STARS2015 - 3rd Caribbean Symposium on Cosmology, Gravitation, Nuclear and Astroparticle Physics / SMFNS2015 - 4th International Symposium on Strong Electromagnetic Fields and Neutron Stars

Report of Contributions

Contribution ID: **51** Type: **Talk**

The Mass and Radius of Compact Object in 4U 1746-37

Tuesday, 12 May 2015 16:20 (30 minutes)

Photospheric radius expansion (PRE) bursts have already been used to constrain the masses and radii of neutron stars. *RXTE* observed three PRE bursts in 4U 1746-37, all with low touchdown fluxes. We discuss here the possibility of low mass neutron star in 4U 1746-37 because the Eddington luminosity depends on stellar mass. With typical values of hydrogen mass fraction and color correction factor, a Monte-Carlo simulation was applied to constrain the mass and radius of neutron star in 4U 1746-37. 4U 1746-37 has a high inclination angle. Two geometric effects, the reflection of the far side accretion disc and the obscuration of the near side accretion disc have also been included in the mass and radius constraints of 4U 1746-37. If the reflection of the far side accretion disc is accounted, a low mass compact object (mass of $0.41 \pm 0.14\ M_{\odot}$ and radius of 8.73 ± 1.54 km at 68% confidence) exists in 4U 1746-37. If another effect
operated, 4U 1746-37 may contain an ultra low mass and small radius object ($M = 0.21 \pm 0.06\ M_{\odot}$, $R = 6.26 \pm 0.99$ km at 68% confidence). Combined all possibilities, the mass of 4U 1746-37 is $0.41^{+0.70}_{-0.30}\ M_{\odot}$ at 99.7% confidence. For such low mass NS, it could be reproduced by a self-bound compact star, i.e., quark star or quark-cluster star.

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Co-author: XU, Renxin (Peking University)

Presenter: LI, Zhaosheng (Peking University)

Track Classification: STARS2015

Contribution ID: **53** Type: **Talk**

Magneto-rotational and thermal evolution of near-by young neutron stars

Tuesday, 12 May 2015 14:40 (40 minutes)

We perform population synthesis of near-by (up to a few kpc) young (less than a few Myrs) neutron stars. We consider objects observable in soft X-rays due to their thermal surface emission. Observations demonstrate than about a dozen of young cooling neutron stars are observed int he solar vicinity. They represent two populations: radio pulsars and so-called "Magnificent Seven". We study how properties of these sources can be reproduced in different models of cooling (including different EoS of neutron stars) and field evolution.
We demonstrate that despite the Log N - Log S distribution can be reproduced in different models, it is not easy to reproduce the P-Pdot distribution without fine tuning of the initial magnetic field distribution or selection effects.

Primary author: POPOV, Sergei (Moscow State University)

Presenter: POPOV, Sergei (Moscow State University)

Track Classification: STARS2015

Contribution ID: **54** Type: **Talk**

Magnetic field decay in radio pulsars

Friday, 15 May 2015 12:00 (30 minutes)

We apply a new method to probe evolution of the magnetic field of normal radio pulsars in the range of ages from several tens of thousand years to several hundred thousand years. It is demonstrated that in the period ˜80000-300000 years the field decay by a factor ˜2. We discuss how this evolution can be related to the Hall cascade and Hall attractor.

Primary author: POPOV, Sergei (Moscow State University)

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Presenter: POPOV, Sergei (Moscow State University)

Track Classification: SMFNS2015

Contribution ID: **55** Type: **Talk**

A proposal of quantization with a minimal length present

Sunday, 10 May 2015 10:40 (40 minutes)

The proposal consists of extending the 4-dimensional physical space to an 8-dimensional pseudo-complex (pc) space. The pc-extension introduces a minimal length as a parameter, thus, it is unaffected by Poincaré transformations. All continuous symmetries are maintained. In the extended space, standard quantization rules are applied and it is shown that after projection to the 4-dimensional physical space it is equivalent to non-commuting coordinates and non-commuting linear moments. A simple (1+1)-dimensional model is discussed investigating remnant effects of the 4-dimensional (in pc-coordinates) origin. The main result is: Extending to a higher dimensional space might offer to maintain the standard quantization rules and continuous symmetries, but at the same time simulating the effects of a minimal length and non-commutative properties of coordinates.

