TeV Particle Astrophysics 2016

Report of Contributions

Contribution ID: **0** Type: **Oral Contributions**

Vector-like fermion dark matter in light of di-photon excess at LHC

Friday, September 16, 2016 3:00 PM (20 minutes)

Recent data from CMS and ATLAS experiments at CERN LHC suggest a diphoton excess of invariant mass around 750 GeV. Apparently the width of the resonance is around 45 GeV. To explain this anomaly we introduce a singlet scalar and a dark sector comprising of a vector-like lepton doublet and a singlet which are odd under a Z_2 symmetry. As a result the dark matter emerges as an admixture of the neutral component of the doublet and the singlet leptons. The charge partner of the vector-like doublet lepton assists the additional scalar to decay to diphotons of invariant mass 750 GeV and thus explaining the excess observed at LHC. We show the relevant parameter space for correct relic density and direct detection of dark matter.

Summary

Primary author: Dr SAHU, Narendra (IIT HYderabad, India)

Presenter: Dr SAHU, Narendra (IIT HYderabad, India)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **1** Type: **Oral Contributions**

Towards a more precise prediction of the dark matter relic density

Thursday, September 15, 2016 2:00 PM (20 minutes)

Calculating the neutralino relic density is a strong possibility to identify favoured and disfavoured regions of the parameter space of a supersymmetric theory such as the MSSM. With the latest results of the Planck mission, the cosmological parameters including the dark matter abundance are determined to an unprecedented precision. In order to reduce the theoretical uncertainty in the prediction, and to keep up with the experimental improvements, we present a next-to-leading order calculation in QCD of the neutralino (co)annihilation cross-section.

We present recent results for selected annihilation and co-annihilation processes. We demonstrate that QCD corrections can have a significant impact on the cosmologically favoured parameter regions. They are thus of general interest for parameter studies and global fits.

Related recent references:

[1] J. Harz, B. Herrmann, M. Klasen, K. Kovařík and M. Meinecke, SUSY-QCD corrections to stop annihilation into electroweak final states including Coulomb enhancement effects, Phys. Rev. D 91: 034012 (2015), arXiv:1410.8063 [hep-ph]

[2] J. Harz, B. Herrmann, M. Klasen and K. Kovařík, Radiative corrections to neutralino-stop coannihilation revisited, Phys. Rev. D 91: 034028 (2015), arXiv:1409.2898 [hep-ph]

[3] B. Herrmann, M. Klasen, K. Kovařík, M. Meinecke and P. Steppeler, One-loop corrections to gaugino (co-)annihilation in the MSSM, Phys. Rev. D 89: 114012 (2014), arXiv:1404.2931 [hep-ph]

[4] J. Harz, B. Herrmann, M. Klasen, K. Kovařík and Q. Le Boulc'h, Neutralino-stop co-annihilation into electroweak gauge and Higgs bosons at one loop, Phys. Rev. D 87: 054031 (2013), arXiv:1212.5241 [hep-ph]

[5] J. Harz, B. Herrmann, M. Klasen, K. Kovařík, P. Steppeler, Theoretical uncertainty of the supersymmetric dark matter relic density from scheme and scale variations, arXiv:1602.08103 [hep-ph]

Summary

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[1] J. Harz, B. Herrmann, M. Klasen, K. Kovařík and M. Meinecke, SUSY-QCD corrections to stop annihilation into electroweak final states including Coulomb enhancement effects, Phys. Rev. D 91: 034012 (2015), arXiv:1410.8063 [hep-ph]

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[4] J. Harz, B. Herrmann, M. Klasen, K. Kovařík and Q. Le Boulc'h, Neutralino-stop co-annihilation into electroweak gauge and Higgs bosons at one loop, Phys. Rev. D 87: 054031 (2013), arXiv:1212.5241 [hep-ph]

[5] J. Harz, B. Herrmann, M. Klasen, K. Kovařík, P. Steppeler, Theoretical uncertainty of the supersymmetric dark matter relic density from scheme and scale variations, arXiv:1602.08103 [hep-ph]

Primary author: HERRMANN, Björn (LAPTh, CNRS / Université Savoie Mont Blanc)

Presenter: HERRMANN, Björn (LAPTh, CNRS / Université Savoie Mont Blanc)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **3** Type: **Oral Contributions**

Bayesian analysis of Cosmic Ray Propagation Parameters of Spatial Dependent Model: antiproton-to-proton ratio is consistent with Two-Halo-Model prediction.

Tuesday, September 13, 2016 3:00 PM (20 minutes)

I will present the results of the scan of the parameter space for cosmic ray (CR) injection and propagation of Two-Halo-Model (THM). A Bayesian analysis is performed with Markov Chain Monte Carlo algorithm (MCMC). In THM, the propagation halo is divided into two different regions along the z-axis: inner and outer, where CRs will suffer from different propagation effects. We use proton and other light-nuclei data (He, C, Be-10/Be-9, B/C) to determine the relevant parameters and their uncertainties. I will also present the predicted antimatter spectra from secondary production with their uncertainties concerning propagation and production cross sections. Comparisons with conventional model predictions and with new antiproton data from AMS-02 will be presented and discussed.

Summary

Primary author: FENG, Jie (Academia Sinica (TW))

Co-author: TOMASSETTI, Nicola (Centre National de la Recherche Scientifique (FR))

Presenter: FENG, Jie (Academia Sinica (TW))

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **4** Type: **Oral Contributions**

Direct dark matter detection and the neutrino floor

Tuesday, September 13, 2016 3:00 PM (20 minutes)

The search for WIMP dark matter by direct detection faces an encroaching background due to coherent neutrino nucleus scattering. In this talk I will review the various types of neutrino that are backgrounds to direct detection - Solar, supernovae and atmospheric neutrinos - and explain how their presence results in the theoretical limit known as the neutrino floor. The proximity of the neutrino floor to the sensitivity of existing and near future experiments is highly dependent on the uncertainty in the ingredient parameters of the expected signal. In particular, astrophysical uncertainties are crucial to understand when attempting to distinguish WIMPs and neutrinos. I will also outline a possible approach for circumventing the neutrino floor by utilising the unique directional signatures of the WIMP and Solar neutrino event rates.

Summary

Primary author: O'HARE, Ciaran (Nottingham)

Presenters: O'HARE, Ciaran (Nottingham); O'HARE, Ciaran (Nottingham)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **5** Type: **Oral Contributions**

The case for the 100 GeV bino-like Dark Matter particle

Friday, September 16, 2016 2:20 PM (20 minutes)

Observations with the Fermi Large Area Telescope indicate an excess in gamma rays originating from the center of our Galaxy. A possible explanation for this excess is the annihilation of Dark Matter (DM) particles. We have investigated the annihilation of neutralinos as DM candidates within the phenomenological Minimal Supersymmetric Standard Model (pMSSM) and found solutions that are not excluded by direct detection, indirect detection or collider experiments. These SUSY scenarios consist of a bino-like DM particle with a mass around 100 GeV, and a next-to-lightest SUSY particle with a mass around 125 GeV. The solutions are consistent with the most recent limits on the annihilation cross section derived from dwarf galaxies and can account for a possible weak excess signal observed in the direction of the dwarf galaxy Reticulum II.
In addition, two global fit studies performed in the pMSSM seem to suggest the same compressed SUSY spectra. These scenarios are however not probed by traditional (monojet or electroweak) SUSY searches in the LHC. With the aid of an extended search strategy for ATLAS and CMS we can exclude or discover these favored pMSSM spectra with the LHC14.

Summary

Primary author: Ms VAN BEEKVELD, Melissa Corona (IMAPP Radboud University (NL))

Presenter: Ms VAN BEEKVELD, Melissa Corona (IMAPP Radboud University (NL))

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **6** Type: **Oral Contributions**

Recent Results from the PandaX-II Dark Matter Experiments

Monday, September 12, 2016 4:30 PM (20 minutes)

The particle physics nature of the dark matter is one the top unknowns in physics. The Particle and Astrophysical Xenon (PandaX) project is a series of xenon-based experiments in the China Jin-Ping Underground Laboratory (CJPL). The first and second stage experiments (PandaX-I and II) both utilize dual-phase xenon time-projection chamber to carry out direct search for the dark matter particles. PandaX-II, a half-ton scale experiment, is currently under operation. In this talk, after a brief introduction, I shall focus on the recent progress on PandaX-II and present preliminary results from its latest physics run.

Summary

Primary author: Prof. LIU, Jianglai (Shanghai Jiao Tong University)

Presenter: Prof. LIU, Jianglai (Shanghai Jiao Tong University)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **7** Type: **Oral Contributions**

Particle dark matter signals in the anisotropic sky: a cross-correlations approach

Monday, September 12, 2016 5:30 PM (20 minutes)

Anisotropies in the electromagnetic emission produced by dark matter (DM) annihilation or decay in the extragalactic sky are a recent tool in the quest for a particle DM evidence.
In particular, the angular two-point cross-correlation signal between non-gravitational DM emissions and the gravitational manifestation of DM has been shown to be a promising novel technique to disentangle a WIMP DM contribution.
I will discuss recent results and future prospects involving gamma-rays from the Fermi-LAT telescope and gravitational tracers of DM distribution in the Universe, such as lensing and galaxy surveys.

Summary

Primary author: REGIS, Marco (INFN - National Institute for Nuclear Physics)

Presenter: REGIS, Marco (INFN - National Institute for Nuclear Physics)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **8** Type: **Poster Contributions**

Dark matter decays from non-minimal coupling to gravity

Wednesday, September 14, 2016 5:45 PM (15 minutes)

In the framework of the Standard Model extended with a dark matter particle in curved spacetime, we investigate the impact of terms in the Lagrangian linear in the dark matter field and proportional to the Ricci scalar on the dark matter stability. We show that this non-minimal coupling induces decay even if the dark matter particle only has gravitational interactions, and that the decay branching ratios into Standard Model particles only depend on the dark matter mass. We compute the dark matter decay widths in some simple scenarios and we set conservative limits on the non-minimal coupling parameter from experiments.

Summary

Primary author: CATA, Oscar

Presenter: CATA, Oscar

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **10** Type: **Oral Contributions**

Probing BSM physics at eLISA

Tuesday, September 13, 2016 2:40 PM (20 minutes)

Status of eLISA; Gravitational waves from first-order phase transitions; BSM physics with first-order phase transitions.

Summary

A first-order phase transition produces gravitational waves and such a transition only occurs if there is physics beyond the Standard Model (SM). In this sense gravitational wave experiments can be considered as detectors of new physics. In this talk we review the status of the eLISA experiment and we analyse its capabilities for probing first-order phase transitions. We demonstrate that in some cases eLISA is able to discover new physics arising at the electroweak scale or even much above. In particular, by considering an illustrative supersymmetric model with a first-order electroweak phase transition, we determine the detection potential of eLISA in parameter regions that are hard to probe at the LHC.

Primary author: NARDINI, Germano (DESY)

Presenter: NARDINI, Germano (DESY)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **11** Type: **Oral Contributions**

Electron and Positron Fluxes in Primary Cosmic Rays Measured with the Alpha Magnetic Spectrometer on the International Space Station

Monday, September 12, 2016 2:20 PM (20 minutes)

Precision measurements by the Alpha Magnetic Spectrometer on the International Space Station of the primary cosmic-ray electron flux in the range 0.5 to 700 GeV and the positron flux in the range 0.5 to 500 GeV are presented. The electron flux and the positron flux each require a description beyond a single power-law spectrum. Both the electron flux and the positron flux change their behavior at ~30 GeV but the fluxes are significantly different in their magnitude and energy dependence. Between 20 and 200 GeV the positron spectral index is significantly harder than the electron spectral index. The results show, for the first time, that neither e+ nor e- can be described by a single power law above 27.2 and 52.3 GeV, respectively. The determination of the differing behavior of the spectral indices versus energy is a new observation and provides important information on the origins of cosmic-ray electrons and positrons.
The dependence of the electron and positron fluxes on time will also be discussed.

Summary

Primary author: ZIMMERMANN, Nikolas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Presenter: ZIMMERMANN, Nikolas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **12** Type: **Oral Contributions**

Realistic simplified dark matter models

Thursday, September 15, 2016 2:40 PM (20 minutes)

We show that simplified models used to describe the interactions of dark matter with Standard Model particles do not in general respect gauge invariance and that perturbative unitarity may be violated in large regions of the parameter space. The modifications necessary to cure these inconsistencies may imply a much richer phenomenology and lead to stringent constraints on the model. We illustrate these observations by considering the simplified model of a fermionic dark matter particle and a vector mediator. The resulting constraints are typically stronger than the 'classic' constraints on DM simplified models such as monojet searches and make it difficult to avoid thermal overproduction of dark matter.

Summary

We show that simplified models used to describe the interactions of dark matter with Standard Model particles do not in general respect gauge invariance and that perturbative unitarity may be violated in large regions of the parameter space.

Primary author: VOGL, Stefan (Karlsruhe Institute of Technology)

Presenter: VOGL, Stefan (Karlsruhe Institute of Technology)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **13** Type: **Oral Contributions**

T12A – a minimal model for dark matter and neutrino masses

The model T12A addresses two major questions of modern particle physics: by adding fermionic and bosonic singlets and doublets to the Standard Model particle content, this model allows to radiatively generate neutrino masses, while at the same time it includes viable candidates for the cold dark matter in our Universe.
We present the first extensive study of the parameter space of this model performing the calculation of the particle masses at the one-loop level and including one-loop renormalization group equations.
We impose theoretical constraints such as perturbativity, vacuum stability, and unitarity. Moreover, we evaluate the scale up to which the model can be extrapolated with respect to these requirements.
We than impose experimental constraints such as the observed neutrino mass differences and the Higgs boson mass. A special focus of our study is on lepton-flavour violating decays.
Finally, we impose constraints related to the dark matter relic density as well as direct and indirect detection. I will present the main results of this parameter space analysis, and discuss possible implications for LHC searches.

Summary

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Finally, we impose constraints related to the dark matter relic density as well as direct and indirect detection. I will present the main results of this parameter space analysis, and discuss possible implications for LHC searches.

Primary author: Dr HERRMANN, Bjorn (Unite Reseaux du CNRS (FR))

Presenter: Dr HERRMANN, Bjorn (Unite Reseaux du CNRS (FR))

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **14** Type: **Oral Contributions**

Orphan gamma-ray flares from relativistic blobs comptonizing radiation of luminous stars in jets of AGNs

Monday, September 12, 2016 6:00 PM (15 minutes)

Massive black holes in active galaxies are surrounded by bulges of both evolved late type and also young luminous stars in nuclear stellar clusters. The luminous stars can enter a jet region which contain fast moving blobs filled with relativistic electrons. We calculate
the gamma-ray spectra and light curves produced by these electrons in the Inverse Compton electron-positron pair cascade process. Such scenario can explain the appearance of the orphan gamma-ray flares in blazars. As an example, we model the GeV and TeV gamma-ray emission from the nearby BL Lac type AGNs (1ES 1959+650 or Mrk 421) and from a distant
FSRQ PKS 1222+21.

Summary

We consider the mechanism for orphan gamma-ray flares in blazars in which blobs containing relativistic electrons in the jet encounter luminous stars. Gamma-rays are produced in the inverse Compton electron-positron pair cascade initiated by electrons in the soft radiation of the star. As an example, we discuss application of such scenario to specific objects.

Primary author: BEDNAREK, Wlodek (University of Lodz)

Co-author: Dr SITAREK, Julian (University of Lodz, Lodz,Poland)

Presenter: BEDNAREK, Wlodek (University of Lodz)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **15** Type: **Oral Contributions**

Probing the nature of the electroweak phase transition/baryogenesis from the particle colliders to the gravitational wave detectors

Tuesday, September 13, 2016 3:20 PM (20 minutes)

We report on the first joint analysis of observational signatures from the electroweak baryogenesis in both gravitational wave (GW) detectors and particle colliders to explore the nature of the electroweak phase transtion. Working with both the effective field theory and concrete models ,we show that a modified Higgs potential can keep the observed 125 GeV Higgs mass and produce a strong first order phase transition (SFOPT) for the electroweak baryogenesis and interestingly predict new phenomena in the Higgs sector, which can be tested at colliders such as the Large Hadron Collider (LHC) and the planning Circular Electron Positron Collider (CEPC). We point out this SFOPT can also lead to detectable signals for the GW interferometers , such as eLISA. Our present study on the electroweak phase transition/baryogenesis bridges the particle physics at colliders with the astrophysics and cosmology in the early universe.

Summary

Primary author: HUANG, Fa Peng (IHEP)

Presenter: HUANG, Fa Peng (IHEP)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **16** Type: **Oral Contributions**

Antiproton Flux and Antiproton-to-Proton Flux Ration Measured by with the Alpha Magnetic Spectrometer on the International Space Station

Monday, September 12, 2016 2:40 PM (20 minutes)

A precision measurement by AMS of the antiproton flux and
the antiproton-to-proton flux ratio in primary cosmic rays in the
absolute rigidity range from 1 to 450 GV is presented based on 3.49×10^5 antiproton events and
2.42×10^9 proton events. The
antiproton-to-proton flux ratio reaches a maximum at ~20 GV and is
rigidity independent above 60.3 GV.

Summary

Primary author: BACHLECHNER, Andreas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Presenter: BACHLECHNER, Andreas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **17** Type: **Oral Contributions**

MAGIC observations of very-high-energy gamma-ray flare from PKS1510-089 in May 2015.

Monday, September 12, 2016 5:45 PM (15 minutes)

PKS1510-089 is a flat spectrum radio quasar with a redshift of 0.36 and is one of the few such sources detected in very-high-energy (VHE, >100 GeV) gamma rays. PKS1510-089 is highly variable at GeV energies, but until recently no variability in the VHE range has been observed.
In 2015 May PKS1510-089 showed a high state in optical and in the GeV range. MAGIC observations performed at that time detected a VHE gamma-ray flare, showing the first example of VHE gamma-ray flux variability in this source. We will present the MAGIC results from this observation and discuss their temporal and spectral properties in the multi-wavelength context.
MAGIC is a system of two 17 m diameter Imaging Atmospheric Cherenkov telescopes located in La Palma, Spain. It allows observations of gamma-rays with energies from 50 GeV.

Summary

We will present results of PKS1510-089 observations during a flare in May 2015, the first example of VHE gamma-ray flux variability in this source.

Primary author: SITAREK, Julian (University of Łódź)

Presenter: SITAREK, Julian (University of Łódź)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **18** Type: **Oral Contributions**

DARWIN: Towards the Ultimate Dark Matter Detector

Friday, September 16, 2016 3:30 PM (20 minutes)

In this talk I will present the concept of the DARWIN detector, discuss its physics reach in various channels, the main sources of backgrounds, as well as the ongoing detector design and R&D efforts.

Summary

DARk matter WImp search with liquid xenoN (DARWIN) will be a multi-ton, dual-phase time-projection chamber with a low-energy threshold and ultra-low background level for direct dark matter detection and neutrino physics.

Its primary goal is to explore the entire experimentally accessible parameter space for Weakly Interacting Massive Particles (WIMPs) in a wide mass-range from 5 GeV to 100 TeV.

In addition, it will be sensitive to other rare events, and will allow searches for solar axions and galactic axion-like particles, for the neutrinoless double-beta decay of Xe-136, and for coherent neutrino-nucleus interactions. It will be able to measure the low-energy solar neutrino flux through elastic scattering off electrons with <1% precision, thus constraining solar models.

Primary author: Dr KISH, Alexander (University of Zurich)

Presenter: Dr KISH, Alexander (University of Zurich)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **19** Type: **Oral Contributions**

Mass bound variables to confront dark matter production at the LHC

Monday, September 12, 2016 3:20 PM (20 minutes)

After the monumental discovery of the Higgs boson, the LHC presently confronts the major challenge in searching for new physics. Any such observation necessitates the determination of mass and other quantum numbers like spin, polarization etc for the new resonance. Most of the BSM theories motivated from profound experimental indication of dark matter (DM), trying to accommodate them as some stable BSM particle within their framework. In a wide class of such scenario, any production of heavy resonance particles eventually decay semi-invisibly resulting at least two massive stable undetectable particles in the final state. Reconstruction of these events at a hadron collider or the mass determination of these new particles are challenging. Here we discuss two interesting mass-constraining variables, M_{2Cons} and $\sqrt{\hat{s}}$, which possesses an array of rich features having the ability to use on-shell mass constraints inclusively. We argue the consequence of applying the additional resonance mass-shell constraint in the context of a semi-invisible antler decay topology produced at the LHC. Our proposed variable, under additional constraint, develops a new kink solution at the true masses. This enables one to determine the invisible (DM) particle mass simultaneously with the parent particle mass from these events. We also demonstrate the ability of these constrained variables to reconstruct the semi-invisible events with the momenta of invisible particles and thus improving the measurements to reveal the properties of new physics.

Summary

Primary author: SWAIN, Abhaya Kumar (Physical Research Laboratory)

Presenter: SWAIN, Abhaya Kumar (Physical Research Laboratory)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **20** Type: **Oral Contributions**

Gamma-ray Observations of Galaxy Clusters: Current Constrains and Future Prospects

Tuesday, September 13, 2016 5:00 PM (30 minutes)

Despite several gamma-ray observational campaigns of clusters of galaxies in the last years, both by Fermi-LAT and Cherenkov telescopes, the diffuse high-energy emission that is expected to come from cosmic-ray hadronic interactions with the abundant ambient gas remains elusive. Nevertheless, we significantly improved our understanding of non-thermal phenomena in clusters. I will summarize the most important results obtained so far in this field and their impact on clusters' cosmic-ray physics and magnetic fields, with particular emphasis on the cases of Coma and Perseus. Finally, I will discuss prospects for the future, particularly for the Cherenkov Telescope Array.

Summary

Primary author: ZANDANEL, Fabio (University of Amsterdam)

Presenter: ZANDANEL, Fabio (University of Amsterdam)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **21** Type: **Oral Contributions**

Originating the hot Big Bang from the Standard Model Higgs

Tuesday, September 13, 2016 2:00 PM (20 minutes)

Under general circumstances, the Standard Model Higgs is excited in the form of a condensate during or towards the end of inflation. The Higgs condensate is then forced to decay afterwards — due to non-perturbative effects — into the rest of the SM species. I will present the cosmological implications of this primordial decay, quantifying the necessary conditions to achieve a successful mechanism for 'reheating' the Universe into the SM. If there is enough time, I will also discuss the implications for primordial gravitational waves.

Summary

Primary author: FIGUEROA, Daniel G. (CERN)

Presenter: FIGUEROA, Daniel G. (CERN)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **22** Type: **Oral Contributions**

Global analysis of cosmic-ray propagation in the light of AMS-02 and the impact on indirect detection of dark matter

Monday, September 12, 2016 3:00 PM (20 minutes)

Astroparticle physics of Galactic cosmic rays (CR) has entered a new level of precision with the measurements of AMS-02. On the other hand, uncertainties in CR production in the sources and in their propagation are still large. We thus perform a global analysis of injection and propagation parameters testing how the current diffusion models perform in the light of the new precise data. Using tools like Galprop and MultiNest we derive constraints in the CR parameter space using only the three elements protons, helium and antiprotons. We then compare the results with the ones derived using preliminary AMS-02 measurements of lithium and the boron-to-carbon ratio. Finally, we use the results of this scan to derive new limits on dark matter annihilation from the AMS-02 anti-proton measurements marginalizing over the propagation uncertainties.

Summary

Primary author: KORSMEIER, Michael (RWTH Aachen University)

Co-author: CUOCO, Alessandro (U)

Presenter: KORSMEIER, Michael (RWTH Aachen University)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **23** Type: **Poster Contributions**

Dark Matter Detection with Laser Interferometers

Wednesday, September 14, 2016 5:45 PM (15 minutes)

A worldwide network of kilometer-scale laser interferometers will come into operation during the next several years. Future terrestrial and space-based detectors have also been planned. We investigate the use of gravitational-wave observatories as detectors of dark matter in the process of direct interaction of DM objects with detectors. We will present the prospects for a detection based on gravitational interaction and on possible additional interactions – modeled as a Yukawa potential – between dark matter and the particles of the standard model. We will also briefly discuss the possibility of a domain wall (DW) detection, albeit the equation of state for a DW network is not appropriate as a DM candidate.

Summary

Primary author: FROLOV, Valera (LIGO lab)

Presenter: FROLOV, Valera (LIGO lab)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (direct detection)

Contribution ID: **24** Type: **Oral Contributions**

Radiative Type III Seesaw Model and its collider phenomenology

Tuesday, September 13, 2016 5:10 PM (20 minutes)

We analyze the present bounds of a scotogenic model, the Radiative Type III Seesaw (RSIII), in which an additional scalar doublet and at least two fermion triplets of $SU(2)_L$ are added to the Standard Model (SM). In the RSIII the new physics (NP) sector is odd under an exact global Z_2 symmetry. This symmetry guaranties that the lightest NP neutral particle is stable, providing a natural dark matter (DM) candidate, and leads to naturally suppressed neutrino masses generated by a one-loop realization of an effective Weinberg operator. We focus on the region with the highest sensitivity in present and future LHC searches, with light scalar DM and at least one NP fermion triplet at the sub-TeV scale. This region allows for significant production cross-sections of NP fermion pairs at the LHC. We reinterpret a set of searches for supersymmetric particles at the LHC obtained using the package CheckMATE, to set limits on our model as a function of the masses of the NP particles and their Yukawa interactions. The most sensitive search channel is found to be dileptons plus missing transverse energy. In order to target the case of tau enhanced decays and the case of compressed spectra we reinterpret the recent slepton and chargino search bounds by ATLAS. For a lightest NP fermion triplet with a maximal branching ratio to either electrons or muons we exclude NP fermion masses of up to 650 GeV, while this bound is reduced to approximately 400 GeV in the tau-philic case. Allowing for a general flavor structure we set limits on the Yukawa couplings, which are directly related to the neutrino flavor structure.

Summary

Primary author: Prof. RESTREPO, Diego (Universidad de Antioquia)

Presenter: Prof. RESTREPO, Diego (Universidad de Antioquia)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **25** Type: **Oral Contributions**

Searches for Axionlike Particles with the Fermi Large Area Telescope

Thursday, September 15, 2016 6:10 PM (20 minutes)

Axionlike particles (ALPs) are dark-matter candidates that occur in a variety of extensions of the Standard Model. Signatures of these particles could be detected at gamma-ray energies with the Fermi Large Area Telescope (LAT) due to the coupling of ALPs to photons in external electromagnetic fields. To date, Fermi-LAT observations provide the strongest constraints on the photon-ALP coupling for ALP masses between 0.5 and 20 neV.
Here, we summarize these constraints and present the sensitivity to detect an ALP induced gamma-ray burst from a Galactic core-collapse supernova. ALPs would be produced in the stellar medium via the Primakoff effect and convert into gamma rays in the Galactic magnetic field. Fermi LAT observations would be able to probe couplings where ALPs could constitute the entire dark matter. Below 1 neV, the Fermi-LAT sensitivity would surpass that of future laboratory experiments by one order of magnitude.

Summary

Primary author: MEYER, Manuel (Stockholm University)

Presenter: MEYER, Manuel (Stockholm University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **26** Type: **Oral Contributions**

Dark Gamma Ray Bursts

Friday, September 16, 2016 3:40 PM (20 minutes)

It is well known that a star can capture dark matter (DM) particles, which condense close to its center and eventually annihilate. In this work, we trace capture, evaporation and annihilation rates throughout the life of a massive star and show that it culminates in an intense annihilation burst coincident with the death of the star in a core collapse supernova. The reason is that, along with the stellar interior, also its DM core heats up and contracts, so that the DM density increases rapidly during the final stages of stellar evolution. We argue that, somewhat counter-intuitively, the annihilation burst is more intense if DM annihilation is a p-wave process than for s-wave annihilation. If among the DM annihilation products are particles like dark photons that can escape the exploding star and decay to Standard Model particles later, the annihilation burst results in a flash of gamma rays accompanying the supernova. For a galactic supernova, this "dark gamma ray burst" may be observable in Fermi-LAT, H.E.S.S. or CTA.

Summary

Primary authors: LIU, Jia (Johannes Gutenberg University Mainz); KOPP, Joachim (Johannes-Gutenberg-Universitaet Mainz (DE))

Presenter: LIU, Jia (Johannes Gutenberg University Mainz)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **27** Type: **Oral Contributions**

Dark Photons at LHCb

Tuesday, September 13, 2016 4:50 PM (20 minutes)

Dark photons appear in many well-motivated dark matter scenarios, which leads to a worldwide effort to search for them. In this talk, I will present two novel search methods for dark photons at the LHCb experiment. One is an exclusive search in charm meson decay, and the other is a fully data-driven inclusive search based on di-muon resonances. These searches advance particle physics by showing how LHCb can have sensitivity to large regions of unexplored dark-photon parameter space.

Summary

Primary author: XUE, Wei (MIT)

Presenter: XUE, Wei (MIT)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **28** Type: **Poster Contributions**

Searching for new physics in the flavor composition of high-energy astrophysical neutrinos

Wednesday, September 14, 2016 5:45 PM (15 minutes)

High-energy astrophysical neutrinos are a novel arena to test for the presence of new neutrino physics. With them, we can look for new physics at scales of tens of TeV to a few PeV, far beyond the reach of laboratory experiments. Even tiny modifications from new physics might accumulate over the presumed cosmological-scale baselines and become detectable. New physics models include, for instance, enhanced neutrino-neutrino interactions, violation of fundamental symmetries, active-sterile neutrino mixing, and neutrino decay. For the latter, we use current flavor composition results from IceCube to improve the limits on neutrino lifetimes. To tap into the full potential of flavor composition measurements, we propose a technique to distinguish between particle showers initiated by electron-neutrinos and tau-neutrinos on a statistical basis. Together with higher statistics and detector upgrades, it will bolster the prospects of finding new physics and of identifying the neutrino sources.

Summary

Primary author: BUSTAMANTE, Mauricio (Ohio State University)

Presenter: BUSTAMANTE, Mauricio (Ohio State University)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **29** Type: **Oral Contributions**

Priorless derivation of the dark matter density profile in Dwarf Spheroidal Galaxies of the Milky Way

Monday, September 12, 2016 4:50 PM (20 minutes)

We use the Maximum Likelihood technique to derive the density profile parameters of the the dark matter halos containing the Dwarf Spheroidal Galaxies of the Milky Way. This is done using the Jeans equation formalism on the the stellar kinematic data available for such systems. The method is validated on simulated data generated by the Gaia Challenge team.

Summary

Primary authors: Mr CHIAPPO, Andrea (Oskar Klein Center, Department of Physics, Stockholm University); Prof. CONRAD, Jan (Oskar Klein Center, Department of Physics, Stockholm University); COHEN-TANUGI, Johann (Université de Montpellier, CNRS/IN2P3)

Presenter: Mr CHIAPPO, Andrea (Oskar Klein Center, Department of Physics, Stockholm University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **30** Type: **Oral Contributions**

Indirect searches of dark matter via polynomial spectral features

Monday, September 12, 2016 5:50 PM (20 minutes)

I will discuss a model-independent approach to calculate the spectra arising from dark matter annihilations or decays into intermediary particles with arbitrary spin, which subsequently produce neutrinos or photons via two-body decays. I illustrate this with two examples. First, with the neutrino spectra arising from dark matter annihilations into the massive Standard Model gauge bosons. Second, with the gamma-ray and neutrino spectra generated by dark matter annihilations into hypothetical massive spin-2
particles. Then, I will apply these concepts to the 750 GeV diphoton
excess observed at the LHC if interpreted as a spin-0 or spin-2 particle
coupled to dark matter. I also show limits on the dark matter annihilation
cross section into this resonance from the non-observation of the associated
gamma-ray spectral features by the H.E.S.S. telescope.

Summary

Primary author: Dr GARCIA-CELY, Camilo (ULB)

Co-author: Dr HEECK, Julian (ULB)

Presenter: Dr GARCIA-CELY, Camilo (ULB)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **31** Type: **Oral Contributions**

Multi-messenger light curves from gamma-ray bursts

Tuesday, September 13, 2016 5:30 PM (20 minutes)

Gamma-ray bursts (GRBs) are potential sources of high-energy (> 100 TeV) neutrinos and ultra-high-energy (> 10^9 GeV) cosmic rays (UHECRs). Recent neutrino searches have constrained the connection between them in the one-zone version of the internal shock model. It calculates the prompt particle emission from a single representative collision of plasma shells in the GRB jet, assuming that the jet parameters inferred from gamma-rays observations are representative for neutrino and cosmic-ray emission. Yet, in the internal shock model, the prompt emission must originate from multiple collision zones. Efficient energy dissipation implies a spread in the position of the collisions. We produce light curves of gamma rays in different wavelength bands and of neutrinos, from the properties of the central GRB engine. We predict a minimal neutrino flux which, contrary to conventional estimates, hardly depends on parameters such as baryonic loading — the proportion of energy in baryons — and average Lorentz boost of the jet. We also find interesting relationships between delays in high-energy gamma-ray bands observable by Fermi and CTA, neutrino emission efficiency, and shape features of the gamma-ray light curves which can be traced back to the properties of the central engine.

