRC2015-I":

282

Poster 3 GA - Board: 74 / 1035

Blazars identification among the unidentified sources of the 3FGL gamma-ray catalog

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The LAT telescope on board of the Fermi satellite provides the deepest survey of the gamma-ray sky in the 100 MeV to 300 GeV energy range. Recently published, the 3FGL catalog contains 3033 sources obtained from the analysis of 4 years of data. While 2043 of these sources are associated with objects identified at other wavelengths, the most numerous populations corresponding to blazars (1145) and pulsars (166), the nature of a significant fraction (992; 33%) of the 3FGL catalog objects is still unknown. In order to investigate their nature, and in particular to find blazar candidates among the unidentified sources, we have developed a multivariate analysis based on the blazar/non-blazar discriminant power contained in the spectral and temporal information provided by the 3FGL catalog. In addition, considering the specificities of blazars in the infrared colors space, we have developed an other multivariate analysis to identify blazars with astrometric precision among the tens and sometimes hundreds of sources detected by the infrared WISE space telescope in spatial coincidence with each Fermi unidentified source. We have applied these two analyses on the set of 3FGL unidentified sources and provide a list of blazar candidates.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

816

Poster 3 DM and NU - Board: 254 / 951

XMASS 1.5, the next step of the XMASS experiment

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XMASS, the Kamioka Dark Matter direct detection experiment with an eye to future multi purpose detector, is planning to improve its Dark Matter sensitivity by increasing the amount of liquid xenon in its inner detector volume from the current 832kg to 5 metric tons. Challenges identified with the current detector informed the design of this upgrade. In this presentation, we present the new detector design and discuss how it addresses these challenges. In particular we discuss how the new photomultipliers with their non-flat photocathode layout improve fiducialization.

Registration number following "ICRC2015-I/":

806

Poster 3 SH - Board: 17 / 1295

Turbulence-based model of the Forbush decrease

Author: Anna wawrzynczak¹

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We show that the source of the energy dependence of the rigidity spectrum of the Forbush decrease (Fd) of the galactic cosmic ray (GCR) intensity are the structural changes in the interplanetary magnetic field (IMF) turbulence driven by the shock waves either directly creating near the Sun or shock waves related to the propagation of the CME in interplanetary space. We recognize that during the Fd is observed the 3-D turbulence of the IMF unlike to the ideal slab/2-D model. This turbulence generally is stipulated by fluctuations of the Alfvén waves in all three spatial directions. We assume that B_x and B_y Components of the IMF are contributing in drift effect owing to their regular parts, while B_z does not, because of it consists only from the fluctuations.

Based on the modeling of the GCR transport in the heliosphere we examine what conditions must be fulfilled to obtain the energy dependence of the rigidity spectrum of the Fd from the model. In order to build the most reliable 3D non-stationary model of the Fd, we discuss the various diffusion theories taking into account the perpendicular transport of the turbulence (e.g., Unified Non-Linear Transport-UNLT, Noisy Reduced MagnetoHydroDynamic-NRMHD).

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

801

Poster 3 CR - Board: 220 / 1358

Measurement of the cosmic-ray nuclear composition using cherenkov detectors at Mount Chacaltaya

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Cosmic ray nuclear composition has a very important role to reveal the origin of cosmic rays. Especially, composition with energy around knee region must be related to the mechanisms of particle accelerations.

In the BASJE (Borivian Air Shower Joint Experiment) group, we constructed new large air shower array at Mount Chacaltaya (5,200m above sea level) to observe air showers with energies above 10^{15} eV, and has operated since 2010.

In addition, We installed 7 Cherenkov light detectors radially from the center of the air shower array with 50m intervals, and started to measure air shower development by the Cherenkov light emitted from air shower particles.

It is known that the longitudinal development of air shower strongly depends on the type of the primary nucleus, and the Cherenkov light emitted from air shower electrons is closely correlated to the air shower longitudinal development. Actually, we performed a Monte-Carlo simulation of Cherenkov light emissions from air showers and found that primary cosmic ray nuclei types can be distinguished by measuring lateral distributions and arrival timings (waveforms) of Cherenkov lights associated with air showers.

Since 2012, we have started operation of the Cherenkov detectors along with the air shower array. In this paper, we present the characteristics of the new detectors and preliminary results from the first observation.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1008

Poster 3 GA - Board: 92 / 1369

Searching for Very High Energy Emission from Pulsars Using the High Altitude Water Cherenkov (HAWC) Observatory

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There are currently over 150 known gamma-ray pulsars. While most of them are detected only from space, at least two are now seen also from the ground. MAGIC and VERITAS have measured the gamma ray pulsed emission of the Crab pulsar up to hundreds of GeV and more recently MAGIC has reported $> 1\text{TeV}$ emission. Furthermore, in the southern hemisphere, H.E.S.S. has detected the Vela pulsar above 30 GeV. In addition, non-pulsed TeV emission coincident with pulsars has been detected by many groups, including the Milagro Collaboration. These GeV-TeV observations open the possibility of searching for very-high-energy (VHE, $> 100\text{ GeV}$) pulsations from gamma-ray pulsars in the HAWC field of view. This work will present a preliminary analysis of the partial array of HAWC, HAWC-111 dataset, to search for very high energy emission, in particular, for the Crab pulsar.

Collaboration:

HAWC

Registration number following "ICRC2015-I":

1022

Poster 3 CR - Board: 147 / 590

The Expected Angular Resolution Performance of the Tilted JEM-EUSO Instrument

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JEM-EUSO (The Extreme Universe Observatory onboard the Japanese Experiment Module) is a space borne UV-telescope which will be mounted on the ISS (International Space Station).

It is designed for the observation of UHECR induced extensive air showers (EAS) above an energy of 10^{19} eV by using the earth's atmosphere as a large detector.

Due to the amount of monitored target volume it gains an effective aperture of approx. $2 \cdot 10^5\text{ km}^2\text{ sr}$.

During the mission lifetime, JEM-EUSO will observe several hundred of events above $E = 5 \cdot 10^{19}\text{ eV}$, significantly improving the statistics in this part of the UHECR spectrum.

The default operation mode of the instrument is envisaged to be along its nadir direction. However, in a later stage of the mission, a tilting of the telescope, away from its nadir direction, is discussed as a potential strategy to further increase the exposure at the highest energies. In the tilted mode operation the exposure would increase by a factor of 5 to 7. Hence, the regime of extreme energies above 10^{20} eV could be explored in a reasonable amount of time. Naturally, in this setup the angular resolution of the instrument is expected to decrease. In the scope of this work we evaluate the expected angular resolution performance of the JEM-EUSO instrument in dependence of the tilting angle.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

506

Poster 3 CR - Board: 214 / 1201

YAC sensitivity for measuring the light-component spectrum of primary cosmic rays at the "knee" energies

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A new air-shower core-detector array (YAC: Yangbajing Air-shower Core-detector array) has been developed to measure the primary cosmic-ray composition at the "knee" energies in Tibet, China, focusing mainly on the light components. The prototype experiment (YAC-I) consisting of 16 detectors has been constructed and operated at Yangbajing (4300 m a.s.l.) in Tibet since May 2009. YAC-I has been placed near the center of the Tibet-III AS array operating together. In this paper, we have performed a Monte Carlo simulation to check the sensitivity of YAC-I+Tibet-III array to the light-component (protons and helium nuclei) in the primary cosmic rays around the knee energies, taking account of the observation conditions of actual YAC-I+Tibet-III array. We have checked the sensitivity of YAC array to the interaction models (SIBYLL2.1, EPOS-LHC (v3400) and QGSJETII-04) and primary cosmic-ray composition models ("He-poor", "He-rich" and Gaisser-fit") around the knee using the high-energy core events observed by the YAC-I+Tibet-III array. The simulation shows that the light-component spectrum estimated by our methods can well reproduce the input ones within 10% error, and there will be about 30% systematic errors mostly induced by the primary and interaction models used.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

920

Poster 3 DM and NU - Board: 253 / 1365

Geant4 simulations of multi-neutron events observed underground.

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In low background underground laboratories neutrons create important background in experiments searching for very rare events. These neutrons might origin from incoherent radioactive decays or large number of neutrons might be produced in coherent way in muon induced cascades. Neutrons produced in muon cascades might have significantly larger energies than those from radioactive sources. We had searched for multi-neutron events in our neutron background measurements made in the Gran Sasso Underground Laboratory (Italy), Slanic Salt Mine laboratory of IFIN-HH (Romania) and in our underground laboratory of NCBJ in Łódź. We have used the same tray of helium counters placed in polyethylene moderator. Neutron number distributions and rates depend on the depth of the underground site. The maximum number of neutrons observed within 2 milliseconds was 8 in Slanic and 45 in Łódź. The induced neutron number must be much larger since the probability of detection of a single neutron penetrating polyethylene moderator is at the level of 1 percent (neutron initial energy dependent value).

We present results of Geant4 simulations of expected muon energy spectra at different depths underground, and number and energy distributions of muon induced gammas and neutrons. Results of simulations of neutron number distribution will be compared with measurements we have made in the three underground laboratories.

Registration number following "ICRC2015-I/":

1014

Poster 3 SH - Board: 34 / 475

Three-dimensional MHD simulation of the solar wind from the solar surface to 400 solar radius using REPPU (REProduce Plasma Universe) code

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Three-dimensional MHD simulation code, REPPU (REProduce Plasma Universe) code, is developed for modeling of space plasma phenomena, and is utilized for the solar surface and the global solar wind structure. The distinguishing features of this code is the 3-D grid system, which has no polar singularity though it is able to fit the spherical structure. This grid system makes it possible to set fine grids on the inner boundary of the inner simulation region which corresponds to the solar surface. Magnetic field structure on the solar surface is significantly important for the solar disturbances because it determines the global structure of the solar wind. REPPU code achieved both the implementations for the fine grid structure on the inner boundary and for the wide range grids in

global solar wind configuration. We extend the outer boundary to 400 solar radius, though the previous our model covered 200 solar radius. We split the simulation region at several 10 solar radius where the solar wind speed is super-sonic. The simulation model for the inner region is developed in a rotational frame and the observed magnetic field data are input on the solar surface as the inner boundary. The frame of the simulation model for the outer region is a fixed frame and simulation data in the inner region are set at the inner boundary of this code. This improvement made it possible to perform stable simulation in the outer region where rotational component of the solar wind velocity is high. We describe REPPU code and present several simulation results.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

419

Poster 3 SH - Board: 7 / 479

Forbush-decrease in a Magnetic Cloud

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Calculation of cosmic ray intensity in a magnetic cloud is realized. It is supposed that the magnetic cloud near the Sun has the shape of a torus segment with typical structure of the magnetic field (magnetic field rope). The magnetic cloud is located in the coronal mass ejection having distribution of movement velocity by radius. The subsequent propagation of ejection in interplanetary space is determined on the basis of kinematic model. The magnetic field is determined by the freezing-in condition.

It is supposed that the cosmic ray intensity in a magnetic cloud is determined by the large-scale electromagnetic field. The zero, first and second moments of distribution function of cosmic ray with different energies are calculated. It is revealed influence of the regions connecting a magnetic cloud to the Sun on cosmic ray intensity. Comparison of calculation results with measurements is shown.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

167

High-Light Talks / 1368

Decaying dark matter in X-rays?

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Registration number following "ICRC2015-I":

1299

High-Light Talks / 703

Highlights from ANTARES, and prospects for KM3NeT

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The ANTARES experiment has been running in its final configuration since 2008. It is the largest neutrino telescope in the Northern hemisphere. After the discovery of a cosmic neutrino diffuse flux by the IceCube detector, the search for its origin has become a key mission in high-energy astrophysics. Particularly interesting is the indication (although not significant with the present IceCube statistics) of an excess of signal events from the Southern sky region.

The ANTARES sensitivity is large enough to constrain the origin of the IceCube excess from regions extended up to 0.2 sr in the Southern sky. Assuming different spectral indexes for the energy spectrum of neutrino emitters, the Southern sky and in particular central regions of our Galaxy are studied searching for point-like objects, for extended regions of emission, and for signal from transient objects selected through multimessenger observations. The results of the unblinded analyses will be presented

ANTARES has also provided results on atmospheric neutrinos, searches for rare particles (such as magnetic monopoles and nuclearites in the cosmic radiation), multi-messenger studies of the sky in combination with different experiments, and Earth and Sea science. Of particular note are the searches for Dark Matter: the limits obtained for the spin-dependent WIMP-nucleon cross section overcome that of existing direct-detection experiments.