Primary author: HESS, Peter

Presenter: HESS, Peter

Track Classification: SMFNS2015

Contribution ID: **56** Type: **Talk**

Simulations of accretion disks in pseudo-complex General Relativity

Friday, 15 May 2015 15:30 (30 minutes)

After a brief résumé on pseudo-complex General Relativity (pc-GR), circular orbits and stable orbits in general are discussed, including predictions compared to observations. Using a modified version of a model for accretions disks, presented by Page and Thorne, we apply the raytracing technique, in order to simulate the appearance of an accretion disk as it appears in a detector. In pc-GR we predict a dark ring near a very massive, rapidly rotating object.

Primary author: HESS, Peter

Co-author: GREINER, Walter (J.W. Goethe-University Frankfurt am Main)

Presenter: HESS, Peter

Track Classification: STARS2015

Contribution ID: **57** Type: **Talk**

Galaxy Evolution observed with MOS at the E-ELT

Monday, 11 May 2015 14:00 (40 minutes)

The European Extremely Large Telescope (E-ELT) is the current 1st priority flagship project of European ground-based Astronomy in the optical and NIR. After completion in 2024, the E-ELT will be the most advanced and most sensitive facility for diffraction limited imaging and spectroscopy with a giant aperture for the next decades to come. MOSAIC is a conceptual idea to exploit this sensitivity for multiobject spectroscopy (MOS), covering the full range of E-ELT science and including input from a broad cross-section of astronomers across the ESO partner countries. I will highlight cases relating to studies of high-redshift galaxies, galaxy evolution, and stellar populations. A general requirement is the need for two observational modes to best exploit the large (≥40 arcmin2) patrol field of the E-ELT. The first mode ('high multiplex') requires integrated-light (or coarsely resolved) optical/near-IR spectroscopy of >100 objects simultaneously. The second ('high definition'), enabled by wide-field adaptive optics, requires spatially-resolved, near-IR of >10 objects/sub-fields.

Primary author: ROTH, Martin

Presenter: ROTH, Martin

Track Classification: STARS2015

Contribution ID: **58** Type: **Talk**

Can General Relativity's N-body Lagrangian Be Obtained From Iterative Algebraic Scaling Equations?

Sunday, 10 May 2015 14:40 (40 minutes)

A local system of bodies in General Relativity whose exterior metric field asymptotically approaches the Minkowski metric effaces any effects of the matter distribution exterior to the Minkowski boundary condition. A local gravitational system also exhibits certain invariances under time dilation and spatial contractions upon boosts. For composite body sources, interior effacement is manifest in General Relativity as well, leaving a single mass-energy parameter to represent the body in its spherical limit. By enforcing to all orders these properties of gravity which seem to hold in nature, a new method using linear algebraic scaling equations is developed which generates by an iterative process an N-body Lagrangian expansion for gravity which fulfills the mentioned properties — exterior and interior effacement, and the time dilation and Lorentz contraction features of special relativity. The algebraic method is then used to produce the N-body gravity Lagrangian to the 1/cˆ4 order of expansion.

Primary author: NORDTVEDT, Kenneth (Montana State University)

Presenter: NORDTVEDT, Kenneth (Montana State University)

Track Classification: STARS2015

Contribution ID: **59** Type: **Talk**

Unification of Inflation and Dark Energy in a Non Singular Emergent Scenario

Sunday, 10 May 2015 12:00 (30 minutes)

A new class of gravity-matter models defined in terms of two independent non-Riemannian volume forms (alternative generally covariant integration measure densities) on the space-time manifold are studied in some detail. These models involve an additional Rˆ2 (square of the scalar curvature) term as well as scalar matter field potentials of appropriate form so that the pertinent action is invariant under global Weyl-scale symmetry. Scale invariance is spontaneously broken upon integration of the equations of motion. After performing transition to the physical Einstein frame we obtain: (i) An effective potential for the scalar field with two flat regions which allows for a unified description of both early universe inflation as well as of present dark energy epoch; (ii) For a definite parameter range the model possesses a non-singular "emergent universe" solution which describes an initial phase of evolution that precedes the inflationary phase.