Summary

Primary author: BUSTAMANTE, Mauricio (Ohio State University)

Presenter: BUSTAMANTE, Mauricio (Ohio State University)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **32** Type: **Oral Contributions**

Foreground effect on the J-factor estimation of the dwarf spheroidal galaxies

Monday, September 12, 2016 4:30 PM (20 minutes)

One of the most promising way to detect dark matter is to look for its annihilation or decay products among cosmic-rays. Especially, it is found that quite strong constraints can be imposed by the gamma-ray measurements of dwarf spheroidal galaxies. However, recent studies reveal that these constraints are largely affected by the uncertainty of the dark matter halo density. In this talk, we will discuss robustness of the dark matter halo estimation especially focusing on the effect of the contamination of foreground stars. We show this effect by constructing realistic mock data, which gives a prospect of the future kinematical survey of the dwarf member stars. In our study, we also test the dark matter profile estimation and introduce a new likelihood to eliminate the effect of the foreground contamination.

Summary

Primary author: ICHIKAWA, Koji (Kavli IPMU)

Co-author: Prof. MATSUMOTO, Shigeki (Kavli IPMU)

Presenter: ICHIKAWA, Koji (Kavli IPMU)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **33** Type: **Poster Contributions**

Indirect dark matter detection from non-spherical dark halo in the Galactic dwarf spheroidals

Wednesday, September 14, 2016 5:45 PM (15 minutes)

We estimate the annihilation (J) factors of non-spherical dark halos in the Galactic dwarf spheroidal (dSph) galaxies.
This is motivated by the fact that most of such estimations have so far treated the dSphs and their dark halos as spherical systems for simplicity, even though the luminous parts of dSphs as well as the shapes of dark halos predicted by cold dark matter simulations are not actually spherical but flattened.
Therefore, we address non-spherical mass models for dSphs rather than spherical mass models to obtain more reliable and realistic limits on J-factor values.
Using generalized axisymmetric Jeans modeling, we apply these to most recent kinematic data for 17 ultra faint dwarfs as well as 7 classicals and evaluate their astrophysical factors for dark matter annihilation.
From our analysis, we have three main results.

1. Our axisymmetric mass models are so much better fit than spherical ones, thus our work should be the more reliable estimator for astrophysical factors than spherical works.
2. Among analyzed dSphs, Triangulum 2 ultra faint dwarf galaxy is the most promising target in spite of large uncertainties.
3. The estimations of astrophysical factor are affected by non-sphericity of luminous and dark components as well as other systematic uncertainties such as sample size, the prior range and edge of dark halo.

Summary

Primary author: ICHIKAWA, Koji (Kavli-IPMU)

Co-authors: Dr ISHIGAKI, Miho (Kavli IPMU); Dr MATSUMOTO, Shigeki (Kavli IPMU)

Presenter: ICHIKAWA, Koji (Kavli-IPMU)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **34** Type: **Oral Contributions**

Atmospheric Neutrino Oscillations for Earth Tomography

Thursday, September 15, 2016 2:20 PM (20 minutes)

Modern proposed atmospheric neutrino oscillation experiments, such as PINGU in the Antarctic ice or ORCA in Mediterranean sea water, aim for precision measurements of the oscillation parameters including the ordering of the neutrino masses. They can, however, go far beyond that: Since neutrino oscillations are affected by the coherent forward scattering with matter, neutrinos can provide a new view on the interior of the earth. We show that the proposed atmospheric oscillation experiments can measure the lower mantle density of the earth with a precision at the level of a few percent, including the uncertainties of the oscillation parameters and correlations among different density layers. While the earth's core is, in principle, accessible by the angular resolution, new technology would be required to extract degeneracy-free information.

Summary

Primary author: WINTER, Walter (DESY)

Presenter: WINTER, Walter (DESY)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **35** Type: **Oral Contributions**

Searches for point sources in the Galactic Center region

Thursday, September 15, 2016 3:00 PM (20 minutes)

Several groups have demonstrated the existence of an excess in the gamma-ray emission around the Galactic Center (GC) with respect to the predictions from a variety of Galactic Interstellar Emission Models (GIEMs) and point source catalogs. The origin of this excess, peaked at a few GeV, is still under debate. A possible interpretation is that it comes from a population of unresolved Millisecond Pulsars (MSPs) in the Galactic bulge. We investigate the detection of point sources in the GC region using new tools which the Fermi-LAT Collaboration is developing in the context of searches for Dark Matter (DM) signals.
These new tools perform very fast scans iteratively testing for additional point sources at each of the pixels of the region of interest. We show also how to discriminate between point sources and structural residuals from the GIEM.
We apply these methods to the GC region considering different GIEMs and testing the DM and MSPs intepretations for the GC excess. Additionally, we create a ranked list of MSP candidate targets by probability to detect them at other wavelengths.

Summary

Primary author: DI MAURO, mattia (Stanford University)

Co-authors: CHARLES, Eric (SLAC National Accelerator Laboratory (US)); WOOD, Matthew

Presenter: DI MAURO, mattia (Stanford University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **36** Type: **Oral Contributions**

Constraining Dark Matter Explanations of the Icecube Neutrino Flux with Fermi-LAT

Tuesday, September 13, 2016 6:10 PM (20 minutes)

Difficulties in explaining the origin of the high energy neutrinos observed by Icecube using traditional astroparticle physics have motivated ideas this flux could in part be due to the decay of PeV scale dark matter. In such scenarios, the decay is necessarily associated with the production of gamma rays at much lower energies that can be observed by Fermi-LAT. This is true even for decays directly to neutrinos due to electroweak corrections. This fact can be exploited to set limits on PeV scale dark matter, which I will present in this talk, using 356 weeks of Fermi data. In particular, I will show that certain scenarios may already be in tension with Fermi, giving an important insight into what models can viably contribute to the Icecube data.

Summary

Primary author: RODD, Nicholas (Massachusetts Institute of Technology)

Presenter: RODD, Nicholas (Massachusetts Institute of Technology)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **37** Type: **Oral Contributions**

Observations and models of gamma-ray emission toward the Galactic Center the case of the Fermi GeV excess

Thursday, September 15, 2016 2:00 PM (20 minutes)

I will present recent results on the Galactic Center from the Fermi-LAT Collaboration using 6.5 years of LAT Pass 8 data, and comparisons with previous works. My talk will focus on our new analysis of the Galactic Center that includes the Fermi Bubbles in some detail; in particular I will show the effect on the previously reported Galactic excess from low-latitude emission from the Fermi Bubbles. As time permits I will explore other possible gamma ray sources. Implications for a dark matter model interpretation will be discussed along with other possible more conventional models.

Summary

The region toward the Galactic center emits gamma rays due to interactions of cosmic rays with interstellar gas and stellar radiation in the Milky Way, and numerous energetic objects along the line of sight. Based on the analysis of observations from the Large Area Telescope (LAT) on board the Fermi Gamma-ray Space Telescope, several groups have reported the detection of extended residual emission peaking at a few GeV toward the Galactic center in excess of conventional models for interstellar emission and known individual sources. For some time, this excess was claimed to be consistent with models of dark-matter annihilation. More recently alternative models such as a population of unresolved sources, e.g. millisecond pulsars, or systematic effects from imperfect modeling of interstellar emission have been proposed that can also explain this excess. We present an assessment of the uncertainties on the morphology and spectrum of the excess related to modeling the various components of gamma-ray emission in that region, using 6.5 years of LAT Pass 8 data. In particular we consider uncertainties in the distribution of interstellar gas along the line of sight, in the low-latitude emission from the Fermi bubbles, and in the abundance of cosmic-ray sources in the innermost Galaxy. The excess persists in all the models considered, though the spectrum varies significantly. We consider implications of the findings for potential interpretations of the excess.

Primary author: Prof. BLOOM, Elliott (KIPAC-SLAC, Stanford University)

Co-author: Dr MALYSHEV, Dmitry (Erlangen University, Germany)

Presenter: Prof. BLOOM, Elliott (KIPAC-SLAC, Stanford University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **38** Type: **Oral Contributions**

Momentum-dependent dark matter couplings and monojets

Friday, September 16, 2016 3:40 PM (20 minutes)

Momentum-dependent couplings between dark matter and the visible sector can appear in models where dark matter is a pseudo-Nambu-Goldstone boson, a scalar field associated with the spontaneous breaking of a global symmetry at a given energy scale. From a low-energy perspective, these couplings appear as non-renormalizable operators involving derivatives at the effective Lagrangian level. The momentum dependence results in interesting differences in the jet transverse momentum distribution with respect to conventional models commonly used to interpret monojet searches for dark matter at the Large Hadron Collider. I will discuss the monojet constraints on a simple model involving derivative couplings and compare these to those obtained when dark matter is assumed to couple to the visible sector in a more conventional manner. I will also briefly comment on the perspectives of distinguishing the two scenarios in future LHC searches.

Summary

Primary author: Dr ANDREAS, GOUDELIS (HEPHY - Vienna)

Presenter: Dr ANDREAS, GOUDELIS (HEPHY - Vienna)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **39** Type: **Oral Contributions**

Indirect dark matter search using neutrino data recorded by Super-Kamiokande

Thursday, September 15, 2016 4:30 PM (20 minutes)

Super-Kamiokande (SK), a large water Cherenkov detector located
underground at the Kamioka Observatory in Japan,
can search for weakly interacting massive particles (WIMPs)
by detecting WIMP-induced neutrinos from the Sun and the Milky Way.

An excess of neutrinos from the Sun and Milky Way direction were
searched for compared to the expected atmospheric neutrino background.

For the WIMP search from the Sun, data set of 3902.7 live-time days for fully-contained
(FC) and partially-contained (PC) events and 4206.7 live-time days for upward-going
muon (UPMU) events (collected from 1996 to 2012) were used.
For the WIMP search from the Milky Way, additional data set collected in 2013 and
2014, which in total corresponds to 4223.3 live-time days for FC/PC and
4527.0 live-time days for UPMU events were used.
In these analyses, not only UPMU events but also FC/PC events
with interaction vertices in the detector were used to increase
the signal acceptances.

We found no significant excess over expected atmospheric-neutrino background
and the result is interpreted in terms of upper limits on WIMP-nucleon
elastic scattering or WIMP self-annihilation cross sections.

Summary

Super-Kamiokande (SK), a large water Cherenkov detector located
underground at the Kamioka Observatory in Japan,
can search for weakly interacting massive particles (WIMPs)
by detecting WIMP-induced neutrinos from the Sun and the Milky Way.

An excess of neutrinos from the Sun and Milky Way direction were
searched for compared to the expected atmospheric neutrino background.
We found no significant excess over expected atmospheric-neutrino background
and the result is interpreted in terms of upper limits on WIMP-nucleon
elastic scattering or WIMP self-annihilation cross sections.

In this talk, I will present the result of the indirect WIMP search using
neutrino data recorded by SK.

Primary author: TAKEDA, Atsushi (University of Tokyo)

Presenter: TAKEDA, Atsushi (University of Tokyo)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **40** Type: **Poster Contributions**

The impact of axisymmetric halos on the upper limits on the dark matter annihilation cross section in dSphs

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Dwarf spheroidals (dSphs) are low-luminosity satellite galaxies of the Milky Way highly dominated by dark matter. Therefore, they are prime targets to search for signals from dark matter annihilation using gamma-ray observations. Recent stellar kinematical data show that the dark matter density profiles are better described by axisymmetric profiles than by the traditionally used spherically symmetric NFW profile. We performed an analysis of 7 classical dSphs, using PASS8 data of Fermi-LAT, adopting both the NFW profile and observationally motivated axisymmetric density profiles, and derived upper limits on the dark matter annihilation cross section. I will discuss the results for the different dSphs and show that the impact of axisymmetric profiles is very important. In some cases, the upper limits differ by a factor of 2-6.

Summary

Primary author: KLOP, Niki (GRAPPA, University of Amsterdam)

Co-authors: ZANDANEL, Fabio (University of Amsterdam); ANDO, Shin'ichiro (University of Amsterdam)

Presenter: KLOP, Niki (GRAPPA, University of Amsterdam)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **41** Type: **Oral Contributions**

Leading the search for light WIMPs: CDMSlite and SuperCDMS SNOLAB

Friday, September 16, 2016 2:50 PM (20 minutes)

The particle nature of dark matter is being investigated vigorously by searches for its production, annihilation, decay, and scattering. Assuming dark matter is produced thermally, dark matter particle masses must lie within a wide range of masses between the keV and TeV scales. Theoretical simplicity and the available technology motivated most existing direct searches for dark matter scattering to focus on masses above 10 GeV. As the parameter space for weak-scale dark matter diminishes, searches for low-mass dark matter are becoming increasingly important. New, well motivated dark matter models, such as asymmetric dark matter, predict such low-mass particles.

The Cryogenic Dark Matter Search Low Ionization Threshold Experiment (CDMSlite) modified the operation and readout of existing SuperCDMS detectors. These detectors measure the dramatically enhanced signal from Luke-Neganov phonons that are generated as electrons and holes drift across a germanium crystal biased to 70 V. Thus, very small ionization signals produced by low-mass dark matter scattering become detectable. The latest world-leading results from CDMSlite will be presented.

Engineering and planning are underway for the new SuperCDMS SNOLAB experiment using silicon and germanium detectors optimized for Luke-Neganov operation (SuperCDMS HV) in addition to detectors designed to measure ionization and phonons independently (SuperCDMS iZIP). The HV detectors will be sensitive to eV scale energy depositions created by dark matter particles lighter than 1 GeV. The status and goals of the SuperCDMS SNOLAB project will be presented, in anticipation of starting operation in 2020.

Summary

Primary author: ROBINSON, Alan (Fermilab)

Presenter: ROBINSON, Alan (Fermilab)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **42** Type: **Oral Contributions**

First results from Phase II of the neutrinoless double beta decay experiment GERDA

Tuesday, September 13, 2016 2:40 PM (20 minutes)

The search for neutrinoless double beta decay ($0\nu\beta\beta$) might be the only window to observe lepton number violation. Its observation would have many implications in neutrino physics (Majorana nature, mass scale and ordering, etc) and beyond.
The GERmanium Detector Array (GERDA) experiment, located at the Laboratori Nazionali del Gran Sasso, has been constructed to search for this rare decay in ^{76}Ge atoms. GERDA operates high purity germanium detectors submersed barely in liquid argon (LAr).
Phase I of the experiment was completed in 2013 reaching an exposure of about 21 kg·yr with an unprecedented low background of 10^{-2} counts/(keV·kg·yr) in the region of interest. No signal was observed, a half-life limit of $T^{0\nu}_{1/2} > 2.1 \times 10^{25}$ yr was achieved.
In Phase II, which started in December 2015, 35 kg of germanium detectors enriched in ^{76}Ge have been deployed. The goal is to increment the exposure by factor 5, to further reduce the background level by one order of magnitude and thus to reach a half-life sensitivity of $\mathcal{O}(10^{26})$ yr. The Phase II setup comprises 30 newly produced Broad Energy Germanium (BEGe) detectors. Compared to former detector designs, these detectors allow for an improved energy resolution and active background rejection via an enhanced pulse shape performance. To achieve the necessary background reduction, the experimental infrastructure was complemented with an active LAr scintillation light veto.
The present talk reviews the upgrades implemented in the GERDA Phase II setup and discusses the results from the first data release of Phase II.

Summary

Primary author: Dr MANESCHG, Werner (Max-Planck-Institut für Kernphysik)

Presenter: Dr MANESCHG, Werner (Max-Planck-Institut für Kernphysik)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **43** Type: **Oral Contributions**

Nuclear physics meets the sources of the ultra-high energy cosmic rays

Thursday, September 15, 2016 6:05 PM (15 minutes)

Ultra high energy cosmic rays (UHECRs) are expected to be accelerated in astrophysical sources and to travel through extragalactic space before hitting the Earth atmosphere. They interact both with the environment in the source and with the intergalactic photon fields they encounter, causing different processes at various scales depending on the photon energy in the nucleus rest frame.

Nuclear cross section data are compared with existing theoretical models, and a complete overview of the existing gamma-nuclei measurements is offered. The composition of cosmic rays emitted from candidate sources is also discussed against various assumptions for nuclear interactions and for radiation densities in the source.

The modeling of cross sections for simulating the interaction processes in astrophysical sources and in extragalactic photon fields has an impact in the predictions for observables as the energy spectrum and the composition at Earth, affecting the interpretation of UHECR measurements. The need of new inputs from nuclear physics in order to reduce the uncertainties coming from lack of measurements and from different parametrizations in existing codes is pointed out.

Summary

Primary author: BONCIOLI, denise

Co-authors: FEDYNITCH, Anatoli; WINTER, Walter (DESY)

Presenter: BONCIOLI, denise

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **44** Type: **Oral Contributions**

Dark matter searches with IceCube

Thursday, September 15, 2016 4:50 PM (20 minutes)

The IceCube Neutrino Observatory is a cubic kilometer neutrino detector located in the deep clear ice below the surface at the geographic South Pole. In the pursuit of a better understanding of particle physics, IceCube can be used to detect dark matter indirectly through the self-annihilation to neutrinos. In this talk I will discuss the dark matter searches in IceCube, and present the latest results.

Summary

Primary author: MEDICI, Morten

Presenter: MEDICI, Morten

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **45** Type: **Oral Contributions**

A TeV scale messenger (e.g. 750 GeV) of Dark Matter

Friday, September 16, 2016 3:20 PM (20 minutes)

Standard Model and Dark sector can be related via a (pseudo)scalar mediator particle, 'messenger'. The scenario belongs to a wider class of 'simplified models' of DM. One can think the models expand the pure effective operator interactions including the degrees of freedom of a mediator particle. We will present some physical scenarios having a TeV scale messenger (for example, 750 GeV). We show the scenario with a rather light DM candidate can satisfy all the LHC and cosmic constraints including the abundance of DM. Having a slight tension with the LHC mono-jet constraint, a light DM particle can explain the Galactic gamma-ray excess at 1-5 GeV. However, extending our study to more complete model building, the TeV messenger seems to point a heavier DM particle in the TeV scale. We will provide some concrete examples. The talk is based on the results of arXiv:1603.07263 and arXiv:1602.00004.

Summary

Primary author: HEKTOR, Andi (Nat. Inst. of Chem.Phys. & Biophys. (EE))

Presenter: HEKTOR, Andi (Nat. Inst. of Chem.Phys. & Biophys. (EE))

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **46** Type: **Oral Contributions**

Higgs doublet decay as the origin of the baryon asymmetry

Monday, September 12, 2016 3:00 PM (20 minutes)

In this talk I will start by considering a question which curiously had not been properly considered so far: in the standard seesaw model what is the minimum value the mass of a right-handed (RH) neutrino must have for allowing successful leptogenesis via CP-violating decays? I show that, for low RH neutrino masses and thanks to thermal effects, leptogenesis turns out to proceed efficiently from the decay of the Standard Model scalar doublet components into a RH neutrino and a lepton. If the RH neutrino has thermalized prior from producing the asymmetry, this mechanism turns out to lead to the bound mN>2 GeV. If, instead, the RH neutrinos have not thermalized, leptogenesis from these decays is enhanced further and can be easily successful, even at lower scales. This Higgs-decay leptogenesis new mechanism works without requiring an interplay of flavor effects and/or cancellations of large Yukawa couplings in the neutrino mass matrix. Last but not least, such a scenario turns out to be testable, from direct production of the RH neutrino(s).

Summary

Presenter: Dr TERESI, Daniele (Université Libre de Bruxelles)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **47** Type: **Oral Contributions**

Diffuse Emission Models of the Galactic Center and the GeV Excess

Thursday, September 15, 2016 2:20 PM (20 minutes)

Fermi-LAT observations have discovered a gamma-ray excess emanating from the Galactic center of the Milky Way. While this excess may be explained by populations of gamma-ray pulsars or by dark matter annihilation, it is worth noting that the intensity of this excess is comparable to the systematic uncertainties in the diffuse astrophysical gamma-ray emission near the Galactic plane. Thus, a detailed understanding of the intensity, spectrum, and morphology of gamma-rays from hadronic and leptonic processes in the Galactic center is necessary to determine both the existence and characteristics of the gamma-ray excess. In this talk, I will discuss significant improvements in gamma-ray diffuse emission modeling that enhance our understanding of high energy astrophysics near the Galactic center, and will describe the impact of these models on our understanding of the gamma-ray excess.

Summary

Primary author: Dr LINDEN, Tim (The Ohio State University)

Presenter: Dr LINDEN, Tim (The Ohio State University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **48** Type: **Oral Contributions**

Search for dark matter with the Cherenkov Telescope Array

Friday, September 16, 2016 2:40 PM (20 minutes)

The nature of dark matter (DM) is a longstanding enigma of physics; it may consist of particles beyond the Standard Model that are still elusive to experiments.
Indirect DM searches with the Fermi Gamma-ray Space Telescope and Imaging Atmospheric Cherenkov Telescopes (IACTs) are playing a crucial role in constraining the nature of the DM particle through the study of their annihilation into gamma rays from different astrophysical structures.
The Cherenkov Telescope Array (CTA) is the next generation ground-based gamma-ray observatory. It will serve as an open observatory to a wide astrophysics community and will provide a deep insight into the non-thermal high-energy universe.
The design foresees a factor of 5-10 improvement in sensitivity in the current very high energy gamma ray domain of about 100 GeV to some 10 TeV, and an extension of the accessible energy range from well below 100 GeV to above 100 TeV
In this talk I will describe the sensitivity projections for DM searches on the various targets taking into account the latest instrument response functions expected for CTA together with estimations for the systematic uncertainties from diffuse astrophysical and cosmic-ray backgrounds

Summary

Primary author: MORSELLI, Aldo (INFN)

Presenter: MORSELLI, Aldo (INFN)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **49** Type: **Oral Contributions**

Dim Jets as Very High Energy Neutrino Sources

Tuesday, September 13, 2016 5:10 PM (20 minutes)

The Antarctic neutrino observatory IceCube (IC) has detected a robust diffuse flux signal consistent with neutrinos of extragalactic origin. To date, none of the observed neutrinos have been associated with point sources or transient events. New analyses by the IC and *Fermi* collaborations have introduced tension between electromagnetic measurements and the gamma-ray signal theorized to accompany the astrophysical neutrinos. I will discuss choked jet gamma-ray bursts (GRBs) as possible neutrino sources. Such choked jets may explain transrelativistic SNe or low-luminosity GRBs by launching quasi-spherical shocks that breakout in an optically thick wind. The jet propagation physics and radiation constraints are taken into account. We find that the same conditions which cause a jet to stall also produce a favorable environment for the efficient shock acceleration of cosmic rays and the production of neutrinos via photohadronic ($p\gamma$) processes. Our results are compatible with the IC data around 10-100 TeV without contradicting the gamma-ray limits. Precursor TeV neutrinos emerging prior to the electromagnetic emission of such an explosion can be used as smoking gun evidence for a choked jet model for low-luminosity GRBs.

Summary

New evidence implies that the sources of the IceCube diffuse neutrino signal are gamma-ray dim. Choked jet gamma-ray bursts and jetted tidal disruption events are considered as potential neutrino sources.

Primary author: SENNO, NICHOLAS BENJAMIN (Penn State)

Presenter: SENNO, NICHOLAS BENJAMIN (Penn State)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **50** Type: **Oral Contributions**

Complementarities of Dark Matter searches with Spin-Dependent interactions

Tuesday, September 13, 2016 5:50 PM (20 minutes)

I analyze the constraints on Dark Matter from direct and indirect detection and from the LHC in the case in which the interaction between the DM particle and the SM ones is spin-dependent. This can happen for example if the DM is a Majorana fermion and the interaction is mediated by a heavy Z', or in the case in which the mediator is a pseudo-scalar (having in mind the possible 750 GeV resonance). If the DM mass is larger than a few hundred GeV, the dominant bounds come from the IceCube experiments, which looks for neutrinos coming from annihilation of DM particles in the Sun. I also discuss the consistent use of simplified models in putting bounds on DM properties.

The talk will be mostly based on 1605.06513 and 1603.05592.

Summary

Primary author: MORGANTE, Enrico (University of Geneva)

Presenter: MORGANTE, Enrico (University of Geneva)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **52** Type: **Poster Contributions**

Improved constraints on annihilating dark matter from cosmic-ray antiprotons

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Local measurements of Galactic cosmic-ray antiprotons are known to provide constraints on the properties of annihilating cold dark matter (CDM). It is also known that CDM candidates generically lead to the structuring of matter on scales much smaller than typical galaxies. This clustering translates into a very large population of subhalos in galaxies, which induces an enhancement of the average annihilation rate with respect to a smooth-halo assumption. Taking these subhalos into account, and using measurements by the PAMELA and AMS-02 experiments, we derive new stringent constraints on annihilating CDM candidates.

Summary

Primary author: STREF, Martin (Montpellier University)

Presenter: STREF, Martin (Montpellier University)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **53** Type: **Oral Contributions**

Deciphering the Dipole Anisotropy of Galactic Cosmic Rays

Friday, September 16, 2016 3:00 PM (20 minutes)

Recent measurements of the dipole anisotropy in the arrival directions of Galactic cosmic rays (CRs) indicate a strong energy dependence of the dipole amplitude and phase in the TeV-PeV range. We argue here that these observations can be well understood within standard diffusion theory as a combined effect of (i) one or more local sources at Galactic longitude 120deg < l < 300deg dominating the CR gradient below 0.1-0.3 PeV, (ii) the presence of a strong ordered magnetic field in our local environment, (iii) the relative motion of the solar system, and (iv) the limited reconstruction capabilities of ground-based observatories. We show that an excellent candidate of the local CR source responsible for the dipole anisotropy at 1-100 TeV is the Vela supernova remnant.

Summary

Primary author: AHLERS, Markus

Presenter: AHLERS, Markus

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **54** Type: **Oral Contributions**

From warm dark matter to dark radiation: General cosmological constraints on a second dark component in the Universe

Thursday, September 15, 2016 3:00 PM (20 minutes)

A mixed dark matter model consists of a cold dark matter (CDM) fraction and a fraction given by another dark component (non-cold). The free-streaming length increases with the velocity of the dark matter particle, varying from a scale value of Mpc for a warm dark matter component up to the size of Universe for a relativistic species that we label as dark radiation.
We study these models varying the mass of the non-cold dark matter particle and the fraction of total energy density that it brings. We perform our analysis by using the combination of recent Planck Cosmic Microwave Background (CMB) measurements (Planck TT+lowP dataset) to put bounds on the masses the non-cold dark matter species as well as on the amount of the additional energy density of relativistic species. Considering the matter power spectrum, used also to calculate the amount of the dwarf galaxies satellites, we can explore which components contribute to the total energy density and we can put limits either on the fraction of this second component with respect to the total dark matter, or on its mass.
A particle associated to this second component of dark matter with a larger free-streaming length, indeed, could affect the matter power spectrum on the smallest scales, improving the compatibility with the observations of the local Universe.
We finally analyse how the variation of the free-streaming length could shed light on the different (non-cold) dark matter species for all ranges of masses.

Summary

In this work we explore the phenomenology of a mixed dark matter (DM) model that consists of a cold DM and a general non-cold component. The non-cold component can act as either warm DM, hot DM or dark radiation (DR), depending on the characterizing free-streaming length that varies in our analysis between Mpc and Gpc scales. We perform a Bayesian analysis based on a combination of recent Planck observations of the cosmic microwave background, the observation of dwarf spheroidal galaxies and galaxy distributions. We put constraints on the energy density of the non-cold component as function of the free-streaming length and discuss future observational prospects.

Primary author: Mrs DIAMANTI, Roberta (University of Amsterdam)

Presenter: Mrs DIAMANTI, Roberta (University of Amsterdam)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **55** Type: **Oral Contributions**

Cosmological constraints on the electromagnetic decay of exotic particles

Thursday, September 15, 2016 5:50 PM (20 minutes)

In this talk, I would like to review how the combination of CMB power spectra, spectral distortions and BBN can be used to put stringeant constraints on the lifetime and abundance of exotic particles (such as dark matter but not only) with electromagnetic decay products. I will emphasize that this has the major advantages over cosmic rays of beeing (almost) free of theoritical uncertainties and to extend to very short lifetimes (few minutes after the big bang). Results using the very last Planck CMB data will be shown. I will then present how 21cm signal, one of the main target of future experiments, could be used in order to improve (but not always !) over these bounds.

Summary

Primary author: POULIN, Vivian (LAPTh, Annecy-le-vieux and RWTH, Aachen)

Co-author: SERPICO, Pasquale (Unite Reseaux du CNRS (FR))

Presenter: POULIN, Vivian (LAPTh, Annecy-le-vieux and RWTH, Aachen)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **56** Type: **Poster Contributions**

A fresh look at linear cosmological constraints on a decaying dark matter component

Wednesday, September 14, 2016 5:40 PM (20 minutes)

It is well known that CMB is a very powerful tool to constraints Dark Matter decays, even if this decay happens in some invisible -so called “dark”- radiation.
I would like to show that, in multi-component models, or more generally for non-trivial dark sector decoupled from standard model, CMB can constraints both lifetime and abundance of decaying dark matter into dark radiation (that could be played by neutrinos). Interestingly, in the context of gravitationnal waves detections, these bounds also apply to merging primordial black holes, often invoked as possible dark matter candidates. Finally, it has been claimed that recent tensions between low redshift astronomical dataset and CMB power spectra could be solved by such models. With the most accurate treatment to this day, I will show that DM decay into relativistic dark radiation with no special interacting properties can at most help in loosening these tensions, but not totally solve it. This talk is based on arXiv:1606.02073.

Summary

Primary author: POULIN, Vivian (LAPTh, Annecy-le-vieux and RWTH, Aachen)

Co-authors: LESGOURGUES, Julien (TTK, RWTH Aachen University); SERPICO, Pasquale (Unite Reseaux du CNRS (FR))

Presenter: POULIN, Vivian (LAPTh, Annecy-le-vieux and RWTH, Aachen)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **57** Type: **Oral Contributions**

Dark matter velocity spectrocopy

Friday, September 16, 2016 3:20 PM (20 minutes)

Dark matter decays or annihilations that produce line-like spectra may be smoking-gun signals. However, even such distinctive signatures can be mimicked by astrophysical or instrumental causes. We show that velocity spectroscopy-the measurement of energy shifts induced by relative motion of source and observer-can separate these three causes with minimal theoretical uncertainties. The principal obstacle has been energy resolution, but upcoming experiments will reach the required 0.1% level. We show some examples of this application.

Summary

Dark matter decays or annihilations that produce line-like spectra may be smoking-gun signals. However, even such distinctive signatures can be mimicked by astrophysical or instrumental causes. We show that velocity spectroscopy-the measurement of energy shifts induced by relative motion of source and observer-can separate these three causes with minimal theoretical uncertainties. The principal obstacle has been energy resolution, but upcoming experiments will reach the required 0.1% level. We show some examples of this application.

Primary author: LAHA, Ranjan (Stanford University)

Presenter: LAHA, Ranjan (Stanford University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **59** Type: **Oral Contributions**

Status of NEWS: Nuclear Emulsions for WIMP Search

Friday, September 16, 2016 2:30 PM (20 minutes)

NEWS collaboration submitted Letter of Intent to the Gran Sasso Scientific
Committee last year. Since a few years a lot of R&D is undertaken in emulsion and scanning technologies in the collaboration. We would like to report ongoing activities; reporting the update on our sensitivity including the direction information. Please consider abstract below for oral presentation in the TeV particle Astrophysics.

Summary

Nowadays there is compelling evidence for the existence of dark matter in the Universe. A general consensus has been expressed on the need for a directional sensitive detector to confirm, with a complementary approach, the candidates found in "conventional" searches and to finally extend their sensitivity beyond the limit of neutrino-induced background. We propose here the use of a detector based on nuclear emulsions to measure the direction of WIMP-induced nuclear recoils. The production of nuclear emulsion films with nanometric grains has been recently established. Several measurement campaigns have demonstrated the capability of detecting sub-micrometric tracks left by low energy ions in such emulsion films with nanometric grains. Innovative analysis technologies with fully automated optical microscopes have made it possible to achieve the track reconstruction for path lengths down to one hundred nanometres and there are good prospects to further exceed this limit. The detector concept we propose foresees the use of a bulk of nuclear emulsion films surrounded by a shield from environmental radioactivity, to be placed on an equatorial telescope in order to cancel out the effect of the Earth rotation, thus keeping the detector at a fixed orientation toward the expected direction of galactic WIMPs. We report the performances and the schedule of the NEWS experiment, with its one-kilogram mass pilot experiment, aiming at delivering the first results on the time scale of five years.