The presentation will conclude with an outlook to the next-generation experiment KM3NeT, which is already under construction. KM3NeT will consist of two components: ORCA, optimised for measuring atmospheric neutrino oscillation parameters in the few-GeV range; and ARCA, for studying astrophysical neutrinos at higher energies. The status of KM3NeT will be summarised and the resulting prospects for ORCA and ARCA discussed.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

476

High-Light Talks / 1375

Summary of Results from the telescope Array Experiment

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The Telescope Array (TA) is the largest experiment in the northern hemisphere actively observing ultrahigh energy cosmic rays. TA is a hybrid detector system combining the precision of the air fluorescence technique with the efficiency of a surface scintillator array. Three fluorescence stations each view 108 degrees in azimuth and up to 30 degrees in elevation. They are located at the periphery of a ground array consisting of 507 plastic scintillator counters. The surface detectors are arranged in a square grid of 1.2km spacing, covering over 700 square kilometers. TA has now collected over seven years of data. We will present the cosmic ray spectra from both TA and its low energy extension (TALE), covering a range of energies from 10 PeV to over 100 EeV. We will also discuss the latest results from the measurements of mass composition by the TA group. Finally, we will present our results from the search for arrival direction anisotropy, including the observed large excess of events at the highest energies, seen in the region of the northern sky centered on Ursa Major. Based on the current results, TA is vigorously pursuing expansion of our detectors to four times its current size.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I/":

1109

Invited Review Talks / 1387

Possible physics scenarios behind cosmic-ray anomalies

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Direct techniques for cosmic ray observations have reached an unprecedented level of precision, unveiling fine-details of the energy spectra. I will introduce the evidence for new spectral features which has been accumulated by new experiments over the past few years, and review the main ideas invoked in the theoretical explanations of the revealed spectral breaks and elemental spectra non-universality. I will also briefly comment on the complementary situation of antimatter observations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1079

Invited Review Talks / 1381

Neutrino properties, mass hierarchy, and CP-violation

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All what we know about neutrinos with high confidence fits well the three-neutrino paradigm: 3 massive and mixed neutrinos with interactions described by the Standard Model. The paradigm is challenged by possible existence of new neutrino species - sterile neutrinos and new ("non-standard") interactions.

The outstanding unknowns include the type of neutrino mass ordering (hierarchy) and value of the CP-violation phase. Possibilities to determine these unknowns using the astrophysical and atmospheric neutrinos will be considered.

It appears that studies of the atmospheric neutrinos with future large underice/water detectors, like PINGU and ORCA, have a good chance to determine the hierarchy first. The hierarchy can be established from analysis of the Galactic supernova neutrino bursts.

Although it is believed that the CP phase will be measured using accelerator neutrinos, a possibility should be explored to determine the phase with atmospheric neutrinos and low, (0.5 - 1) GeV, energy threshold upgrades of PINGU and ORCA.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1073

Parallel CR20 TH accel / 123

Diffusive cosmic ray acceleration at relativistic shock waves

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The analytical theory of diffusive cosmic ray acceleration at parallel shock waves is generalized to arbitrary shock speeds $V_s = \beta_1 c$, including in particular relativistic speeds. This is achieved by applying the diffusion approximation to the relevant Fokker-Planck particle transport equation formulated in the mixed comoving coordinate system. In this coordinate system the particle's momentum coordinates p and $\mu = p_{\parallel}/p$ are taken in the rest frame of the streaming plasma, whereas the time and space coordinates are taken in the observer's system. For magnetostatic slab turbulence the diffusion-convection transport equation for the isotropic (in the rest frame of the streaming plasma) part of the particle's phase space density is derived. For a step-wise shock velocity profile the steady-state diffusion-convection transport equation is solved. For a symmetric pitch-angle scattering Fokker-Planck coefficient $D_{\mu\mu}(-\mu) = D_{\mu\mu}(\mu)$ the steady-state solution is independent of the microphysical scattering details. For nonrelativistic mono-momentum particle injection at the shock the differential number density of accelerated particles is a Lorentzian-type distribution function which at large momenta approaches a power law distribution function $N(p \geq p_c) \propto p^{-\xi}$ with the spectral index $\xi(\beta_1) = 1 + [3/(\Gamma_1 \sqrt{r^2 - \beta_1^2} - 1)(1 + 3\beta_1^2)]$. For nonrelativistic ($\beta_1 \ll 1$) shock speeds this spectral index agrees with the known result $\xi(\beta_1 \ll 1) \simeq (r + 2)/(r - 1)$, whereas for ultrarelativistic ($\Gamma_1 \gg 1$) shock speeds the spectral index value is close to unity.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

134

Parallel CR 19 Future IN / 1308

Upgrade of the Pierre Auger Observatory

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The data collected with the Pierre Auger Observatory have led to a number of surprising discoveries. While a strong suppression of the particle flux at the highest energies has been established unambiguously, the dominant physics processes related to this suppression cannot yet be identified. Within the energy range covered by fluorescence detector observations with sufficient statistics, an unexpected energy evolution of the distribution of depth of shower maximum is found. Using LHC tuned interaction models these observations can be understood as a correlated change of the fluxes of different mass groups. On the other hand, they could also indicate a change in hadronic interactions above the energy of the ankle. Complementing the water-Cherenkov detectors of the surface array with scintillator detectors will, mainly through the determination of the muonic shower component, extend the composition sensitivity of the Auger Observatory into the flux suppression region. The upgrade of the Auger Observatory will allow us to estimate the primary mass of the highest energy cosmic rays on a shower-by-shower basis. In addition to measuring the mass composition, the upgrade will open the possibility to search for light primaries at the highest energies, to perform composition-selected anisotropy studies, and to search for new phenomena including unexpected changes in hadronic interactions. After introducing the physics motivation for upgrading the Auger Observatory, the planned detector upgrade is presented. In the second part of the contribution, the expected performance and improved physics sensitivity of the upgraded Auger Observatory are discussed.

Collaboration:

Pierre Auger

Registration number following "ICRC2015-I":

975

Parallel SH 08 Theory / 135

Response of atmospheric ground level temperatures to changes in the total solar irradiance

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The attribution of part of 'global warming' to changes in the total solar irradiance (TSI) is an important topic which is not, yet, fully understood. Here, we examine the TSI induced temperature (T) changes on a variety of time scales, from one day to centuries and beyond, using a variety of assumptions. Also considered is the latitude variation of the T-TSI correlations, where it appears that over most of the globe there is a small increase in the sensitivity of temperature to TSI in time. It is found that the mean global sensitivity α measured in $K(Wm^{-2})^{-1}$ varies from about 0.003 for 1 day, via 0.05 for 11-years to ~ 0.2 for decades to centuries. We conclude that mean global temperature changes related to TSI are not significant from 1975 onwards.

Before 1975, when anthropogenic gases were less important, many of the temperature changes can be attributed to TSI variations. Over much longer periods of time, from Kyear to Myear, the TSI changes are more efficient still, α increasing to about 0.5. Since 1975 the changes in mean global temperature are not due to TSI changes, but rather to the increasing atmospheric CO₂ content.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1215

Parallel GA17 GAL / SNRs / 1311

Revealing Cosmic-Ray acceleration in the SNR W51C

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SNR are commonly assumed to accelerate the cosmic rays of $E < 1$ PeV observed at Earth. SNRs that interact with molecular clouds (MCs) are very promising targets to distinguish between leptonic and hadronic-induced gamma-ray emission. One of the brightest Fermi/LAT-detected SNRs interacting with a MC is W51C. Here we present a very detailed analysis of 5 years of Fermi/LAT data revealing a very significant low-energy break in the gamma-ray spectrum associated with the production threshold of neutral pions. This unmistakable feature of CR-acceleration in W51C is further investigated and we present a detailed modelling of the source with various gamma-ray production mechanisms. We finally compare the derived properties of W51C with those of the other known CR accelerators W44 and IC443.

Collaboration:

FERMI

Registration number following "ICRC2015-I/":

699

Parallel GA18 EGAL / 375

Gamma-ray cosmology and fundamental physics with TeV blazars: results from 20 years of observations

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Gamma rays from TeV blazars have been detected by ground-based experiments for more than two decades. We have collected the most extensive set of archival spectra from these sources in order to constrain the processes affecting gamma-ray propagation on cosmological distances. We discuss our results on the diffuse photon field that populates universe, called the extragalactic background light, on the expansion rate of the Universe, on redshift constraints, and on fundamental physics in the form of axion-like particles and Lorentz invariance violation. Specifically, we present a spectrum of the extragalactic background light from 0.26 to 105 microns constructed from the gamma-ray observations, we measure a value of the Hubble constant compatible with other estimates, and we constrain the energy scale at which Lorentz invariance violation impacts gamma-ray absorption by the extragalactic background light to be larger than sixty percent of the Planck scale.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

363

Parallel CR 19 Future IN / 1022

Telescope Array extension: TAx4

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The Telescope Array (TA), located in Utah, USA, observes highest energy cosmic rays using Surface Detectors (SDs) and Fluorescence Detectors (FDs). The SD array consists of 507 scintillation detectors on a 1.2-km square grid covering 700 km². The FD sets located at three sites look over the surface array. Using the first 6-year data collected by the surface detectors, we found a cluster of cosmic rays with energies above 57 EeV that we call the hotspot. With enhanced statistics, we expect to observe the structure of that hotspot, other excess spots, point sources and the correlation with extreme phenomena in the nearby universe. Therefore, we plan to quadruple the SD array, which covers 3,000 km², by adding 500 surface detectors with 2.1-km spacing. Two FD stations will be constructed at the new SD array. This TA extension that we call TAx4 would speed up in the detection rate to elucidate the above objectives, the measurement of energy spectrum and composition study in the highest energy region. Here we present the plan of TAx4.

Collaboration:

Telescope Array

Registration number following "ICRC2015-I":

849

Parallel GA17 GAL / SNRs / 945

Evidence of two VHE gamma-ray sources in the W51 region

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W51C is a supernova remnant (SNR) known to be interacting with a molecular cloud (MC). Gamma-rays from hundreds of MeV up to tens of TeV were discovered towards this region. However a probable contamination from a pulsar wind nebula (PWN) prevents from directly investigating cosmic ray acceleration at the SNR shock. For the first time, thanks to new data analysis methods, H.E.S.S. reveals the two component gamma-ray morphology from this region. Distinct emission from the SNR/MC interaction region and the PWN are observed, allowing to extract individual very-high-energy gamma-ray spectra from these two probable contributors. The latest H.E.S.S. results will be shown and compared to the latest observation by Fermi-LAT.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

1245

Parallel CR20 TH accel / 72

Non-relativistic Perpendicular Shocks in Young Supernova Remnants

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For parameters that are applicable to the conditions at young supernova remnants, we present results of 2D3V particle-in-cell simulations of a non-relativistic plasma shock with a large-scale perpendicular magnetic field. We developed a new clean setup that uses the collision of two plasma slabs with different density and velocity, leading to the development of two distinctive shocks and a contact discontinuity without artificial transients that may limit the veracity of the simulation. The Alfvénic Mach number of both shocks is $M_A \simeq 30$, whereas the sonic Mach numbers differ with values $M_s \simeq 250$ and $M_s \simeq 750$.

Both the forward and the reverse shocks are mediated by a Weibel-like filamentation instability that produces mainly magnetic turbulence.

We observe significant shock rippling and strong fluctuations in the turbulent shock structure, and

also features of the shock self-reformation. Proton reflection at the shocks leads to shock-surfing acceleration that generates a moderate non-thermal tail in the particle spectra measured downstream, suggesting that few ions undergo more than one reflection cycle. Electrons are pre-accelerated in a layer of Buneman waves at the shock foot, but are very efficiently isotropized upon passage through the shock ramp, and hence their downstream spectrum is quasi-thermal with high temperature. We note that electrons and ions show the same transverse drift in the ramp region, which is commensurate with $E \times B$ drift, but not the gradient drift that is usually invoked for shock drift acceleration. Thus, electrons loose energy by drifting.

We discuss the impact of our findings on pre-acceleration of electrons at high-Mach-number perpendicular shocks and their injection into diffusive shock acceleration. First results of the studies of oblique quasi-perpendicular shocks will also be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

82

Parallel SH 08 Theory / 222

Effects of dispersive wave modes on charged particles transport

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The transport of charged particles in the heliosphere and the interstellar medium is governed by the interaction of particles and magnetic irregularities. For the transport of protons a rather simple model using a linear Alfvén wave spectrum which follows the Kolmogorov distribution usually yields good results. Even magnetostatic spectra may be used.