Primary author: GUENDELMAN, Eduardo (Ben Gurion University)

Presenter: GUENDELMAN, Eduardo (Ben Gurion University)

Track Classification: STARS2015

Contribution ID: **60** Type: **Talk**

Axion Photon Scalar QED analogy, photon and axion spitting in strong magnetic fields

Thursday, 14 May 2015 11:00 (30 minutes)

A Scalar QED analogy is possible for the photon axion system that allows to describe axion photon spitting in strong magnetic fields. Results from these analysis have been used recently to claim evidence for axion like particles from the sun. Also possible photon splitting effects could appear in pulsars, we will review this subject

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Presenter: GUENDELMAN, Eduardo (Ben Gurion University)

Track Classification: SMFNS2015

Contribution ID: **62** Type: **Talk**

Super-Eddington accretion onto neutron stars and black holes

Sunday, 10 May 2015 16:50 (40 minutes)

I will present most recent results, not yet published, concerning the super-Eddington accretion onto neutron stars and black holes. In the case of neutron stars, a new phenomenon is predicted: a levitating atmosphere. In the case of black holes, the Polish Doughnut model for super critical accretion is critically revisited.

Primary authors: WIELGUS, Maciek (Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences); ABRAMOWICZ, Marek (Goteborg University, Goteborg, Sweden)

Presenter: WIELGUS, Maciek (Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences)

Track Classification: STARS2015

Contribution ID: **63** Type: **Talk**

Stellar entropy and stellar evolution

Sunday, 10 May 2015 15:20 (40 minutes)

Evolution of entropy in stellar systems

Primary author: HORVATH, Jorge (IAG-USP)

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Presenter: HORVATH, Jorge (IAG-USP)

Track Classification: STARS2015

Contribution ID: **64** Type: **Talk**

Evolution of magnetic fields in accreting neutron star systems

Thursday, 14 May 2015 16:00 (30 minutes)

Evolution of magnetic fields in accreting neutron star systems

Primary author: HORVATH, Jorge (IAG-USP)

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Presenter: HORVATH, Jorge (IAG-USP)

Track Classification: SMFNS2015

Contribution ID: **68** Type: **Talk**

Cherenkov Telescope Array (CTA)

Monday, 11 May 2015 12:00 (30 minutes)

Gamma-ray astronomy holds a great potential for Astrophysics, Particle Physics and Cosmology. The CTA is an international initiative to build the next generation of ground- based gamma-ray observatories, which will represent a factor of 5-10x improvement in the sensitivity of observations in the range 100 GeV - 10 TeV, as well as an extension of the observational capabilities down to energies below 100 GeV and beyond 100 TeV. The array will consist of two telescope networks (one in the Northern Hemisphere and another in the South) so to achieve a full-sky coverage, and will be composed by a hybrid system of 4 different telescope types. It will operate as an observatory, granting open access to the community through call for submission of proposals competing for observation time. The CTA will give us access to the non-thermal and high-energy universe at an unprecedented level, and will be one of the main instruments for high-energy astrophysics and astroparticle physics of the next 30 years. CTA has now entered its prototyping phase with the first, stand-alone instruments being built. Brazil is an active member of the CTA consortium, and the project is represented in Latin America also by Argentina, Mexico and Chile. In the next few months the consortium will define the site for installation of CTA South, which might come to be hosted in the Chilean Andes, with important impact for the high-energy community in Latin America. In this talk we will present the basic concepts of the CTA and the detailed project of the observatory. Emphasis will be put on its scientific potential and on the Latin-American involvement in the preparation and construction of the observatory whose first seed, the ASTRI mini-array, is currently being constructed in Sicily, in a cooperation between Italy, Brazil and South Africa. ASTRI should be installed on the final CTA site in 2016, whereas the full CTA array is expected to be operational by the end of the decade.