Presenter: ROSA, Giovanni (Universita e INFN, Roma I (IT))

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **60** Type: **Oral Contributions**

Low energy IceCube data and Dark Matter

Thursday, September 15, 2016 5:10 PM (20 minutes)

IceCube evidence for extraterrestrial neutrinos poses the intriguing puzzle concerning their origin. The 4-years IceCube HESE data show a 2-sigma excess at low energy (60 - 100 TeV) with respect to an astrophysical power-law with spectral index -2, predicted by the standard Fermi mechanism. Moreover, the IceCube MESE data exhibit an excess located in the same energy range in both southern and northern hemispheres. A statistical analysis on the neutrino energy spectrum and on the angular distribution of neutrino arrival directions is performed in order to shed light on the origin of such an excess. The scenario of a dark matter signal is studied and constrained. A combined analysis of different data samples and a multi-messenger analysis can confirm the presence of such a low energy excess and its explanation in terms of dark matter.

Summary

Primary author: Mr CHIANESE, Marco (Università di Napoli Federico II & INFN, Sezione di Napoli)

Presenter: Mr CHIANESE, Marco (Università di Napoli Federico II & INFN, Sezione di Napoli)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **61** Type: **Oral Contributions**

The standard solar model up to date: recent developments

Thursday, September 15, 2016 3:00 PM (20 minutes)

In this talk I will present the most recent generation of standard solar models (SSM) that include the latest developments in the input physics entering its calculations, most notably updated nuclear reaction rates and radiative opacity calculations and experimental results. I will describe the impact on SSM predictions for helioseismic diagnostics and solar neutrino fluxes and, in the light of recent combined analysis of solar neutrino experiments, discuss consequences for our understanding of solar interior structure. Finally, the necessity of measuring CN neutrino fluxes for learning about solar and stellar physics will be advocated.

Summary

Primary author: SERENELLI, Aldo (Institute of Space Sciences (IEEC-CSIC))

Presenter: SERENELLI, Aldo (Institute of Space Sciences (IEEC-CSIC))

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **63** Type: **Oral Contributions**

Challenges to Cosmic Self-Acceleration in Modified Gravity from Gravitational Waves and Large-Scale Structure

Thursday, September 15, 2016 3:40 PM (20 minutes)

Scalar-tensor modifications of gravity have long been considered as an alternative explanation for the late-time accelerated expansion of our Universe. I will first show that a rigorous discrimination between acceleration from modified gravity and from a cosmological constant or dark energy is not possible with observations of the large-scale structure alone. I will then demonstrate how gravitational-wave observations break this dark degeneracy and how the combination of the two challenges the concept of cosmic acceleration from a genuine scalar-tensor modification of gravity.

Summary

Primary author: Dr LOMBRISER, Lucas (University of Edinburgh)

Presenter: Dr LOMBRISER, Lucas (University of Edinburgh)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **64** Type: **Oral Contributions**

Latest results and current status of KamLAND-Zen

Tuesday, September 13, 2016 2:20 PM (20 minutes)

to be added

Summary

to be added

Primary author: Dr KOZLOV, Alexandre (Kavli IPMU)

Presenter: Dr KOZLOV, Alexandre (Kavli IPMU)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **65** Type: **Oral Contributions**

Determining the Local Dark Matter Density

Friday, September 16, 2016 2:00 PM (30 minutes)

An accurate determination of the local dark matter (DM) density is crucial to interpreting data from direct detection and certain indirect detection experiments, as it is degenerate with the DM-nucleon interaction strength. Here I give an update to our ongoing project to make a determination of the local DM density. Our method uses the positions and velocities of a set of tracer stars extending upwards out of the Milky Way disc, to which we fit a baryon and dark matter mass model using Bayesian nested sampling. The framework we have set up holds the promise of allowing us to minimise the number of assumptions needed, and thus determine the local DM density accurately and with a full quantification of its uncertainty. We have begun to apply our method to data from SDSS, and we also plan to apply it to Gaia data as it becomes available.

Summary

Primary author: SILVERWOOD, Hamish (University of Amsterdam)

Presenter: SILVERWOOD, Hamish (University of Amsterdam)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **66** Type: **Oral Contributions**

A strong first order electroweak phase transition from varying yukawas at the weak scale

Monday, September 12, 2016 2:00 PM (20 minutes)

I will discuss, in a model-independent way, how the nature of the electroweak phase transition is completely changed when the Standard Model Yukawas vary at the same time as the Higgs is acquiring its vacuum expectation value. (Large Yukawas before the electroweak phase transition also give an unsuppressed source of CP violation, see abstract/talk by Sebastian Bruggisser.) The thermal contribution of the fermions creates a barrier between the symmetric and broken phase minima of the effective potential, leading to a first-order phase transition. This offers new routes for generating the baryon asymmetry at the electroweak scale, strongly tied to flavour models. There are good motivations to consider that the flavour structure could emerge during electroweak symmetry breaking, for example if the Froggatt-Nielsen field dynamics were linked to the Higgs field.

Summary

Primary author: BALDES, Iason

Presenter: BALDES, Iason

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **67** Type: **Oral Contributions**

IGRB tomography and Dark Matter Searches via cross-correlations with Large Scale Structures

Monday, September 12, 2016 6:30 PM (15 minutes)

will be based on

A.~Cuoco, J.~Q.~Xia, M.~Regis, E.~Branchini, N.~Fornengo and M.~Viel,
%"Dark Matter Searches in the Gamma-ray Extragalactic Background via Cross-correlations With Galaxy Catalogs,"
Astrophys.\ J.\ Suppl.\ {\bf 221} (2015) no.2, 29
doi:10.1088/0067-0049/221/2/29
[arXiv:1506.01030 [astro-ph.HE]]

M.~Regis, J.~Q.~Xia, A.~Cuoco, E.~Branchini, N.~Fornengo and M.~Viel,
%"Particle dark matter searches outside the Local Group,"
Phys.\ Rev.\ Lett.\ {\bf 114} (2015) no.24, 241301
doi:10.1103/PhysRevLett.114.241301
[arXiv:1503.05922 [astro-ph.CO]].

J.~Q.~Xia, A.~Cuoco, E.~Branchini and M.~Viel,
%"Tomography of the Fermi-lat γ-ray Diffuse Extragalactic Signal via Cross Correlations With Galaxy Catalogs,"
Astrophys.\ J.\ Suppl.\ {\bf 217} (2015) no.1, 15
doi:10.1088/0067-0049/217/1/15
[arXiv:1503.05918 [astro-ph.CO]].

Summary

I will discuss the recent observations of correlation of the Extra-Galactic Gamma-ray Background with catalogues of galaxies as tracers of the Large Scale Structures of the Universe. These observations offer a new way to investigate the diffuse extra-galactic gamma-rays providing access to the redshift distribution of this emission. Furthermore, this allows to derive new stringent constraints on the presence of a possible dark matter annihilation signal.

Primary author: CUOCO, Alessandro (RWTH Aachen TTK)

Presenter: CUOCO, Alessandro (RWTH Aachen TTK)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **68** Type: **Poster Contributions**

Indirect Searches for Dark Matter Signatures at INO

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Weakly Interactive Massive Particles (WIMPs) are among the most favored Dark Matter candidates.
As the Solar System moves through Dark Matter halo, the WIMPs may scatter on the nuclei in the Sun/Earth, lose energy, and get trapped by their gravitational potentials. Their capture and subsequent
annihilations in the core of Sun/ Earth may subsequently give rise to neutrinos, through various annihilation channels.
We look at the possibility of detection of such neutrinos at INO (India-Based Neutrino Observatory),
which will house a 50-kt Iron Calorimeter (ICAL) detector. Detection of these neutrinos and studing their
properties would help us to reconstruct nature of light Dark Matter.
In the present analysis, we give an estimate of the muon events at the detector due to WIMP annihilations in the Sun; 10 years of ICAL running. For our work, WIMP masses upto 100 GeV have been considered.
The atmospheric neutrinos in GeV range will pose background to the signal neutrinos. However, exploiting
the excellent angular resolution of the ICAL detector, the background can be suppressed considerably. We
also perform a χ^2 analysis to obtain limits on WIMP-nucleon cross sections.

Summary

We look for WIMP Dark Matter annihilation in the Sun and its subsequent signatures at ICAL detector in the form of neutrinos. We try to estimate such signal events above the atmospheric background and use it to put limits on the WIMP-nucleon cross-sections.

Primary author: Mr TIWARI, Deepak (INO, Harish Chandra Research Institute)

Presenter: Mr TIWARI, Deepak (INO, Harish Chandra Research Institute)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **69** Type: **Oral Contributions**

Innovative features in modeling CR transport with DRAGON2: hadrons and diffuse gamma rays

Thursday, September 15, 2016 5:15 PM (15 minutes)

We present DRAGON2, the new version of the well-known numerical package designed to simulate all processes related to cosmic-ray (CR) transport: diffusion (treated in a general, position-dependent way), reacceleration, advection, energy losses, nuclear processes.

This talk is focused on the propagation of hadrons, both from steady-state and transient sources in the Galaxy, discussing in detail the technical solutions, the new features and the difference with other codes in the literature.
We focus in particular on the energy losses, and on some aspects of diffusion, showing the implications of position-dependent diffusion coefficient on the interpretation of several long-standing anomalies in the gamma-ray data, and several relevant predictions for neutrino searches.

We also briefly cover the recently developed set of independent cross sections computed with FLUKA and the impact of this new ingredient on the determination of best-fit transport parameters.

Finally, we discuss the relevance of DRAGON2 for dark-matter related searches, with particular focus on the antiproton channel.

Summary

Primary author: GAGGERO, Daniele

Co-authors: VITTINO, Andrea (TU Munich); Dr EVOLI, Carmelo (Gran Sasso Science Institute); DI MAURO, mattia (Stanford University)

Presenter: GAGGERO, Daniele

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **70** Type: **Oral Contributions**

New measurement of anisotropy angular power spectrum in the Fermi-LAT diffuse gamma-ray data

Monday, September 12, 2016 5:10 PM (20 minutes)

The Diffuse Gamma-Ray Background (DGRB) collects the radiation produced by all those sources that are not bright enough to be resolved individually. Therefore, it represents an essential tool to study faint gamma-ray emitters, like star-forming or radio galaxies and the exotic Dark Matter. The anisotropy pattern of the DGRB is extremely informative: I will review the recent measurement of the anisotropy angular power spectrum performed by the Fermi LAT Collaboration with more than 80 months of data. This novel and high-significance result provides original and complementary information on the composition of the DGRB. In particular, I will show how it constrains the emission expected from Dark Matter.

Summary

Primary author: FORNASA, Mattia (GRAPPA Institute (University of Amsterdam))

Presenter: FORNASA, Mattia (GRAPPA Institute (University of Amsterdam))

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **71** Type: **Poster Contributions**

DRAGON2 : A novel code for Cosmic-Ray transport in the Galaxy

Wednesday, September 14, 2016 5:45 PM (15 minutes)

In this talk we introduce DRAGON2, the new version of the public software package designed to study Cosmic Ray (CR) propagation in the Galaxy. Our aim is to illustrate the approach followed in the writing of the code and to present its most important features. We describe the properties of the numerical scheme that has been adopted to implement all the processes related to CR transport and we investigate its correctness by comparing our numerical results with a set of analytical solutions. Starting from these validation tests, we study in detail the performances of the code by probing the different factors that influence its accuracy and its speed under a wide range of different conditions. The second part of the talk is focused on the propagation of leptons. In particular, we investigate how the new features introduced in DRAGON2 in the treatment of diffusion, energy losses and reacceleration can impact the predicted fluxes, in comparison also with the results given by other numerical codes.

Summary

Primary author: VITTINO, Andrea (TU Munich)

Co-authors: Dr EVOLI, Carmelo (Gran Sasso Science Institute); GAGGERO, Daniele; GRASSO, Dario (INFN); DI MAURO, mattia (Stanford University)

Presenter: VITTINO, Andrea (TU Munich)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Cosmic rays

Contribution ID: **72** Type: **Oral Contributions**

Low-mass Dark Matter search with EDELWEISS: latest results and outlook

Tuesday, September 13, 2016 2:00 PM (20 minutes)

EDELWEISS experiment performs direct dark matter search by means of Ge heat-and-ionization bolometers operated at 18 mK in the underground laboratory of Modane (LSM, France). The third phase of the experiment is accumulating data using an array of twenty-four 800-g detectors with improved resolution and rejection capabilities relative to EDELWEISS-II. The performance of these detectors and the reduction of the external gamma-ray background made it possible for the first time to measure the intensity of the tritium background in Ge detectors, which will be shown. The recent results on the spin-independent WIMP-nucleon cross-section for WIMP mass below 30 GeV from a fiducial exposure of 582 kg-d will be presented. Prospects for further improvements of the experiment, including our studies on the Neganov-Luke amplification technique, will be discussed as well.

Summary

Primary author: KOZLOV, Valentin (KIT)

Presenter: KOZLOV, Valentin (KIT)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **73** Type: **Oral Contributions**

Statistical Measurement of the Gamma-ray Source Count Distribution as a Function of Energy

Tuesday, September 13, 2016 5:30 PM (15 minutes)

Statistical properties of photon count maps have recently been proven to provide a sensitive observable for characterizing gamma-ray source populations and for measuring the composition of the gamma-ray sky with high accuracy. In this contribution, we generalize the use of the standard 1-point probability distribution function (1pPDF) to decompose the high-latitude gamma-ray emission observed with Fermi-LAT into: (i) point-source contributions, (ii) the Galactic foreground contribution, and (iii) a diffuse isotropic background contribution. To that aim, we analyze the gamma-ray data in five adjacent energy bands between 1 GeV and 171 GeV. We measure the source-count distribution $\mathrm{d}N/\mathrm{d}S$ as a function of energy, and we demonstrate that our results extend current measurements from point-source catalogs to the regime of so far undetected sources. Our method improves the sensitivity for resolving point-source populations by about one order of magnitude in flux. The $\mathrm{d}N/\mathrm{d}S$ distribution as a function of flux is found to be compatible with a broken power law. We derive upper limits on further possible breaks as well as the angular power of unresolved sources. We discuss the composition of the gamma-ray sky and future prospects and capabilities of the 1pPDF method.

Summary

Primary author: Dr ZECHLIN, Hannes (University of Torino and INFN)

Co-authors: CUOCO, Alessandro (RWTH Aachen TTK); REGIS, Marco (INFN - National Institute for Nuclear Physics)

Presenter: Dr ZECHLIN, Hannes (University of Torino and INFN)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **74** Type: **Oral Contributions**

Probing neutrinos (and axions) with the next galactic supernova

Thursday, September 15, 2016 3:40 PM (20 minutes)

We present the physics potential of a future galactic supernova observation in probing neutrino properties. Particular attention will be devoted to neutrino oscillations in supernovae. It will be also discussed the modification of the observable supernova neutrino signal induced by the

Summary

We present the physics potential of a future galactic supernova observation in probing neutrino properties. Particular attention will be devoted to neutrino oscillations in supernovae. It will be also discussed the modification of the observable supernova neutrino signal induced by the emission of axions during the supernova explosion.

Primary author: MIRIZZI, Alessandro

Presenter: MIRIZZI, Alessandro

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **75** Type: **Oral Contributions**

A global fit of the gamma-ray galactic center excess within the scalar Higgs portal model

Thursday, September 15, 2016 3:40 PM (20 minutes)

We present an interpretation of the excess in the gamma-ray emission from the center of our galaxy observed by Fermi-LAT in terms of dark matter annihilation within the scalar singlet Higgs portal model. In particular, we include the astrophysical uncertainties from the dark matter distribution and allow for unspecified additional dark matter components. We demonstrate through a detailed numerical fit that the strength and shape of the gamma-ray spectrum can indeed be described by the model in various regions of dark matter masses and couplings. Constraints from invisible Higgs decays, direct dark matter searches, indirect searches in dwarf galaxies and for gamma-ray lines, and constraints from the dark matter relic density reduce the parameter space to dark matter masses near the Higgs resonance. We find two viable regions: one where the Higgs-dark matter coupling is of O(0.01), and an additional dark matter component beyond the scalar WIMP of our model is preferred, and one region where the Higgs-dark matter coupling may be significantly smaller, but where the scalar WIMP can constitute a significant fraction or all of dark matter. Both viable regions are hard to probe in future direct detection and collider experiments.

Summary

Primary authors: CUOCO, Alessandro (RWTH Aachen TTK); HEISIG, Jan (RWTH Aachen University)

Presenter: HEISIG, Jan (RWTH Aachen University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **76** Type: **Poster Contributions**

Photodisintegrated gamma rays and neutrinos from heavy nuclei in the gamma-ray burst jet of GRB 130427A

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Detection of ~ 0.1-70 GeV prompt gamma-ray emission from the exceptionally bright gamma-ray burst (GRB) 130427A by the Fermi-Large Area Telescope provides an opportunity to explore the physical processes of GeV gamma-ray emission from the GRB jets. In this work we discuss interactions of Iron and Oxygen nuclei with observed keV-MeV photons in the jet of GRB 130427A in order to explain an additional, hard spectral component observed during 11.5-33 second after trigger. The photodisintegration time scale for Iron nuclei is comparable to or shorter than this duration. We find that gamma rays resulting from the Iron nuclei disintegration can account for the hard power-law component of the spectra in the 1-70 GeV range, before the gamma-gamma to electron-positron pair production with low-energy photons severely attenuates emission of higher energy photons. Electron antineutrinos from the secondary neutron decay, on the other hand, can be emitted with energies up to 2 TeV. The flux of these neutrinos is low and consistent with non-detection of GRB 130427A by the IceCube Neutrino Observatory.

Summary

Understanding the production mechanism of GeV prompt gamma ray emission from GRB 130427A.

Primary author: JOSHI, Jagdish (Raman Research Institute)

Presenter: JOSHI, Jagdish (Raman Research Institute)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **77** Type: **Poster Contributions**

PeV Neutrinos from PKS B-1424 418

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Recently a potential correlation between the discovery of the IceCube PeV-neutrino event (IC 35) and the outburst phase of the blazar PKS B1424-418 has been reported. In this study, we simulate both the multi-wavelength photon and neutrino emission for this source using a self-consistent one-zone model. After a study on the parameter space we find that the simple hadronic model fails to explain the spectral energy distribution for this source, but a leptonic model with a sub-dominant hadronic component can explain both the photon and the neutrino event. We also show the constraints on the proton to electron ratio and the proton maximum energy, derived from both the multi-wavelength and
neutrino channels.

Summary

Primary author: Dr GAO, Shan (DESY)

Presenter: Dr GAO, Shan (DESY)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **78** Type: **Poster Contributions**

An Empirical Determination of the Intergalactic Background Light from UV to FIR Wavelengths Using FIR Deep Galaxy Surveys and the Gamma-ray Opacity of the Universe

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Our direct results on the IBL are consistent with those from complimentary \gray analyses using observations from the {\it Fermi}-LAT \gray space telescope and the H.E.S.S. air \v{C}erenkov telescope. Figure \ref{Ackermann} indicates how well our opacity results for $z = 1$ overlap with those obtained by the {\it Fermi} collaboration (Ackermann et al. 2012). Our results are also compatible with those obtained from higher energy \gray observations using H.E.S.S. (Abramowski et al. 2013). This overlap of results from two completely different methods strengthens confidence that both techniques are indeed complimentary and supports the concept that the spectra of cosmic \gray sources can be used to probe the IBL (Stecker et al. 1992).

Thus, we find no evidence for modifications of \gray spectra by processes other than absorption by pair production, either by cosmic-ray interactions along the line of sight to the source (Essey \& Kusenko 2014) or line-of-sight photon-axion oscillations during propagation ({\it e.g.}, De Angelis et al. 2007; Mayer \& Horns 2013). In this regard, we note that the {\it Fermi} Collaboration has very recently searched for irregularities in the \gray spectrum of NGC 1275 that would be caused by photon-axion oscillations and reported negative results (Ajello et al. 2016).

We conclude that modification of the high energy \gray spectra of extragalactic sources occurs dominantly by pair production interactions of these \grays with photons of the IBL. They therefore support the concept of using the future {\it \v{C}erenkov Telescope Array} instruments to probe the cosmic background radiation fields at infrared wavelengths. This method can be used in conjunction with future deep galaxy survey observations using the near infrared and mid-infrared instruments aboard the {\it James Webb Space Telescope}.

Summary

We have previously calculated the intergalactic background light (IBL) as a function of redshift from the Lyman limit in the far ultraviolet to a wavelength of 5 μm near infrared range, based purely on data from deep galaxy surveys. Here we utilize similar methods to determine the mid- and far-infrared IBL from 5 μm to 850 μm. Our approach enables us to constrain the range of photon densities, by determining the uncertainties in observationally determined luminosity densities and spectral gradients. By also including the effect of the 2.7 K cosmic background photons, we determine upper and lower limits on the opacity of the universe to \grays up to PeV energies within a 68\% confidence band.
Our direct results on the IBL are consistent with those from complimentary \gray analyses using observations from the {\it Fermi} \gray space telescope and the H.E.S.S. air \v{C}erenkov telescope. Thus, we find no evidence of previously suggested processes for the modification of \gray spectra other than that of absorption by pair production alone.

Primary author: STECKER, Floyd (NASA)

Presenter: STECKER, Floyd (NASA)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **79** Type: **Oral Contributions**

Studying generalised dark matter interactions with extended halo-independent methods

Tuesday, September 13, 2016 2:40 PM (20 minutes)

The interpretation of dark matter direct detection experiments is complicated by the fact that neither the astrophysical distribution of dark matter nor the properties of its particle physics interactions with nuclei are known in detail. I will present a new framework that combines the full formalism of non-relativistic effective interactions with state-of-the-art halo-independent methods to deal with both of these issues in a very general way. This approach makes it possible to analyse direct detection experiments for arbitrary DM interactions independent of astrophysical uncertainties. I will demonstrate that the degeneracy between astrophysical uncertainties and particle physics unknowns is not complete and therefore future direct detection experiments will be able to infer at least some information on the coupling structure of dark matter without the need to make assumptions on its astrophysical distribution.

Summary

Primary author: KAHLHOEFER, Felix (DESY)

Co-author: WILD, Sebastian (TU Munich)

Presenter: KAHLHOEFER, Felix (DESY)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **80** Type: **Oral Contributions**

Falsifying Baryogenesis Models via Observation of Lepton Number Violation

Monday, September 12, 2016 2:40 PM (20 minutes)

Interactions that manifest themselves as lepton number violating processes at low energies in combination with sphaleron transitions typically erase any pre-existing baryon asymmetry of the Universe. We demonstrate in a model independent approach that the observation of lepton number violation, namely in neutrinoless double beta decay and at the LHC, would impose a stringent constraint on mechanisms of high-scale baryogenesis, including leptogenesis scenarios. In combination with the observation of lepton flavor violating processes, we can further strengthen this argument, closing the loophole of asymmetries being stored in different lepton flavors.

Summary

Primary author: DEPPISCH, Frank (University College London (UK))

Presenter: DEPPISCH, Frank (University College London (UK))

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **81** Type: **Poster Contributions**

GRAPES-3 sensitivity for diffuse gamma-ray studies with expanded muon detector

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Extensive air shower (EAS) arrays with muon identification capability are ideal to investigate diffuse γ-rays at multi-TeV energies. The GRAPES-3 experiment at Ooty in India is equipped with a dense array of 400 scintillator detectors and a large area (560 m^2) tracking compact muon detector. It is designed to investigate γ-rays and cosmic ray nuclear composition in the energy range of 10^{13} - 10^{16} eV. The muon content in EAS is an effective parameter to discriminate the tiny flux of γ-rays from the overwhelming background of charged cosmic rays. The GRAPES-3 group is constructing another 560~m^2 area muon detector close to the existing one. With the area getting doubled, a significant enhancement in the rejection of cosmic ray background is expected to be achieved. We carried out a detailed Monte Carlo simulation to compute the cosmic ray rejection efficiency and estimated the GRAPES-3 sensitivity for diffuse γ-ray detection. In this meeting, the results from the simulation study will be presented and the construction status of the muon detector will be updated.

Summary

Primary author: MOHANTY, PRAVATA (Tata Institute of Fundamental Research, Mumbai, India)

Presenter: MOHANTY, PRAVATA (Tata Institute of Fundamental Research, Mumbai, India)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Cosmic rays

Contribution ID: **82** Type: **Oral Contributions**

Propagation of cosmic ray positrons and dark matter searches.

Tuesday, September 13, 2016 4:50 PM (20 minutes)

We developed a new semi-analytical method to better estimate the propagated cosmic-ray positron flux from a few hundreds MeV to 1 TeV.
It allows us to take into account Galactic convection, energy losses inside the disc and diffusive reacceleration, that are often neglected or badly considered
as most of the analyses concentrate on energies above 10 GeV.
Therefore, we are now able to compare rapidly the theoretical positron flux with the AMS-02 data over all the experimental energy range.
Using the recent proton and helium fluxes measured by the AMS-02 experiment, we first reevaluate the astrophysical component of secondary positrons.
We find that the low energy part of the positron spectrum considerably constrains the propagation parameter space.
Then, we explore the possibility to explain the AMS-02 positron data with annihilating dark matter.
We investigate the case of dark matter annihilating through one single channel as well as combinations of channels.
Using solely the AMS-02 positron data, it appears that the room left for dark matter to explain the positron signal becomes very restricted.

Summary

Primary author: BOUDAUD, Mathieu (LAPTh Annecy France)

Presenter: BOUDAUD, Mathieu (LAPTh Annecy France)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **83** Type: **Oral Contributions**

The Coannihilation Codex

Tuesday, September 13, 2016 5:30 PM (20 minutes)

We present a classification of simplified models of coannihilating dark matter. Assuming tree-level and renormalizable interactions we construct all possible simplified models (containing dark matter, its coannihilation partner and a mediator) which respect gauge and Lorentz invariance. We go on to identify the possible LHC signatures associated with these models and identify new search strategies. Finally we demonstrate how to use the classification to quickly identify searches relevant for a given model.

Summary

Primary author: BAKER, Michael (JGU Mainz)

Co-author: KOPP, Joachim (Johannes-Gutenberg-Universitaet Mainz (DE))

Presenter: BAKER, Michael (JGU Mainz)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **84** Type: **Oral Contributions**

Cosmogenic Neutrinos Challenge the Cosmic Ray Proton Dip Model

Thursday, September 15, 2016 6:20 PM (15 minutes)

We fit the recent UHECR spectrum measurements from the Telescope Array experiment under the assumption of pure proton composition, as assumed by the proton dip model.

We present a a full scan of the three main physical model parameters of UHECR-injection: source redshift evolution, injected maximal proton energy and spectral power-law index. We discuss how the result qualitatively changes compared to earlier two-parameter fits in the literature: : a mild preference
for a maximal energy cutoff at the sources instead of the Greisen–Zatsepin–Kuzmin (GZK) cutoff, hard injection spectra, and strong source evolution.

We show that the predicted neutrino flux exceeds the IceCube limit for any parameter combination. As a result, the proton dip model is challenged at more than 95% C.L.
This is strong evidence against the dip-model independent of mass composition measurements.

Summary

Primary author: HEINZE, Jonas (DESY)

Co-authors: BUSTAMANTE, Mauricio (Ohio State University); WINTER, Walter (DESY); BONCIOLI, denise

Presenter: HEINZE, Jonas (DESY)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **85** Type: **Poster Contributions**

The Smith Cloud and its potential for indirect Dark Matter detection using radio waves

Wednesday, September 14, 2016 5:45 PM (15 minutes)

One of the key predictions of the "WIMP" paradigm for Dark Matter (DM) is that DM particles can annihilate into charged particles. These annihilations will proceed in e.g. Galactic subhalos such as dwarf Galaxies or, as recently pointed out, high velocity clouds such as the "Smith" cloud. In this talk I will argue that among the several messengers of the DM annihilations occurring in the Smith cloud, radio signals stand out. I will also discuss the applicability and the prospects of these ideas in big data radio surveys such as LOFAR.

Summary

Primary author: Dr VOLLMANN, Martin (TU Munich)

Presenter: Dr VOLLMANN, Martin (TU Munich)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **86** Type: **Oral Contributions**

Search for light dark matter with the CRESST experiment

Tuesday, September 13, 2016 2:20 PM (20 minutes)

The CRESST (Cryogenic Rare Event Search with Superconducting Thermometers) experiment, located in the Gran Sasso underground laboratory (LNGS) in Italy, searches for nuclear recoil events induced by the elastic scattering of dark matter particles in cryogenic detectors. The use of scintillating $CaWO_4$ crystals as absorbers allows the simultaneous measurement of a phonon and a light signal, which are used to discriminate radioactive backgrounds from a possible dark matter signal. The low energy thresholds achievable with these detectors make them especially suited to detect the tiny recoil energies produced by light dark matter particles.

We give a summary of the results from the recently completed phase 2 of CRESST-II, which provide the best limits at masses below ~ 1.7 GeV/c^2 obtained with a 300 g detector having an energy threshold for nuclear recoils of 307 eV. In CRESST-III, novel detectors with a reduced mass of 25 g each are used, which are designed for thresholds <100 eV. We present the status of the currently ongoing phase1 of CRESST-III, which is taking data with 10 of these detectors, as well as the projected sensitivity of this phase 1 and of future upgrades.

Summary

Primary author: STRANDHAGEN, Christian

Presenter: STRANDHAGEN, Christian

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **87** Type: **Oral Contributions**

Gamma-ray blazars at the dawn of the Universe

Monday, September 12, 2016 5:00 PM (15 minutes)

A broadband study of high-z (z>3) blazars enables us to understand the evolution of the properties of relativistic jets over cosmic time. Moreover, it has been found in many studies that such high-z blazars host extremely massive black holes (M_{BH}> 1e9 $M_{\odot}$) and thus shed a new light on the formation of supermassive black holes in the early Universe. Here we report the first detection of γ-ray emitting blazars beyond z=3.1 using the sensitive Pass 8 dataset of $Fermi$-LAT. They are found to host extremely massive black holes at their centers, as confirmed from both IR-UV continuum modeling with a standard accretion disk and also with the emission line measurements using optical spectroscopy. Further details of the results will be presented within the framework of the disk-jet connection in powerful jetted AGNs.

Summary

Primary author: PALIYA, Vaidehi (Clemson University)

Presenter: PALIYA, Vaidehi (Clemson University)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **88** Type: **Oral Contributions**

GAPS - Hunt for dark matter using cosmic ray antideuterons

Tuesday, September 13, 2016 5:30 PM (20 minutes)

The GAPS experiment is foreseen to carry out a dark matter search by hunting for low-energy cosmic-ray antideuterons with a novel detection approach. The theoretically predicted antideuteron flux resulting from secondary interactions of primary cosmic rays, e.g. protons, with the interstellar medium is very low. So far not a single cosmic antideuteron has been detected by any experiment, but well-motivated theories beyond the standard model of particle physics, e.g., supersymmetry or universal extra dimensions, contain viable dark matter candidates, which could lead to a significant enhancement of the antideuteron flux due to self-annihilation of dark matter particles. This flux contribution is calculated to be especially large at low energies, which leads to a high discovery potential for GAPS. GAPS is designed to achieve its goals via a series of ultra-long duration balloon flights at high altitude in Antarctica and had a successful prototype flight in June 2012.

The presentation will briefly review the theoretical and experimental implications for a cosmic-ray antideuteron search and discuss the current status and perspectives of the GAPS experiment.

Summary

Primary author: VON DOETINCHEM, Philip (University of Hawaii at Manoa)

Presenter: VON DOETINCHEM, Philip (University of Hawaii at Manoa)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **89** Type: **Poster Contributions**

Studying hadronic interactions with inclusive atmospheric leptons

Wednesday, September 14, 2016 5:45 PM (15 minutes)

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Summary

Inclusive fluxes of atmospheric muons and neutrinos originate from cosmic ray induced particle cascades in the Earth's atmosphere. Such cascades contain all kinds of hadrons which can decay and produce leptons, or, they can interact and initiate sub-cascades at lower energies. The power-law nature of the cosmic ray flux emphasizes the very forward particle production phase-space, probing a highly non-perturbative regime. New sophisticated atmospheric lepton flux calculation methods enable us to study the role of non-perturbative processes, such as the leading particle effect or associated production, at energies far beyond recent fixed-target experiments. In our calculations we mainly employed the new version of the hadronic interaction model SIBYLL 2.3 to study the role of various hadron types, including charmed mesons. This talk will also address the connection between atmospheric lepton observables, such as the muon and neutrino fluxes and their charge or flavor ratios, to typical observables in particle physics experiments and show the relevant energy and Feynman-x ranges.