For the case of electron transport, particles will resonate with the high- k end of the spectrum. Here the magnetic fluctuations do not follow the linear dispersion relation, but the kinetic regime kicks in. We will discuss the interaction of fluctuations of dispersive waves in the kinetic regime using a particle-in-cell code (Kilian et al. 2012). Especially the scattering of particles following the idea of Lange et al. (2013) and its application to PiC codes (Schreiner & Spanier 2014) will be discussed.

The effect of the dispersive regime on the electron transport will be discussed in detail.

Kilian et al. 2012: P. Kilian, T. Burkart, F. Spanier, in: W. E. Nagel, D. B. Kröner, M. M. Resch (Eds.), *High Performance Computing in Science and Engineering '11*, (Springer, 2012), p. 5.

Lange et al. 2013: S. Lange, F. Spanier, M. Battarbee, R. Vainio, T. Laitinen, *Astronomy and Astrophysics* 553 (2013) A129.

Schreiner & Spanier 2014: C. Schreiner, F. Spanier, *Computer Physics Communications* 185 (2014), p. 1981.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

187

Parallel GA18 EGAL / 309

MAGIC observations of the February 2014 flare of 1ES 1011+496 and measurement of the Extragalactic Background Light density

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1ES 1011+496 is a blazar located at a redshift $z=0.212$, revealed as a very-high-energy gamma-ray emitter by MAGIC in 2007. In February 2014 the source underwent an unprecedented flaring episode. Following a flare alert issued by VERITAS, the MAGIC telescopes carried out an observation campaign for a total of 17 nights between February 6 and March 7, during which the source reached a peak flux of almost 14 times the flux measured by MAGIC at the time of discovery, before returning to its low state. Despite the large flux variations, the estimated intrinsic spectral shape was remarkably stable through the whole period. The average spectrum during the flare could be well measured up to a few TeV, which makes it an ideal observation for probing the Extragalactic Background Light (EBL) through its effects on the gamma-ray flux. We implemented a method similar to the one used recently in high- and very-high-energy gamma-ray astronomy for this purpose, consisting in a likelihood maximization in which both the intrinsic spectral parameters of the source and the EBL density are free parameters. With this method we computed limits on the EBL density using as a template Dominguez et al. (2011) model with an additional scaling parameter. This measurement is among the most constraining ones obtained with gamma-ray telescopes on a single source and strengthens the case for no significant contribution of unresolved sources to the EBL.

Collaboration:

MAGIC

Registration number following "ICRC2015-I":

470

Parallel SH 08 Theory / 1080

Simulation of energetic particle interaction with shock waves in a focused transport model

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We use numerical solutions of the focused transport equation to study the evolution of the pitch-angle dependent distribution function of protons in the vicinity of parallel and oblique shock waves and compare the results

with predictions of diffusive shock acceleration theory. We then consider the case that a seed population of protons is injected close to the Sun simultaneously with a travelling interplanetary shock, and investigate the effects of pitch-angle dependent spatial diffusion, first-order Fermi acceleration at the shock and adiabatic energy losses in the expanding solar wind behind the shock. We analyze the resulting energy spectra, angular distributions and intensity-time profiles at various distances from the Sun and discuss the question whether the typically observed spectra can be explained from acceleration out of a thermal seed population, or whether a hard injection spectrum would be necessary. Finally, we apply our simulations to model a number of interplanetary particle events involving shock waves which were observed on the Helios, ACE and Wind spacecraft.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

0897

Parallel GA17 GAL / SNRs / 612

Study of high-energy particle acceleration in Tycho with gamma-ray observations

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Gamma-ray emission from supernova remnants (SNRs) can provide a unique window to observe the cosmic-ray acceleration believed to take place in these objects. Tycho is an especially good target for investigating hadronic cosmic-ray acceleration and interactions because it is a young type Ia SNR that is well studied in other wavelengths, and it is located in a relatively clean environment. Several different theoretical models have been advanced to explain the broadband spectral energy emission of Tycho from radio to the gamma-ray emission detected by Fermi-LAT in the GeV and by VERITAS in the TeV.

We will present an update on the high-energy gamma-ray studies of Tycho with ~ 150 hours of VERITAS and ~ 77 months of Fermi-LAT observations, which represents about a factor of two increase in exposure over previously published data. VERITAS data also include exposure with an upgraded camera, which made it possible to extend the TeV measurements toward lower energy, thanks to its improved low energy sensitivity. We will interpret these observations in the context of the particle acceleration in Tycho and proposed emission models.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

548

Parallel CR20 TH accel / 404

Production of Secondary Cosmic Rays in Supernova Remnants

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We study production of secondary cosmic rays (CR) in supernova remnants (SNR). The model includes reacceleration of already existing in interstellar medium secondary CR particles as well as creation of secondary CRs in nuclear collisions of accelerated protons with gas nuclei and their subsequent acceleration by SNR shock. It is shown that production secondary CRs in SNRs produces considerable effect in their resultant energy spectrum making it essentially flatter above 10 GeV. It is shown that calculated energy spectra of antiprotons, positrons and secondary nuclei Li, Be, B are well consistent experimental data obtained in recent experiments PAMELA, Fermi and AMS-02.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

142

Parallel GA18 EGAL / 641

Update on the determination of the extragalactic background light spectral energy distribution with H.E.S.S.

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When very high-energy photons (VHE, $E > 100$ GeV) travel over cosmological distances, they interact with background light by pair production. In the Earth reference frame it turns out the threshold of the reaction with photons from IR to UV falls in the energy range where the H.E.S.S. array of Cherenkov telescopes is the most sensitive. Observations of spectral features in the VHE band of extragalactic sources related to this energy-dependent process allow measuring the spectral energy distribution (SED) of the extragalactic background light (EBL), otherwise very difficult to determine. We will present an update of the estimation of the SED of the EBL based on the measurements of the energy spectra of blazars with H.E.S.S. at redshifts up to $z=0.2$.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

554

Parallel CR 19 Future IN / 1352

Cosmic Ray Science Potential for an Extended Surface array at the IceCube Observatory

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IceTop is the 1 km² surface array of the IceCube Neutrino Observatory. Measurements of ground level particles by IceTop have been used for high precision measurements of the cosmic ray spectrum for energies of 3-300 PeV. Composition has been studied by considering coincident measurements of TeV muon bundles in the 2 km deep IceCube neutrino detector. Including IceTop data for GeV muons may reduce uncertainties inherent to hadronic interaction models; however, all three parts of this program are somewhat limited by the size of IceTop. We explore the potential to improve the IceCube cosmic ray science program with a surface array of order 10 km², permitting a factor of ~5 increase in spectral range, nearly an order of magnitude in coincident composition studies, and enabling lateral and production depth muon measurements for every event. Our studies are parameterized by the spacing and size of detector array elements, as well as time resolution and discrete assumptions concerning particle identification. We consider coincidence of an extended surface array with 1st and 2nd generation in-ice arrays.

Collaboration:

IceCube

Registration number following "ICRC2015-I":

969

Parallel SH 08 Theory / 1128

New Method for Determination of Diffusion Coefficients in Turbulent Plasmas

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The transport of charged particles in turbulent magnetic fields is a topic of great interest in astrophysics, since our ability to successfully use cosmic rays as astronomic messengers depends on our understanding of the transport processes. One of the primary effects is the scattering of particles on magnetic irregularities leading in the first instance to a change in the pitch-angle μ of the particle. Further transport parameters e.g. diffusion coefficients or the mean free path can then be inferred from $\Delta\mu$.

We introduce new numerical methods to evaluate the pitch angle diffusion coefficient $D_{\mu\mu}$ and the perpendicular diffusion coefficient D_{\perp} that work well in both weak and strong turbulence scenarios and compare with analytic results from Quasi Linear Theory.

We present results obtained by applying these methods to test-particle data

from simulation of heliospheric conditions with our spectral MHD code Gismo. The results are then compared with test-particle simulations of the novel Perlin-noise-type pseudo-turbulence to show its viability for large-scale particle transport simulations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

435

Parallel GA17 GAL / SNRs / 400

The VERITAS Survey of the Cygnus Region of the Galaxy

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The Cygnus region is a very active region of our Galaxy, with many sources of GeV and TeV gamma-ray emission, such as supernova remnants, pulsar wind nebulae, high mass X-ray binaries and massive star clusters. A detailed study of the Cygnus region can give insight into the processes of particle acceleration in astrophysical sources. VERITAS is an array of four 12 meter diameter imaging atmospheric cherenkov telescopes located at Mt Hopkins, AZ, USA. From 2007 through 2012 it has gathered nearly 300 hours of data in the Cygnus region from 67 to 83 degrees Galactic longitude and from -2 to 5 degrees in Galactic latitude. We have reanalyzed the VERITAS data with updated analysis techniques, and will be cross correlating that data with the results of an analysis of over five years of Fermi-LAT data in the region. Using a cross correlation of these results we can motivate continued observations in this active region of the Galaxy.

Collaboration:

VERITAS

Registration number following "ICRC2015-I/":

254

Parallel GA18 EGAL / 832

VERITAS Search for Magnetically Broadened Emission From Blazars

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A non-zero intergalactic magnetic field (IGMF) would potentially produce detectable effects on cascade emission from blazars. Depending on the strength of the IGMF, the cascade emission may be time delayed or angularly broadened compared to the blazar's primary, unscattered emission.

Ground-based imaging atmospheric-Cherenkov telescopes, such as VERITAS, have the precise angular resolution needed to search for magnetically broadened emission. We present the latest VERITAS results on the search for extended gamma-ray emission, based on observations of a number of strongly detected TeV blazars at a range of redshifts. The consequent constraints on the strength of the IGMF are discussed.

Collaboration:

VERITAS

Registration number following "ICRC2015-I":

724

Parallel CR20 TH accel / 316

On Cosmic-Ray Production Efficiency at Realistic Supernova Remnant Shocks

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Using three-dimensional (3D) magnetohydrodynamics (MHD) simulations, we show that the efficiency of cosmic-ray (CR) production at supernova remnants (SNRs) is over-predicted if it could be estimated based on proper motion measurements of H α filaments in combination with shock-jump conditions.

The CR production efficiency at the SNR has been widely discussed, which seems to be ubiquitously so high

Recent multi-dimensional MHD simulations of shock propagation through inhomogeneous diffuse interstellar

In order to study influence of upstream inhomogeneities, we perform 3D MHD simulation of a shock wave pro

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

324

Parallel CR 19 Future IN / 735

JEM-EUSO Science

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The Extreme Universe Space Observatory (EUSO) to be accommodated in the Japanese Experiment Module (JEM) of the International Space Station (ISS), JEM-EUSO, is designed to discover the origin of ultrahigh energy cosmic rays by observing extremely energetic extensive airshowers from space. The JEM-EUSO design is based on a wide field of view (60°) refractor with an ultrafast 0.3 M pixel UV camera that records the extensive airshower fluorescence and backscattered cherenkov. The main science goal of JEM-EUSO is to accumulate significantly higher number of events than available from ground-based observatories at the highest energies. The ISS orbit guarantees full sky coverage and its altitude provides the ability to monitor two orders of magnitude more atmosphere when compared to fluorescence telescopes on the ground. The large number of observed extremely energetic events will provide a sky map of the relatively nearby sources. The increase in statistics will also provide a measurement of the spectral shape around the GZK feature, which may have a recovery depending on the maximum energy of UHECR sources. Extremely energetic neutrinos may also be observed as well as fast atmospheric phenomena in the UV. JEM-EUSO will also test physics beyond the standard model by searching for the decay products of super-heavy dark matter and tracks produced by strangelets or meteoroids.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I/":

557

Parallel GA18 EGAL / 239

Results from monitoring TeV blazars with HAWC

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The recently completed High Altitude Water Cherenkov (HAWC) gamma-ray observatory has been taking data in a partial configuration with >95% duty cycle for more than one year. With an instantaneous field of view of 2 sr, two-thirds of the sky is surveyed every day at gamma-ray energies between 100 GeV and 100 TeV. Any source location in the field of view can be monitored each day, with an exposure of up to ~6 hours and a sensitivity of ~1 Crab for sources that transit near zenith. These unprecedented observational capabilities allow us to continuously scan the highly variable extra-galactic gamma-ray sky. Monitoring the flaring states of Active Galactic Nuclei will significantly increase the data base for characterizing particle acceleration mechanisms and cosmological parameters like the extra-galactic background light. We will present first studies of over 1 year of light curve data from bright TeV blazars like Markarian 421 and 501, providing a first look at the frequency of flaring states and highlighting coincident multi-wavelength observations. We will also discuss the status of performing analyses such as a daily flare search immediately after data taking, with the potential to quickly alert other observatories in case of flare detections.