Primary author: FEDYNITCH, Anatoli (DESY Zeuthen)

Co-author: ENGEL, Ralph Richard (KIT - Karlsruhe Institute of Technology (DE))

Presenter: FEDYNITCH, Anatoli (DESY Zeuthen)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Cosmic rays

Contribution ID: **90** Type: **Oral Contributions**

Possible interpretations to AMS-02 electron and positron data

Monday, September 12, 2016 3:40 PM (20 minutes)

We present a combined analysis of the recent AMS-02 data on electrons, positrons, electrons plus positrons and positron fraction. We consider a self-consistent framework where we realize a theoretical modeling of all the astrophysical components that can contribute to the observed fluxes. The primary electron contribution is modeled through a smooth spatial distribution of distant supernova remnants and with the fluxes from the local sources taken from the Green catalog. The secondary electron and positron contribution originates from interactions on the interstellar medium of primary cosmic rays, for which we derive a novel determination by using AMS-02 proton and helium data. Primary positrons and electrons from pulsar wind nebulae are calculated using the objects from the ATNF catalog. 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 contributions. Other exotic emission mechanisms could produce a sizeble flux of electrons and positrons. Probably the most popular one is from the interaction of Weakly Interactive Massive particles (WIMPs) of Dark Matter (DM). Taking into account the above cited astrophysical contributions and adding also the flux from DM annihilation, we derive upper limits for the annihilation cross section of DM. We compare also the shape of high energy positrons flux from pulsars wind nebulae and DM respect to AMS-02 data trying to predict which of these two components should explain this part of the measured spectra.

Summary

Primary author: DI MAURO, mattia (Stanford University)

Co-authors: VITTINO, Andrea (TU Munich); DONATO, Fiorenza (INFN - National Institute for Nuclear Physics); FORNENGO, Nicolao (University of Torino and INFN)

Presenter: DI MAURO, mattia (Stanford University)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **91** Type: **Oral Contributions**

Spherical Cows of Dark Matter Indirect Detection

Monday, September 12, 2016 6:10 PM (20 minutes)

The morphology of dark matter annihilation/decay signals offers a handle for discrimination of dark matter against astrophysical backgrounds. Recent advances in N-body simulations allow us to map out the expected distribution of morphological parameters, rather than focusing on a small sample of halos which are assumed to be representative. In this talk, I will use data from the Illustris simulation to present an analysis of the expected morphology of dark matter annihilation and decay signals, either originating from the Galactic Center or from halos other than our own. I will discuss how these expectations, and those for simulated gas and stars, compare to observations of astrophysical background emission and hints of potential signals.

Summary

Primary authors: NECIB, Lina (MIT); Prof. SLATYER, Tracy (MIT)

Presenter: NECIB, Lina (MIT)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **92** Type: **Oral Contributions**

Including massive neutrinos in nonlinear perturbation theory

Thursday, September 15, 2016 3:20 PM (20 minutes)

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Summary

Cosmological perturbation theory has proved to be particularly efficient to model the formation of the large-scale structure of the universe. Many refinements have been realized over the years in order to be in tune with the precision reached by observational cosmology. In particular, the effect of neutrinos on the linear matter power spectrum is now well understood. However, a robust analytic model of the impact of neutrinos on the nonlinear matter power spectrum is still missing. In this talk, I will present attempts to remedy this.

Primary author: Dr DUPUY, Helene (Universite de Geneve (CH))

Presenter: Dr DUPUY, Helene (Universite de Geneve (CH))

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **93** Type: **Oral Contributions**

Constraining the production of cosmic rays by pulsars

Monday, September 12, 2016 3:20 PM (20 minutes)

One of the possible sources of hadronic cosmic rays (CRs) are newborn pulsars. If it is indeed the case, they should feature diffusive gamma-ray halos produced by interactions of CRs with interstellar gas. In my talk I will report on the attempts to identify extended gamma-ray emission around young pulsars making use of the 7-year Fermi-LAT data.
I will describe the method and the selected set of 8 pulsars that are most likely to possess detectable gamma-ray halos.
I will present the only one found candidate which might be interpreted as a gamma-ray halo and discuss its properties.
Irrespectively of the nature of this source I will put bounds on the luminosity of gamma - ray halos which suggest that pulsars' contribution to the overall energy budget of galactic CRs is subdominant in the GeV-TeV range.

Summary

I will discuss pulsars as potential sources of GeV-TeV cosmic rays and constraints on the related cosmic-ray fluxes derived from gamma-ray observations.

Primary author: IVANOV, Mikhail (Ecole Polytechnique Federale de Lausanne (CH))

Co-authors: RUBTSOV, Grigory (INR RAS); PSHIRKOV, Maxim (Moscow State University)

Presenter: IVANOV, Mikhail (Ecole Polytechnique Federale de Lausanne (CH))

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **94** Type: **Oral Contributions**

Population synthesis of Fermi LAT sources: A Bayesian analysis using posterior predictive distributions

Thursday, September 15, 2016 4:45 PM (15 minutes)

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Summary

Fermi-LAT has provided an unprecedented view of the gamma-ray sky and in particular has found a host of previously unknown point sources, i.e. the 3FGL. Of the 3033 objects in the 3FGL, 1010 remain unassociated to a particular source class. To create effective follow up surveys of these objects it is essential to make probabilistic statements about the potential class of an individual source. We present a statistically rigorous method of analysing the entire 3FGL data set to provide constraints on spatial distributions, luminosity functions, and spectral shapes whilst also providing "semi heirachical" posteriors for the association of a source to different classes of objects. We do this by combining the power of an unbinned likelihood analysis and generation of the posterior predictive distribution in a Bayesian framework. In this talk I will present our method and discuss its results in the context of the potential population of millisecond pulsars towards the galactic centre.

Primary author: WENIGER, Christoph (University of Amsterdam)

Presenter: EDWARDS, Thomas (University of Amsterdam)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **95** Type: **Poster Contributions**

Towards a new agnostic top-down approach for studying dark matter signals over the entire sky

Wednesday, September 14, 2016 5:45 PM (15 minutes)

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Summary

Indirect dark matter (DM) searches have, to date, provided no compelling evidence of a typical WIMP decay or annihilation signal. Typically it has been accepted that either the galactic centre or dwarf spheroidal's will provide the strongest constraints on DM. This statement is in principle not true for all models of DM. Given the situation it is essential to have a systematic framework to predict signals for a variety of DM models allowing one to select the best targets for observation. I will first present initial steps towards a unified framework for indirect DM searches. Secondly, I will discuss scenarios in which extragalactic halos could provide the strongest constraints on DM properties and finally examine the ultimate limits one can hope to achieve with a perfect experiment.

Primary authors: WENIGER, Christoph (University of Amsterdam); EDWARDS, Thomas (University of Amsterdam)

Presenter: EDWARDS, Thomas (University of Amsterdam)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **96** Type: **Oral Contributions**

Gamma-ray polarimetry in the pair regime with the HARPO TPC

Monday, September 12, 2016 3:00 PM (15 minutes)

I will first describe the experimental setup with which we took data at different photon energies from 1.7MeV to 74MeV, and with different polarisation configurations.
I will present the software I developed to reconstruct the photon conversion events, especially for low energies.
I will also introduce the complete detailed simulation I made of the detector.
Finally I will present the performances of the detector, and in particular its sensitivity to polarisation, as extracted from this analysis and compare them to results from models and simulations.

Summary

Current gamma-ray telescopes suffer from a gap in sensitivity in the energy range between 100keV and 100MeV, and no polarisation measurement has ever been made on cosmic sources above 1MeV.
A higher angular resolution is needed to improve the sensitivity to point sources, and to access the polarisation of the photons.
We demonstrated that this is possible only with an active gaseous detector.
The measurement of the polarisation of gamma sources will allow us to probe the physical structure of their magnetic fields thus enabling us to better understand the acceleration mechanisms at work in the sources and to place constraints on emission models.
These measurements will also allow us to address new physics topics like Lorentz Invariance Violation.

HARPO is an R&D program to characterize the operation of a gaseous detector (Time Projection Chamber or TPC) as a high angular-resolution and sensitive telescope and polarimeter for γ-rays from cosmic sources.
It represents a first step towards a future space instrument.

We built and characterised a 30cm cubic demonstrator, and put it in a polarised gamma-ray beam at the NewSUBARU accelerator in Japan.
From this we measure polarisation and angular resolution capabilities of the technology.

Our beam-test qualification of a gas TPC prototype in a gamma-ray opens the way to high-performance gamma-ray astronomy and polarimetry in the MeV-GeV energy range in the next future.
A concept for a larger module to be operated in a stratospheric balloon, with realistic signal and background, will be introduced.

Primary author: GROS, Philippe (Centre National de la Recherche Scientifique (FR))

Presenter: GROS, Philippe (Centre National de la Recherche Scientifique (FR))

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **97** Type: **Poster Contributions**

Probing EAS primaries and their interactions by combining individual muon tracks and shower depth

Wednesday, September 14, 2016 5:45 PM (15 minutes)

The current large area cosmic ray detector surface arrays typically measure only the net flux and arrival-time of the charged particles produced in an extensive air shower (EAS). Measurement of the individual charged particles at a surface array will provide additional distinguishing parameters to identify the primary and to map the very high energy interactions in the upper layers of the atmosphere. In turn these may probe anomalies in QCD interactions at energies beyond the reach of current accelerators. The recent attempts of studying the individual muon tracks are limited in their expandability to larger arrays and can only probe primary particles with energy up to about $10^{15.5}$ eV. New developments in detector technology allow for a realistic cost of large area detectors, however with limitations on energy resolutions, directional information and dynamic range. In this study, we perform a simulation study using CORSIKA to combine the energy spectrum and lateral spread of the muons with the longitudinal depth (X_{max}) of an EAS initiated by a primary at ultra high energies (10^{16} -10^{19} eV). Using proton and iron as the shower primaries, we show that the muon observables and X_{max} together can be used to distinguish the primary. This study can be used to design a future detector for surface array, which will be able to enhance our knowledge of primaries and QCD interactions.

Summary

This work is on combining the information on the muon tracks and the shower depth of an extensive air shower (EAS), and to probe the primaries and their interaction. The information on muons provide additional distinguishing parameters, which are useful to probe the very high energy interactions initiating EAS.

Primary author: Dr DEVI, Moon Moon (Weizmann Institute of Science, Israel)

Presenter: Dr DEVI, Moon Moon (Weizmann Institute of Science, Israel)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Cosmic rays

Contribution ID: **98** Type: **Poster Contributions**

Cold and Warm Dark Matter Particles in the Mirror Model with Massive Mirror Photon

Wednesday, September 14, 2016 5:45 PM (15 minutes)

One of a promising asymmetric dark matter model is the mirror model, where the gauge group is doubled the standard model (SM) gauge group, i.e. $SU(3)_1 \otimes SU(3)_2 \otimes SU(2)_L \otimes SU(2)_R \otimes U(1)_{Y1} \otimes U(1)_{Y2}$, and the particles content consist of the ordinary (o) SM particles (plus the right handed neutrinos) and their parity mirror (m) partners. To this model I add a singlet scalar ϕ_e and its mirror partner ϕ_E, whose quantum numbers are the same as the singlet right handed electron and its m-partner. The kinetic mixing of the abelian gauge bosons has been ignored, and the particles are assumed to be separated and thermaly decoupled into o- and m-sectors after the electroweak symmetry breaking. A general scalar potential which is invariant under the gauge group and the parity mirror symmetry, can have parameters that allows the ϕ_E to have a non zero VEV, while the ϕ_e remains with zero VEV. As consequences of this, several phenomena can take place: 1. The SU(2)-doublet scalar (which is the usual SM Higgs) and its m-partner can have non-zeros and unequal VEVs; 2. Mirror photon will gain mass, with its mass naturally in the order of neutral weak boson mass; 3. Unlike its mirror partner, since ϕ_e has zero VEV, it will decay slowly after decoupled from thermal equilibrium, thus producing more entropy in the o-sector than in the m-sector, and making the temperature of o-sector higher than the m-sector. This gives an escape to the BBN constraint for this model; 4. There are mixings among six types of particles, the o- and m-singlet neutrinos, the o- and m-doublet neutrinos, and the m-singlet and m-doublet electrons. One of the consequence of this mixing is the m-doublet electron will be lighter than the o-electron, and can have mass in the keV order, thus they may be the keV sterille neutrinos.

Assuming the VEVs of the usual SM Higgs and its m-partner are of the same order, the asymmetric part of m-baryons will contribute to the energy density approximately the same as the o-baryon energy density Ω_B, and they are forming the cold dark matter part of the model. The symmetric part of m-baryons will annihilates into m-mesons which eventually will decay into m-electrons and m-neutrinos. The m-electrons cannot annihilate into m-photons, and its abundance is comparable to the o-photons. But since m-electron mass is of the keV order, they can contribute to the remaining part of the dark energy density as a warm dark matter with $\Omega \approx 4\Omega_B$.

Summary

Primary author: Dr SATRIAWAN, Mirza (Physics Department, Universitas Gadjah Mada)

Presenter: Dr SATRIAWAN, Mirza (Physics Department, Universitas Gadjah Mada)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **99** Type: **Oral Contributions**

Probing the expansion of the Universe using gravitational wave standard sirens at eLISA

Tuesday, September 13, 2016 3:40 PM (20 minutes)

We investigate the capability of various configurations of the space interferometer eLISA to probe the late-time background expansion of the universe using gravitational wave standard sirens. We simulate catalogues of standard sirens composed by massive black hole binaries whose gravitational radiation is detectable by eLISA, and which are likely to produce an electromagnetic counterpart observable by future surveys. The main issue for the identification of a counterpart resides in the capability of obtaining an accurate enough sky localisation with eLISA. This seriously challenges the capability of four-link (2 arm) configurations to successfully constrain the cosmological parameters. Conversely, six-link (3 arm) configurations have the potential to provide a test of the expansion of the universe up to z~8 which is complementary to other cosmological probes based on electromagnetic observations only. In particular, in the most favourable scenarios, they can provide a significant constraint on H0 at the level of 0.5%. Furthermore, (ΩM,$\Omega\Lambda$) can be constrained to a level competitive with present SNIa results. On the other hand, the lack of massive black hole binary standard sirens at low redshift allows to constrain dark energy only at the level of few percent.

Summary

Primary author: CAPRINI, Chiara (CEA-Saclay)

Presenter: CAPRINI, Chiara (CEA-Saclay)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **100** Type: **Oral Contributions**

Testable Leptogenesis

Tuesday, September 13, 2016 3:20 PM (20 minutes)

We revisit the production of baryon asymmetries in the minimal type I seesaw model with heavy Majorana singlets in the GeV range. In particular we include for the first time "washout" effects from scattering processes with gauge bosons and higgs decays and inverse decays, besides the dominant top scatterings. We show that in the minimal model with two singlets, and for an inverted light neutrino ordering, future measurements from SHiP and neutrinoless double beta decay could in principle provide sufficient information to predict the matter-antimatter asymmetry in the universe up to a sign. We also show that SHiP measurements could provide very valuable information on the PMNS CP phases.

Summary

Primary author: LOPEZ PAVON, Jacobo (INFN)

Presenter: LOPEZ PAVON, Jacobo (INFN)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **101** Type: **Oral Contributions**

The Third Catalog of Hard Fermi-LAT Sources (3FHL)

Monday, September 12, 2016 4:30 PM (30 minutes)

We present the new Third Catalog of Hard Fermi-LAT Sources, dubbed 3FHL, which describes the sky at energies above 10 GeV. Relying on 7 years of data and the Pass 8 event level analysis, this catalog reports the detection of more than 1700 sources, representing a huge step forward relative to the 1FHL, which characterizes the sky at the same energies. The improved flux sensitivity (factor of 3) allows us to detect a factor of 3.5 more sources than 1FHL (including about 50 extended sources) making it ideal for large statistical population studies. Furthermore, by comparing the 2FHL and 3FHL source counts, we estimate that for the same energy flux level there is a factor of about 2 more sources at 10 GeV than at 50 GeV. This result highlights the importance of lowering the energy threshold of Cherenkov telescopes, as much as possible, for population studies.

Summary

Primary author: Dr DOMINGUEZ, Alberto (Universidad Complutense de Madrid)

Presenter: Dr DOMINGUEZ, Alberto (Universidad Complutense de Madrid)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **102** Type: **Poster Contributions**

Gravitational effects on the electroweak vacuum stability

Wednesday, September 14, 2016 2:00 PM (20 minutes)

In this talk I will describe the main effects due to Einstein's general relativity on the stability of the electroweak vacuum. A perturbative (weak gravity) expansion will be discussed.

Summary

Primary author: SALVIO, Alberto (CERN)

Presenter: SALVIO, Alberto (CERN)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **103** Type: **Oral Contributions**

Effect of the primary cosmic ray flux uncertainties on the secondary positron flux

Tuesday, September 13, 2016 2:40 PM (20 minutes)

In view of the latest publications of the primary CR fluxes, namely proton and helium flux from AMS-02 and CREAM, we aim at re-evaluating the positron flux coming from conventional astrophysical processes, i. e. secondary positrons. Moreover, we plan to estimate how the experimental uncertainties on the primary CR fluxes affect the secondary positron flux, computed by means of a new semi-analytical method for the propagation of cosmic ray positrons, from few hundreds of MeV to 1 TeV. The point of novelty is in the description of the wind convection, the disc energy losses and the diffusive reacceleration, that are often neglected or badly considered in the analytical calculation.

Summary

Primary author: VECCHI, Manuela (Universidade de Sao Paulo (BR))

Co-authors: BOUDAUD, Mathieu (LAPTh Annecy France); POULIN, Vivian (LAPTh, Annecy-le-vieux)

Presenter: VECCHI, Manuela (Universidade de Sao Paulo (BR))

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **104** Type: **Oral Contributions**

Status of LZ dark matter search experiment

Friday, September 16, 2016 3:10 PM (20 minutes)

[]

Summary

Direct searches for dark matter attempt to observe signals of Weakly Interacting Massive Particle (WIMP) elastic interactions with normal matter. Sensitive direct search measurements have probed masses as low as a few GeV. Presently in operation, the LUX experiment uses a 370-kg liquid-xenon target as a time projection chamber to set most stringent limits on the cross section for dark matter interaction with Xe nuclei, as a function of WIMP mass. The LUX-Zeplin (LZ) liquid-xenon (7 tonnes active Xe volume) WIMP dark matter direct search project concept was selected by the US DOE Office of High Energy Physics for support as one 2nd generation direct dark matter search for the Cosmic Frontier Program. The LZ experiment will scale up proven two-phase liquid xenon detection technology to significantly extend previous searches and discover or provide the best limits of WIMP dark matter for WIMP mass above a few GeV. This talk will describe the R&D underway, results from initial system tests and status of construction of the LZ experiment.

Primary author: DASU, Sridhara (University of Wisconsin-Madison (US))

Presenter: DASU, Sridhara (University of Wisconsin-Madison (US))

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **105** Type: **Oral Contributions**

Anisotropy constraints on blazar models

Monday, September 12, 2016 6:15 PM (15 minutes)

Angular power spectrum is getting more and more important in recent years to study components of the diffuse gamma-ray background. Understanding constituents through this and other measurements is extremely important for our generic knowledge on high-energy sky. If we are interested in searching for new physics such as dark matter annihilation, it is essential to address all possible astrophysical source components. This study goes along this line, by providing important piece of information on blazars.

Summary

We interpret recent measurements of the angular power spectrum of the extragalactic gamma-ray background in order to constrain astrophysical components. Among several sources, blazars are considered to be the dominant source of the detected angular power spectrum. Therefore, we are able to extract important information on blazar luminosity function. In this work, we analyze data of both the source flux distribution and the angular power spectrum of the gamma-ray background, and put stringent constraints on relevant parameters of blazar luminosity function. We also discuss constraints on other components such as starburst galaxies.

Primary author: ANDO, Shin'ichiro (University of Amsterdam)

Co-author: FORNASA, Mattia (GRAPPA Institute (University of Amsterdam))

Presenter: ANDO, Shin'ichiro (University of Amsterdam)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **106** Type: **Oral Contributions**

Hunting for Point Sources in the Extragalactic Gamma-Ray Sky

Tuesday, September 13, 2016 5:45 PM (15 minutes)

In this talk, I will present an analysis of the extragalactic gamma-ray background (EGB) using data from the *Fermi* Large Area Telescope. The method takes advantage of photon-count statistics to determine the properties of resolved and unresolved gamma-ray sources that contribute to the EGB. I will present the source-count functions, as a function of energy, from 1.89 GeV to 2 TeV, as well as the energy spectra of the different contributing source components, and will discuss how the results are affected by a variety of systematic uncertainties. These results allow us to determine the fraction of point sources in the EGB, which has potential implications for the interpretation of the ultra-high-energy neutrinos observed by IceCube. I will also comment on the consequences of these results for future TeV observatories such as the Cherenkov Telescope Array.

Summary

Primary authors: NECIB, Lina (MIT); LISANTI, Mariangela (Princeton University)

Presenter: MISHRA SHARMA, Siddharth (Princeton University)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **107** Type: **Oral Contributions**

On bound state effects in dark matter freeze-out

Thursday, September 15, 2016 2:00 PM (20 minutes)

The standard WIMP freeze-out analysis, based on Boltzmann equations, contains unknown theoretical uncertainties, which may start to matter now that many benchmark scenarios are strongly constrained by data. In this talk a few issues which are not always included in phenomenological analyses are elaborated upon. In particular the potential importance of strongly interacting bound states (e.g. of gluinos) is re-evaluated. The bound states are shown to significantly boost the co-annihilation rate with respect to a Sommerfeld-enhanced analysis, thereby perhaps helping to avoid overclosure.

Summary

Primary author: LAINE, Mikko (U. Bern)

Presenter: LAINE, Mikko (U. Bern)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **108** Type: **Oral Contributions**

Time dependent searches for point source emissions of Neutrinos with the IceCube Neutrino Observatory

Monday, September 12, 2016 5:50 PM (20 minutes)

We performed a set of time dependent and multi-messenger searches for neutrino flaring emissions from astrophysical sources. We present the results of three searches applied to IceCube data measured between April 2008 and April 2015. The most generic search is an un-triggered scan for clustering of track like IceCube events simultaneously in both, time and direction. The second one is a triggered multi-messenger search using Fermi LAT lightcurves to look for coincidence of track like IceCube events and gamma ray flares. A third analysis was carried out with a catalog of periodic X-Ray, and Gamma Ray candidate sources searching for in phase neutrino emission. A development of a framework for monthly monitoring of candidate neutrino sources with the IceCube data will be presented as well.

Summary

Primary author: CHRISTOV, Asen (Universite de Geneve (CH))

Presenter: CHRISTOV, Asen (Universite de Geneve (CH))

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **109** Type: **Poster Contributions**

A novel statistical test for dark matter induced dark matter sources

Wednesday, September 14, 2016 5:45 PM (15 minutes)

The firm establishment of gamma-ray sources of dark matter is often impeded by source confusion. Conventional astrophysical sources can mimic hypothetical dark matter sources, manifested in unidentified sources in the Fermi-LAT catalogues or in the GC excess. In statistical terms, the question of whether a sources is dark matter or conventional astrophsyics is an example of a non-standard hypothesis test where the usual chi-squared approximations do not apply because the hypotheses are not nested. We can reformulate the problem in a way that allows us to leverage methods developed to handle so called trial factors and obtain asymptotically valid frequentist tests. We illustrate the proposed method in a series of numerical studies that validate its power and false positive rate.

Summary

Primary author: ALGERI, Sara (Imperial College London)

Co-author: Prof. CONRAD, Jan (Stokcholm University)

Presenter: ALGERI, Sara (Imperial College London)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **110** Type: **Oral Contributions**

Neutrino Physics with the PINGU extension of IceCube

Monday, September 12, 2016 4:30 PM (20 minutes)

The Precision IceCube Next Generation Upgrade (PINGU) is a proposed low-energy in-fill extension to the IceCube Neutrino Observatory that will feature the world's largest effective mass of a few MTon for neutrinos at an energy threshold of a few GeV. The unprecedented statistical sample of GeV-scale atmospheric neutrinos will enable PINGU to quickly and at a modest cost investigate the following: determination of the neutrino mass ordering, non-maximal θ_{23} and an ensuing octant determination, and unitarity of the neutrino mixing matrix via ν_τ appearance. The physics topics extend beyond oscillation-based analyses to include tomography of the Earth's core and indirect dark matter searches.

The status of the project will be presented.

Summary

Primary author: KOSKINEN, David Jason (University of Copenhagen)

Presenter: KOSKINEN, David Jason (University of Copenhagen)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **111** Type: **Oral Contributions**

Electron and positron fluxes: the role of anisotropies from known astrophysical sources

Friday, September 16, 2016 3:20 PM (20 minutes)

High energy cosmic ray electrons and positrons probe the local properties of our Galaxy. In fact, regardless of the production mechanism, electromagnetic energy losses limit the typical propagation scale of GeV-TeV electrons and positrons to a few kpc.
In the diffusion model, the presence of nearby and dominant sources may produce an observable dipole anisotropy in the cosmic ray fluxes. This observable is crucial to discern the physical origin of the observed electron and positron fluxes.
I will present a detailed study on the role of anisotropies from nearby sources in the interpretation of present cosmic ray electron and positrons fluxes. Predictions for the dipole anisotropy from known astrophysical sources as supernova remnants and pulsars of the Green and ATNF catalogs will be shown. In particular, I will discuss anisotropies for single sources as well as for a distribution of catalog sources.
The results [1] will be compared with current anisotropy upper limits from the Fermi-LAT, AMS-02 and PAMELA experiments.

[1]S.Manconi, M.Di Mauro, F.Donato, in preparation.

Summary

Primary author: MANCONI, Silvia (INFN - National Institute for Nuclear Physics)

Co-authors: DONATO, Fiorenza (INFN - National Institute for Nuclear Physics); DI MAURO, mattia (Stanford University)

Presenter: MANCONI, Silvia (INFN - National Institute for Nuclear Physics)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **112** Type: **Oral Contributions**

Cosmic ray antiprotons : where are we ?

Tuesday, September 13, 2016 5:10 PM (20 minutes)

The antiproton-to-proton ratio is about to be published by the AMS collaboration. Any excess with respect to the astrophysical background could potentially be the eagerly awaited signal for the presence of WIMPs inside the Milky Way. These massive and weakly interacting species are natural candidates for the astronomical dark matter. Pervading the Galaxy, they are expected to pair-annihilate and yield antiprotons. If so, the antiproton flux at the Earth would be anomalously large.

I will present recent calculations of the antiproton background and will review how precisely it can be estimated, paying particular attention to the limits set by the positron flux on the cosmic ray propagation parameters. I will show that no claim of an antiproton excess can be made at the moment. I will finally comment on how constraining the new data are on WIMP properties.

Summary

Primary author: SALATI, P. (Unite Reseaux du CNRS (FR))

Presenter: SALATI, P. (Unite Reseaux du CNRS (FR))

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **113** Type: **Poster Contributions**

Spectral asymmetries of Galactic pulsars and the signature of photon-ALPs mixing

Wednesday, September 14, 2016 5:45 PM (15 minutes)

Abstract : Axion-like particles (ALPs) as an extension of the standard model define a generic class of light pseudo-sclars with a rich phenomenology because of their coupling to photons. Here we explore a so-far neglected opportunity to search for ALPs-photon coupling in the disappearance channel, i.e. a characteristic energy dependent suppression of gamma-rays. To verify this phenomenon we use seven years of Fermi-LAT Pass 8 data with P8R2_SOURCE_V6 IRFs of two gamma-ray pulsar sources and investigate the presence of spectral features of them in accordance with photon-ALPs coupling using particular models of the large-scale Galactic magnetic field. We estimate best fit values of parameters like photon-ALPs coupling and ALPs mass.

Summary

Primary author: Ms MAJUMDAR, Jhilik (Institut für Experimentalphysik, University of Hamburg)

Presenter: Ms MAJUMDAR, Jhilik (Institut für Experimentalphysik, University of Hamburg)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **114** Type: **Oral Contributions**

Indirect Dark Matter Search with CALET

Tuesday, September 13, 2016 4:30 PM (20 minutes)

The ISS-based CALET (Calorimetric Electron Telescope) detector is directly measuring the energy spectrum of electron+positron cosmic rays up to 20 TeV with an expected energy resolution of 2%. With an estimated proton rejection capability of $1 : 10^5$ and an aperture of approximately 1200 cm^2 sr, it will provide good statistics even well above one TeV. This precise spectrum is going to be analysed for signatures from nearby astrophysical sources such as pulsars and supernova remnants (SNR), as well as from Dark Matter annihilation and decay.
Pulsars and Dark Matter are candidates for the postulated extra source emitting an equal amount of electrons and positrons that is regarded as the origin of the positron excess.
Assuming a single pulsar is the extra source, the limits on a potential additional component from Dark Matter annihilation in the galactic halo expected to be obtained from 5 years of CALET observation are presented. It is shown that CALET could significantly improve upon current limits, especially for Dark Matter candidates with a large fraction of annihilation directly into electron+positron, such as the LKP (Lightest Kaluza-Klein particle).
As a possible case of a Dark Matter only explanation of the positron excess, Dark Matter decaying in a 3-particle leptonic mode was studied, as it is not constrained by anti-proton measurements and multiple theories predict suitable Dark Matter candidates. Based on the expected signal and background in CALET, the potential to discern the signatures of this decay from a pulsar being the extra source is shown.
The influence of a nearby SNR as an additional spectrum component in the TeV region and the prospects of using anisotropy in identification of the cosmic rays' origin are discussed as well.

Summary

The CALET detector is directly measuring the electron+positron cosmic ray spectrum up to 20 TeV with high precision. This measurement is going to be analysed for nearby astrophysical sources, as well as from Dark Matter annihilation and decay. Based on simulation of the expected CALET data, it is shown that it will allow for significant improvement upon current limits on Dark Matter annihilation, and discerning several possible Dark Matter explanations of the positron excess from the nearby pulsar explanation.

Primary author: MOTZ, Holger Martin (Waseda University)

Presenter: MOTZ, Holger Martin (Waseda University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **115** Type: **Oral Contributions**

The XENON dark matter program - results, status and prospects

Monday, September 12, 2016 4:50 PM (20 minutes)

The XENON program aims at direct detection of Weakly Interacting Massive Particles (WIMPs) detection with dual phase xenon time projection chambers (TPCs), located at the Laboratori Nazionale de Gran Sasso. This contribution is going to review recent results of the still operational XENON-100 detector, as well as discuss the status and prospects for the presently commissioned XENON-1T detector, the first tonne scale xenon TPC, and its planned upgrades.

Summary

The XENON program aims at direct detection of Weakly Interacting Massive Particles (WIMPs) with dual phase xenon time projection chambers (TPCs), located at the Laboratori Nazionale del Gran Sasso. This contribution is going to review recent results of the still operational XENON100 detector, as well as discuss the status and prospects for the presently commissioned XENON1T detector, the first tonne scale xenon TPC, and its planned upgrades.

Primary author: Prof. CONRAD, Jan (Stokcholm University)

Presenter: Prof. CONRAD, Jan (Stokcholm University)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **116** Type: **Oral Contributions**

Dark Matter Detectors and Neutrinos

Tuesday, September 13, 2016 3:20 PM (20 minutes)

I will talk about ongoing research into aspects of the fact that the next generation of dark matter detectors will detect neutrinos. I will describe some of the physics which will be constrained using such detections and also new methods to both eliminate and study the neutrino background.

Summary

Primary author: FAIRBAIRN, Malcolm

Presenter: FAIRBAIRN, Malcolm

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **117** Type: **Oral Contributions**

CP-violation and baryon-asymmetry from varying Yukawas at the weak scale.

Monday, September 12, 2016 2:20 PM (20 minutes)

Varying Yukawas open new possibilities for electroweak baryogenesis. In this talk I will focus on the CP-violation and the baryon-asymmetry (for details on the strength of the phase transition, see abstract by Iason Baldes). Starting from first principles, I will derive the general form of the CP-violating semiclassical force and the diffusion equations for models with varying Yukawa couplings. This represents a very general framework to determine the baryon-asymmetry generated in a given model. I will discuss the necessary ingredients for successful baryogenesis and I will apply this framework to different models and discuss the CP-violation and the amount of baryon-asymmetry produced.

Summary

Primary author: BRUGGISSER, Sebastian (DESY Theory-Group)

Co-author: SERVANT, Geraldine (Deutsches Elektronen-Synchrotron (DE))

Presenter: BRUGGISSER, Sebastian (DESY Theory-Group)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **118** Type: **Oral Contributions**

The last gasp of dark matter effective theories

Friday, September 16, 2016 2:40 PM (20 minutes)

Effective theories are a great tool to present constraints on broad BSM assumptions in a rather model-independent fashion. However, effective theories have a limited range of validity which can, especially in collider searches, complicate an analysis. We argue that in order to achieve a consistent analysis more specific hypotheses about BSM physics are needed and can subsequently be tested. This does not imply that the generality of EFTs has to be abandoned in favour of complete or simplified models. I will present large classes of theories (including naturally light pseudo Goldstone bosons, Goldstini and composite dark matter) where a parametrisation in terms of effective operators is indeed appropriate. We can classify these theories by the symmetries of the underlying UV-theory. Finally, I will discuss the consequences for an experimental analysis.

Summary

Primary author: BRUGGISSER, Sebastian (DESY Theory-Group)

Presenter: BRUGGISSER, Sebastian (DESY Theory-Group)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **119** Type: **Oral Contributions**

Antideuterons in cosmic rays: Sources and discovery potential

Tuesday, September 13, 2016 3:40 PM (20 minutes)

Antinuclei are a very promising discovery channel for exotic cosmic ray sources such as decaying or annihilating dark matter and evaporating primordial black holes. This talk will present an improved calculation of the antideuteron background including also collisions of primary cosmic rays in supernova remnants and will discuss the discovery potential for antideuterons in the light of present AMS-02 antiproton data.

Summary

Primary author: HERMS, Johannes (TUM)

Co-authors: IBARRA, Alejandro; WILD, Sebastian (TU Munich)

Presenter: HERMS, Johannes (TUM)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **120** Type: **Oral Contributions**

CALET Gamma-ray Burst Monitor: in-flight performance and preliminary results

Monday, September 12, 2016 3:15 PM (15 minutes)

The CALET Gamma-ray Burst Monitor (CGBM) is the secondary scientific instrument of the CALET mission on the International Space Station (ISS), which was successfully launched and attached to the International Space Station (ISS) at the end of August 2015 and began scientific operations in October 2015.
The CGBM consists of two LaBr3(Ce) and one BGO scintillators, each read by a single photomultiplier, with spectral sensitivity 7 keV - 1 MeV and 100 keV - 20 MeV respectively. The primary goal of CGBM is to observe a wide variety of gamma-ray bursts and other X/gamma-ray transients in both temporal regime (with 62.5 us resolution of time-tagged data) and spectral range (7 keV - 20 MeV overall energy band). The CGBM has been detecting GRBs with an average rate of ~3 per month.
By combining the data of CGBM and CALET primary instrument, Calorimeter (CAL), the energy coverage is extended to the GeV - TeV range. CALET participates in the electromagnetic follow-up campaign to support direct observations of gravitational waves made by LVC collaboration, specifically by investigating the existence of possible X-ray and gamma-ray counterparts.
In this presentation, we report on the CGBM operational status, in-flight performances and preliminary results on GRB observation.

Summary

Primary author: RICCIARINI, Sergio Bruno (INFN)

Presenters: RICCIARINI, Sergio Bruno (INFN); RICCIARINI, Sergio Bruno (Universita e INFN, Firenze (IT))

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **121** Type: **Oral Contributions**

VHE gamma-ray observations of binary systems with the MAGIC telescopes.

Thursday, September 15, 2016 5:30 PM (15 minutes)

There are several types of Galactic sources that can potentially accelerate charged particles up to GeV and TeV energies. These accelerated particles can produce Very High Energy (VHE) gamma-ray emission through different processes like inverse Compton scattering of ambient photon fields by accelerated electrons.
We present here the results of our observations on X-ray and gamma-ray binaries and the subclass of binary systems known as novae, performed with the MAGIC telescopes. The focus lies on four sources: LS I +61 303, MWC 656, Cygnus X-1 and AE Aquarii. We observed the binary system LS I +61 303 in a long-term monitoring campaign for 8 years. We will show the newest results on our search for superorbital variability also in context with a 4-yr contemporaneous optical observations. MWC 656 is a unique detected high-mass X-ray binary system, since it is up to now the only one known composed of a Be star and a black hole. Cygnus X-1 is one of the brightest X-ray sources and best studied microquasars along a broad range of wavelengths. We will present the results of our search of steady and variable emission. Results of our multiwavelength observation campaign regarding the cataclysmic variable AE Aquarii and observations of several novae events will be discussed. Furthermore, we will present the observations of the only super-critical accretion system known in our galaxy: SS433.

Summary

Primary author: FERNÁNDEZ-BARRAL, Alba (Institut de Fisica d'Altes Energies-IFAE)

Presenter: FERNÁNDEZ-BARRAL, Alba (Institut de Fisica d'Altes Energies-IFAE)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **122** Type: **Poster Contributions**

Modelling the flux distribution of the high-energy neutrino sky

Wednesday, September 14, 2016 5:45 PM (15 minutes)

We perform a spectral and anisotropic one-point-fluctuation analysis of high-energy Icecube data, based on data-driven modelling of both galactic and extragalactic contributions to the flux.

Summary

We perform a spectral and anisotropic one-point-fluctuation analysis of high-energy Icecube data, based on data-driven modelling of both galactic and extragalactic contributions to the flux.

Primary author: FEYEREISEN, Michael (University of Amsterdam)

Presenter: FEYEREISEN, Michael (University of Amsterdam)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **123** Type: **Oral Contributions**

Simplified models vs EFTs for DM searches at the LHC

Thursday, September 15, 2016 3:00 PM (20 minutes)

As results from Run II of the LHC continue to be released, it is important to evaluate the ways in which we study DM at colliders. EFTs can be a useful tool to constrain DM in a semi-model-independent way, but it is now clear that this approach has limitations.

EFTs are now supplemented by simplified models of dark matter, and it is important to approach these models in a logical and consistent way so that we can learn as much as possible about the dark sector. Simplified models are designed to be simple so that the full parameter space can be explored. At the same time, they are designed to still provide much of the same phenomenology as full models, so that we don't miss any potential signals. I will talk about some recent developments in the usage of simplified models, and some of the challenges and techniques we use to achieve these sometimes contradictory goals.

Summary

Primary author: JACQUES, Thomas David (Scuola Int. Superiore di Studi Avanzati (IT))

Presenter: JACQUES, Thomas David (Scuola Int. Superiore di Studi Avanzati (IT))

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **124** Type: **Oral Contributions**

Probing thermal freeze-out with searches for dijet resonances at LHC and 100 TeV

Thursday, September 15, 2016 2:20 PM (20 minutes)

A new Z' boson with couplings to quarks and dark matter offers an intriguing possibility for setting the dark matter relic abundance via thermal freeze-out. Hadron colliders are a promising tool for probing this set-up using searches for dijet resonances. Nevertheless, there are various ways to hide the new mediator: the Z' could couple so strongly to dark matter that it decays almost always invisibly, the width of the Z' could be so large that it is not easily recognizable as a resonance or dark matter annihilation in the early Universe could proceed with a large resonant enhancement and rather small couplings. In my talk I will explore these possibilities and discuss whether they can be constrained by the LHC or a 100 TeV collider. I will show that a Z' with a broad width is already tightly constrained, while a 100 TeV collider can make significant progress even for small couplings and narrow resonances.

Summary

Primary author: KAHLHOEFER, Felix (DESY)

Co-author: FAIRBAIRN, Malcolm

Presenter: KAHLHOEFER, Felix (DESY)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **125** Type: **Poster Contributions**

MAGIC searches for IceCube HESE track directions

Wednesday, September 14, 2016 5:20 PM (15 minutes)

The MAGIC telescopes can potentially detect very-high-energy gamma-rays emitted by multi-messenger sources.
One such interesting target that has been found recently, is astrophysical neutrino events.
Gamma-ray observations of neutrino directions have a potential to find hadronic gamma-ray emissions from the neutrino directions and to identify neutrino sources.
The IceCube Collaboration has reported detection of up to 55 astrophysical neutrino events, resulting from interactions with the material inside the IceCube detector's active volume – the so-called High Energy Starting Events (HESE).
These include 13 track-like events, usually generated by a muon neutrino via charged-current interaction.
The track-like events (as opposed to cascade-like ones, made via neutral-current interaction) are characterised by a good angular resolution (<1 degree) which enables follow-up observations by IACTs.
In 2016 the MAGIC telescopes carried out follow-up observations of 4 selected HESE track-like events from the Northern hemisphere: HESE-37, HESE-38, HET (ATel #7856), and the latest GCN alert of 27th April (GCN #19363), whose deposited energies range from >30 TeV up to 2600 TeV.
In this contribution we will present the results of the MAGIC observations and discuss their ensuing constraints on the density of astrophysical neutrino sources.

Summary

Primary author: NODA, Koji (Max-Planck-Institute for Physics)

Presenter: NODA, Koji (Max-Planck-Institute for Physics)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **126** Type: **Poster Contributions**

The spectrum of the core of Centaurus A as seen by H.E.S.S. and Fermi

Wednesday, September 14, 2016 5:05 PM (15 minutes)

Cen A is the nearest radio-galaxy detected as a VHE gamma-ray source. Discovered by the H.E.S.S. telescopes in Namibia, Cen A is a faint VHE gamma-ray emitter, and the flux derived from the H.E.S.S. data is much higher than that expected from a single zone SSC model which adequately describes the emission from Cen A at lower frequencies. New observations with H.E.S.S. were performed to clarify the spectral characteristics of the VHE emission from the core of Cen A. We report the results of the analysis of the complete H.E.S.S. dataset with a live-time which is two times longer than the previously published one and an update of the Cen A spectrum obtained with Fermi-LAT at GeV energies.

Summary

Primary author: PROKHOROV, Dmitry (Linnaeus University)

Presenter: PROKHOROV, Dmitry (Linnaeus University)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **127** Type: **Oral Contributions**

The VERITAS Dark Matter and Astroparticle Physics Program

Friday, September 16, 2016 2:00 PM (20 minutes)

VERITAS is an array of imaging atmospheric Cherenkov telescopes devoted to the study of the gamma-ray sky in the energy range between 85 GeV and > 30 TeV. VERITAS observations enable a broad program of scientific inquiry, including the study of extreme astrophysical sources both within and beyond our galaxy, the search for dark matter, and a number of topics in astroparticle physics. We present an update on indirect dark matter searches performed with VERITAS, describe the current status and future prospects of the VERITAS multimessenger program, and summarize recent astroparticle physics results.

Summary

Primary author: Prof. HUMENSKY, Brian (Columbia University)

Presenter: Prof. HUMENSKY, Brian (Columbia University)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **128** Type: **Oral Contributions**

Understanding uncertainties in modeling the Galactic diffuse gamma-ray emission

Thursday, September 15, 2016 2:40 PM (20 minutes)

The nature of the Galactic diffuse gamma-ray emission as measured by the Fermi Gamma-ray Space Telescope has remained an active area of research for the last several years. In particular, the discovery of a GeV excess towards the Galactic center has generated enormous interest in trying to understand its origins, whether astrophysical or more exotic. While most analyses of the GeV excess confirm its existence, its morphology is not well-constrained, which limits our ability to understand the origin of this excess.

We therefore introduce a new template-fitting approach to study the various components of the Galactic diffuse gamma-ray emission, and their correlations and uncertainties. One application will be to characterize the morphology and the spectrum of the excesses in the inner Galaxy. Rather than starting from fixed predictions from cosmic-ray propagation codes and examining the residuals to understand the quality of fits and the presence of excesses, we introduce additional fine-grained variations in the templates that account for uncertainties in gas tracers and the small scale variations in the density of cosmic rays. This approach results in ~100,000 free parameters for analysis of the Galactic disk, which we fit with an algorithm borrowed from positron emission tomography imaging.

I will present first results from applying this template-fitting approach to the Galactic diffuse gamma-ray emission, including a characterization of the GeV excess in the Galactic center as well as other distinct excesses along the disk.

Summary

Primary author: STORM, Emma (GRAPPA, University of Amsterdam)

Co-author: WENIGER, Christoph (University of Amsterdam)

Presenter: STORM, Emma (GRAPPA, University of Amsterdam)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **129** Type: **Oral Contributions**

Galactic cosmic rays: Lesson from diffuse gamma-ray observations

Thursday, September 15, 2016 5:00 PM (15 minutes)

Low-latitude Fermi-LAT data, together with the high resolution gas (CO & HI) and the dust opacity maps, has been recently exploited to study the radial emissivity of γ-rays induced by interactions of cosmic rays (CRs) with the interstellar medium along the Galactic Plane.
Both the absolute emissivity and the energy spectra of γ-rays exhibit significant variations along the galactic plane.
For the first time, models about the galactic distribution of CR factories, as well as about the CR propagation throughout the Galaxy, can be severely tested against not-local observations.
In this talk, we will show how the latest measurements pose constraints on the different CR source candidates and call for inhomogeneous transport conditions in the Galaxy.

Summary

Low-latitude Fermi-LAT data, together with the high resolution gas (CO & HI) and the dust opacity maps, has been recently exploited to study the radial emissivity of γ-rays induced by interactions of cosmic rays (CRs) with the interstellar medium along the Galactic Plane.
Both the absolute emissivity and the energy spectra of γ-rays exhibit significant variations along the galactic plane.
For the first time, models about the galactic distribution of CR factories, as well as about the CR propagation throughout the Galaxy, can be severely tested against not-local observations.
In this talk, we will show how the latest measurements pose constraints on the different CR source candidates and call for inhomogeneous transport conditions in the Galaxy.

Primary author: Dr EVOLI, Carmelo (Gran Sasso Science Institute)

Co-author: Prof. AHARONIAN, Felix (Max-Planck-Institut f uer Kernphysik, Heidelberg, Germany)

Presenter: Dr EVOLI, Carmelo (Gran Sasso Science Institute)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **130** Type: **Poster Contributions**

Stellar and solar Inverse Compton emission computation with StellarICs

Wednesday, September 14, 2016 5:45 PM (15 minutes)

We present the software StellarICs in development since 2013, year of the first release.

Summary

StellarICs is software to compute gamma-ray emission from inverse-Compton scattering by cosmic-ray leptons in the heliosphere and in the photospheres of stars. It includes a formulation of modulation in the heliosphere, but can be used for any user-defined modulation model. Profiles and spectra are output to FITS files in a variety of forms for convenient use. Also included are general-purpose inverse-Compton routines with other features like energy loss rates and emissivity for any user-defined target photon and lepton spectra. The software is publicly available and it is under continuing development.

Primary author: Dr ORLANDO, Elena (HEPL/KIPAC, Stanford University)

Presenter: Dr ORLANDO, Elena (HEPL/KIPAC, Stanford University)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **131** Type: **Poster Contributions**

VHE gamma-rays from S50716+714 during its brightest outburst

Wednesday, September 14, 2016 5:45 PM (15 minutes)

S5 0716+714 is a well known BL-Lac object, characterized by an extreme variability across the whole electromagnetic spectrum. The discovery in the Very High Energy band (VHE, E> 100 GeV) by MAGIC happened in 2008, but at that time Fermi-LAT data were not yet available. During January 2015 the source went through the brightest optical state ever observed, triggering MAGIC follow-up observations, which resulted in a VHE detection with ~13 sigma significance (ATel #6999). The data, combined with simultaneous Fermi-LAT observations in the High Energy (HE, 100 MeV < HE <100 GeV) regime allow to constrain the inverse Compton peak of the spectrum. Moreover, the presence of simultaneous data from MAGIC in the VHE gamma-ray range and Fermi-LAT in the HE band will lead to a more precise estimation of the redshift. Rich multiwavelength coverage of the impressive high state allowed us to study the broad-band spectral energy distribution of S50716+714 during its brightest outburst. We present the preliminary analysis of MAGIC and Fermi-LAT data of the flaring activity in January and February 2015 for the HE and VHE band, together with radio (Metsahovi, OVRO, VLBA, Effelsberg), sub-millimeter (SMA), optical (Tuorla, Perkins, Steward, AZT-8+ST7, LX-200, Kanata), X-ray and UV (Swift-XRT and UVOT), in the same time-window. We also report on a preliminary study on the Extragalactic Background Light absorption with implications on current EBL models and on the redshift determination.

Summary

S5 0716+714 is a well known BL-Lac object, characterized by an extreme
variability across the whole electromagnetic spectrum. It was discovered by MAGIC in 2008, when Fermi-data were not yet available. In Jan 2015 an extreme outburst in all the wavelenghts, from radio to VHE, allowed us to deeply study the source and investigate its variable nature taking advantage of the rich multi-wavelength coverage.

Primary author: Dr MANGANARO, Marina (IAC (Instituto de Astrofísica de Canarias))

Presenter: Dr MANGANARO, Marina (IAC (Instituto de Astrofísica de Canarias))

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **132** Type: **Poster Contributions**

VHE gamma-rays from the blazar S4 0954+65 by the MAGIC Telescopes during an exceptionally high optical state

Wednesday, September 14, 2016 5:45 PM (15 minutes)

The blazar S4 0954+65 (at a disputed redshift of z=0.368 or z>=0.45) underwent an exceptionally high state in optical during January and February 2015, as revealed by the Tuorla and St. Petersburg University blazar monitoring programs: a brightening of more than 3 magnitudes in the R-band from the average monitored states. Simultaneous data from the Fermi/LAT satellite at high energy gamma rays (100 MeV < E < 100 GeV) also show a period of increased activity.
MAGIC observations, triggered by the enhanced emission state at lower energies, led to the discovery of very high energy (VHE, E > 100 GeV) emission from S4 0954+65 (ATel #7080). The VHE flux above 150 GeV is estimated to be about 6% of the Crab nebula flux above the same threshold.
In this contribution we present a comprehensive multiwavelength picture of this object, including data from mm/optical/X-ray/HE and VHE gamma-ray bands along with an analysis of the parsec-scale jet behavior. The study of the optical polarization degree and of the rotation of the polarization angle yields information about the magnetic field topology in the acceleration and emission region. The high emission state during the flare allows us to compile the simultaneous broadband spectral energy distribution and to characterize it in the scope of blazar jet emission models. With an unbiased and uniform scan of the multi-dimensional space of model parameters and an a posteriori evaluation of the model-to-data agreement, the applicability of current emission models, e.g. the synchrotron self-Compton scenario, can be tested. The agreement of the broadband spectrum with an emission mechanism commonly invoked for flat spectrum radio quasars (i.e. inverse Compton scattering on an external soft photon field from the dust torus) will be also discussed.

Summary

In Jan and Feb 2015 The blazar S4 0954+65 underwent an exceptionally high state in optical a brightening of more than 3 magnitudes in the R-band from the average monitored states.
MAGIC observations, triggered by the enhanced emission state at lower energies, led to the discovery of very high energy (VHE, E > 100 GeV) emission from S4 0954+65 (ATel #7080).

Primary authors: PEDALETTI, Giovanna; Dr MANGANARO, Marina (IAC (Instituto de Astrofísica de Canarias))

Presenter: Dr MANGANARO, Marina (IAC (Instituto de Astrofísica de Canarias))

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **133** Type: **Oral Contributions**

Study of the AMS-02 results of cosmic electron/positron spectra and anti-proton fraction

The Alpha Magnetic Spectrometer (AMS-02) has published the unprecedentedly precise measurement of the cosmic electron and positron spectra as well as the positron fraction and anti-proton fraction. We have given a quantitative study on the AMS-02 results by a global fitting to the electron and positron spectra, together with the positron fraction data. The primary electron spectrum and the parameters for pulsars or dark matter that contribute extra positrons are determined simultaneously. We find that there is a hardening of the primary electron spectrum at ~60 GeV. With such a new feature at the background spectrum, both the pulsars and dark matter can explain the AMS-02 results very well. The anti-proton fraction measured by AMS-02 is also studied systematically, focusing on the uncertainties of secondary anti-proton prediction from cosmic rays propagation and hadronic interaction.

Summary

Primary author: BI, Xiaojun (Institute of High Energy Physics, CAS)

Co-author: LIN, Sujie (Chinese Academy of Sciences (CN))

Presenter: BI, Xiaojun (Institute of High Energy Physics, CAS)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **134** Type: **Oral Contributions**

Evidence against star-forming galaxies as the dominant source of IceCube neutrinos

Tuesday, September 13, 2016 4:50 PM (20 minutes)

The cumulative emission resulting from hadronic cosmic-ray interactions in star-forming galaxies (SFGs) has been proposed as the dominant contribution to the astrophysical neutrino flux at TeV to PeV energies reported by IceCube.
The same particle interactions also inevitably create gamma-ray emission that could be detectable as a component of the extragalactic gamma-ray background (EGB), which is now measured with the *Fermi*-LAT in the energy range from 0.1 to 820 GeV.
New studies of the blazar flux distribution at gamma-ray energies above 50 GeV place an upper bound on the residual non-blazar component of the EGB.
We show that these results are in strong tension with models that consider SFGs as the dominant source of the diffuse neutrino backgrounds.
A characteristic spectral index for parent cosmic rays in starburst galaxies of $\Gamma_{\rm SB} \simeq 2.3$ for $dN/dE \propto E^{-\Gamma_{\rm SB}}$ is consistent with the observed scaling relation between gamma-ray and IR luminosity for SFGs, the bounds from the non-blazar EGB, and the observed gamma-ray spectra of individual starbursts, but underpredicts the IceCube data by approximately an order of magnitude.

Summary

Primary author: BECHTOL, Keith (University of Wisconsin-Madison)

Presenter: BECHTOL, Keith (University of Wisconsin-Madison)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **135** Type: **Oral Contributions**

Neutrinos in cosmology

Thursday, September 15, 2016 2:00 PM (20 minutes)

Neutrinos deeply affect cosmological observables, such as the cosmic microwave background and the power spectrum of matter fluctuations. Thanks to these fingerprints cosmology can detect the cosmic neutrino background and constrain the number of neutrino species and the neutrino mass sum with greater precision than current laboratory experiments. However cosmological bounds are model dependent, therefore complementary results from earth based neutrino experiments are essential to provide robust constraints.
In this framework the case of sterile neutrinos represents an open question.
Indeed over the last decade oscillation data have provided hints of the existence of one (or more) sterile neutrinos in the eV mass range, while the latest Planck results rule out additional neutrino species at high significance.
In this talk, after reviewing the up to date cosmological constraints on neutrinos, I will present a pseudoscalar model of secret interactions which provides a simple and elegant way of reconciling eV sterile neutrinos with precision cosmology.

Summary

Primary author: ARCHIDIACONO, Maria

Presenter: ARCHIDIACONO, Maria

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **136** Type: **Oral Contributions**

Self-consistent Calculation of the Sommerfeld Enhancement

Tuesday, September 13, 2016 6:10 PM (20 minutes)

The Sommerfeld enhancement is an important effect to modify the dark matter annihilation cross section if the dark matter couples with a force mediator whose mass is much smaller than the dark matter mass. Usually, the cross section is estimated as a product of the leading order cross section and the enhancement factor, which is calculated by solving Schrodinger equation with long range potential. However, this calculation is not guaranteed to satisfy partial wave unitarity upperbound. In this talk, I will discuss the dark matter s-wave annihilation in non-relativistic regime. In our calculation, the annihilation effect is consistently included in the Schrodinger equation. Our procedure gives a cross section formula which satisfy the partial wave unitarity bound.

Summary

Primary author: SATO, Ryosuke

Presenter: SATO, Ryosuke

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **137** Type: **Oral Contributions**

Dark matter models with two mediators

Thursday, September 15, 2016 3:20 PM (20 minutes)

A reliable comparison of different dark matter searches requires models that satisfy certain consistency conditions like gauge invariance and perturbative unitarity. These conditions can easily be satisfied in U(1)' extensions of the Standard Model, where a fermionic dark matter candidate as well as a new Z' gauge boson obtain their mass from the spontaneous breaking of the U(1)' by a dark Higgs. These dark matter scenarios contain two mediators, the new gauge boson and the dark Higgs, which can also act as final states in dark matter annihilation. I will discuss the general framework of consistent dark matter models with two mediators, and then review a class of dark matter models where baryon number is a local gauge symmetry.

Summary

Primary author: DUERR, Michael (DESY)

Presenter: DUERR, Michael (DESY)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **138** Type: **Oral Contributions**

Multi-frequency, broad-band variability study of BL Lac OJ 287

Monday, September 12, 2016 5:30 PM (15 minutes)

The main results from our analysis are :
(1) nature of processes generating
flux variability at optical/radio frequencies is different from
those at GeV freqeuncies ($\beta \sim 2$ and 1, respectively); this could
imply, that $\gamma-$ray variability, unlike the Synchrotron (radio-to-optical) one,
is generated by superposition of two stochastic processes with different
relaxation timescales, (2) the main driver behind the optical variability
is same on years, months, days, and hours timescales ($\beta \sim 2$), which argues
against the scenario where different drivers behind the long-term flux
changes and intra-night flux changes are considered, such as internal shocks
due to the jet bulk velocity fluctuation (long-term flux changes) versus small-scale magnetic
reconnection events taking place at the jet base (intra-night flux
changes). Implications of these results
are discussed in the context of blazar emission models.

Summary

The power spectral densities (PSDs) of blazar light curves,
$P(f) = Af^{-\beta}$, where A is the normalization and β is the slope,
indicate that the variability is generated by the underlying {\it stochastic}
processes (i.e., $\beta \simeq 1-3$, characteristic of flicker/red noise).
Study of power-law slopes, normalization or characteristic
timescales (if any), in the PSD is important for constraining
the physics of emission and energy dissipation processes in the blazar jets.
We present the results of PSD analysis of the BL Lac object OJ 287
at GeV ({\it Fermi}-LAT), optical (R-band)
and radio (GHz band from UMRAO and OVRO programmes),
covering few decades to sub-hours timescales.
The novelty of this study is that at optical frequency,
by combining long-term (historical optical light curve starting from 1986),
Kepler 2 mission data and densely sampled intra-night
lightcurves, the PSD characterisitics are investigated for temporal frequencies
ranging over 7 orders of magnitude.

Primary author: GOYAL, Arti (AO-JU)

Presenter: GOYAL, Arti (AO-JU)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **139** Type: **Poster Contributions**

Multimessenger constraints on the origin of IceCube high-energy neutrinos

Wednesday, September 14, 2016 5:35 PM (15 minutes)

In baseline scenarios, energetic astrophysical neutrinos are produced in decays of charged pions, which in turn originate from proton-proton or proton-gamma collisions. Neutral-pion decays produce an accompanying gamma-ray flux, and observational data on gamma rays and cosmic rays impose serious constraints on scenarios explaining the origin of IceCube high-energy events. I review these constraints, present some promising models and discuss prospects of their testing in the yet-unexplored field of (sub)-PeV gamma-ray astronomy.

Summary

Primary author: Prof. TROITSKY, Sergey (Institute for Nuclear Research, Russian Academy of Sciences (RU))

Presenter: Prof. TROITSKY, Sergey (Institute for Nuclear Research, Russian Academy of Sciences (RU))

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **140** Type: **Oral Contributions**

Search for Cosmic Ray Anisotropy with the Alpha Magnetic Spectrometer on the International Space Station

Friday, September 16, 2016 2:40 PM (20 minutes)

The search for cosmic positron anisotropy has been performed using particles collected by the Alpha Magnetic Spectrometer on the International Space Station. The positron to electron ratio is consistent with isotropy at all energies and angular scales. The analysis of the positron to proton ratio yields consistent results.

Summary

Primary author: ZEISSLER, Stefan (KIT - Karlsruhe Institute of Technology (DE))

Co-author: GEBAUER, Iris (KIT - Karlsruhe Institute of Technology (DE))

Presenter: ZEISSLER, Stefan (KIT - Karlsruhe Institute of Technology (DE))

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **141** Type: **Oral Contributions**

The SHIP Experiment at CERN

Tuesday, September 13, 2016 4:30 PM (20 minutes)

SHIP is a new general purpose fixed target facility, whose Technical Proposal has been recently reviewed by the CERN SPS Committee and by the CERN Research Board. The two boards recommended that the experiment proceeds further to a Comprehensive Design phase in the context of the new CERN Working group "Physics Beyond Colliders", aiming at presenting a CERN strategy for the European Strategy meeting of 2019. In its initial phase, the 400GeV proton beam extracted from the SPS will be dumped on a heavy target with the aim of integrating 2×1020 pot in 5 years. A dedicated detector, based on a long vacuum tank followed by a spectrometer and particle identification detectors, will allow probing a variety of models with light long-lived exotic particles and masses below O(10) GeV /c2. The main focus will be the physics of the so-called Hidden Portals, i.e. search for Dark Photons, Light scalars and pseudo-scalars, and Heavy Neutrinos. The sensitivity to Heavy Neutrinos will allow for the first time to probe, in the mass range between the kaon and the charm meson mass, a coupling range for which Baryogenesis and active neutrino masses could also be explained. Another dedicated detector will allow the study of neutrino cross-sections and angular distributions. $\nu\tau$ deep inelastic scattering cross sections will be measured with a statistics 1000 times larger than currently available, with the extraction of the F4 and F5 structure functions, never measured so far and allow for new tests of lepton non-universality with sensitivity to BSM physics.

Summary

SHIP is a new general purpose fixed target facility, whose Technical Proposal has been recently reviewed by the CERN SPS Committee and by the CERN Research Board. The two boards recommended that the experiment proceeds further to a Comprehensive Design phase in the context of the new CERN Working group "Physics Beyond Colliders", aiming at presenting a CERN strategy for the European Strategy meeting of 2019. In its initial phase, the 400GeV proton beam extracted from the SPS will be dumped on a heavy target with the aim of integrating 2×1020 pot in 5 years. A dedicated detector, based on a long vacuum tank followed by a spectrometer and particle identification detectors, will allow probing a variety of models with light long-lived exotic particles and masses below O(10) GeV /c2. The main focus will be the physics of the so-called Hidden Portals, i.e. search for Dark Photons, Light scalars and pseudo-scalars, and Heavy Neutrinos. The sensitivity to Heavy Neutrinos will allow for the first time to probe, in the mass range between the kaon and the charm meson mass, a coupling range for which Baryogenesis and active neutrino masses could also be explained. Another dedicated detector will allow the study of neutrino cross-sections and angular distributions. $\nu\tau$ deep inelastic scattering cross sections will be measured with a statistics 1000 times larger than currently available, with the extraction of the F4 and F5 structure functions, never measured so far and allow for new tests of lepton non-universality with sensitivity to BSM physics.

Primary author: SHIP, Collaboration (CERN)

Presenters: SHIP, Collaboration (CERN); CAMPANELLI, Mario (University College London (UK))

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **142** Type: **Poster Contributions**

New tests of the anomalous transparency of the Universe for gamma rays and of its axionic explanation.

Wednesday, September 14, 2016 4:50 PM (15 minutes)

New observational tests of anomalies in absorption of gamma rays from distant sources, which may point to existence of light axion-like particles, are discussed. Constraints on parameters of the would-be axion-like particle are presented and various scenarios are tested.

Summary

Primary author: Prof. TROITSKY, Sergey (Institute for Nuclear Research, Russian Academy of Sciences (RU))

Co-author: RUBTSOV, Grigory (INR RAS)

Presenter: Prof. TROITSKY, Sergey (Institute for Nuclear Research, Russian Academy of Sciences (RU))

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **143** Type: **Oral Contributions**

Mrk421 and Mrk501 as high-energy physics laboratories to study the nature of blazars

Monday, September 12, 2016 5:15 PM (15 minutes)

The blazars Mrk421 and Mrk501 are among the brightest keV and TeV sources in the sky, and among the few sources whose (radio to VHE gamma-rays) Spectral Energy Distributions (SEDs) can be characterized by current instruments by means of relatively short observations (minutes to hours). Consequently, Mrk421 and Mrk501 can be studied with a larger degree of accuracy than most of the other blazars whose emissions are weaker or are located farther away. Since 2008, there has been an unprecedentedly long and dense monitoring of the broadband emission from these two archetypical TeV blazars, involving the participation of Fermi, MAGIC, VERITAS, FACT, F-GAMMA, Swift, RXTE, NuSTAR, GASP-WEBT, VLBA, and other collaborations/groups and instruments which have been providing the most detailed temporal and energy coverage on these sources to date. In the conference I will report some highlight results from these campaigns that have been recently published. Both Mrk421 and Mrk501 have shown a large complexity in the temporal evolution of their broadband SEDs, with the presence of different flavors of flaring activity. Despite some differences in their variability patterns, there are also a number of similarities that support a broadband emission dominated by leptonic scenarios, as well as indications for in situ electron acceleration in multiple compact regions.