Collaboration:

HAWC

Registration number following "ICRC2015-I/":

257

Parallel SH 08 Theory / 1139

Particle acceleration and foreshock evolution in heliospheric shocks from self-consistent Monte Carlo simulations

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Self-consistent Monte Carlo simulations have been a fruitful approach to model particle acceleration dynamically coupled with the foreshock development in quasi-parallel shocks. Our group has developed the global Coronal Shock Acceleration (CSA) Monte Carlo simulation capable of modeling self-consistent shock acceleration from the inner corona to the solar wind. However, in the currently used CSA model, the resonant interactions of particles with the foreshock Alfvénic turbulence are not modeled using the full resonance condition. The applied simplification leads to isotropic pitch-angle scattering of particles off the turbulence. In contrast, the exact (within quasi-linear theory) treatment implies anisotropic pitch-angle scattering with reduced scattering efficiency at large pitch-angles. This changes the modeled acceleration efficiency of the shock. We have developed a new Monte Carlo model of particle acceleration at shock, in which we overcome the previous simplification. We present energy spectra of accelerated protons and Alfvén wave distributions in the foreshock, resulting from the new model and compare them with those resulting from the CSA model and from the analytical steady-state theory. The simulations are done for a parallel coronal shock and for the Earth's magnetospheric bow shock. In the latter case, we compare our results on foreshock evolution with those of hybrid-Vlasov simulations (kinetic ions, fluid electrons) to probe the range of applicability of quasi-linear theory.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

807

Parallel GA17 GAL / SNRs / 1136

The Fermi-LAT and H.E.S.S. views of the supernova remnant W49B

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The supernova remnant (SNR) W49B is a mixed-morphology remnant interacting with molecular clouds (MC) which originated in a Type Ib/Ic supernova explosion that occurred between one to four thousand years ago. It has one of the highest radio surface brightnesses, and is one of the brightest X-ray SNRs of our Galaxy. Gamma-ray observations of SNR/MC are a powerful tool to constrain the origin of Galactic cosmic rays, as they can probe the acceleration of hadrons through their interaction with the surrounding medium and subsequent emission of high-energy photons. W49B has been detected in gamma-rays at high energies (0.1-100GeV) and very high energies (> 100 GeV) with the Fermi-LAT and the H.E.S.S. Cherenkov telescopes, respectively. The latest results obtained on W49B with these instruments will be presented. In particular, we will report on the detection of a spectral break at low energies with the Fermi-LAT, similar to that previously found in other SNRs and interpreted as the signature of gamma-ray emission produced through neutral-pion decay. The implications of these results on the particle population and the physical processes leading to the observed gamma-ray emission in W49B will be discussed.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

562

Parallel CR20 TH accel / 976

Cosmic ray streaming instability generated in the intergalactic medium

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We solve the Vlasov equation describing the escape of cosmic rays (CRs) from a point source, in the case when the Larmor radius is smaller than the coherence scale of the cosmological magnetic field in which CRs are propagating, right after leaving the source. The electric current that follows from this calculation is used to calculate the growth rate of a non-resonant instability. We study the effect of such instability on CR propagation and we compare the growth rate with typical time scales relevant for the source, as the lifetime. We find that particles with energies less than a critical value (which depends on CR luminosity and distance from the source) are self-confined.

We also discuss the development of this instability as due to a current of CRs associated with the anisotropy in the distribution of their sources in the intergalactic medium.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

701

Parallel CR 19 Future IN / 694

The JEM-EUSO Program

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JEM-EUSO, on board the International Space Station, is a mission that aims at unveiling the nature and the origin of the ultra high energy cosmic rays (UHECRs), and to address basic problems of fundamental physics at extreme energies. The instrument is designed to measure the arrival direction, the energy and, possibly, the nature of these particles. It consists of a wide-field of view telescope that looks down from the International Space Station during night-time to detect UV photons emitted from air showers generated by UHECRs in the atmosphere, in order to identify their individual sources and their association with known nearby astronomical objects. An infrared camera and an atmosphere monitoring system improve the performance of the instrument. The EUSO program is progressing with a number of payloads based on similar technology. Two pathfinders have been developed: EUSO-Balloon flew on board a stratospheric balloon in August 2014, and EUSO-TA is currently operating at the Telescope Array site. A super-pressure balloon payload is now being developed (EUSO-SPB) and a small version of the telescope, named Mini-EUSO, has been approved to be installed inside the Russian module of the ISS. A modified KLYPVE with EUSO technology, named K-EUSO, is planned for deployment on the Russian module of the ISS. JEM-EUSO will be proposed for delivery on to the JEM via the space-X Dragon.

16 Countries and about 350 researchers are collaborating in JEM-EUSO.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

1222

Parallel CR 19 Future IN / 738

First results from a prototype for the Fluorescence detector Array of Single-pixel Telescopes

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We present a concept for large area, low-cost detection of ultra-high energy cosmic rays (UHECRs) with a Fluorescence detector Array of Single-pixel Telescopes (FAST), addressing the requirements for the next generation of UHECR experiments. In the FAST design, a large field of view is covered by a few pixels at the focal plane of a mirror or Fresnel lens. We report first results of a FAST prototype installed at the Telescope Array site, consisting of a single 8" photo-multiplier tube at the focal plane of a 1 m² Fresnel lens system taken from the prototype of the JEM-EUSO experiment. The FAST prototype took data for 19 nights, demonstrating remarkable operational stability. We detected laser shots at distances of several kilometres as well as 16 highly significant UHECR shower candidates.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

619

Parallel CR20 TH accel / 706

The Onset of Cosmic Ray Acceleration at Supernovae: From Shock Breakout to the First Decades**Author:** Gwenael Giacinti¹**Co-author:** Anthony R. Bell¹¹ *University of Oxford, Clarendon Laboratory***Corresponding Author:** gwenael.giacinti@physics.ox.ac.uk

We investigate the beginning of cosmic ray (CR) acceleration at supernovae, from the first day to the first few decades following the explosion. We show that supernovae occurring in dense winds should accelerate CR protons to energies $E > \text{PeV}$. We present a detailed study of the maximum CR energy, magnetic field amplification at the shock, and compute fluxes of secondary gamma-rays and neutrinos.

We also demonstrate, for the first time, that CR acceleration can start significantly before shock breakout for some supernovae surrounded with optically thick winds. Diffusive shock acceleration notably requires the presence of a collisionless shock (CS). It is usually thought that the shock is initially radiation-dominated, and that the CS only forms in the optically THIN layers of the wind. However, we show analytically and numerically, that a CS forms deep inside the THICK layers of the wind for some astrophysically-relevant progenitors, such as possibly SN 2008D.

An observational consequence is that secondary TeV neutrinos can reach the observer up to ~ 10 hours before the first photons from shock breakout, enabling one to study the otherwise inaccessible optically thick layers of such winds.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

623

Parallel GA17 GAL / SNRs / 1107

Study of the Very High Energy Emission from the Galactic Supernova Remnant Population with H.E.S.S.**Authors:** Diane Fernandez¹; Jacco Vink²; Joachim Hahn³; Matthieu Renaud¹; Ryan C. G. Chaves¹; Sabrina Casanova³; Samar Safi-Harb⁴; Vincent Marandon³¹ *LUPM*² *GRAPPA*

³ MPIK⁴ University of Manitoba**Corresponding Author:** joachim.hahn@mpi-hd.mpg.de

Supernova remnants (SNRs) are considered prime candidates for the acceleration of Galactic cosmic-rays up to the knee of the cosmic-ray spectrum. More than 300 SNRs have been discovered in radio and higher frequency observations, of which ~ 250 fall into the H.E.S.S. Galactic Plane Survey region. Approximately 50 of these objects are spatially coincident with very-high-energy (VHE; $E > 0.1$ TeV) gamma-ray sources, but the VHE emission could only be firmly associated with the SNR in a handful of cases. In this work, the VHE emission from the remaining sample of SNRs has been investigated. We will present the final H.E.S.S. Phase-I results from this Galactic SNR population study, and compare the theoretical expectations of the VHE gamma-ray emission from SNRs with the flux upper limits derived in the same energy band. Our results will be also discussed in the context of future observations with the Cherenkov Telescope Array.

Collaboration:

H.E.S.S.

Registration number following "ICRC2015-I":

556

Parallel GA18 EGAL / 149

FACT - TeV Flare Alerts Triggering Multi-Wavelength Observations

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Active galactic nuclei show variability on time scales ranging from minutes to decades. The radiation from these extreme objects spans many orders of magnitude along the whole electromagnetic spectrum. It shows two peaks, where for the subgroup of blazars the first peak is in the radio to x-ray regime, while the second peak is in the gamma-ray regime. Due to the extreme variability and the wide spectral range, simultaneous multi-wavelength observations are vital to understand the underlying physics. Furthermore, long-term monitoring is crucial to obtain an unbiased data sample.

While for the measurements of the low-energy peak, many instruments are available, the data at TeV energies are sparse. The First G-APD Cherenkov Telescope (FACT) is a gamma-ray telescope dedicated to the long-term monitoring of bright TeV blazars. Operational since October 2011, it has collected more than three years of data from a dedicated sample of sources. The results of an automatic quick look analysis are publicly available on a website the same night. Based on this, other instruments are informed in case of a high flux state and target-of-opportunity observations are carried out. In the previous year, seven flare alerts have been sent to the community and several periods of strong variability have been observed for the blazars Mrk 421 and Mrk 501.

Collaboration:

FACT

Registration number following "ICRC2015-I":

165

Parallel SH 08 Theory / 1182

Helical Ion Beams from Fluctuating Shock Structures

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Heliospheric shocks are well-known accelerators of particles, responsible for the creation of gradual solar energetic particle events. While the fact that particle beams are formed in shock interactions is firmly established, many open questions remain in regard to the microphysics of the acceleration process and the shape of the resulting beam distribution.

The standard analytic assumption for the distribution functions of shock-accelerated particle beams is that of a gyrotropic loss-cone distribution. However, using two independent simulation methods (test-particle simulations and hybrid-Vlasov simulations) we have identified situations in which the presence of foreshock waves leads to the formation of beams with distribution functions departing significantly from this prediction.

In particular, helical, highly non-gyrotropic beam structures in velocity space appear upstream of fluctuating shock structures.

We identify the origins of these helix structures at the shock, analyze the instability behaviour of these beams and discuss observational signatures from synthetic observations.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

792

Parallel CR21 Future IN / 137

Mid-Decade Outlook for Balloon-Borne Particle Astrophysics Research

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The NASA Particle Astrophysics Program covers the Origin of the Elements, Nearest Sources of Cosmic Rays, How Cosmic Particle Accelerators Work, The Nature of Dark Matter, and Ultrahigh Energy Neutrinos. Progress in each of these topics has come from sophisticated instrumentation flown on Long Duration Balloon (LDB) flights around Antarctica for more than two decades. Super

Pressure Balloons (SPB) and International Space Station (ISS) platforms are emerging opportunities that promise major steps forward for these and other objectives. NASA has continued development and qualification flights leading to SPB flights capable of supporting 1000 kg science instruments to 33 km for upwards of hundred day missions, with plans for increasing the altitude to 38 km. This goal is even more important now, in view of the National Research Council Astro2010 Decadal Study recommendation that NASA should support ultra-long duration ballooning development. Astro2010 emphasized that NASA should support such missions for indirect detection of dark matter and for cosmic-ray physics and astrophysics. Scientific ballooning as a vital infrastructure component for cosmic ray and general astrophysics investigations, including training for young scientists, graduate and undergraduate students, leading up to the 2020 Decadal Study and beyond, will be presented and discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

141

Parallel SH 09 Modulation II / 1152

An ab initio approach to solar-cycle dependent cosmic-ray modulation

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Very often cosmic-ray modulation studies entail adjusting ad hoc parameters in order to fit observed cosmic-ray intensities. Since typically not all of the parameters in such models are related to observable physical quantities like magnetic field variances and correlation scales, they cannot predict changes in cosmic-ray intensity caused by changes in turbulence quantities. In this ab initio study we use a three-dimensional steady-state cosmic-ray modulation code in which the effects of composite slab- and two-dimensional turbulence, on both diffusion and drift, are included. This is a simplified version of the model described by Engelbrecht and Burger (2013), who considered only solar minimum conditions. In the present study we use results from a recent project on the solar-cycle dependence of turbulence quantities at Earth to study long-term modulation, covering all levels of solar activity. We discuss the conditions required to explain the higher than usual cosmic-ray intensities observed during the solar minimum in 2009, compared with the 1986 minimum when the large-scale orientation of the heliospheric magnetic field was the same as in 2009. We also discuss the assumptions required to obtain an inverse relationship between reasonably realistic diffusion coefficients parallel- and perpendicular to the background field, and the magnitude of the heliospheric magnetic field. We use the present study to illustrate that such a relationship is restricted to time-dependence, and does not necessarily apply to spatial dependence.