Summary

Primary author: PANEQUE, David (Max Planck Institute for Physics, Munich)

Presenter: PANEQUE, David (Max Planck Institute for Physics, Munich)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **144** Type: **Oral Contributions**

Tests of general relativity with gravitational waves

Thursday, September 15, 2016 5:50 PM (20 minutes)

The direct detection of gravitational waves with Advanced LIGO has opened up the possibility of probing the genuinely strong-field dynamics of pure spacetime for the first time. Several tests of general relativity (GR) were carried out with the gravitational wave events GW150914 and GW151226. In the case of GW150914, the merger itself was in the most sensitive part of the detectors' frequency band, allowing for a check of the relation that exists in GR between the masses and spins of the initial component black holes and the mass and spin of the single black hole resulting from their merger. Furthermore, the data following the peak of the signal were consistent with the "ringdown" of this highly excited remnant black hole. From the properties of the signal after propagation from source to observer, it was possible to infer a bound on the graviton mass of $m_g < 1.2 \times 10^{-22}\,\mathrm{eV}/c^2$. In the case of GW151226, many more cycles from the "inspiral" of the initial black holes were in the detectors' sensitive band, allowing for stringent constraints on deviations from GR to high order in an expansion in powers of v/c, with v the characteristic velocity. So far all tests show consistency with GR in the highly non-linear, dynamical regime. Possible future checks, depending on what new kinds of compact binary mergers we will see, will also be discussed.

Summary

Primary author: Dr VAN DEN BROECK, Chris (Nikhef)

Presenter: Dr VAN DEN BROECK, Chris (Nikhef)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **145** Type: **Poster Contributions**

Can we see neutrino flares? Exploring the source parameter space for detectability.

Wednesday, September 14, 2016 4:35 PM (15 minutes)

The new generation of powerful instruments are reaching sensitivities and temporal resolutions that will allow a multi-messengers detection of transient phenomena. In this study, we explore the parameter-space of flaring sources (in particular in terms of luminosity, time-variability or emission energy band) that would enable the detection of transient neutrino signatures. We consider neutrinos produced by photo-hadronic interactions on various photon fields in the source. We give robust necessary conditions on the photon flux from the sources to ensure the detection of neutrinos from current and upcoming experiments.

Summary

Primary author: GUÉPIN, Claire (IAP)

Co-author: KOTERA, Kumiko (Institut d'Astrophysique de Paris)

Presenters: GUÉPIN, Claire (IAP); KOTERA, Kumiko (Institut d'Astrophysique de Paris)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **146** Type: **Invited Contributions**

Leptogenesis from Oscillations of Heavy Neutrinos with Large Mixing Angles

Monday, September 12, 2016 3:20 PM (20 minutes)

The extension of the Standard Model by heavy right-handed neutrinos can simultaneously explain the observed neutrino masses via the seesaw mechanism and the baryon asymmetry of the Universe via leptogenesis. If the mass of the heavy neutrinos is below the electroweak scale, they may be found at LHCb, BELLE II, the proposed SHiP experiment or a future high-energy collider. In this mass range, the baryon asymmetry is generated via CP-violating oscillations of the heavy neutrinos during their production. We study the generation of the baryon asymmetry of the Universe in this scenario from first principles of non-equilibrium quantum field theory, including spectator processes and feedback effects.
We eliminate several uncertainties from previous calculations and find that the baryon asymmetry of the Universe can be explained with larger heavy neutrino mixing angles, increasing the chance for an experimental discovery.
For the limiting cases of fast and strongly overdamped oscillations of right-handed neutrinos, the generation of the baryon asymmetry can be calculated analytically up to corrections of order one.

Summary

Primary authors: GARBRECHT, Bjorn; Mr GUETER, Dario (Technische Universität München); DREWES, Marco (Technische Universitaet Muenchen (DE))

Presenter: Mr KLARIC, Juraj (Technische Universität München)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **147** Type: **Oral Contributions**

Tachyonic Reheating to a Higgs Boson

Thursday, September 15, 2016 2:20 PM (20 minutes)

A trilinear coupling between an inflaton and the Standard Model Higgs boson opens up an exponentially enhanced decay channel. Such a coupling is for instance generically present in a combined Goldstone Inflation and Composite Higgs scenario. Here I will discuss our analysis of such a scenario and its constraints, paying attention to both the feasibility of the production of Standard Model particles and the stability of the electroweak vacuum.

Summary

A trilinear coupling between an inflaton and the Standard Model Higgs boson opens up an exponentially enhanced decay channel. Such a coupling is for instance generically present in a combined Goldstone Inflation and Composite Higgs scenario. Here I will discuss our analysis of such a scenario and its constraints, paying attention to both the feasibility of the production of Standard Model particles and the stability of the electroweak vacuum.

Primary author: CROON, Djuna (University of Sussex)

Presenter: CROON, Djuna (University of Sussex)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **148** Type: **Oral Contributions**

MAGIC observations of the enigmatic Gamma Cygni supernova remnant

Thursday, September 15, 2016 5:45 PM (15 minutes)

Gamma Cygni SNR (G78.2+2.1) is one of the first supernova remnants (SNR) detected in the high-energy gamma-ray band. It is a middle-aged SNR (~7000 years old) situated in the Cygnus region. The high-energy observations by VERITAS and Fermi-LAT revealed a complex, energy-dependent morphology of the SNR in the GeV-TeV band, different from that observed in X-rays. G78.2+2.1 also hosts the pulsar PSR J2021+4026, which is the only variable gamma-ray pulsar known to date. Here we present the results from recent MAGIC observations of the Gamma Cygni nebula and pulsar complex. We discuss the TeV morphology of the source and possible origins of the gamma-ray emission in the multi-wavelength context.

Summary

Primary author: Mr STRZYS, Marcel (Max Planck Institute for Physics, Germany)

Presenter: Mr STRZYS, Marcel (Max Planck Institute for Physics, Germany)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **149** Type: **Oral Contributions**

Status of LBNF and DUNE

Tuesday, September 13, 2016 2:00 PM (20 minutes)

The global neutrino physics community is coming together to develop the Deep Underground Neutrino Experiment (DUNE). It is a groundbreaking science experiment for long-baseline neutrino oscillation studies and for neutrino astrophysics and nucleon decay searches. The facility required for DUNE, the Long-Baseline Neutrino Facility (LBNF), comprises an expansion of the underground infrastructure at the Sanford Underground Research Facility (SURF) in South Dakota and the creation of a megawatt neutrino-beam facility at Fermilab. DUNE will install a very large (4 × 10 kT) modular liquid argon time-projection chamber (LArTPC) located deep underground together with a high-resolution near detector hosted at Fermilab site, providing a 1300 km baseline. In this presentation I will describe the status of DUNE/LBNF and its scientific capabilities.

Summary

Primary author: GARCIA-GAMEZ, Diego

Presenter: GARCIA-GAMEZ, Diego

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **150** Type: **Oral Contributions**

Precision Measurement of Nuclei Fluxes and their Ratios in Cosmic Rays with the Alpha Magnetic Spectrometer on the International Space Station

Tuesday, September 13, 2016 2:20 PM (20 minutes)

The nuclei fluxes with rigidity and their ratios are important for understanding the production, acceleration and propagation mechanisms of cosmic rays. Latest result from the Alpha Magnetic Spectrometer on the International Space Station of the light nuclei measurement will be presented.

Summary

Primary author: YAN, Qi (Massachusetts Inst. of Technology (US))

Presenter: YAN, Qi (Massachusetts Inst. of Technology (US))

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **151** Type: **Oral Contributions**

Probing the high energy neutrino universe with ANTARES

Monday, September 12, 2016 5:30 PM (20 minutes)

The ANTARES high energy neutrino telescope, the largest in the Northern Hemisphere and the first one ever built under the sea, has been running in its final configuration since 2008. It is located in the Mediterranean Sea 40 km off the Southern coast of France, at a depth of 2.5 km.

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. ANTARES searches the Southern sky for diffuse fluxes of high-energy neutrinos of all flavours, using different event topologies and reconstruction methods. It also looks, e.g., for point-like objects or for extended regions of emission (galactic plane, Fermi bubbles for instance), and for signals from transient objects selected through multimessenger observations. The latest results obtained by ANTARES in all these domains will be discussed.

ANTARES has for instance participated to a high-energy neutrino follow-up of the gravitational wave signal GW150914, providing the first constraint on high-energy neutrino emission from a binary black hole coalescence. ANTARES has also performed indirect searches for Dark Matter, yielding limits for the spin-dependent WIMP-nucleon cross-section that improve upon those of current direct-detection experiments.

Summary

This contribution is a presentation of the most important results obtained recently by the ANTARES high energy neutrino telescope. Other contributions dedicated to, e.g., multi-messenger studies or the all-flavour searches for neutrino point-like sources, will also be submitted.

Primary author: Dr PRADIER, Thierry (IPHC)

Presenter: Dr PRADIER, Thierry (IPHC)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **152** Type: **Poster Contributions**

Serarch for AGN populations with the ANTARES neutrino telescope

Wednesday, September 14, 2016 2:20 PM (15 minutes)

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 single point like sources and not to collective effects. We present the results of a search based on this two point correlation method performed on ANTARES 2007-2015 data, providing constraints on models of a population of Active Galactic Nuclei (AGN) too faint to be detected by the likelihood-based method.

Summary

Primary author: Mr GRACIA RUIZ, Rodrigo (A.P.C.)

Presenter: Mr GRACIA RUIZ, Rodrigo (A.P.C.)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **153** Type: **Oral Contributions**

HAWC: A New View of the Very High Energy Sky

Monday, September 12, 2016 3:30 PM (15 minutes)

The High Altitude Water Cherenkov (HAWC) Observatory has been fully operational since its inauguration on 20 March 2015. HAWC opens a new window for survey observations of gamma rays and cosmic rays in the very high energy (VHE) range from 100 GeV to 100 TeV, facilitating studies of Galactic and extragalactic particle accelerators, indirect dark matter searches, gamma-ray bursts, and many other topics. With its large field of view of ~2 sr and high duty cycle of >95 percent, HAWC surveys 2/3 of the entire sky every day, making it an ideal instrument to search for both new sources and transient activity in the VHE band. In this talk, I will discuss the results from HAWC's first year of data, highlighting several new Galactic sources and demonstrating the capability of HAWC to identify VHE transients. I will also summarize the dark matter and gamma-ray burst searches and highlight the unique collaborative opportunities that HAWC provides for advancing our understanding of the very high energy universe.

Summary

Primary author: WEISGARBER, Thomas (University of Wisconsin–Madison)

Presenter: WEISGARBER, Thomas (University of Wisconsin–Madison)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **154** Type: **Oral Contributions**

High-energy neutrinos from newborn pulsars and magnetars

Tuesday, September 13, 2016 4:30 PM (20 minutes)

Newborn pulsars and magnetars turn out to be very promising sources to accelerate cosmic rays up to high and ultrahigh energies, thanks to their rotational and magnetic energy reservoirs. Interestingly, most scenarios that involve hadronic acceleration in these objects should lead to copious amount of neutrino production. Indeed, pulsars and magnetars are not born naked, but surrounded by a dense supernova and a radiative nebula, on which accelerated particles should interact. In this talk, we will review the neutrino fluxes and energies expected for the various types of neutron star populations and for some identified single sources. We will see that the IceCube sensitivities are already placing strong constraints on many of the potential scenarios.

Summary

Primary author: KOTERA, Kumiko (Institut d'Astrophysique de Paris)

Presenter: KOTERA, Kumiko (Institut d'Astrophysique de Paris)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **155** Type: **Poster Contributions**

Detection of high-energy gamma rays from Cygnus X-1 associated with its relativistic jets

Wednesday, September 14, 2016 4:20 PM (15 minutes)

Cygnus X-1 is the prototype black hole high-mass microquasar.
As a persistent and bright X-ray source is considered an optimal candidate to study the disk-jet coupling. It displays the typical soft and hard X-ray spectral states of black hole binaries where the emission is dominated by the thermal black body radiation and by non-thermal emission from the inner part of the disk and the relativistic jets, respectively. We report the detection of a 8-sigma excess, above 60 MeV, spatially coincident with Cygnus X-1 by using 7.5 yr of Fermi-LAT data and the latest Pass8 software version. The point-like signal is clearly associated to the microquasar since the emission correlates with the hard X-ray state. In addition, there is a hint of orbital flux variability with most of the emission coming around the superior conjunction. The high energy emission is most likely associated with the jets. We will discuss the possible mechanisms at work and the constraints on the emission regions that can be derived.

Summary

Primary author: FERNANDEZ BARRAL, Alba (Institut de Fisica d'Altes Energies (IFAE))

Co-author: ZANIN, Roberta (Universitat de Barcelona)

Presenter: FERNANDEZ BARRAL, Alba (Institut de Fisica d'Altes Energies (IFAE))

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Gamma-ray astrophysics

Contribution ID: **156** Type: **Oral Contributions**

Searches for continuous gravitational waves in the advanced detector era

Thursday, September 15, 2016 5:30 PM (20 minutes)

We have entered the advanced era for ground-based gravitational wave detectors in dramatic fashion. The improvement in sensitivity also benefits searches for continuous gravitational waves. Here I summarize the current activities, and plans for the future, of continuous wave searches in Advanced LIGO and Virgo data.

Summary

Primary author: WOAN, Graham

Presenter: WOAN, Graham

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **157** Type: **Oral Contributions**

DarkSUSY 6: An Advanced Tool to Compute Dark Matter Properties Numerically

We introduce a radically new version of the widely used DarkSUSY package, which allows to compute the properties of dark matter particles numerically. With DarkSUSY 6 one can accurately predict a large variety of astrophysical signals from dark matter, such as direct detection in low-background counting experiments and indirect detection through antiprotons, antideuterons, gamma-rays and positrons from the Galactic halo, or high-energy neutrinos from the center of the Earth or of the Sun. For WIMPs, high-precision tools are provided for the computation of the relic density in the Universe today, as well as for the size of the smallest dark matter protohalos. Compared to earlier versions, DarkSUSY 6 introduces many significant physics improvements and extensions. The most fundamental new feature of this release, however, is that the code has been completely re-organized and brought into a highly modular and flexible shape. Switching between different pre-implemented dark matter candidates has thus become straight-forward, just as adding new – WIMP or non-WIMP – particle models or replacing any given functionality in a fully user-specified way. I provide a brief overview of the physics behind the computer package, along with the main structure and philosophy of this major revision of DarkSUSY.

Summary

Primary author: BRINGMANN, Torsten (University of Oslo)

Presenter: BRINGMANN, Torsten (University of Oslo)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **158** Type: **Oral Contributions**

The Compton Spectrometer and Imager (COSI)

Monday, September 12, 2016 2:30 PM (30 minutes)

The Compton Spectrometer and Imager (COSI) is a balloon-borne, gamma ray imager, spectrometer, and polarimeter with sensitivity from 0.2 to 5 MeV. Utilizing a compact Compton telescope design with twelve cross-strip, high-purity germanium detectors, COSI has three main science goals: study the 511 keV positron annihilation line from the galactic plane, image diffuse emission from stellar nuclear lines, and perform polarization studies of gamma-ray bursts and other extreme astrophysical environments. COSI has just completed a successful 45+ day flight on NASA's new Super Pressure Balloon, launched from Wanaka, New Zealand in May 2016. We will present an overview of the instrument and the 2016 flight. We will further discuss COSI's main science goals, predicted performance, and preliminary results.

Summary

The Compton Spectrometer and Imager (COSI) is a balloon-borne, gamma ray imager, spectrometer, and polarimeter with sensitivity from 0.2 to 5 MeV. Utilizing a compact Compton telescope design with twelve cross-strip, high-purity germanium detectors, COSI has three main science goals: study the 511 keV positron annihilation line from the galactic plane, image diffuse emission from stellar nuclear lines, and perform polarization studies of gamma-ray bursts and other extreme astrophysical environments. COSI has just completed a successful 45+ day flight on NASA's new Super Pressure Balloon, launched from Wanaka, New Zealand in May 2016. We will present an overview of the instrument and the 2016 flight. We will further discuss COSI's main science goals, predicted performance, and preliminary results.

Primary authors: TOMSICK, John (University of California, Berkeley); BOGGS, Steven (University of California, Berkeley)

Presenters: TOMSICK, John (University of California, Berkeley); TOMSICK, John

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **159** Type: **Oral Contributions**

Fast LHC Signal Prediction using Machine Learning

Monday, September 12, 2016 3:00 PM (20 minutes)

Expensive detector simulations are in general required to assess the implications of LHC data on extensions of the Standard Model of particle physics, as they allow to directly compare the predicted phenomenology for a given point in (an often high-dimensional) theory parameter space, with actual data. We show here that a suitable application of advanced machine learning methods that can bypass the need of expensive simulations. Using natural SUSY as a test case, we discuss the substantial benefits and potential pitfalls of this method.

Summary

Primary author: LIEM, Sebastian (GRAPPA, University of Amsterdam)

Presenter: LIEM, Sebastian (GRAPPA, University of Amsterdam)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **160** Type: **Poster Contributions**

Ultra High Energy Cosmic Ray radioactivity in flight painting TeV anisotropy sky.

Wednesday, September 14, 2016 4:05 PM (15 minutes)

The presence of large scale TeVs anisotropy in Milagro, ARGO, ICECUBE and today Hawc sky remain a mistery: how may charged cosmic rays at tens TeV remain correlated while being bent by local solar and galactic magnetic fields in an expected smeared nearly homogeneous maps? We considered UHECR as mostly light (or partial heavy) radioactive nuclei whose decay in flight may feed by alfa and neutron as well as gamma secondaries the TeVs anisotropy. We show in the overlapped UHECR and TeV sky remarkable correlation, whose presence might point for nearby galactic sources as Crab, Vela, Cygnus X3 and maybe nearest AGN as Cen A. The ARGO multi-energy gamma-CR sky is somehow the most telling in this source search connection.

Summary

Primary author: Prof. FARGION, Daniele (Rome University 1 Sapienza and INFN)

Presenter: Prof. FARGION, Daniele (Rome University 1 Sapienza and INFN)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **162** Type: **Oral Contributions**

Formation models for antideuterons from dark matter

Tuesday, September 13, 2016 5:50 PM (20 minutes)

Antideuterons are a potential messenger for dark matter annihilation or decay in our own galaxy, with very low backgrounds expected from astrophysical processes. The standard coalescence model of antideuteron formation, while simple to implement, has potentially large uncertainties from Monte Carlo modelling, and is under considerable strain by recent data from the LHC. We suggest two new approaches: i) a model where the uncertainties are better quantified, and ii), a model which is better able to cope with the new data.

Summary

Primary author: RAKLEV, Are (University of Oslo (NO))

Presenter: RAKLEV, Are (University of Oslo (NO))

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **163** Type: **Poster Contributions**

Boost factor analysis for dark matter annihilation in Galaxy Clusters

Wednesday, September 14, 2016 3:50 PM (15 minutes)

The HAWC Observatory is able to perfom dark matter (DM) searches for annihilation or decay of TeV candidates. In the case of annihilation of DM particles, sub-structure enhancement in highly extended sources is important, and it is described through the astrophysical J factor. A related quantity is the boost factor, which quantifies how large the enhancement can be due to sub-structure effects and others, such as the presence of baryons. We computed the J factor for the Virgo Cluster using several configurations for spatial and mass distributions of sub-structure, as well as concentration parameters, to evaluate the expected boost factor for the Virgo Cluster.

Summary

Primary author: HERNANDEZ CADENA, Sergio

Presenter: HERNANDEZ CADENA, Sergio

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **164** Type: **Oral Contributions**

Gravitational waves from oscillons after inflation

Tuesday, September 13, 2016 2:20 PM (20 minutes)

We investigate the production of gravitational waves during the preheating process after inflation in the common case of field potentials that are asymmetric around the minimum where the universe reheats. In particular, we study the impact of oscillons, comparatively long lived and spatially localized regions where a scalar field (e.g. the inflaton) oscillates with large amplitude. Contrary to a previous study, which considered a symmetric potential, we find that oscillons in asymmetric potentials associated with a phase transition can generate a pronounced peak in the spectrum of gravitational waves, that largely exceeds the linear preheating spectrum. In my talk, I will discuss the possible implications of this enhanced amplitude of gravitational waves. For instance, for low scale inflation models, the contribution from the oscillons can strongly enhance the observation prospects at current and future gravitational wave detectors.

Summary

Primary author: CEFALÀ, Francesco (University of Basel)

Presenter: CEFALÀ, Francesco (University of Basel)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **165** Type: **Oral Contributions**

Constraining dark matter neutrino interactions at the direct detection experiments

Tuesday, September 13, 2016 3:40 PM (20 minutes)

The direct detection experiments are reaching new limits in the upcoming searches. Among other things, they will be sensitive to the coherent neutrino scattering background. I will demonstrate the effect of new physics scenarios on the neutrino background at the direct detection experiments. I will further describe the impact on the dark matter constraints due to such a change in the neutrino coherent scattering background.

Summary

Primary author: KULKARNI, Suchita (Austrian Academy of Sciences (AT))

Presenter: KULKARNI, Suchita (Austrian Academy of Sciences (AT))

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **166** Type: **Oral Contributions**

The nature of dark matter: observations and experiments

Friday, September 16, 2016 2:00 PM (20 minutes)

The nature of dark matter is perhaps the most intriguing and open issue in Physics, whose resolution is likely to bring us beyond the Standard Model. The experimental energy scale of TeV is most pivotal for the recent advances in the booming field of astroparticle. On the other side, recent astrophysical observations have revealed, in the distribution of matter in Galaxies, some extremely surprising property . The investigation of single and coadded objects kinematics has shown that the mass profile of galaxies follow, from their centers out to their virial radii, an universal profile that suggests that the dark and luminous mass components in galaxies interact not only by brute gravitational force. These results poses important challenges to the presently theoretically favored Î›CDM Standard Cosmology and lead to the vision in which ordinary atoms in stars interact with this elusive particle.

Summary

Primary author: SALUCCI, Paolo (SISSA)

Presenter: SALUCCI, Paolo (SISSA)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **167** Type: **Poster Contributions**

Search for point and extended sources with the ANTARES neutrino telescope

Wednesday, September 14, 2016 3:35 PM (15 minutes)

The main aim of the ANTARES neutrino telescope is to detect neutrinos from astrophysical sources. Due to its location, ANTARES has a privileged visibility of the Galactic Centre, which provides the most stringent sensitivities for this region for neutrino energies below 100 TeV. The latest results of the all-flavour neutrino analysis for point and extended sources using data from 2007 to 2015 is described.

Summary

The main aim of the ANTARES neutrino telescope is to detect neutrinos from astrophysical sources. Due to its location, ANTARES has a privileged visibility of the Galactic Centre, which provides the most stringent sensitivities for this region for neutrino energies below 100 TeV. The latest results of the all-flavour neutrino analysis for point and extended sources using data from 2007 to 2015 is described.

Primary author: BARRIOS MARTÍ, Javier (IFIC (CSIC-UV))

Presenter: BARRIOS MARTÍ, Javier (IFIC (CSIC-UV))

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **168** Type: **Oral Contributions**

Why the GeV gamma-ray excess cannot originate from DM

Thursday, September 15, 2016 3:20 PM (20 minutes)

An excess of diffuse gamma-rays towards the Galactic Center (GC) is usually assumed to originate from the GC with the most exciting interpretations being the contributions from dark matter (DM) annihilation and/or unresolved sources, like millisecond pulsars.

Up to now no studies have been undertaken to see if the excess occurs in other regions of the Galactic plane, which is a challenge, since the presently used methods are not suitable for such an analysis. The first method uses the diffuse galactic model from the Fermi Science Team, but this model does not provide errors and has no high spatial and spectral resolution, since it is intended to provide a smooth, polynomial background for the search for point sources. The second, most common, analysis method uses the spatial emissivity templates predicted by Galactic models. However, these models do not describe the diffuse gamma-ray emission in the Galactic plane, so they cannot be used for analysing the Galactic plane.
Therefore, we follow a different approach: we fit energy templates of the various contributions to the diffuse gamma ray spectrum in a given direction. Since the spectral shapes of the various contributions are quite different, one can disentangle the contributions by fitting the sum of the templates to the observed spectrum in finely binned cones. Well-known contributions, as implemented in the Galactic models, are π^0 production, inverse Compton scattering (IC) and Bremsstrahlung (BR). A bad χ^2 in the template fit for a certain cone indicates the need for an additional component in that direction.

Two known components missing in Galactic models are the Fermi Bubbles and the so-called source cosmic rays (SCRs), as discussed previously (arXiv:1407.4114). SCRs are the ''fresh" component of the CRs during the time they are accelerated inside the sources.
The Fermi Bubbles and the SCRs both have a gamma-ray spectrum corresponding to π^0 production from a hard $1/E^{2.1}$ nucleon spectrum (E is the nucleon rigidity), as expected for diffuse shock wave acceleration. The gamma-ray template from this hard SCR component turns out to be needed towards the Fermi Bubbles and in all directions with the presence of the 1.809 MeV line from ^{26}Al, a tracer of CR sources, which are typically embedded inside molecular clouds (MCs).

This template greatly improved the quality of the fit, but in several regions of the Galactic plane the observed maximum of the gamma-ray spectrum (multiplied with E^2 for each bin with energy E) in the data is shifted from 0.7 to 2 GeV. This can either be interpreted as a new source producing gamma-rays predominantly around 2 GeV or a depletion of gamma-rays below 2 GeV. Since we observe this shift in MCs, as was evident from the correlation of the shift with the 1.809 MeV line from ^{26}Al again (arXiv:1509.05310), it is more likely to be a depletion, which can happen in dense MCs. The reason is rather simple:
MCs have a mass substructure of filaments and cloudlets which are embedded in high magnetic fields. If cosmic rays (CRs) enter a region of a high magnetic field, we know from CRs approaching the earth, that most of the CRs with rigidities below 20 GV do not reach the earth because of the geomagnetic cut off in the earth magnetic field. Since the magnetic moment of the cloudlets inside MCs have easily a magnetic moment similar to the earth, we expect that low energy nuclei will not enter the cloudlets, thus depleting the gamma-ray spectrum from MCs regions at low energies. This leads to a shift in the maximum of the gamma-ray spectrum from MCs towards higher energy, usually called the gamma-ray excess. In reality, it is a depletion at low energies inside MCs, as expected from the strong correlation in space between the shift in the gamma-ray spectrum and the occurrence of the ^{26}Al line. The regions with the shift were identified after including a template from gamma-ray production with a break in the proton spectrum at 13 GV, which yields a maximum in the gamma-ray spectrum at 2 GeV.

The ^{26}Al line is strong towards the GC, where the gas in the inner Galaxy is dominated by the Central Molecular Zone, towards the central Bar region and towards the tangent point of the spiral arms and a few star-forming regions like the Cygnus region. Exactly towards these region we observe the shift in the maximum of the gamma-ray spectrum. Since this morphology contradicts the morphology from DM, the DM interpretation is excluded by this observation.

Summary

A 2015 Nature article entitled: „Mysterious Galactic Signal points LHC to Dark Matter(DM)“ discusses the so-called GeV gamma-ray excess in the Galactic Center (GC), see http://www.nature.com/news/mysterious-galactic-signal-points-lhc-to-darkmatter-1.17485. This excess has been widely discussed in the literature as a possible DM signal.
We prove that this excess in not only from the GC, but observed in all directions of star-forming molecular cloud regions. Hence, it is not connected to DM. We show that the excess is easily explained by the propagation of cosmic rays in the dense environment of molecular clouds, thus making an essential step towards solving this outstanding problem.

Primary author: DE BOER, Wim (KIT - Karlsruhe Institute of Technology (DE))

Presenter: DE BOER, Wim (KIT - Karlsruhe Institute of Technology (DE))

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **169** Type: **Oral Contributions**

First light from DEAP-3600, a single phase liquid argon detector for dark matter search

Monday, September 12, 2016 5:30 PM (20 minutes)

DEAP-3600 is a liquid Argon detector with competitive sensitivity to dark matter interaction especially at high mass (above 100 GeV/c2). The detector is currently 25% full of liquid Argon and filling is expected to be completed in July 2016. When full, DEAP-3600 will hold 3600kg of liquid Argon within an acrylic sphere surrounded by 255 photo-multiplier tubes. Only the scintillation light is recorded in order to maximize the pulse shape discrimination capability that is critical for rejecting electron recoils produced by gamma interactions and by 39Ar decays occurring at an expected rate of 1Hz/kg. The detector concept also relies on having minimum intrinsic radioactivity in the core of the detector (liquid Argon, TPB wavelength shifter and acrylic vessel), in particular to minimize the background from mis-reconstructed α decays. In this talk we will show the key elements of the DEAP-3600 detector concept focusing on the various background mitigation strategies. And we will show data of the detector in operation starting with operation in Nitrogen gas in 2015 to operation with liquid Argon in 2016.

Summary

Primary author: RETIERE, Fabrice (TRIUMF)

Presenter: RETIERE, Fabrice (TRIUMF)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **170** Type: **Oral Contributions**

Non-linear diffusion of cosmic rays escaping from supernova remnants

Thursday, September 15, 2016 4:45 PM (15 minutes)

The mechanism through which cosmic rays (CRs) propagate away from their accelerators still remains an open issue. The main difficulty is the high non-linearity of the problem: CRs themselves excite the magnetic turbulence that confines them close to their sources. We solve numerically the coupled differential equations describing the evolution in space and time of the escaping particles and of the waves generated through the CR streaming instability. We consider two different phases of the interstellar medium, warm ionized and warm neutral, which are characterised by a significant presence of neutral particles. The friction between those neutrals and ions results in a very effective wave damping mechanism. It is found that streaming instability affects the propagation of CRs even in the presence of ion-neutral friction. The diffusion coefficient can be suppressed by more than a factor of ~ 2 over a region of few tens of pc around the remnant. The suppression increases for smaller distances. The propagation of ≈ 10 GeV particles is affected for several tens of kiloyears after escape, while ≈ 1 TeV particles are affected for few kiloyears. This might have a great impact on the interpretation of gamma-ray observations of molecular clouds located in the vicinity of supernova remnants.

Summary

Primary author: NAVA, Lara

Co-author: GABICI, Stefano

Presenter: NAVA, Lara

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **171** Type: **Oral Contributions**

May spectral features of cosmic ray fluxes be explained by a conspiracy of the sources in space-time?

Tuesday, September 13, 2016 3:20 PM (20 minutes)

In the new "precision era" for cosmic ray astrophysics, theoretical predictions cannot content themselves with average trends,
but need to correctly take into account intrinsic uncertainties. The space-time discreteness of the cosmic ray sources, joined with a
substantial ignorance of their precise epochs and locations (with the possible exception of the most recent and close ones) plays an
important role in this sense. We elaborate a statistical theory to deal with this problem, relating the composite probability P(Ψ) to obtain a flux Ψ at the
Earth to the single-source probability p(ψ) to contribute with a flux ψ. The main difficulty arises since p(ψ) is a "fat tail" distribution,
characterized by power-law or broken power-law behaviour up to very large fluxes for which central limit theorem does not hold, and leading to well-known "stable laws" as opposed to Gaussian distributions.
We find that relatively simple recipes provide a satisfactory description of the probability P(Ψ). We also find that a naive Gaussian fit to simulation results would underestimate the probability of very large fluxes, i.e. several times above the average, while overestimating the probability of relatively milder excursions. At large energies, large flux fluctuations are prevented by causal considerations, while at low energies a partial knowledge on the recent and nearby population of sources plays an important role. A few proposal have been recently discussed in the literature to account for spectral breaks recently reported in cosmic ray data in terms of local contributions. We apply our newly developed theory to assess their probabilities, finding that they are relatively small.

Summary

Primary author: GENOLINI, yoann (LAPTh)

Co-authors: SALATI, PIERRE (LAPTh & Université de Savoie Mont Blanc); SERPICO, Pasquale (Unite Reseaux du CNRS (FR))

Presenter: GENOLINI, yoann (LAPTh)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **172** Type: **Oral Contributions**

Searches for Angular Extension in High-Latitude Fermi-LAT Sources

Tuesday, September 13, 2016 6:00 PM (15 minutes)

We present a comprehensive search for angular extension in high-latitude gamma-ray sources detected by the Fermi Large Area Telescope (LAT). While the majority of high-latitude LAT sources are extragalactic blazars that appear point-like within the LAT angular resolution, there are several physics scenarios that predict the existence of populations of spatially extended sources. Gamma-ray blazars could have extended "pair halos" produced through the deflection of pair cascades by the Intergalactic Magnetic Field (IGMF). The detection of a pair halo component around one or more LAT-detected blazars would provide constraints on the strength and coherence length scale of the IGMF. If Dark Matter (DM) consists of Weakly Interacting Massive Particles, the annihilation or decay of these particles in subhalos of the Milky Way would appear as a population of unassociated gamma-ray sources with finite angular extent. The detection of spatial extension in nearby subhalos could provide compelling evidence for a DM interpretation and would serve as an independent cross-check against searches for DM subhalos in the spectral domain. We report on an angular extension catalog based on 7.5 years of Pass 8 data and discuss the implications of these results in the context of searches for both IGMF-induced pair halos and DM subhalos.