Collaboration:

– not specified –

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815

Parallel CR22 TH / 530

Cosmic ray self-confinement close to extragalactic sources

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Ultra-high energy cosmic rays observed at the Earth are most likely accelerated in extra-galactic sources. For typical source luminosities invoked for such sources, we show that the electric current associated with cosmic rays escaping their sources is large enough to induce plasma instabilities that create magnetic fluctuations able to confine particles close to their sources for energies below $\sim 10^7 - 10^9$ GeV. The implications for models of the transition from Galactic to extragalactic will be discussed. We show that the magnetic field that results from the confinement is basically the equipartition magnetic field caused by the current of escaping cosmic rays.

Collaboration:

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466

Parallel NU 06 / 1027

Search for PeV-EeV Tau Neutrinos and Optical Transients with Ashra-1

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Ashra is a project to build an unconventional optical telescope complex that images a very wide field of view (FOV), covering 77% of the sky, yet with the angle resolution of a few arcmin, with the use of image intensifier and CMOS technology. The project primarily aims to observe Cherenkov and fluorescence light from air-shower developments. It can also be used to monitor optical transients in the wide FOV.

The Earth-skimming (ES) tau neutrino technique uses air-showers produced by tau lepton decays in the atmosphere. The taus, produced by tau neutrinos that interact with the Earth matter they traverse, emerge out of a mountain or the ground facing the detector, hence producing a large target mass. The detector has great sensitivity in the PeV-EeV region, and can be used to search for neutrinos originating from hadron acceleration in astronomical objects. Additional advantages are perfect shielding of cosmic ray secondaries, precision determination of arrival direction, and negligible atmospheric neutrino background. Ashra can take advantage of this promising method well.

The demonstration phase, Ashra-1, has been running at the Mauna Loa site (3300m a.s.l.) in Hawaii since 2008. It succeeded in the first search for ES tau neutrinos originating from a GRB in the commissioning run. Ashra-1 completes its 3rd observation period, the first dedicated to taking physics data for PeV-EeV tau neutrinos with the best instantaneous sensitivity and optical transients, in March

2013. From January 2012 until end of February 2013, more than 1720 hours of data have been taken out of 1860.6 hours possible due to light constraints. For optical transients, we have 3763 additional hours of data taken from 2008 until 2011.

We present the analysis of these data taken for the PeV-EeV tau neutrinos and optical transients from violent objects like GRBs as well as some physics interpretations.

Collaboration:

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820

Parallel GA19 Fermi / 629

Simulating Cherenkov Telescope Array observation of RX J1713.7–3946

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We perform simulations of Cherenkov Telescope Array (CTA) observations of a young supernova remnant RX J1713.7–3946. This target is not only one of the brightest sources ever discovered in very high-energy (VHE) gamma-rays but also well observed in other wavebands. In X-rays, the

emission is dominated by synchrotron radiation, which links directly to the existence of high-energy electrons. Radio observations of CO and HI gas have revealed a highly inhomogeneous medium surrounding the SNR, such as clumpy molecular clouds. Therefore gamma-rays from hadronic interactions are naturally expected. However, the spectrum in GeV energy range measured by Fermi/LAT indicates more typical of leptonic emission from accelerated electrons. Despite lots of multi-wavelength information, the competing interpretations have led to much uncertainty in the quest of unraveling the true origin of the gamma-ray emission from RX J1713.7–3946. CTA will achieve highest performance ever in sensitivity, angular resolution, and energy resolution. We estimate CTA capability to examine the emission mechanisms of the gamma-rays through simulated spatial distribution, spectra, and their time variation.

Collaboration:

CTA

Registration number following "ICRC2015-I":

0550

Parallel CR22 TH / 713

Are Cosmic Rays still a valuable probe of Lorentz Invariance Violations in the Auger era?

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In the last years a general consensus has emerged that ultra-high energy cosmic ray (UHECR) data can serve as a powerful probe of the validity of special relativity. This applies in particular to the propagation of cosmic rays from their sources to Earth through diffuse extragalactic background radiation, which is responsible for energy suppressions due to pion photoproduction by UHE protons (the Greisen-Zatsepin-Kuzmin limit) and photodisintegration of UHE nuclei (the Gerasimova-Rozental' limit). A suppression in the flux of UHECRs at energies above 40 EeV – as expected from these interactions – has been established experimentally beyond any doubt by current experiments. However, such an observation is still not conclusive on the origin of the suppression. In particular, data from the Pierre Auger Observatory can be interpreted in a scenario in which the suppression is due to the maximum acceleration energy at the sources rather than to interactions in the background radiation. In this scenario, UHECR data can no longer yield bounds on Lorentz invariance violations which increase the thresholds for interactions of nuclei on background photons, in particular through modification of the dispersion relations. Here we argue in turn that the study of UHECRs still represents a unique opportunity to test Lorentz invariance, by discussing the possibility of deriving limits on

violation parameters from UHECR phenomena other than propagation. In particular we study the modifications of the shower development in the atmosphere due to the possible inhibition of the decay of unstable particles, especially neutral pions.

Collaboration:

– not specified –

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1097

Parallel CR21 Future IN / 1287

The Heavy Nuclei eXplorer

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The Heavy Nuclei eXplorer (HNX) is a new instrument proposed as a NASA Small Explorer by NASA Goddard Space Flight Center, University of California, Berkeley, Washington University in St. Louis, and the Jet Propulsion Laboratory. HNX will investigate the nature of the reservoirs of nuclei at the cosmic-ray sources, the mechanisms by which nuclei are removed from the reservoirs and injected into the cosmic accelerators, and the acceleration mechanism. HNX will measure, for the first time, the abundance of every individual element in the periodic table from carbon through the actinides, providing the first measurement of many of these elements. Several thousand ultra-heavy galactic cosmic ray (UHGCR) nuclei with atomic number $Z \geq 30$ will be recorded, including about 50 actinides. To measure UHGCR with unprecedented statistics and individual element resolution over its full measurement range, HNX will use two large instruments, the Extremely-heavy Cosmic-ray Composition Observer (ECCO) using sophisticated glass detectors and the Cosmic-ray Trans-Iron Galactic Element Recorder (CosmicTIGER) using electronic detectors evolved from SuperTIGER. HNX will be accommodated in the SpaceX DragonLab orbiting laboratory that will also return it to Earth for post-flight processing of the ECCO detectors. HNX measurements will determine whether GCR are accelerated from new or old material, and find their age. The measured mix of R-process and S-process material will determine the mix of nucleosynthesis processes responsible for the UHGCRs and investigate how UHGCR elements are selected for acceleration. The measured secondary to primary ratios will give the mean integrated pathlength traversed by UHGCRs before observation. The scientific motivation of HNX and details of its instruments will be discussed.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

900

Parallel GA19 Fermi / 407

Tracing the propagation of cosmic rays in the Milky Way halo with Fermi-LAT observations of high- and intermediate-velocity clouds

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Cosmic rays up to at least PeV energies are usually described in the framework of an elementary scenario that involves acceleration by objects that are located in the disk of the Milky Way, such as supernova remnants or massive star-forming regions, and then diffusive propagation throughout the Galaxy. Details of the propagation process are so far inferred mainly from the composition of cosmic rays measured near the Earth and then extrapolated to the whole Galaxy. Large uncertainties exist about the propagation in the Galactic halo and the escape into the intergalactic medium. The densities of cosmic rays in specific locations can be traced via the gamma rays they produce in inelastic collisions with clouds of interstellar gas. Therefore, we analyze 73 months of Fermi-LAT data from 300 MeV to 10 GeV in the direction of several high- and intermediate-velocity clouds that are located in the halo of the Milky Way. These clouds are supposed to be free of internal sources of cosmic rays and hence any gamma-ray emission from them samples the large-scale distribution of Galactic cosmic rays. We evaluate for the first time the gamma-ray emissivity per hydrogen atom up to ~ 7 kpc above the Galactic disk. The emissivity is found to decrease with distance from the disk, which provides direct evidence that cosmic rays at the relevant energies originate therein. Furthermore, the emissivities of intermediate-velocity clouds hint at a 50% decline of cosmic rays within 2 kpc from the disk.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

97

Parallel NU 06 / 413

Atmospheric Neutrino Oscillations at Super-Kamiokande

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Spanning several orders of magnitude in both neutrino energy and path length, atmospheric neutrinos are a versatile probe of both standard and exotic mixing scenarios. Indeed, recent measurements of θ_{13} by reactor antineutrino experiments have opened up the possibility to observe the effect of the earth's matter on neutrino oscillations and to subsequently determine the neutrino mass hierarchy using atmospheric neutrinos. Further, the existence of a sterile neutrino outside of the standard three-neutrino oscillation paradigm would produce observable distortions in the atmospheric neutrino flux that can be used to probe hints from short-baseline oscillation experiments supporting an additional neutrino. Atmospheric neutrinos can similarly be used to explore possible deviations from Lorentz invariance

and are particularly sensitive to violations of this symmetry that induce oscillation effects that scale with the neutrino energy and path length. The latest results from searches for each of these phenomena using Super-Kamiokande atmospheric neutrino data will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

389

Parallel SH 09 Modulation II / 263

LATITUDE SURVEY INVESTIGATION OF GALACTIC COSMIC RAY SOLAR MODULATION DURING 1994–2007

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The Galactic cosmic ray spectrum exhibits subtle variations over the 22 yr solar magnetic cycle in addition to the more dramatic variations over the 11 yr sunspot cycle. Neutron monitors are large ground-based detectors that provide accurate measurements of variations in the cosmic ray flux at the top of the atmosphere above the detector. At any given location the magnetic field of the Earth excludes particles below a well-defined rigidity (momentum per unit charge) known as the cutoff rigidity, which can be accurately calculated using detailed models of the geomagnetic field. By carrying a neutron monitor to different locations, e.g., on a ship, the Earth itself serves as a magnet spectrometer. By repeating such latitude surveys with identical equipment, a sensitive measurement of changes in the spectrum can be made. In this work, we analyze data from the 1994 through 2007 series of latitude surveys conducted by the Bartol Research Institute, the University of Tasmania, and the Australian Antarctic Division. We confirm the curious “crossover” in spectra measured near solar minima during epochs of opposite solar magnetic polarity, and show that it is directly related to a sudden change in the spectral behavior of solar modulation at the time of the polarity reversal, as revealed from contemporaneous variations in the survey data and a fixed station. We suggest that the spectral change and crossover result from the interaction of effects due to gradient/curvature drifts with a systematic change in the interplanetary diffusion coefficient caused by turbulent magnetic helicity. Supported in part by the Thailand Research Fund, the US National Science Foundation (OPP-0838839, PLR-124593, and predecessors), and the Australian Antarctic Division.