Summary

Primary author: WOOD, Matthew

Co-authors: MEYER, Manuel (Stockholm University); DI MAURO, mattia (Stanford University)

Presenter: WOOD, Matthew

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **173** Type: **Oral Contributions**

The Primary Importance of Secondaries: Gamma-Ray Detectability of MeV Dark Matter

Friday, September 16, 2016 3:00 PM (20 minutes)

The past two decades have seen a rapid development of γ-ray astronomy, in particular at energies above a few hundred MeV where Fermi-LAT has revolutionised the field. As a result, extensive studies have been undertaken to characterise gamma-ray annihilation spectra of dark matter with masses above $\sim 1\,\mathrm{GeV}$. However, due to the lacking sensitivity of current experiments at lower energies, the so-called MeV gap, MeV dark matter has been much less studied. At these mass scales the main annihilation channels are to either neutrinos, electrons, pions or directly to photons. The electron channel has been extensively studied in the context of the 511 keV line. In this work, we study the general prospects for detecting MeV dark matter annihilating predominantly to electrons and positrons. We emphasise the importance of the often overlooked bremsstrahlung and in-flight annihilation spectral features, which in many cases provide the dominant γ-ray signal in this regime.

Summary

Primary authors: WENIGER, Christoph (University of Amsterdam); GAGGERO, Daniele; BARTELS, Richard (University of Amsterdam)

Presenter: BARTELS, Richard (University of Amsterdam)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **174** Type: **Poster Contributions**

Modeling the Galactic Plane emission from GeV to PeV

Wednesday, September 14, 2016 3:20 PM (15 minutes)

Our galactic plane is a diffuse heterogeneous emitter at high and very high energies. Several gamma-ray campaigns, like that of Fermi-LAT in the GeV range and H.E.S.S. and Milagro in the TeV range, reported an enhanced diffuse emission from different regions of the plane. With a comprensive cosmic-ray transport model, able to reproduce the observed gamma-ray spectra from the galactic plane, we compute the expected neutrino spectrum generated by the interaction of cosmic rays with the galactic interstellar gas. After reproducing the observations made by H.E.S.S., Milagro and Fermi-LAT for different galactic regions, we obtain the expected neutrino flux and we confront the results with the sensitivities of the global neutrino network observatories. Adding to the expected Galactic spectrum a possible extra-Galactic component we compare the resulting flux with the recent observations of the IceCube experiment and the upper limits set by the ANTARES experiment. Within the presented scenario we highlight also the expected diffuse gamma-ray component inside the Pevatron annulus measured by H.E.S.S. around Sagittarius A* and the implications for identifying the Pevatron injector inside this target rich region.

Summary

Primary author: Dr MARINELLI, Antonio (INFN-Pisa)

Presenter: Dr MARINELLI, Antonio (INFN-Pisa)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **175** Type: **Oral Contributions**

Vacuum gaps in black holes magnetospheres

Tuesday, September 13, 2016 6:15 PM (15 minutes)

We consider particle acceleration in the vacuum gaps in split-monopole magnetospheres of slow and maximally rotating black holes, embedded in the radiatively-inefficient accretion flow (RIAF) environment. The gap height is limited by the onset of gamma-gamma pair production on the infrared photons originating in the RIAF.
We numerically calculate the acceleration and propagation of charged particles by taking the detailed structure of the electric and magnetic fields in the gap and in the entire black hole magnetosphere into account, as well as the radiative energy losses and interactions of gamma rays produced by the propagated charged particles with the background radiation field of the RIAF.
We show that the presence of the vacuum gap has clear observational signatures almost independent on the black hole angular momentum. The spectra of emission from gaps embedded in a relatively high-luminosity RIAF are dominated by the inverse Compton emission with a sharp, super-exponential cut-off in the very-high-energy gamma-ray band. The cut-off energy is determined by the properties of the RIAF and is largely independent of the structure of magnetosphere and geometry of the gap. The spectra of the gap residing in low-luminosity RIAFs are dominated by synchrotron or curvature emission with the spectra extending into 1-100~GeV energy range.
We also consider the effect of possible acceleration of protons in the gap and show that both for a slow and for a maximally rotating black hole the proton energy could reach the ultra-high-energy cosmic ray (UHECR) range only in extremely low-luminosity RIAFs with magnetic field in the magnetosphere reaching the Eddington limit.

Summary

Primary author: PTITSYNA, Ksenia (INR Moscow, MSU Moscow, ISDC Geneve)

Presenter: PTITSYNA, Ksenia (INR Moscow, MSU Moscow, ISDC Geneve)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **176** Type: **Oral Contributions**

Testing the seesaw mechanism

Tuesday, September 13, 2016 3:00 PM (20 minutes)

based on 1502.00477

Summary

The type-I seesaw mechanism provides a natural explanation for the smallness of the light neutrino masses due to a suppression by the Majorana masses of heavier right handed neutrinos. The magnitude of these Majorana masses is unknown because neutrino oscillation data is only sensitive to ratios of the neutrinos' Yukawa couplings and the Majorana masses. If their Yukawa couplings are comparable to that of the electron, then the heavy Majorana mass scale can lie below the TeV scale, and the heavy neutrinos may be found in laboratory experiments. We combine existing constraints from various direct and indirect searches as well as cosmology to constrain the parameter space of the low scale seesaw and outline the perspective to probe the seesaw mechanism in future experiments.

Primary author: DREWES, Marco (Technische Universitaet Muenchen (DE))

Co-author: GARBRECHT, Bjorn

Presenter: DREWES, Marco (Technische Universitaet Muenchen (DE))

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **177** Type: **Oral Contributions**

Stochastic Acceleration by Turbulence in the Fermi Bubbles

Thursday, September 15, 2016 5:00 PM (15 minutes)

The discovery of the Fermi bubbles - a huge bi-lobular structure seen in GeV gamma-rays above and below the Galactic center - implies the presence of a large reservoir of cosmic rays up to ~ 10 kpc from the disk. Diffuse shock acceleration, which is at work in known sources of cosmic rays, cannot explain the cosmic rays in the bubbles since there is no evidence for the presence of a strong shock. Furthermore, multi-wavelength observations point towards electrons producing the emission by inverse Compton scattering. We have investigated the time-dependent acceleration of electrons and protons in a numerical model including the relevant transport and energy loss processes and will discuss the challenges in satisfying all spectral and morphological features of the bubbles.

Summary

Primary author: MERTSCH, Philipp

Co-author: PETROSIAN, Vahe' (Stanford University)

Presenter: MERTSCH, Philipp

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **178** Type: **Oral Contributions**

Sterile neutrino Dark Matter - an update

Thursday, September 15, 2016 5:30 PM (20 minutes)

This talk is based on the recent review 1602.04816, which contains contributions from many different authors. Rather than focusing on any particular aspect, I aim to give a condensed summary of the status of the field.

Summary

Heavy sterile neutrinos with sufficiently small mixing angle are a natural Dark Matter candidate. This scenario can be tested indirectly by searches for an emission line from Dark Matter decays. Moreover, sterile neutrinos have non-thermal momentum distributions that depend on the way they were produced in the early universe and may have left an observable imprint in the small scale distribution of matter in the universe. Finally, it has been proposed to search for sterile neutrino Dark Matter "directly" in high precison measurements of tritium beta decay spectra. We summarise recent progress in constraining the sterile neutrino DM scenario from theory, experiment and astronomical observation.

Primary author: DREWES, Marco (Technische Universitaet Muenchen (DE))

Presenter: DREWES, Marco (Technische Universitaet Muenchen (DE))

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **179** Type: **Oral Contributions**

Searches for Dark Matter and Primordial Black Holes with the HAWC Gamma-Ray Observatory

Friday, September 16, 2016 2:20 PM (20 minutes)

The High Altitude Water Cherenkov (HAWC) gamma-ray observatory is a continuously operated, wide field-of-view (FOV) observatory sensitive to 100 GeV - 100 TeV gamma rays. HAWC has been making observations since summer 2012 and officially commenced data-taking operations with the full detector in March 2015. With an instantaneous FOV of 2 steradians, HAWC observes 2/3 of the sky in 24 hours and can be used to search for astrophysical signatures of dark matter (DM) and primordial black holes (PBHs). In particular, HAWC should be the most sensitive experiment for signals coming from annihilation or decay of DM with masses greater than 10-100 TeV.

Summary

For the HAWC Collaboration.

I will present HAWC's latest results on searches for dark matter signals from dwarf spheroidal galaxies and galaxy clusters, and for evaporating Primordial Black Holes.

Primary author: LINNEMANN, James Thomas (Michigan State University (US))

Presenter: LINNEMANN, James Thomas (Michigan State University (US))

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **180** Type: **Oral Contributions**

Supernova Neutrino Physics with Xenon Dark Matter Detectors

Thursday, September 15, 2016 3:20 PM (20 minutes)

The dark matter experiment XENON1T is now operational and sensitive to all flavors of neutrinos emitted from a supernova through coherent elastic neutrino-nucleus scattering. We show that the proportional scintillation signal (S2) allows for a clear observation of the neutrino signal and guarantees a particularly low energy threshold, while the backgrounds are rendered negligible during the SN burst. XENON1T (XENONnT and LZ; DARWIN) will be sensitive to a SN burst up to 25 (40; 70) kpc from Earth at a significance of more than 5σ, observing approximately 35 (123; 704) events from a 27 $M_{\odot}$ SN progenitor at 10 kpc. Moreover, it will be possible to measure the average neutrino energy of all flavors, to constrain the total explosion energy, and to reconstruct the SN neutrino light curve. A large xenon detector such as DARWIN will be competitive with dedicated neutrino telescopes, while providing complementary information that is not otherwise accessible.

Summary

Primary author: REICHARD, Shayne (Purdue University)

Presenter: REICHARD, Shayne (Purdue University)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **181** Type: **Oral Contributions**

The Milky-Way observed in TeV gamma-rays with H.E.S.S.

Thursday, September 15, 2016 5:15 PM (15 minutes)

A.Donath on behalf of the H.E.S.S. collaboration.

H.E.S.S. (High Energy Stereoscopic System) is a hybrid array of five imaging atmospheric Cherenkov telescopes in Namibia, operating in the very-high-energy (VHE) gamma-ray energy range between ~20 GeV and 100 TeV. In the past decade H.E.S.S. has conducted deep observations of Galactic regions of utmost importance for understanding acceleration mechanisms of cosmic rays and production of VHE gamma rays. Among them are the Galactic Center and Ridge, the Crab Nebula, the energetic Vela pulsar, several supernova remnants (SNR) and pulsar wind nebulae (PWN). The H.E.S.S. Galactic plane survey (HGPS), conducted from 2004 to 2013, was the first high-resolution (~0.1 deg) and sensitive (~1.5% Crab Nebula point-source sensitivity) survey of the Milky Way in TeV gamma-rays. Comprising ~2800-hrs of observation time it revealed the existence of a diverse population of cosmic accelerators in the Galaxy.

This contribution will present the latest results from the Survey, including maps, a comprehensive source catalog, a model for Galactic diffuse VHE emission and association of H.E.S.S. sources with known pulsars and PWNe, SNRs, binary systems and GeV sources detected by the Fermi-LAT. The presentation will highlight results of systematic SNR and PWN source population studies as well as a selection of brand new VHE sources, including newly identified shell-like SNRs.

Summary

Primary author: Mr DONATH, Axel (Max Planck Institute for Nuclear Physics, Heidelberg)

Presenter: Mr DONATH, Axel (Max Planck Institute for Nuclear Physics, Heidelberg)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **182** Type: **Oral Contributions**

The search for a stochastic background of gravitational waves

Thursday, September 15, 2016 6:10 PM (20 minutes)

A stochastic background of gravitational waves can be described as a superposition of several uncorrelated contributions. It can be of both cosmological and astrophysical origin. In the first case, it can constitute potentially a unique probe of the primordial universe. In the second, it can give precious information on stellar populations.
After discussing how this kind of signal can be detected and what information can be estracted from its study, I review the past and ongoing efforts to find it, the current upper limits and the future perspective for its detection.

Summary

I review past and ongoing efforts to detect a stochastic background of gravitational waves with earth bound detectors.

Primary author: Dr CELLA, Giancarlo (INFN sez. Pisa)

Presenter: Dr CELLA, Giancarlo (INFN sez. Pisa)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **183** Type: **Oral Contributions**

Global-fit constraints in the MSSM and scalar singlet dark matter models with GAMBIT

Monday, September 12, 2016 3:40 PM (20 minutes)

As above

Summary

GAMBIT is a new public Beyond-the-Standard-Model global fitting code, based on modular design principles, generic calculations, automation, and with a goal of continual expansion to include evermore models, constraints, and sampling algorithms. In this first round of results from the project we present updates of constraints in several MSSM-based models as well as the scalar singlet dark matter model. Constraints include a variety of dark matter observables (relic density, direct + indirect detection), collider observables (inc. Higgs + SUSY searches for ATLAS, CMS, and LEP), flavour physics (inc. g-2, b->s \gamma, B decays, LHCb likelihoods), and precision electroweak tests (such as W mass, Delta\rho).

Primary author: Dr FARMER, Benjamin (Oskar Klein Centre)

Presenter: Dr FARMER, Benjamin (Oskar Klein Centre)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **184** Type: **Oral Contributions**

The detection of binary black holes in Advanced LIGO's first scientific run

Thursday, September 15, 2016 4:30 PM (20 minutes)

Advanced LIGO's first scientific run, between September 2015 and January 2016, will be historically remembered for the first direct detection of gravitational waves from an astrophysical source. This run also provided the first direct evidence for the existence of stellar-mass black hole binaries. In this talk, we will present details of the detected sources, their astrophysical interpretation, and look at predictions for what can be expected in the next science run, later this year.

Summary

Primary author: Dr PORTER, Edward (The LIGO-Virgo Collaboration)

Presenter: Dr PORTER, Edward (The LIGO-Virgo Collaboration)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **185** Type: **Oral Contributions**

Pick any two? Baryogenesis, gravitational waves and thermal phase transitions

Tuesday, September 13, 2016 3:00 PM (20 minutes)

Gravitational waves are a promising new observational tool, not only for astrophysics but also for cosmology. In various extensions of the Standard Model the phase transition can be first order, and could produce copious gravitational waves from bubble collisions. Other possibilities, such as a tachyonic transition at the electroweak scale, produce a more subdued signature at higher frequencies. This talk will summarise numerical results of gravitational wave production from first-order phase transitions, as well as from tachyonic transitions. The prospects of detection and the compatibility with various models of baryogenesis will also be briefly discussed.

Summary

Primary author: WEIR, David (University of Stavanger)

Presenter: WEIR, David (University of Stavanger)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **186** Type: **Oral Contributions**

Dark Matter faces multijets at 13 TeV

Monday, September 12, 2016 2:40 PM (20 minutes)

It has been recently shown that if dark matter is produced at the LHC via spin-0 mediators, multijet+MET searches are more sensitive than the standard monojet ones. We have recast the latest multijet+MET analysis using 13 TeV data, to show the present and future prospects of exclusion power of this signal. We apply these constraints to several DM well motivated models, including the complementarity with relic density, direct, and indirect detection.

Summary

Primary author: Mr ZALDIVAR, Bryan (LAPTh, Annecy)

Presenter: Mr ZALDIVAR, Bryan (LAPTh, Annecy)

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **188** Type: **Poster Contributions**

Fermionic Minimal Dark Matter and Friends

Wednesday, September 14, 2016 3:05 PM (15 minutes)

We consider a natural extension of the Minimal Dark Matter scenario where Dirac and Majorana SU(2)_L multiplets couple together via the Higgs. We classify and study in a systematic way all the few possible models consistent with the absence of Landau poles up to very high scale, including the results for Direct Detection, and the Sommerfeld-enhanced annihilation. We demonstrate that, at freeze-out, a well educated estimation of the size of the Sommerfeld corrections can be done in the unbroken SU(2)_L limit. This is shown explicitly for the cases not present in previous works on the subject.

Summary

Primary author: Mr ZALDIVAR, Bryan (LAPTh, Annecy)

Presenter: Mr ZALDIVAR, Bryan (LAPTh, Annecy)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Dark matter (indirect detection)

Contribution ID: **189** Type: **Oral Contributions**

Advanced LIGO First Light: Multimessenger Astrophysics at the Birth of Gravitational-Wave Observatory

Thursday, September 15, 2016 5:10 PM (20 minutes)

Advanced LIGO's direct observation of gravitational radiation from a binary black hole merger has sent quakes through the physics and astronomy community. In a few short years, the search for gravitational waves will complete its transformation from an experimental effort into a new discipline of observational astronomy as we rapidly build a sample of merging compact binaries. However, the greatest prize of all may come from combining our new GW observatories with existing electromagnetic ones—uncovering the host environments and formation channels of compact binaries, exposing the mechanism behind short GRBs, explaining the cosmic inventory of r-process elements, and even testing if stellar-mass black hole binaries are truly barren of matter and magnetic fields. I will describe the LIGO/Virgo EM follow-up program and the GW150914 and GW151226 follow-up campaigns in detail. They bring together new real-time GW data analysis techniques and 63 groups who are searching for counterparts of LIGO sources using ground- and space-based partner facilities spanning gamma ray, x-ray, optical, infrared, and radio wavelengths, as well as neutrinos. I will discuss the anticipated trajectory of the worldwide GW detector network from the standpoint of sky localization, and I will conclude with some ideas for future follow-up strategies.

Summary

Primary author: SINGER, Leo (NASA/Goddard)

Presenter: SINGER, Leo (NASA/Goddard)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **190** Type: **Oral Contributions**

The gamma-ray flux from millisecond pulsars in dwarf spheroidal galaxies

Monday, September 12, 2016 6:30 PM (20 minutes)

Dwarf spheroidal galaxies are among the most important targets in the search for gamma rays from dark matter annihilation in the cosmos. In fact, joint likelihood analyses using dozens of dwarfs have recently reached the sensitivity necessary to test the putative dark matter signal detected from the Galactic center. While the gamma-ray flux from conventional astrophysical emission processes in dwarfs is generally assumed to be negligible, these backgrounds have not been previously quantified. Understanding possible backgrounds will be essential if a signal is detected, as we have seen in the case of the Galactic center. We present an estimate of the expected gamma-ray signal produced by millisecond pulsars in 30 dwarf spheroidal galaxies. We predict that millisecond pulsars in the most massive classical dwarfs produce a gamma-ray flux within an order of magnitude of the current Fermi Large Area Telescope sensitivity for individual targets. Moreover, we estimate the millisecond pulsar emission in the ultra-faint dwarfs most important for dark matter searches to be more than an order of magnitude below current upper limits.

Summary

Primary author: Mr JUSTIN, Vandenbroucke (University of Wisconsin)

Presenters: Prof. VANDENBROUCKE, Justin (University of Wisconsin); Mr JUSTIN, Vandenbroucke (University of Wisconsin)

Session Classification: Dark matter (indirect detection)

Track Classification: Dark matter (indirect detection)

Contribution ID: **191** Type: **Oral Contributions**

The DarkSide of Direct Dark Matter Searches

Monday, September 12, 2016 5:50 PM (20 minutes)

The DarkSide-50 experiment employs a dual-phase liquid argon time projection chamber inside a system of two active veto detectors to directly search for WIMP dark matter. DarkSide-50 has recently performed a background-free search using 70 live days of data with low radioactivity argon extracted from underground, setting the strongest limit to date on the WIMP-nucleon elastic cross section with an argon target. The future DarkSide-20k experiment will employ 23 tons of low-radioactivity underground argon as an active target, with further intrinsic radioactivity reduction of underground argon via isotope separation. The scintillation light will be collected with large arrays of radio pure silicon photomultipliers, and the unique pulse shape properties of argon will be utilized to allow discrimination against electronic recoil backgrounds. This pulse-shape discrimination, in combination with the active veto system to tag neutron backgrounds, will enable DarkSide-20k to search for dark matter particles beyond the sensitivities of current experiments while remaining background free. This talk will describe the current status of the DarkSide-50 search and the planned configuration of DarkSide-20k.

Summary

Primary author: PANTIC, Emilija (UC Davis)

Presenter: PANTIC, Emilija (UC Davis)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **192** Type: **Poster Contributions**

Searching Ultra-High Energy Cosmic Neutrinos with ARA Detector

Wednesday, September 14, 2016 2:50 PM (15 minutes)

Detecting ultra-high energy neutrinos (UHECNs) with energies above 10^17eV, or the GZK neutrinos, is a fundamental problem in neutrino astronomy. By finding GZK neutrinos, not only the GZK process can be verified, but also provides valuable insights of the ultra-high energy cosmic rays.

When UHECNs interact with ice, radio signals at the frequencies of few hundreds of MHz will be generated due to the Askaryan effect. Askaryan Radio Array (ARA) is a dedicated experiment located in South Pole to detect those radio signals. Since 2011, there are three ARA stations deployed in South Pole and running continuouly.

We will present the current status of searching the UHECNs with ARA and constraints on ultra-high energy neutrino fluxes from gamma-ray bursts. Future plans will also be discussed.

Summary

Primary author: CHEN, Chin-Hao

Presenter: CHEN, Chin-Hao

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **193** Type: **Poster Contributions**

Last ANTARES multimessenger analysis and associated results

Wednesday, September 14, 2016 2:35 PM (15 minutes)

ANTARES is currently the largest neutrino telescope operating in the Northern Hemisphere, aiming at the detection of high-energy neutrinos from astrophysical sources. Such observations would provide important clues about the processes at work in those sources, and possibly help to understand the sources of very high-energy cosmic rays. In this context, Antares is developing several programs to improve its capabilities of revealing possible spatial and/or temporal correlations of neutrinos with other cosmic messengers: photons, cosmic rays and gravitational waves. The results of the electromagnetic follow-up (optical, radio, X-ray and VHE gamma-ray) of the ANTARES neutrino alerts, the search for a neutrino signal from various transient sources such as fast radio bursts and gamma-ray bursts and the correlation between neutrinos and gravitational waves will be presented.

Summary

Primary author: TURPIN, Damien (IRAP)

Presenter: TURPIN, Damien (IRAP)

Session Classification: Poster Session (coffee at 15:00) & CERN Visit

Track Classification: Neutrinos

Contribution ID: **194** Type: **Oral Contributions**

Parameter inference for compact binaries with the gravitational-wave observatory Advanced LIGO

Thursday, September 15, 2016 4:50 PM (20 minutes)

Gravitational-wave astronomy has made a tremendous stride forward with detections during the first observing run of the Advanced Laser Interferometer Gravitational-wave Observatory (LIGO). The signals have been identified as originating from the merger of black holes, whose parameters it was possible to infer.
In this talk I will explain how the parameter inference from gravitational-wave signals is made, and discuss the results of this analysis for LIGO's first observations.

Summary

Primary author: RAYMOND, Vivien (Max Planck Institute for Gravitational Physics)

Presenter: RAYMOND, Vivien (Max Planck Institute for Gravitational Physics)

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **195** Type: **Oral Contributions**

Solving five problems of particle physics and cosmology in one stroke

Thursday, September 15, 2016 2:40 PM (20 minutes)

-

Summary

I will present a minimal extension of the Standard Model thats solves the strong CP problem, provides primordial inflation and a dark matter candidate (the axion) and explains the baryon asymmetry of the Universe and the smallness of neutrino masses. All of it, obtained from a single scale of new physics around 10^8 TeV. At low energies, the model reduces to the SM plus the QCD axion.

Primary author: BALLESTEROS MARTINEZ, Guillermo (CEA/IRFU,Centre d'etude de Saclay Gif--sur-Yvette (FR))

Presenter: BALLESTEROS MARTINEZ, Guillermo (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **196** Type: **Invited Contributions**

Challenges for leptogenesis at the TeV scale

Monday, September 12, 2016 3:40 PM (20 minutes)

- Present circumstantial evidences that seem to favour a scenario of baryogenesis via leptogenesis from heavy particle decays
- New experimental results that could further support this picture in the next future
- Difficulties for going beyond the level of "circumstantial evidences in favour…". General no-go arguments forbidding leptogenesis scales sufficiently low to be directly accessible in laboratory experiments.
- Conditions and loopholes that might allow to circumvent the previous arguments for building low scale leptogenesis models

Summary

I will review some features of leptogenesis from the decays of heavy particles. After recalling the most appealing theoretical aspects, I will address the issue of the main limitations and difficulties for experimental verification. I will then describe some of the hardest challenges for constructing leptogenesis models at low scales.

Primary author: NARDI, Enrico

Presenter: NARDI, Enrico

Session Classification: Cosmology & Gravitational Waves

Track Classification: Cosmology & Gravitational Waves

Contribution ID: **197** Type: **Oral Contributions**

Resolving the Extragalactic Gamma-ray Background

Models of the extragalactic gamma-ray background (EGB) show that its intensity can be ascribed to the integrated emission of source populations already detected by the Fermi Large Area Telescope (LAT). Taking advantage of the sensitivity increase yielded by Pass 8, the new event-level analysis, we tested this hypothesis employing a photon fluctuation analysis above 50 GeV. For the first time we were able to resolve nearly the entire EGB and show that blazars contribute at least 85% of the EGB intensity. We will discuss how this analysis can be extended to lower energies and present our current understanding of the origin of the EGB.

Summary

Primary author: Dr AJELLO, Marco (Clemson University)

Co-author: DI MAURO, mattia (Stanford University)

Presenter: Dr AJELLO, Marco (Clemson University)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **198** Type: **Oral Contributions**

High-energy interstellar gamma-ray emission from the Milky Way

Tuesday, September 13, 2016 4:30 PM (30 minutes)

Review talk on the high-energy interstellar gamma-ray emission from the Milky Way

Summary

High-energy interstellar gamma-ray emission from the Milky Way is produced by interactions of cosmic rays with interstellar gas and radiation fields. I will review recent developments in this field and discuss the implications for the physics of cosmic rays and the interstellar medium.

Primary author: TIBALDO, Luigi (SLAC)

Presenter: TIBALDO, Luigi (SLAC)

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **199** Type: **Oral Contributions**

Recent Results from the Large Underground Xenon Experiment

Monday, September 12, 2016 5:10 PM (20 minutes)

A brief introduction to two-phase xenon TPCs, the details of the LUX project, illustration of how signals are reconstructed, details of calibrations, analysis and background estimates, and presentation of the most recent results

Summary

Direct searches for dark matter stand as one of the main pillars of particle astrophysics research today. Between early 2013 and mid 2016, the Large Underground Xenon (LUX) experiment operated at the Sanford Underground Research Facility in South Dakota, performing the most sensitive searches to date for weakly interacting massive particles. This sensitivity has been enabled by dedicated in-situ calibrations of both electron and nuclear recoil responses, detailed measurement and understanding of backgrounds, and innovative data acquisition and analysis techniques. Recent results and the status
of the project will be presented.

Primary author: Prof. MURPHY, Alex (Edinburgh)

Presenter: Prof. MURPHY, Alex (Edinburgh)

Session Classification: Dark matter (direct detection)

Track Classification: Dark matter (direct detection)

Contribution ID: **200** Type: **Oral Contributions**

Ultra-high Energy Neutrinos, Antarctica, Greenland, and the Askaryan Effect: A Summary

Monday, September 12, 2016 4:50 PM (20 minutes)

The observation of EeV astrophysical neutrinos will be a significant scientific achievement, and the radio-frequency Antarctic neutrino observatories represent the cutting edge in the field of high-energy neutrino science. Being electrically neutral, astrophysical neutrinos propagate directly from the highest-energy objects in the cosmos, and could reveal the source of the highest energy cosmic-ray hadrons. Further, astrophysical neutrinos scattering in ice are predicted to have center of mass energies currently inaccessible on Earth, implying that tests of fundamental physics could be performed. The ice sheets and ice shelves of Antarctica and Greenland have become the largest, most technically convenient media for high-energy neutrino detection. The Askaryan effect provides a detection mechanism whereby radio frequency pulses are radiated from the particle cascades initiated by the neutrinos, and the cold temperatures of the natural ice formations in polar regions allow the radio pulses to propagate to detectors. The recent achievements and future plans of detectors like ANITA, ARIANNA, ARA, and EVA will be described, along with a brief review of the Askaryan effect, and the accompanying particle physics.

Summary

Primary author: HANSON, Jordan (The Ohio State University)

Presenter: HANSON, Jordan (The Ohio State University)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **201** Type: **Oral Contributions**

Neutrino emission from blazars in quiescence and flaring periods

Tuesday, September 13, 2016 5:50 PM (20 minutes)

Blazars are prime candidate sources for the high energy neutrinos recently detected by IceCube. Being intrinsically variable sources at almost all wavelengths, an accurate modeling of their neutrino emission in both quiescent and flaring states is vital for the interpretation of observations by neutrino telescopes. I will summarize our results on the neutrino emission obtained by the lepto-hadronic modeling of individual BL Lacs both in quiescence and flaring periods. I will discuss in more detail the role of major flares on the expected neutrino event rates.

Summary

Primary author: Dr PETROPOULOU, Maria (Purdue University)

Presenter: Dr PETROPOULOU, Maria (Purdue University)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **202** Type: **Oral Contributions**

Prompt atmospheric neutrinos in the era of LHC and IceCube

Monday, September 12, 2016 6:10 PM (20 minutes)

We evaluate the prompt atmospheric neutrino flux at high energies using different QCD frameworks for calculating the heavy quark production cross section in collisions of cosmic ray protons and atmospheric nuclei. We use QCD parameters consistent with heavy quark production cross sections measured at fixed target experiments, such as RHIC and LHC, to deduce a band of uncertainty for charm and bottom production in the atmosphere, and obtain the prompt neutrino flux expected therefrom. Finally, we compare our results with the IceCube limit on the prompt neutrino flux, which is already providing valuable information about some of the QCD models.

Summary

Primary author: Dr BHATTACHARYA, Atri (University of Liege)

Presenter: Dr BHATTACHARYA, Atri (University of Liege)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **203** Type: **Oral Contributions**

Results from the Search for eV-Sterile Neutrinos with IceCube

Thursday, September 15, 2016 2:40 PM (20 minutes)

The IceCube neutrino telescope at the South Pole has measured the atmospheric muon neutrino spectrum as a function of zenith angle and energy. We have performed a search for eV-scale sterile neutrinos by looking at distortion in those distributions. Such a sterile neutrino, motivated by the anomalies in short-baseline experiments, is expected to have a significant signature in the $\bar{\nu}_\mu$ survival probability due to matter induced resonant effects for energies of order 1 TeV. This effect makes this search unique and sensitive to small sterile mixings. In this talk, I will present the results of the IceCube sterile neutrino search using the a one year high energy sample and also our results obtained by looking at deviations of the standard oscillation pattern below 100 GeV from three years of DeepCore data.

Summary

Primary author: ARGUELLES, Carlos (MIT)

Presenter: ARGUELLES, Carlos (MIT)

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **204** Type: **Oral Contributions**

Measurements of Cosmic-ray Anisotropy with HAWC

Friday, September 16, 2016 2:00 PM (20 minutes)

The HAWC Observatory in Sierra Negra, Mexico has recently recorded its trillionth cosmic-ray air shower in just over 1 year of operation. Using this high statistics data set, we have studied the arrival direction distribution of ~1-100 TeV cosmic rays. The sub-degree angular resolution of the air shower reconstruction allows us to examine the known features of the Northern TeV cosmic-ray sky with unprecedented precision at large (>60°) and small angular scales. We will report the results of our analysis which is sensitive to ~10^-4 anisotropy. Measurements of anisotropy are being used to improve our understanding of the distribution of local cosmic-ray accelerators and orientation of local magnetic fields.

Summary

Primary author: FIORINO, Daniel (University of Maryland College Park)

Presenter: FIORINO, Daniel (University of Maryland College Park)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **205** Type: **Invited Contributions**

New results from PAMELA space mission after 10 years in orbit

Tuesday, September 13, 2016 2:00 PM (20 minutes)

Since June 2006 the PAMELA satellite-borne experiment has presented fundamental results on various aspects of cosmic-ray physics. Above all, PAMELA investigated the features present in the antiparticle component of galactic cosmic rays, which have been interpreted in terms of DM annihilation or pulsar contribution. The combination of a permanent magnet with a silicon-strip spectrometer and a imaging calorimeter allows also precision measurements of the entire charged cosmic radiation. In the last ten years PAMELA studied light nuclei and their isotopes, the propagation of particles inside the eliosphere, the short/long variations of the cosmic ray flux due to the Sun's activity (solar flares, Forbush decrease, solar modulation…), the interactions between galactic particles with the Earth's magnetosphere and so on. This talk illustrates the most recent scientific results obtained by the PAMELA experiment.