Collaboration:

– not specified –

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262

Parallel CR21 Future IN / 1290**Prospects for High Energy Light Isotope Measurements on Balloons****Author:** Scott Wakely¹**Co-authors:** Dietrich Muller¹; Gregory Tarle²; Jim Musser³; Michael Schubnell²; Nahee Park¹; Scott Nutter⁴; Stephane Coutu⁵¹ *University of Chicago*² *University of Michigan*³ *Indiana University*⁴ *Northern Kentucky University*⁵ *Penn State University***Corresponding Author:** wakely@ulysses.uchicago.edu

Recent high-profile ‘anomalies’ detected in the cosmic-ray flux have underscored the importance of improving our understanding of cosmic-ray source and propagation processes. To this end, one of the key observational tasks is obtaining measurements of the relative abundances of the light cosmic-ray isotopes at relativistic energies (above ~ 1 GeV/n) where existing information is extremely scarce. In particular, measurements of the clock isotope ^{10}Be for a range of relativistic time dilations are urgently needed. However, such measurements present a severe experimental challenge. The required mass resolution can only be reached if magnetic spectrometers with strong magnetic fields are equipped with state-of-the-art high-resolution trackers, and combined with devices such as ring-imaging Cherenkov counters for precise velocity measurements. Additionally, large exposure factors are needed for good statistical accuracy. In this presentation, we will briefly review the goals and challenges of such measurements, and describe a new proposed instrument, HELIX (the High-Energy Light Isotope eXperiment), that is designed to meet these challenges on a long-duration Antarctic balloon flight.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

647

Parallel GA19 Fermi / 258**The First Fermi-LAT SNR Catalog: SNR and Cosmic Ray Implications****Author:** T. J. Brandt¹**Co-authors:** Francesco de Palma²; J. W. Hewitt³; Matthieu Renaud⁴; fabio acero⁵

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Galactic cosmic ray (CRs) sources, classically proposed to be Supernova Remnants (SNRs), must meet the energetic particle content required by direct measurements of high energy CRs. Indirect gamma-ray measurements of SNRs with the Fermi Large Area Telescope (LAT) have now shown directly that at least three SNRs accelerate protons. With the first Fermi LAT SNR Catalog, we have systematically characterized the GeV gamma-rays emitted by 279 SNRs known primarily from radio surveys. We present these sources in a multiwavelength context, including studies of correlations between GeV and radio size, flux, and index, TeV index, and age and environment tracers, in order to better understand effects of evolution and environment on the GeV emission. We show that previously sufficient models of SNRs' GeV emission no longer adequately describe the data. To address the question of CR origins, we also examine the SNRs' maximal CR contribution assuming the GeV emission arises solely from proton interactions. Improved breadth and quality of multiwavelength data, including distances and local densities, and more, higher resolution gamma-ray data with correspondingly improved Galactic diffuse models will strengthen this constraint.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

687

Parallel SH 09 Modulation II / 724

Heliospheric modulation and periodicities of galactic cosmic rays during 21-24 solar cycles

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Galactic cosmic rays (GCRs) encounter an outward-moving solar wind with cyclic magnetic-field fluctuation and turbulence. This causes convection and diffusion in the heliosphere. The GCR counts from the ground-based neutron monitor stations show intensity changes that are anti-correlated with the sunspot numbers with a lag of a few months. In this paper, we make a detailed correlative study between GCRs intensity (Lomnický stit neutron monitor station) and different solar/interplanetary parameters for cycles 21-24. We find a clear asymmetry in the cross-correlation between GCRs and solar/heliospheric activity indicators for both odd and even-numbered solar cycles. The time-lags between GCRs and solar/heliospheric parameters are found different in different solar cycles as well as in the opposite polarity states ($A < 0$ and $A > 0$) within the same solar cycle. Further, we have studied the mid-term periodicities of GCRs and found the presence of well-known Rieger; Rieger type and quasi-biennial oscillations (QBOs) in our power spectrum. Possible explanations of the observed results are discussed in light of modulation models, including drift effects.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

255

Parallel NU 06 / 830

Solar neutrino results from Super Kamiokande

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Super-Kamiokande (SK), a 50 kton water Cherenkov detector in Japan, observes ⁸B solar neutrinos with neutrino-electron elastic scattering. SK searches for distortions of the solar neutrino energy spectrum caused by the edge of the MSW resonance in the core of the sun. It also searches for a day/night solar neutrino flux asymmetry induced by the matter in the Earth.

The installation of new front-end electronics in 2009 marks the beginning of the 4th phase of SK (SK-IV). This phase achieved the lowest energy threshold thus far (3.5 MeV kinetic energy).

SK observed solar neutrinos for 17 years, that is about 1.5 solar activity cycles. An analysis about a possible correlation between solar neutrino flux and 11 year activity cycle will be presented.

The combined energy spectrum and the day/night solar neutrino flux asymmetry from SK-I to SK-IV will be presented.

A global oscillation analysis using SK-I,II,III, and SK-IV data and combined with the results of other solar neutrino experiments as well as KamLAND reactor experiment has been carried out. The results of this global analysis will be presented as well.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

718

Parallel CR22 TH / 1131

On the impact of the Local Bubble on cosmic ray electron and positron spectra and anisotropy

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The positron fluxes measured by PAMELA and most recently AMS-02, show an excess far above the expectations of secondary positron

production in the ISM. These locally observed energetic positrons require a near-by source of even more energetic positrons. Among the possible explanations for a primary source of such positrons, unaccounted astrophysical point sources or dark matter (DM) decay or annihilation are the most promising ones. In this context the level of anisotropy in the locally measured e^\pm arrival directions is a key observable to differentiate between point sources, such as pulsars, and the DM hypothesis. Compared to protons and nuclei, energetic e^\pm lose energy on short timescales. Therefore, any source of energetic e^\pm needs to be located in the solar neighborhood, and thus in the proximity of the local bubble, an underdense region surrounding the Sun which is assumed to have its origin in about 20 supernova explosions in the past 10-20 Myrs. This rather peculiar environment may have a non-negligible impact on local cosmic ray transport and in particular on the expected level of anisotropy. Using general assumptions on the local variations of the diffusion coefficient, as expected for the local bubble, we discuss the impact of this structure on the observed e^\pm spectra and the local anisotropy. We find that under reasonable assumptions about the diffusion coefficient, both the spectra and the local level on anisotropy are affected in a sizeable way. We further find that a good description of the AMS-02 data is possible, while the level of anisotropy may be decreased by up to 80%.

Collaboration:

– not specified –

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717

Parallel NU 06 / 588

Transient neutrino emission from the Galactic center studied by ANTARES

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The Galactic center hosts several types of high energy sources that are potential transient neutrino emitters. A time dependent analysis based on the ANTARES data is carried out with the aim of

detecting high energy neutrinos temporally connected with bursts in the electromagnetic spectrum of objects located close to the Galactic center.

This approach, more sensitive than a time-integrated analysis, requires neither prior on the burst timing structure nor on the electromagnetic emission. Therefore, it provides an effective way for looking for neutrino emission of astrophysical sources potentially absorbed in X-ray and gamma-rays.

The timing information of ANTARES events in the Galactic center region is also used together with the X-ray light curve of SgrA* and the time information of the IceCube High Energy Starting Events (HESE) in this region, to evaluate possible correlations in time.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

368

Parallel SH 09 Modulation II / 198

On the causes and mechanisms of the long-term variations in the GCR characteristics

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There is a long-lasting controversy on the main causes of the long-term (11-year and 22-year) variations in the intensity and anisotropy of the galactic cosmic rays (GCR) observed for more than 50 years in the inner heliosphere. Some people believe that the 11-year variation is due entirely to the toroidal branch of solar activity (the area and number of sunspots, the strength of the heliospheric magnetic field etc) because of the diffusion, convection and adiabatic energy loss, while the much smaller 22-year variation is caused by the particle drift connected with the poloidal branch of solar activity. At the same time there were indications from some numerical experiments, both in the past and recent ones, that the contribution of the 22-year processes such as drift could be significant for both 22- and 11-year variations in the GCR characteristics.

In the paper we present the analysis of the causes of the first point of view and the reasons why one can expect the significant contribution of the processes connected with the poloidal branch of solar activity in both types of the long-term variations of the GCR characteristics. The latter considerations are strengthened by the calculations using the simple models.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

215

Parallel CR22 TH / 1207

Multi-wavelength constraints on cosmic-ray leptons in the Galaxy

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Co-authors: Andrew Strong²; Clive Dickinson³; Guðlaugur Jóhannesson⁴; Igor Moskalenko¹; Matias Vidal³; Patrick Leahy³; Seth Digel⁵; Tess Jaffe⁶; Troy Porter¹

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Cosmic rays (CR) interact with the interstellar medium and the magnetic field in the Milky Way, producing diffuse emission from radio to gamma rays. Observations of this diffuse emission and comparison with detailed predictions are powerful tools to unveil the CR distribution and to study CR propagation. We present various GALPROP CR propagation scenarios based on current CR measurements. The associated synchrotron emission is compared to radio surveys and synchrotron maps from WMAP and Planck, and the leptonic interstellar gamma-ray emission is calculated. Finally we discuss how information from radio and microwave observations can be used in studying CR characteristics and diffuse emissions with Fermi-LAT, especially at low energy.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1265

Parallel CR21 Future IN / 190

The High Energy Particle Detector on board the CSES China Seismo-Electromagnetic satellite

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The CSES space mission will study the temporal stability of the inner Van Allen radiation belts, investigating precipitation of trapped particles induced by magnetospheric, ionospheric and tropospheric EM emissions, as well as by seismo-electromagnetic and anthropogenic disturbances.

CSES satellite will be launched in September 2016 and inserted into a circular Sun-synchronous orbit with 98 degrees inclination and 500 km altitude. Expected lifetime is 5 years. CSES hosts several instruments onboard: 2 magnetometers, an electrical field detector, a plasma analyzer, a Langmuir probe and a High Energy Particle Detector (HEPD). The HEPD detector consists of two layer plastic

scintillators, one segmented, for the trigger and a calorimeter constituted by a tower of plastic scintillator counters and a LYSO plane. The direction of the incident particle is provided by two planes of double-side silicon microstrip detectors placed in front of the trigger.

HEPD detector will measure electrons (3 - 100 MeV) and protons (30 - 300 MeV) along CSES orbit. The angular and energy resolution and the detector acceptance are optimized to accurately detect the expected low short-term time variations of the particle flux from the radiation belts.

Topic of this talk is the technical description of the HEPD and its main characteristics.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

208

Parallel GA19 Fermi / 1019

Phase resolved spectral analysis of 25 millisecond gamma-ray pulsars

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Millisecond pulsars (MSPs) are a growing class of gamma-ray emitters. Spectral analyses of their pulsed emission bring important constraints to the theoretical models which describe the electromagnetic processes responsible for high-energy radiations in pulsar magnetospheres. The gamma-ray data collected during five years of Fermi Large Area Telescope (LAT) observations have allowed in-depth phase resolved spectral analyses of 25 of the brightest objects in the 50 MeV to 170 GeV energy band. The sample exhibits a significant evolutionary sequence in spectral energy distribution of the total pulsed emission. The sequence relates three spectral parameters, namely the spectral index at low energy, the apex energy at which the maximum energy flux is emitted, and the cut-off energy, with the spin-down power of the neutron star. As the latter increases, the spectral energy distribution broadens, softens, and shifts in energy. This evolution is primarily driven by the emission in the caustic peaks. Spectral parameters change with phase present systematic patterns. Pulsars with aligned gamma-ray and radio peaks tend to be particularly luminous and soft. The sequence highlights an important transition in MSP evolution near a spin-down power of 10^{27} W and the possible onset of a soft emission component in addition to curvature radiation. The phase dependence of the radiative efficiency also suggests that multiple emitting regions, with different levels of electric field screening, contribute to the total pulsed gamma-ray emission.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

853

Parallel SH 09 Modulation II / 275

Cosmic ray modulation as a possible diagnostic for the low-wavenumber behaviour of turbulence in the heliospheric magnetic field

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Galactic cosmic-ray (CR) intensities calculated using numerical modulation models that proceed from first principles, where the diffusion tensor is calculated using as inputs observationally motivated forms for the heliospheric turbulence power spectrum as function of turbulence quantities yielded by turbulence transport models, are incredibly sensitive to assumptions made as to the low-wavenumber behaviour of the 2D turbulence power spectrum. In this study, a novel *ab initio* CR modulation code that

solves a set of stochastic transport equations equivalent to the Parker transport equation is introduced, and employed to study this sensitivity. Preliminary results, including those pertaining to possible constraints on the low-wavenumber behaviour of the 2D power spectrum gleaned from computed CR spectra, will also be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

117

Parallel GA19 Fermi / 1236

The 3rd Catalog of AGN Detected by the Fermi LAT

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The third catalog of active galactic nuclei (AGNs) detected by the Fermi Large Area Telescope (3LAC) is presented. It is based on the third catalog (3FGL, Acero et al. 2015, arxiv 1501.02003) of sources detected with a test statistic greater than 25, using the first 4 years of data. The 3LAC includes 1591 AGNs located at high ($|\mathit{b}| > 10^\circ$) Galactic latitudes (with 28 duplicate associations, thus corresponding to 1563 gamma-ray sources among 2192 sources in the 3FGL catalog), providing 71% more sources with respect to the 2FGL. Various properties, such as gamma-ray fluxes and photon power law spectral indices, redshifts, gamma-ray luminosities, variability, and their correlations are presented and discussed for the different blazar and non-blazar classes.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

953

Parallel CR21 Future IN / 430**The CALorimetric Electron Telescope (CALET): a High-Energy Astroparticle Physics Observatory on the International Space Station****Author:** Shoji Torii¹¹ *Waseda University (JP)***Corresponding Author:** shoji.torii@cern.ch

The CALorimetric Electron Telescope (CALET) space experiment, which has been developed by Japan in collaboration with Italy and the United States, is a high-energy astroparticle physics mission to be installed on the International Space Station (ISS). The primary goals of the CALET mission include investigating possible nearby sources of high energy electrons, studying the details of galactic particle propagation and searching for dark matter signatures. During a two-year mission, extendable to five years, the CALET experiment will measure the flux of cosmic-ray electrons (including positrons) to 20 TeV, gamma-rays to 10 TeV and nuclei with $Z=1$ to 40 up to 1,000 TeV. The instrument consists of two layers of segmented plastic scintillators for the cosmic-ray charge identification (CHD), a 3 radiation length thick tungsten-scintillating fiber imaging calorimeter (IMC) and a 27 radiation length thick lead-tungstate calorimeter (TASC). CALET has sufficient depth, imaging capabilities and excellent energy resolution to allow for a clear separation between hadrons and electrons and between charged particles and gamma rays. The instrument is currently being prepared for launch, during the 2015 time frame, to the ISS with HTV-5 (HII Transfer Vehicle 5) and installed on the Japanese Experiment Module- Exposed Facility (JEM-EF).

Collaboration:

CALET

Registration number following "ICRC2015-I":

401

Parallel CR22 TH / 126**The millisecond pulsar contribution to the rising positron fraction****Author:** Christo Venter¹**Co-authors:** Alice Harding ²; Andreas Kopp ³; Ingo Buesching ¹; Peter Gonthier ⁴¹ *North-West University, Potchefstroom Campus*² *NASA Goddard Space Flight Center*³ *Institut fuer Experimentelle und Angewandte Physik, Christian-Albrechts-Universitaet zu Kiel*⁴ *Hope College*

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Pair cascades from MSPs may be a primary source of Galactic electrons and positrons that contribute to the increase in positron flux above 10 GeV as observed by PAMELA and AMS-02. The Fermi Large Area Telescope has increased the number of detected gamma-ray millisecond pulsars (MSPs) tremendously. Light curve modelling furthermore favours abundant pair production in MSP magnetospheres, so that models of primary cosmic-ray positrons from pulsars should include the contribution from the larger numbers of MSPs and their potentially higher positron output per source. We model the contribution of Galactic MSPs to the terrestrial cosmic-ray electron / positron flux by using a population synthesis code to predict the source properties of present-day MSPs. We simulate pair spectra assuming an offset-dipole magnetic field which boosts pair creation rates. We also consider positrons and electrons that have additionally been accelerated to very high energies in the strong intrabinary shocks in black widow and redback binary systems. We transport these particles to Earth by calculating their diffusion and the radiative energy losses they suffer in the Galaxy. Our model particle flux increases for non-zero offsets of the magnetic polar caps. We find that pair cascades from MSP magnetospheres contribute only modestly around a few tens of GeV to the measured fluxes. Black widow and redback fluxes may reach a few tens of percent of the observed flux at tens of TeV. Future observations should constrain the source properties in this case.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

889

Parallel NU 06 / 383

New limit for mildly relativistic magnetic monopoles obtained with IceCube

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Registration number following "ICRC2015-I":

340

Parallel SH 09 Modulation II / 54

Modelling the effects of scattering parameters on particle drifts in the solar modulation of galactic cosmic rays.

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It is well known that particle drift motions are suppressed by diffusive scattering as established by direct numerical simulations. The effect of constant scattering on the drift velocities of charged particles has always been included in numerical modulation models provided that the weak scattering drift velocity is scaled down in magnitude, although in an empirical manner as comparisons between drift models and observations required. What has not yet been established is the spatial dependence of the scattering parameter ($\omega\tau$), with ω the gyro-frequency and τ some time scale defined by scattering. What is currently known about the spatial and rigidity dependence of $\omega\tau$ is used to illustrate and discuss its effect on the drift coefficient in the modulation of cosmic ray Carbon in the heliosphere. This is done with a well-established numerical model which includes all four major modulation processes, the solar wind termination shock (TS) and the heliosheath. We estimate that a reasonable range in the magnitude of $\omega\tau$ is $0 \leq \omega\tau \leq 5$, applicable to modulation studies inside and outside the TS. Furthermore, it is found that the considered different scenarios for $\omega\tau$ cause significant modifications to the weak scattering drift coefficient and as such on the subsequent computed differential intensities in both solar magnetic polarity cycles. Scenarios of $\omega\tau$ with strong decreases over the heliospheric polar regions seem unlikely for the modulation of galactic cosmic rays in the upstream region of the TS.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

71

Parallel GA19 Fermi / 1240

Fermi Reveals New Light on Novae in Gamma rays

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Novae are now firmly established as a high-energy (>100 MeV) gamma-ray source class by the Fermi Large Area Telescope (LAT). In symbiotic systems such as V407 Cyg 2010, there is a firm theoretical framework for the production of shock-acceleration particles in the nova ejecta from interactions with the dense wind of the red giant companion. Yet, the >100 MeV emission detected in classical novae involving main sequence companions cannot be explained in the same way and could instead be produced in internal shocks in the ejecta. We will summarize the Fermi-LAT gamma-ray observations of novae, highlighting the main properties that will guide further studies. Additionally, we report on the soft gamma-ray (~0.1 MeV) continuum detection of the oxygen-neon (ONe) type classical nova V382 Vel 1999 with the OSSE detector aboard the Compton Gamma Ray Observatory in light of its Fermi-era analog, V959 Mon 2012.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

943

Parallel CR22 TH / 321

Cosmic ray penetration in diffuse clouds

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Cosmic rays (CR) are a fundamental source of ionization for molecular clouds as well as diffuse clouds, influencing their chemical, thermal, and dynamical evolution. The amount of CR inside a cloud also determines the γ -ray flux produced by hadronic collisions between CR and cloud materials. We study the spectrum of CR inside and outside a diffuse cloud for energies $> \text{MeV}$. We solve the stationary transport equation for CR in 1-D including diffusion, advection and losses due to ionization of neutral Hydrogen atoms. We found that, for typical number density of diffuse clouds $\sim 100 \text{ cm}^{-3}$, and cloud size of $\sim 10 \text{ pc}$, the CR spectrum just on the edge of the cloud has a break at energy $E_{br} \sim 100 \text{ MeV}$. This breaking energy is due to the fact that particles can cross the cloud many times, hence increasing the energy losses. The presence of the breaks also depends on the CR spectrum far from the cloud.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1148

Parallel NU 06 / 70

Measurements of the Atmospheric Neutrino Flux at Super-Kamiokande

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Measurements of the atmospheric neutrino flux have been performed using Super-Kamiokande, a 22.5 kton fiducial-volume water-Cherenkov detector located in the Mozumi mine in Japan. Beginning operation in 1996, the detector has the world's highest statistics for observation of neutrinos originating from cosmic ray interactions in the atmosphere, which may be compared to the predictions given by atmospheric neutrino flux models. We present measurements of the $\nu_e + \bar{\nu}_e$ and $\nu_\mu + \bar{\nu}_\mu$ fluxes as a function of energy, direction, and time, with a detailed analysis of systematic errors. In particular, we compare the energy spectra in the sub-GeV to TeV range to those of the various published flux models, confirm the discovery of azimuthal asymmetries caused by the geomagnetic field for both neutrino flavours, and present an analysis showing the first indications of a correlation between the atmospheric neutrino flux and the solar magnetic activity cycle.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

69

Parallel CR21 Future IN / 1165

Ultra high energy cosmic ray detector KLYPVE on board the Russian Segment of the ISS

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Modified KLYPVE is a novel fluorescence detector of ultra high energy cosmic rays (UHECRs, energies >50 EeV) to be installed on the Russian Segment of the International Space Station. The main goal of the experiment is to register arrival directions and energies of EECRs but it will be able to register other transient events in the atmosphere as well. The main component of KLYPVE is a segmented two component optical system with a large entrance pupil and a wide field of view, which provides annual exposure twice that of Auger. The project is actively developed by a working group of the JEM-EUSO Collaboration led by Skobeltsyn Institute of Nuclear Physics at Moscow State University (Russia). The current status of KLYPVE with a focus on its scientific tasks, technical parameters and instruments is presented.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

1281

Parallel SH 09 Modulation II / 471

Cosmic Rays Propagation with HelMod: Difference between forward-in-time and backward-in-time approaches

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The cosmic rays modulation inside the heliosphere, is well described by a transport equation introduced by Parker in 1965.

To solve this equation several approaches were followed in the past.

Recently the Monte Carlo approach become widely used in force of his advantages with respect to other numerical methods. In the Monte Carlo approach the transport equation is associated to a fully equivalent set of Stochastic Differential Equations. This set is used to describe the stochastic path of quasi-particle from a source, e.g. the interstellar medium, to a specific target, e.g. a detector at Earth. In this work we present both the Forward-in-Time and Backward-in-Time Monte Carlo solutions. We study performances of the numerical solutions as well the precision of both methods. We discuss advantages and disadvantages of the two approaches and the differences with respect to other numerical solutions. Finally we present how both methods were implemented in the HelMod Code for the study of cosmic rays modulation in the heliosphere.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

430

Parallel CR21 Future IN / 725

The EUSO-BALLOON mission

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on behalf of the JEM-EUSO collaboration

EUSO-BALLOON is a pathfinder for JEM-EUSO, the Extreme Universe Space Observatory which is to be hosted on-board the International Space Station. As JEM-EUSO is designed to observe Ultra-High Energy Cosmic Rays (UHECR)-induced Extensive Air Showers (EAS) by detecting their ultraviolet light tracks "from above", EUSO-BALLOON is a nadir-pointing UV telescope too. With its Fresnel Optics and Photo-Detector Module, the instrument monitors a 70 km² surface area in a wavelength band of 290-430 nm, collecting series of images at a rate of 400'000 frames/sec. The objectives of the balloon demonstrator are threefold : a) perform a full end-to-end test of a JEM-EUSO prototype consisting of all the main subsystems of the space experiment, b) measure the effective terrestrial UV background, with a spatial and temporal resolution relevant for JEM-EUSO. c) detect tracks of ultraviolet light "from above" for the first time. The latter is a milestone in the development of UHECR science, paving the way for any future space-based UHECR observatory.

On August 25, 2014, EUSO-BALLOON was launched from Timmins Stratospheric Balloon Base (Ontario, Canada) by the balloon division of the French Space Agency CNES. From a float altitude of 38 km, the instrument operated during the entire astronomical night, observing UV-light from a variety of ground- covers, and simulated EAS, produced by flashers and a laser during a two-hour helicopter underflight. In this paper, an overview of the instrument, its calibration and the balloon flight of August 2014 are presented.

Collaboration:

JEM-EUSO

Registration number following "ICRC2015-I":

637

Parallel CR22 TH / 700

CRIME - cosmic ray interactions in molecular environments

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Molecular clouds act as targets for cosmic ray interactions, such as gamma ray emission via proton-proton interactions. We study the effect of ionization by cosmic ray electrons and protons. Complementary to gamma ray emission, the ionization rate allows to estimate the CR flux. In particular the ionization rate allows access to proton energies below the pion production threshold (~ 270 MeV). To determine the ionization rate fully relativistic cross sections are used. Based on the single differential cross sections the effect of secondary ionization is treated selfconsistently for both electrons and protons. Our code for the ionization as well as tools to calculate the gamma ray emission based on an assumed CR spectrum is publicly accessible via a webinterface.

Based on measured gamma ray fluxes and ionization rates we briefly discuss the case of molecular clouds in the vicinity of supernova remnants.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

385

Parallel NU 06 / 173

Time-dependent search of neutrino emission from X-ray binaries with the ANTARES telescopes

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ANTARES is currently the largest neutrino telescope operating in the Northern Hemisphere, aiming at the detection of high-energy neutrinos from astrophysical sources. By design, neutrino telescopes constantly monitor at least one complete hemisphere of the sky and are thus well set to detect neutrinos produced in transient astrophysical sources. The flux of high-energy neutrinos from transient sources is expected to be lower than the one expected from steady sources, but the background originating from Earth's atmosphere can be drastically reduced by requiring a directional and temporal coincidence of the astrophysical

phenomenon detected by a satellite. The time-dependent point-source search has been applied to a list of 33 X-ray binary systems while observed in high flaring activities in the 2008-2012 satellite data, RXTE/ASM, MAXI and Swift/BAT. The results of this search are presented together with the comparison between the neutrino flux upper-limits with the measured gamma-ray spectral energy distribution and the prediction from astrophysical models.