Summary

Primary author: MARTUCCI, Matteo (Università di Roma Tor Vergata)

Presenter: MARTUCCI, Matteo (Università di Roma Tor Vergata)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **206** Type: **Invited Contributions**

Main results of the Pierre Auger Observatory after 10 years of operation

Thursday, September 15, 2016 5:30 PM (15 minutes)

The nature and the origin of ultra-high energy cosmic rays (UHECRs), above 10^{17} eV, is still unknown. The Pierre Auger Observatory has been operating for more then 10 years obtaining a number of major breakthroughs. To answer the open questions on UHECRs the Observatory was conceived as an hybrid detector consisting of fluorescence telescopes overlooking an array of water Cherenkov stations covering a surface of 3000 km^2. This design and the huge exposure provides us with a large set of high quality data. The main results will be highlighted in this talk. Their coherent interpretation is still missing and has motivated several efforts for the design of an upgrade of the Observatory. The open questions and the future plans will be presented.

Summary

Primary author: Dr SETTIMO, Mariangela (CNRS)

Presenter: Dr SETTIMO, Mariangela (CNRS)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **207** Type: **Oral Contributions**

The JUNO reactor experiment

Tuesday, September 13, 2016 3:40 PM (20 minutes)

Abstract
The Jiangmen Underground Neutrino Observatory (JUNO) is a neu- trino reactor experiment at kt scale which will address the mass hierar- chy problem. The detector consists of a 20 kt Liquid Scintillator target and will be based in an deep underground laboratory (700 m) located at 53 km distance from the Yangjiang and Taishan nuclear power plant site in China. This specific location will resolve the mass hierarchy by analysing the neutrino oscillation spectra but required severe constraints on the energy resolution at 3% level for 1 MeV. The detector will be equipped with a multi-veto system allowing to detect cosmic muons and for e cient background reduction.
In addition, the experiment o□ers a rich physics program and will mea- sure the neutrino oscillation parameters at the percent level opening the precision era in the neutrino sector. The detector is currently in the R&D phase and foreseen to start by 2020 horizon.

Summary

Primary author: BAUSSAN, Eric (Institut Pluridisciplinaire Hubert Curien (FR))

Presenter: BAUSSAN, Eric (Institut Pluridisciplinaire Hubert Curien (FR))

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **208** Type: **Oral Contributions**

Anisotropy in Cosmic-Ray Arrival Directions with Six Years of Data from the IceCube Detector

Friday, September 16, 2016 2:20 PM (20 minutes)

The IceCube Neutrino Observatory has accumulated a total of 318 billion cosmic-ray induced muon events between May 2009 and May 2015. This data set was used for a detailed analysis of the cosmic-ray arrival direction anisotropy in the TeV to PeV energy range. The observed global anisotropy features large regions of relative excess and deficit, with amplitudes on the order of 10^{-3} up to about 100 TeV. A decomposition of the arrival direction distribution into spherical harmonics shows that most of the power is contained in the low-multipole ($\ell \leq 4$) moments. However, higher multipole components are found to be statistically significant down to an angular scale of less than 10°, approaching the angular resolution of the detector. Above 100 TeV, a change in the morphology of the arrival direction distribution is observed, and the anisotropy is characterized by a wide relative deficit whose amplitude increases with primary energy up to at least 5\,PeV, the highest energies currently accessible to IceCube. No time dependence of the large- and small-scale structures is observed in the six-year period covered by this analysis. The high-statistics data set reveals more details on the properties of the anisotropy and is potentially able to shed light on the various physical processes that are responsible for the complex angular structure and energy evolution.

Summary

Primary author: MCNALLY, Frank (University of Wisconsin - Madison)

Presenter: MCNALLY, Frank (University of Wisconsin - Madison)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **209** Type: **Oral Contributions**

Status and perspectives of KM3NeT

Monday, September 12, 2016 5:10 PM (20 minutes)

The KM3NeT Collaboration aims at the discovery and subsequent observation of high neutrino sources in the Universe (ARCA) and at the determination of the neutrino mass hierarchy (ORCA). The KM3NeT technologies, current status and expected performances are reported. In particular the ARCA detector is described and its perspectives for detection of high energy neutrinos signals from different candidate sources are discussed. The ORCA detector and its expected significance for the mass hierarchy determination by means of the measurement of passing through Earth atmospheric neutrinos are also presented.

Summary

Primary author: BARRIOS MARTÍ, Javier (IFIC (CSIC-UV))

Presenter: BARRIOS MARTÍ, Javier (IFIC (CSIC-UV))

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **210** Type: **Invited Contributions**

Opening Remarks

Monday, September 12, 2016 9:20 AM (30 minutes)

Summary

Presenters: RENNER, Christoph (Université de Genève); ELSEN, Eckhard (CERN)

Session Classification: Plenary

Contribution ID: **211** Type: **not specified**

ATLAS results on new physics searches

Monday, September 12, 2016 9:50 AM (20 minutes)

Summary

Presenters: PRIMAVERA, Margherita (Univ. + INFN); PRIMAVERA, Margherita (Universita del Salento (IT))

Session Classification: Plenary

Contribution ID: **212** Type: **not specified**

Recent results from CMS

Monday, September 12, 2016 10:10 AM (20 minutes)

With the increase in center-of-mass energy, a new energy frontier has been opened by the Large Hadron Collider. More than 25 fb^-1 of proton-proton collisions at sqrt(s)=13 TeV have been delivered to both ATLAS and CMS experiments during 2016. This enormous dataset can be used to test the Standard Model in a complete new regime with tremendous precision and it has the potential to unveil new physics or set strong bounds on it. In this talk some of the most recent results made public by the CMS Collaboration will be presented. The focus will mainly be on searches for physics beyond the Standard Model, with particular emphasis on searches for dark matter candidates.

Summary

Presenter: COSTANZA, Francesco (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Plenary

Contribution ID: **213** Type: **not specified**

Dark matter at the LHC: Effective field theories, simplified models & beyond

Monday, September 12, 2016 11:00 AM (30 minutes)

Summary

Presenter: HAISCH, Ulrich Andreas (University of Oxford (GB))

Session Classification: Plenary

Contribution ID: **214** Type: **not specified**

Direct Dark Matter Searches: Status and Perspectives

Monday, September 12, 2016 11:30 AM (30 minutes)

There is overwhelming indirect evidence that dark matter exists, however, the dark matter particle has not yet been directly detected in laboratory experiments. In order to be able to identify the rare dark matter interactions with the target nuclei, such instruments have to feature a very low threshold and an extremely low radioactive background. They are therefore installed in underground laboratories to reduce cosmic ray backgrounds. I will review the status of direct dark matter searches and will discuss the perspectives for the future.

Presenter: SCHUMANN, Marc (University of Bern)

Session Classification: Plenary

Contribution ID: **215** Type: **not specified**

Experimental Axion Review

Monday, September 12, 2016 12:00 PM (30 minutes)

Axions are a natural consequence of the Peccei-Quinn mechanism, the most compelling solution to the strong-CP problem. Similar axion-like particles (ALPs) also appear in a number of possible extensions of the Standard Model, notably in string theories. Both axions and ALPs are very well motivated candidates for the Dark Matter, and in addition would be copiously produced at the stellar cores. Some anomalous astrophysical observations could be hinting the existence of these particles. They are object of increasing interest by experimentalists. I will briefly review the motivation to search for axions and ALPs, as well as the current status and future prospects of the experimental landscape.

Summary

Presenter: GARCIA IRASTORZA, Igor (Universidad de Zaragoza (ES))

Session Classification: Plenary

Contribution ID: **216** Type: **not specified**

Advanced LIGO observations of gravitational waves from binary black hole mergers

Tuesday, September 13, 2016 9:30 AM (30 minutes)

This talk follows announcements earlier this year by the LIGO and Virgo Scientific Collaborations, based on data from the first
four-month observing run the advanced LIGO gravitational wave
detectors (aLIGO). In two instances, on 14.9.2015 and on 26.12.2015, we have directly detected the gravitational waves emitted by the final orbits and merger of massive black hole binary systems. I describe the main results and the basic physics of these systems, as well as some of the "behind the scenes" details of the discovery and subsequent analysis. As the aLIGO detectors improve during the coming few years, the prospects for further exciting discoveries are outstanding. References: B. P. Abbott et al., Phys. Rev. Lett. 116,
061102, 2016; Phys. Rev. Lett. 116, 241103, 2016.

Summary

Presenter: ALLEN, Bruce (Max Planck Society/Albert Einstein Institute Hannover)

Session Classification: Plenary

Contribution ID: **217** Type: **not specified**

Gravitational wave astronomy

Tuesday, September 13, 2016 10:00 AM (30 minutes)

In the past year, the LIGO-Virgo Collaboration announced the first secure detection of gravitational waves. This discovery heralds the beginning of gravitational wave astronomy: the use of gravitational waves as a tool for studying the dense and dynamical universe. In this talk, I will describe the full spectrum of gravitational waves, from Hubble-scale modes, through waves with periods of years, hours and milliseconds. I will describe the different techniques one uses to measure the waves in these bands, current and planned facilities for implementing these techniques, and the broad range of sources which produce the radiation. I will discuss what we might expect to learn as more events and sources are measured, and as this field matures into a standard part of the astronomical milieu.

Presenter: HUGHES, Scott (Massachusetts Institute of Technology)

Session Classification: Plenary

Contribution ID: **218** Type: **not specified**

IceCube and the Development of Neutrino Astronomy

Tuesday, September 13, 2016 11:00 AM (30 minutes)

Abstract: IceCube's discovery of a diffuse flux of astrophysical neutrinos started a new era of neutrino astronomy.I will review the multiple diffuse analyses in IceCube that observe the astrophysical flux, and what each can tell us. Then I will focus on spatial analyses that aim to identify the sources of such astrophysical neutrinos. This will be followed by an attempt to reconcile all results to draw a coherent picture that is the state of neutrino astronomy. Current plans for a streamlined real-time alert system to promote multi-messenger observations, and future plans of new detectors at the South Pole will be discussed to map out a path for discovering the first high-energy neutrino source in the sky.

Presenter: KURAHASHI, Naoko (Drexel University)

Session Classification: Plenary

Contribution ID: **219** Type: **not specified**

Supernova Neutrinos - MeV Messengers of the Extreme

Tuesday, September 13, 2016 11:30 AM (30 minutes)

A core-collapse supernova is a nearly perfect neutrino bomb. While capable of outshining its entire host galaxy, this stunning light show represents just a small portion of the explosion. Indeed, each such cataclysmic event typically radiates two orders of magnitude more energy as low-energy neutrinos than it does as electromagnetic radiation or as kinetic shockwaves. Consequently, MeV-scale neutrinos are made in huge numbers as the star is dying, and because these ghostly subatomic particles interact so rarely with normal matter they easily escape the fireball, providing a window into one of the most violent and interesting volumes in space: the heart of a stellar collapse. This talk will cover some of the history of neutrinos and supernovas, as well as how we are preparing new technology and partnerships to observe the next spectacular explosion in all its multimessenger glory.

Presenter: VAGINS, Mark (Kavli IPMU/UTokyo)

Session Classification: Plenary

Contribution ID: **220** Type: **not specified**

Neutrino particle astrophysics: status and outlook

Tuesday, September 13, 2016 12:00 PM (30 minutes)

The discovery of astrophysical neutrinos at high energy by IceCube raises a host of questions: What are the sources? Is there a Galactic as well as an extragalactic component? How does the astrophysical spectrum continue to lower energy where the dominant signal is from atmospheric neutrinos? Is there a measureable flux of cosmogenic neutrinos at higher energy? What is the connection to cosmic rays? At what level and in what energy region should we expect to see evidence of the $\pi 0$ decay photons that must accompany the neutrinos at production? Such questions are stimulating much theoretical activity and many multi-wavelength follow-up observations as well as driving plans for new detectors. My goal in this presentation will be to connect the neutrino data and their possible interpretations to ongoing multi-messenger observations and to the design of future detectors.

Presenter: GAISSER, Thomas (Bartol Research Institute)

Session Classification: Plenary

Contribution ID: **221** Type: **not specified**

Galactic Gamma-ray astrophysics

Wednesday, September 14, 2016 9:30 AM (30 minutes)

Summary

Presenter: MCENERY, Julie (NASA)

Session Classification: Plenary

Contribution ID: **222** Type: **not specified**

Extragalactic Gamma-Ray Astrophysics

Wednesday, September 14, 2016 10:00 AM (30 minutes)

During the last decades, various classes of radio-loud active galactic nuclei have been established as sources of high-energy radiation extending over a very broad range from soft gamma-rays (photon energies E~MeV) up to very-high-energy gamma-rays (E>100 GeV). These include blazars of different types, as well as young and evolved radio galaxies. The observed gamma-ray emission from such implies efficient particle acceleration processes taking place in highly magnetized and relativistic jets produced by supermassive black holes, processes that have yet to be identified and properly understood. In addition, nearby starforming and starburst galaxies, some of which host radio-quiet Seyfert-type nuclei, have been detected in the gamma-ray range as well. In their cases, the observed gamma-ray emission is due to non-thermal activity in the interstellar medium, possibly including also a contribution from accretion disks and nuclear outflows. Finally, the high-energy emission from clusters of galaxies remains elusive, although the upper limits provided in this respect by Fermi-LAT and ground-based Cherenkov Telescopes, are at this point already very constraining. Those upper limits, along with many other results gathered on extragalactic gamma-ray sources – e.g., timing properties of gamma-ray flares in blazar sources, energetics of the extended gamma-ray lobes in radio galaxies, or spectral characteristics of starburst galaxies in gamma-rays – challenge the standard model of cosmic-ray origin and propagation, and in particular the paradigm of the shock acceleration that plays a major role in the cosmic ray production. Still, in many respect the extragalactic gamma-ray astrophysics is a relatively young field, keeping in mind that a large fraction of the gamma-ray emitters detected in the Fermi-LAT all-sky survey remains unidentified. This constitutes a space for potential new exciting discoveries with future CTA or planned MeV satellite missions, in a combination with already operating neutrino and ultra-high-energy cosmic ray experiments, as it is among such unidentified gamma-ray emitters we may expect to find new classes of extragalactic sources of high-energy emission and particles.

Presenter: STAWARZ, Lukasz (Jagiellonian University)

Session Classification: Plenary

Contribution ID: **223** Type: **not specified**

Gamma-rays and the sources of galactic cosmic rays

Wednesday, September 14, 2016 11:00 AM (30 minutes)

Summary

Presenter: GABICI, Stefano

Session Classification: Plenary

Contribution ID: **224** Type: **not specified**

Indirect dark matter searches: current status and perspectives

Wednesday, September 14, 2016 11:30 AM (30 minutes)

Many theoretical ideas for the particle nature of dark matter exist. The most popular models often predict that dark matter particles self-annihilate or decay, giving rise to potentially detectable signatures in astronomical observations. I will summarize the current status of searches for such signatures and critically reassess recent claims for dark matter signals. I will further provide an outlook on anticipated developments in the next 10 years, and discuss new methods to facilitate strategy development.

Presenter: WENIGER, Christoph (University of Amsterdam)

Session Classification: Plenary

Contribution ID: **225** Type: **not specified**

Towards the APPEC strategy

Wednesday, September 14, 2016 12:00 PM (30 minutes)

Presenter: LINDE, Frank (Nikhef National institute for subatomic physics (NL))

Session Classification: Plenary

Contribution ID: **226** Type: **not specified**

Particle physics constraints from future cosmological surveys

Thursday, September 15, 2016 9:30 AM (30 minutes)

The next generation of cosmological surveys (of large scale structures, CMB polarisation, 21cm line), approved (Euclid, SKA, …) or submitted (COrE+, LiteBird), have the potential to return a lot of relevant information for particle physics. I will present and comment some of the most recent sensitivity forecasts related to neutrino physics, light relics and Dark Matter properties.

Summary

Presenter: LESGOURGUES, Julien (TTK, RWTH Aachen University)

Session Classification: Plenary

Contribution ID: **227** Type: **Oral Contributions**

New Insights on the Origin of Cosmic Rays

Thursday, September 15, 2016 4:30 PM (15 minutes)

I present the results of large kinetic (particle-in-cells) plasma simulations of particle acceleration at non-relativistic collisionless shocks, which in particular allow a first-principles investigation of diffusive acceleration at the blast waves of supernova remnants, the most prominent sources of Galactic cosmic rays (CRs).
Ion acceleration efficiency and magnetic field amplification are obtained as a function of the shock properties and compared with theoretical predictions, multi-wavelength observations of individual remnants, especially Tycho and SN1006.
Finally, I outline an original mechanism (the "espresso mechanism") for the acceleration of nuclei up to ~10^20eV in the relativistic jets of powerful active galactic nuclei. The combination of the "supernova-remnant paradigm" for the origin of Galactic CRs and the "espresso" mechanism provides a unified description of the spectrum and the chemical composition of CRs over more than 11 orders of magnitude in energy.

Summary

Primary author: CAPRIOLI, Damiano (Princeton University)

Presenter: CAPRIOLI, Damiano (Princeton University)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **228** Type: **not specified**

Towards an Effective THeory Of Structure formation (ETHOS)

Thursday, September 15, 2016 10:00 AM (30 minutes)

Although there is substantial gravitational evidence for the existence of dark matter, its particle nature remains one of the biggest mysteries in modern physics. The favourite theoretical model, Cold Dark Matter (CDM), assumes that non-gravitational dark matter interactions are irrelevant for galaxy formation and evolution.

Surprisingly, current astronomical observations allow significant departures from the CDM hypothesis that have a relevant impact on our understanding of how galaxies form and evolve. Moreover, the observed properties of the smallest galaxies have been a consistent challenge for the CDM model.

In this talk, I will argue that to explain galaxy formation and evolution in the broadest sense, an effective dark matter theory must contain a wider range of dark matter particle physics. I will describe the first steps we have taken towards developing ETHOS and present some of its applications.

Summary

Presenter: ZAVALA FRANCO, Jesús

Session Classification: Plenary

Contribution ID: **229** Type: **not specified**

New results from the AMS experiment on the International Space Station

Thursday, September 15, 2016 11:00 AM (30 minutes)

The Alpha Magnetic Spectrometer, AMS, is a general purpose high energy particle phys- ics detector. It was installed on the International Space Station, ISS, on 19 May 2011 to conduct a unique long duration mission of fundamental physics research in space. Knowledge of the precise rigidity dependence of the proton and helium flux is important in understanding the origin, acceleration, and propagation of cosmic rays. Pre- cise measurements of the proton and of the helium flux in primary cosmic rays with rigidities (momentum/charge) up to the TV scale are presented and the detailed varia- tion with rigidity of the flux spectral indices will be discussed.
A precision measurement by AMS of the antiproton flux and antiproton-to-proton ratio in primary cosmic rays in the rigidity range from 1 to 450 GV is presented. This measurement increases the precision of the previous observations and significantly extends their rigidity range. It shows that the antiproton-to-proton ratio remains constant above ~60 GV.
In addition new measurements of the cosmic ray electron and positron flux will be shown and the perspectives for the AMS physics program till the expected end of the lifetime of the International Space Station in 2024 will be discussed.

Presenter: SCHAEL, Stefan (Rheinisch-Westfaelische Tech. Hoch. (DE))

Session Classification: Plenary

Contribution ID: **230** Type: **not specified**

The CALorimetric Electron Telescope (CALET): in-flight performance and preliminary results.

Thursday, September 15, 2016 11:30 AM (30 minutes)

The CALorimetric Electron Telescope (CALET) on the International Space Station is an experiment aimed at precise measurements of the various components of the cosmic-ray spectrum. Its main scientific goal is to measure the electron + positron flux above 1 GeV and to explore the TeV region where the energy resolution is of the order of 2-3%, which can provide valuable data for dark matter searches and also to investigate the presence of nearby sources of cosmic electrons and positrons. Secondary goals are the measurement of the fluxes of the various nuclear species with good energy resolution up to several hundreds of TeV and of the diffuse gamma ray emission.
The instrument includes a charge detector (CHD) to determine the absolute electric charge of impinging particles, an imaging sampling calorimeter (IMC) and a total absorption homogeneous calorimeter (TASC) for a total depth of about 30 radiation lengths.
CALET is a Japanese-led international collaboration that includes the participation of Italian and US
members and the support of the respective space agencies JAXA, ASI and NASA. Launched on August
19th 2015, CALET has been successfully commissioned and is currently taking data at a regular pace.
In this talk, the in-flight performance of the apparatus will be presented together with some preliminary analysis results.

Presenter: SHOJI, Torii

Session Classification: Plenary

Contribution ID: **231** Type: **not specified**

The Future of Gamma Ray Astrophysics

Thursday, September 15, 2016 12:00 PM (30 minutes)

Over the past decade, gamma ray astrophysics has entered the astrophysical mainstream. Extremely successful space-borne (GeV) and ground-based (TeV) detectors, combined with a multitude of partner telescopes, have revealed a fascinating "astroscape" of active galactic nuclei, pulsars, gamma ray bursts, supernova remnants, binary stars, star-forming galaxies, novae much more, exhibiting major pathways along which large energy releases can flow. From a basic physics perspective, exquisitely sensitive measurements have constrained the nature of dark matter, the cosmological origin of magnetic field and the properties of black holes. These advances have motivated the development of new facilities, including HAWC, DAMPE, CTA and SVOM, which will further our understanding of the high energy universe. Topics that will receive special attention include merging neutron star binaries, clusters of galaxies, galactic cosmic rays and putative, TeV dark matter.

Presenter: BLANDFORD, Roger (Stanford University)

Session Classification: Plenary

Contribution ID: **232** Type: **not specified**

Measurements at LHC and their relevance for cosmic ray physics

Friday, September 16, 2016 9:30 AM (30 minutes)

Many LHC measurements are already used to improve hadronic interaction models used in cosmic ray analyses. This already had a positive effect on the model dependence of crucial data analyses. Some of the data and the model tuning is reviewed. However, the LHC still has a lot more potential to provide crucial information. Since the start of Run2 the highest accelerator beam energies are reached and no further increase can be expected for a long time. First data of Run2 are published and the fundamental performance of cosmic ray hadronic interaction models can be scrutinized. The relevance of LHC data in general for cosmic ray data analyses is demonstrated.

Summary

Presenter: ULRICH, Ralf Matthias (KIT - Karlsruhe Institute of Technology (DE))

Session Classification: Plenary

Contribution ID: **233** Type: **not specified**

The Status of the DAMPE (DArk Matter Particle Explorer) Satellite Mission

Friday, September 16, 2016 10:00 AM (30 minutes)

Summary

Presenter: WU, Xin (Universite de Geneve (CH))

Session Classification: Plenary

Contribution ID: **234** Type: **not specified**

Future of CR astroparticle physics

Friday, September 16, 2016 11:00 AM (30 minutes)

The data we are receiving from galactic cosmic rays are reaching an unprecedented precision, over very wide energy ranges. Nevertheless, many problems are still open, while new ones seem to appear when data happen to be redundant. We will discuss some paths to possible progress in the theoretical modelling and experimental exploration of the galactic cosmic radiation.

Presenter: DONATO, Fiorenza (INFN - National Institute for Nuclear Physics)

Session Classification: Plenary

Contribution ID: **235** Type: **not specified**

Prospects for the LHC and future colliders

Friday, September 16, 2016 11:30 AM (30 minutes)

I outline the goals of the future LHC programme, and the current understanding of the physics potential of the possible next generation of lepton and hadron colliders.

Presenter: MANGANO, Michelangelo (CERN)

Session Classification: Plenary

Contribution ID: **236** Type: **not specified**

Concluding Remarks

Friday, September 16, 2016 12:00 PM (30 minutes)

Session Classification: Plenary

Contribution ID: **237** Type: **Oral Contributions**

Recent Observations with the Telescope Array

Thursday, September 15, 2016 5:45 PM (20 minutes)

The Telescope Array (TA) is an observatory for the study of the highest energy cosmic rays (HECR). Located in Utah, U.S.A., TA consists of a surface scintillator array and a set of nitrogen fluorescence detectors which jointly allow hybrid reconstruction of cosmic ray induced extensive air showers. In this talk we will describe the cosmic ray energy spectrum as measured by TA over five orders of magnitude, several anisotropy results including the Ursa Major hotspot, and the latest composition inferences from the distribution of air shower maximum. We will describe a recently funded project to increase the experiment's aperture by a factor of four. Also, Telescope Array has a rich program of affiliated experiments which we will describe, including efforts to measure the radar cross-section of HECR and to study the production of high-energy particles by lightning within the Earth's atmosphere.

Summary

Primary author: BELZ, John (University of Utah)

Presenter: BELZ, John (University of Utah)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **238** Type: **Oral Contributions**

TeV-PeV Cosmic-Ray Anisotropy as a Probe of Interstellar Turbulence

Friday, September 16, 2016 3:40 PM (20 minutes)

IceTop and IceCube have observed a mysterious cold spot in the angular distribution of high energy ($\geq$ 100 TeV) cosmic rays (CR), thereby placing interesting constraints on their transport properties. We examine here these constraints by comparing the observations with the predictions of pitch-angle diffusion in various kinds of turbulence. In the case of Alfvenic turbulence with a Goldreich-Sridhar power-spectrum and a small outer scale ($\ll$ 10 pc), we show that pseudo-Alfven modes can produce a signature that is compatible with the observations. Adding fast magnetosonic modes reduces the CR mean free path. We further show that, in the case of fast modes, the CR anisotropy can still match the observations, for physically relevant values of the turbulence parameters. Finally, we suggest that the increase, with energy, of the size of the cold spot in IceTop data may be a hint at an anisotropy in the power spectrum of the local interstellar magnetic turbulence.

Summary

Primary author: Dr GIACINTI, Gwenael (MPIK Heidelberg)

Presenter: Dr GIACINTI, Gwenael (MPIK Heidelberg)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **240** Type: **not specified**

CONFERENCE: SEEING TWO BLACK HOLES MERGE (WITH GRAVITATIONAL WAVES!)

Wednesday, September 14, 2016 7:00 PM (2 hours)

On 14 September 2015, the advanced LIGO gravitational wave instruments detected the gravitational wave signal emitted as two black holes, about one billion light years away from Earth, made a final few orbits around each other then merged together. This was big news around the world, because scientists have tried to make such observations for more than half a century. Before they merged, the two black holes were about 29 and 36 times as massive as the sun; after the merger was complete, a single black hole about 62 times the sun's mass was left behind. I'll describe what black holes are, how they (and other accelerated masses) produce gravitational waves, and how those waves are detected. I'll also discuss some of the behind-the-scenes details of this discovery, and why we are convinced that this signal, called GW150914, is real. For physics enthusiasts, I'll explain how the main properties of the black holes can be directly determined from the observational data and also why we are convinced that no other explanation is possible.

http://cds.cern.ch/journal/CERNBulletin/2016/33/Events/2207047?ln=en

Presenter: ALLEN, Bruce (Max Planck Society/Albert Einstein Institute Hannover)

Session Classification: Public talk: Seeing two black holes merge (with gravitational waves!)

Contribution ID: **241** Type: **Invited Contributions**

DM searches using missing ET at LHC (CMS)

Monday, September 12, 2016 2:00 PM (20 minutes)

DM searches using missing ET at LHC (CMS)

Summary

Primary author: MOON, Chang-Seong (UNESP - Universidade Estadual Paulista (BR))

Presenter: MOON, Chang-Seong (UNESP - Universidade Estadual Paulista (BR))

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **242** Type: **Invited Contributions**

Searches for light dark matter through dijets and long-lived particles at the LHC (ATLAS)

Monday, September 12, 2016 2:20 PM (20 minutes)

Searches for light dark matter through dijets and long-lived particles at the LHC

Summary

Primary author: ROSTEN, Rachel Christine (University of Washington (US))

Presenter: ROSTEN, Rachel Christine (University of Washington (US))

Session Classification: Dark Matter & colliders

Track Classification: Dark matter & colliders

Contribution ID: **243** Type: **Oral Contributions**

Measurement of the Proton and Helium Flux in Cosmic Rays with the Alpha Magnetic Spectrometer: Results and Interpretations.

Monday, September 12, 2016 2:00 PM (20 minutes)

We present a precision measurement of the cosmic-ray proton flux at rigidity from 1 GV to 1.8 TV and the helium flux at rigidity from 2 GV to 3 TV. The measurement is based on the data collected by the Alpha Magnetic Spectrometer experiment on the International Space Station. The two fluxes are found to progressively harden at rigidities larger than 100 GV, while the proton-to-helium ratio is found to steadily decrease with rigidity.
At rigidity above 45 GV, the ratio is remarkably well described by a single power law, with spectral index 0.077 +/- 0.007. We discuss some possible interpretations of these results in terms of astrophysical models of cosmic-ray acceleration and propagation.

Summary

Primary author: TOMASSETTI, Nicola (Perugia University & INFN- Perugia)

Presenter: TOMASSETTI, Nicola (Perugia University & INFN- Perugia)

Session Classification: Cosmic rays

Track Classification: Cosmic rays

Contribution ID: **244** Type: **Oral Contributions**

Insights into pulsar physics from very high energy gamma-ray observations

Thursday, September 15, 2016 4:15 PM (30 minutes)

Most of the 200 gamma-ray pulsars detected by the Fermi-LAT space telescope exhibit sharp spectral cutoffs around a few GeV. This can be explained by classical pulsar models, in which gamma-ray emission originates from curvature radiation emitted by e-/+ pairs, accelerated either close to the neutron star surface or to the pulsar light cylinder. These models naturally predict the observed cutoffs at a few GeV, suggesting that pulsars are inviable targets for VHE (>100 GeV) ground-based gamma-ray detectors. However, the detection of the Crab pulsar up to hundreds of GeV by MAGIC and VERITAS, and the detection of Vela by HESS, have shown that pulsar spectra can extend beyond what was previously expected. These discoveries have raised important questions about our understanding of pulsar electrodynamics. It seems unlikely that curvature radiation can be the main source of photons at VHE energies, and so new models involving e.g. inverse Compton scattering or emission beyond the light cylinder have been proposed.
In this talk, I will review the latest observations of pulsars with the current VHE gamma-ray instruments. I will discuss the implications of these observations in our understanding of pulsar physics, and summarise the latests ideas to explain such energetic and unexpected radiation. Finally, prospects for pulsar observations with the coming CTA observatory will also be shown.

Summary

Primary author: Dr LÓPEZ MOYA, marcos

Presenter: Dr LÓPEZ MOYA, marcos

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **245** Type: **Oral Contributions**

The future of gamma-ray astronomy

Monday, September 12, 2016 2:00 PM (30 minutes)

The field of gamma-ray astronomy has experienced impressive progress over the last decade. Thanks to the advent of a new generation of imaging air Cherenkov telescopes (H.E.S.S., MAGIC, VERITAS) and thanks to the launch of the Fermi-LAT satellite, several thousand gamma-ray sources are known today, revealing an unexpected ubiquity of particle acceleration processes in the Universe. Major scientific challenges are still ahead, such as the identification of the nature of Dark Matter, the discovery and understanding of the sources of cosmic rays, or the comprehension of the particle acceleration processes that are at work in the various objects. This talk presents some of the instruments and mission concepts that will address these challenges over the next decades.

Summary

Primary author: KNÖDLSEDER, Jürgen

Presenter: KNÖDLSEDER, Jürgen

Session Classification: Gamma-ray astrophysics

Track Classification: Gamma-ray astrophysics

Contribution ID: **246** Type: **Oral Contributions**

Towards CP violation: from T2K to HyperK.

Monday, September 12, 2016 6:30 PM (20 minutes)

Towards CP violation: from T2K to HyperK.

Summary

Primary author: BLONDEL, Alain (Universite de Geneve (CH))

Presenter: BLONDEL, Alain (Universite de Geneve (CH))

Session Classification: Neutrinos

Track Classification: Neutrinos

Contribution ID: **247** Type: **not specified**

Indirect dark matter searches with the MAGIC telescopes

Friday, September 16, 2016 1:45 PM (15 minutes)

Discovering the nature of dark matter (DM) is one of the fundamental challenges of the modern physics. Indirect DM searches are looking for signatures from annihilation and/or decay of DM particles into standard matter in highly DM dominated cosmic regions, such as the Galactic Center, clusters of galaxies, and dwarf spheroidal satellite galaxies (dSphs) of the Milky Way.

In the widely considered cold DM scenario of weakly interacting massive particles (WIMPs), a flux of gamma rays of energies up to the DM mass is expected and could be accessible by Imaging Atmospheric Cherenkov Telescopes (IACTs). Since the beginning of operations, the MAGIC telescopes are carrying out deep observational campaigns of several promising DM targets, with the aim of detecting such signals or alternatively setting stringent constrains to DM particle models in the TeV mass range.

Here, we report on the present status and future prospects of the indirect DM program by MAGIC, focusing on the latest results achieved with dSph observations, where MAGIC reached the strongest constraints on DM annihilation searches above few hundreds of GeV.

Summary

Presenter: Dr PANEQUE, David

Session Classification: Dark matter (indirect detection)