Collaboration:

ANTARES

Registration number following "ICRC2015-I":

188

Parallel GA19 Fermi / 988**A Fermi-LAT view of the sky below 100 MeV****Author:** Thibaut Desgardin¹¹ LUPM**Corresponding Author:** thibaut.desgardin@univ-montp2.fr

The Large Area Telescope (LAT) collaboration has recently completed the development of the "Pass 8" event-level analysis that provides a comprehensive revision of the algorithms used for event reconstruction and particle identification. Among other performance improvements, Pass 8 provides a drastic increase in the effective area of the LAT instrument below 100 MeV. Together with a better modeling of the instrument's energy response function, Pass 8 gives us the opportunity to look with the LAT at the hardly known 10-100 MeV range. In this talk we will summarize the main technical improvements and show preliminary science results obtained below 100 MeV.

Collaboration:

FERMI

Registration number following "ICRC2015-I":

819

Parallel CR21 Future IN / 339**Cosmic Ray Energetics And Mass: from balloons to the ISS****Author:** Eun Suk Seo¹¹ University of Maryland (US)**Corresponding Author:** seo@umd.edu

The balloon-borne Cosmic Ray Energetics And Mass (CREAM) experiment was flown for ~161 days in six flights over Antarctica. Elemental spectra were measured for $Z = 1 - 26$ nuclei over a wide energy range from $\sim 10^{10}$ to $>10^{14}$ eV at an average altitude of ~ 38.5 km with ~ 3.9 g/cm² atmospheric

overburden. Building on the success of the balloon flights, the payload has been reconfigured for exposure on the International Space Station (ISS). The ISS-CREAM instrument is configured with the CREAM calorimeter for energy measurements and four finely segmented Silicon Charge Detector layers for precise charge measurements. In addition, the Top and Bottom Counting Detectors (TCD and BCD) and Boronated Scintillator Detector (BSD) have been newly developed. The TCD and BCD are scintillator based segmented detectors to separate electrons from nuclei using their shower profile differences, while the BSD distinguishes electrons from nuclei by detecting thermal neutrons that are dominant in nuclei induced showers. The ISS-CREAM payload is currently being integrated. After system level qualification tests including EMI/EMC, vibration, and thermal vacuum tests, the payload will be launched from NASA Kennedy Space Center on SpaceX to be installed on the ISS Japanese Experiment Module Exposed Facility. An order of magnitude increase in data collecting power is possible by utilizing the ISS to reach the highest energies practical with direct measurements. The project status, including results from on-going analysis of existing data, and future plans will be presented.

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

79

Parallel CR22 TH / 913

On the cosmic ray spectrum from type II Supernovae expanding in their red giant presupernova wind

Author: Martina Cardillo¹

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While from the energetic point of view supernova remnants are viable sources of Galactic cosmic rays (CRs), the issue of whether they can accelerate protons up to a few PeV remains unsolved. Here we discuss particle acceleration at the forward shock of supernovae, and discuss the possibility that the current of escaping particles may excite a non-resonant instability that in turn leads to the formation of resonant modes that confine particles close to the shock, thereby increasing the maximum energy. This mechanism is at work throughout the expansion of the supernova explosion, from the ejecta dominated (ED) phase to the Sedov-Taylor (ST) phase. The transition from one stage to the other reflects in a break in the spectrum of injected particles. Because of their higher explosion rate, we focus our work on type II SNe expanding in the slow, dense wind, produced by the red super-giant progenitor stars. When the explosion occurs in such winds, the transition between the ED and the ST phase is likely to take place within a few tens of years. The highest energies are reached at even earlier times, when, however, a small fraction of the mass of ejecta has been processed. As a result, the spectrum of accelerated particles shows a break in the slope, at an energy that is the maximum energy (EM) achieved at the beginning of the ST phase. Above this characteristic energy, the spectrum becomes steeper but remains a power law rather than developing an exponential cutoff. An exponential cut is eventually present at much higher energies but it does not have a phenomenological relevance. We show that for parameters typical of type II supernovae, EM for protons can easily reach values in the PeV range, confirming that type II SNRs are the best candidate sources for CRs at the knee.

From the point of view of implications of this scenario on the measured particle spectra, we have tried to fit KASCADE-Grande, ARGO -YBJ and YAC1-Tibet Array data with our model but we could not find any combination of the parameters that could explain all data sets. Indeed the recent measurement of the proton and helium spectra in the knee region, with the ARGO-YBJ and YAC1-Tibet Array, has made the situation very confused. These measurements suggest that the knee in the light component is at ~650 TeV, appreciably below the knee in the overall spectrum. On one hand this finding would resolve the problem of reaching very high energies in supernovae, but on the other it would open a critical issue in the transition region between Galactic and extragalactic CRs.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

777

Parallel SH 09 Modulation II / 865

The AD 775 cosmic ray event shown in Beryllium-10 data from Antarctic Dome Fuji ice core

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¹⁴C content in tree rings and ¹⁰Be concentration records in ice core provide information about past cosmic ray intensities. Some studies reported a large annual increase in the ¹⁴C content from AD 774 to 775. Also quasi-decadal ¹⁰Be data in the Dome Fuji ice core show a sharp peak in a corresponding period of the AD 775 event. However, annual ¹⁰Be variations in the Dome Fuji core or in other cores have not been revealed. We measured ¹⁰Be concentration in the Dome Fuji ice core with quasi-annual resolution for the period approximately from AD 763 to 794. We found a clear ¹⁰Be increase around AD 775 on a background variation. Since the quasi-annual ¹⁰Be and Na⁺ ion data show a good agreement in our measurement period, the background variation in ¹⁰Be concentration is considered as a climatic noise. It is possible that the quasi-annual ¹⁰Be increase is occurred by the AD 775 cosmic ray event.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

627

Parallel NU 06 / 1112

Search for sterile neutrinos with the IceCube Neutrino Observatory

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The IceCube Neutrino Observatory is a 1 km³ Cherenkov detector located at the geographic South Pole. It records several tens of thousands of identified atmospheric muon neutrino events per year and has proven to be suitable for the measurement of muon neutrino disappearance due to oscillations. Using similar methods, IceCube allows the search for additional sterile neutrino states with mass differences on the order of 1 eV.

If those sterile neutrino states exist and mix with muon neutrinos, IceCube can measure a deficit compared to the expected neutrino rate in the energy range around one TeV due to strong matter effects in the neutrino propagation through Earth. This survival probability depends on the energy and the path of the neutrino through the Earth and thus its zenith angle. The high statistics and resolutions in the relevant range of energies and baselines make IceCube an ideal tool for testing models of one or more sterile neutrinos.

This work will present the analysis method and results obtained from one year of data taken with the IceCube 59-string configuration.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

894

Parallel GA19 Fermi / 1224

Gamma-ray Flares from the Gravitationally Lensed Blazar B0218+357

Author: Sara Buson¹

Co-authors: C.C. Cheung²; J. Finke²; J. Scargle³; S. Larsson⁴

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The double-image gravitationally lensed blazar B0218+357 displayed several intervals of enhanced activity at gamma-rays. Fermi LAT observations focussed on the 2012 flaring interval led to the measurement at >100 MeV energies of a delay between the two lensed images of 11.46 ± 0.16 days. The delay is about 1 day longer than previously measured at radio wavelengths. Renewed flaring activity has been detected recently in 2014 when the source displayed an exceptionally hard spectrum, significantly different from the 2012 interval, and a different behaviour between the images. We present new Fermi LAT variability and spectral studies of the system and discuss them in the context of previous measurements.

Collaboration:

FERMI

Registration number following "ICRC2015-I/":

944

High-Light Talks / 1116

Recent Observations of Atmospheric Neutrinos with the IceCube Observatory

Author: Paolo Desiati¹¹ *University of Wisconsin - Madison***Corresponding Author:** desiati@wipac.wisc.edu

The IceCube Neutrino Observatory, designed to identify high energy neutrinos of astrophysical origin, efficiently collects the penetrating by-products of cosmic ray induced extensive air showers: the muons and neutrinos. IceCube, along with its densely instrumented in-fill array Deep-Core, has collected and identified approximately 450,000 neutrinos in the energy range from 10 GeV to over 100 TeV. Such event sample makes it possible to constrain the atmospheric neutrino flux at low energy and determine its properties at unprecedented high energies. Standard neutrino oscillations at 20-30 GeV are well known; besides, uncertainties from cosmic ray flux and mass composition, and from high energy hadronic interaction models are relatively small below 1 TeV neutrino energy. The large statistics observation of neutrino flux at high energy makes it possible to probe physics beyond the standard model, such as the existence of sterile neutrinos or the violation of Lorentz invariance. In addition it is essential in the understanding of the transition from atmospheric to astrophysical origin. In particular, heavy quark production in the atmosphere in the forward region, not directly probed by any existing collider experiment, is a key element in the assessment of the nature of the collected neutrinos. An overview of the recent results on atmospheric neutrinos obtained by IceCube will be presented in the context of its importance at high energy and of the possibility to probe global properties of hadronic interaction models.

Collaboration:

IceCube

Registration number following "ICRC2015-I/":

309

High-Light Talks / 866

Highlights from the High Altitude Water Cherenkov Observatory

Author: John Pretz¹¹ *Pennsylvania State University***Corresponding Author:** john.pretz@gmail.com

The High Altitude Water Cherenkov (HAWC) Gamma-Ray Observatory was completed this year at a 4100-meter site on the flank of the Sierra Negra volcano in Mexico. HAWC is a water Cherenkov ground array with the capability to distinguish 100 GeV - 100 TeV gamma rays from the hadronic

cosmic-ray background. HAWC is uniquely suited to study extremely high energy cosmic-ray sources, search for regions of extended gamma-ray emission, and to identify transient phenomena. HAWC will play a key role in triggering multi-wavelength and multi-messenger studies of active galaxies, gamma-ray bursts, supernova remnants and pulsar wind nebulae. Observation of TeV photons also provide unique tests for a number of fundamental physics phenomena including dark matter annihilation and primordial black hole evaporation. Operation began mid-2013 with the partially-completed detector. Multi-TeV emission from the Galactic Plane is clearly seen in the first year of operation, confirming a number of known TeV sources, and a number of AGN have been observed. This talk will discuss the science of HAWC, summarize the status of the experiment, and highlight first results from analysis of the data.

Collaboration:

HAWC

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748

High-Light Talks / 103

Assessment of F200 fluence for major solar energetic particle events on the multi-millennial time scale

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Solar energetic particle (SEP) fluxes are typically quantified in the F30 units (integrated fluence of particles with energy above 30 MeV) and their direct measurements are available only for the last several decades. On the other hand, a reconstruction of major SEP events in the distant past (centennia-millennia) is possible using data on the cosmogenic isotopes ¹⁴C and ¹⁰Be in stratified and independently datable terrestrial archives (tree trunks or polar ice cores). While such events (or at least candidates) can be identified in the cosmogenic records with a degree of confidence, the estimate of the F30 flux/fluence is ambiguous depending on the proposed SEP energy spectrum. Here we introduce a new index, the integral fluence of an SEP above 200 MeV, F200, which is related to the effective energy of the production of the cosmogenic isotopes by SEP in the Earth atmosphere. This index is robust against the assumptions on the exact shape of the energy spectrum of the event in a wide range of parameters. Using several records of cosmogenic isotopes, we present a reconstruction of the F200 fluence for major SEP events in the past, and also assess the occurrence probability density function for extreme events. In particular, we evaluate that extreme SPEs with $F200 > 10^{10} \text{ cm}^{-2}$ may occur no more frequently than once per 10 000 years or even rarer up to never.

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

113

Rapporteur Talks / 1388**Solar and heliospheric phenomena**

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Rapporteur talk

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

863

Rapporteur Talks / 1394**Cosmic rays: direct measurements**

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Rapporteur talk

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1078

Rapporteur Talks / 1393**Cosmic rays: air showers from low to high energies**

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Rapporteur talk

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

956

Rapporteur Talks / 1390

Neutrino Astronomy

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Rapporteur talk

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

421

Rapporteur Talks / 1396

Space-based gamma-ray astronomy

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rapporteur talk

Collaboration:

– not specified –

Registration number following "ICRC2015-I/":

1084

Rapporteur Talks / 1389

Ground-based gamma-ray astronomy

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Rapporteur talk

Collaboration:

– not specified –

Registration number following "ICRC2015-I":

1077

Rapporteur Talks / 1392

Dark matter phenomena

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Rapporteur talk

Collaboration:

– not specified –

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1119

Closing / 1405

Closing

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