Primary author: BARRES DE ALMEIDA, Ulisses (Centro Brasileiro de Pesquisas Físicas)

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Track Classification: STARS2015

Contribution ID: **69** Type: **Talk**

Hybrid modelling of relativistic heavy ion collisions

Tuesday, 12 May 2015 10:40 (40 minutes)

We review current concepts and models used to describe the evolution of the hot and dense matter created in heavy ion collisions at LHC, RHIC and FAIR. To this aim, we will discuss recent extensions of transport models based on the Boltzmann equation to include a hydrodynamical stage that allows for a consistent treatment of all stages of the reaction, including a phase transition to a QGP. Then we discuss how a dynamical model for the exploration of the critical point of QCD and the phase transition can be constructed and present results for a broad variety of observables for heavy ion collisions at FAIR, RHIC and LHC.

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Presenter: BLEICHER, Marcus (Uni Frankfurt & FIAS)

Track Classification: STARS2015

Contribution ID: **72** Type: **Talk**

Ultraluminous X-ray pulsar: accreting magnetar?

Friday, 15 May 2015 11:00 (30 minutes)

Magnetars are neutron stars powered by their superstrong magnetic field.
The discovery of low magnetic field magnetars etc has deeped our understanding of magnetars.
Accreting normal neutron stars are discovery 40 years ago. However,
no strong evidence for the existence of accreting magnetars are found up to now.
Recently, an ultraluminous X-ray source powered by an accreting neutron star is discoveryed (Bachetti et al. 2014, Nature, 514, 202). It may be an accreting magnetar candidate. For an aged magnetar, it is more like to be a low magnetic field magnetar. An accreting low magnetic field magnetar may explain both the radiative and timing observations of the ultraluminous X-ray pulsar. Combined with previous researches, three signatures of accreting magnetar are available at present: (1) magnetar-like bursts, (2) a hard X-ray tail, and (3) an ultraluminous X-ray pulsar.

Primary author: TONG, Hao (Xinjiang Astronomical Observatory, Chinese Academy of Sciences)

Co-author: XU, Renxin (P)

Presenter: TONG, Hao (Xinjiang Astronomical Observatory, Chinese Academy of Sciences)

Track Classification: SMFNS2015

Contribution ID: **77** Type: **Talk**

Compact stars on the brane: what could they reveal about extra dimensions?

Tuesday, 12 May 2015 12:00 (30 minutes)

According to braneworld models the observable universe could be restricted to a 1+3 surface (a "brane"where Standard Model particles and fields are trapped) embedded in a higher dimensional spacetime (the "bulk") that can be accessed by gravity. In this work we investigate the properties of compact stars in the Randall-Sundrum II type braneworld. Adopting the well established BPS equation of state below a fiducial density, and a causal equation of state above it, we solve the Tolman-Oppenheimer-Volkoff equations on the brane and obtain the causal limit for stellar configurations in the mass-radius diagram. Such limit is different to the one obtained within the frame of general relativity due to local and nonlocal extra-dimensional modifications to the structure equations on the brane. We analyse the properties of quark and hadronic stars using the MIT bag model and a relativistic mean-field model for the equation of state. We examine the stability of the stellar configurations and discuss smoking guns for extra dimensions that could emerge from future compact star observations.

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Presenter: LUGONES, German (UFABC)

Track Classification: STARS2015

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

Magnetized Quark stars and anisotropic stellar structure

The fact that a magnetic field in a fermion system breaks the spherical symmetry suggest that the intrinsic geometry of this system is axisymmetric rather than spherical. In this work we analyze the impact of anisotropic pressures, due to the presence of a magnetic field, in the structure equations of a magnetized quark star. We assume a cylindrical metric and an anisotropic energy momentum tensor for the source. We found that there is a maximum magnetic field that the star can sustain, closely related to the violation of the virial relations

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Presenter: PEREZ MARTINEZ, Aurora (ICIMAF)

Track Classification: SMFNS2015

Contribution ID: **79** Type: **Talk**

Super Chandrasekhar masses for magnetized WD?

Friday, 15 May 2015 09:30 (30 minutes)

The problem of the maximum masses of magnetized White Dwarfs (WD) is revisited considering the impact
of a strong magnetic field onto the structure equations. The magnetic field splits the pressure in parallel and perpendicular one. Firstly we will present stable solutions of TOV equations for the parallel pressures, and physical solutions vanish for the perpendicular pressure when $B > 10^{13}G$. This fact establishes an upper bound for a magnetic field and the stability of the configurations in the (quasi) spherical approximation. Our findings also indicate that it is not possible to obtain stable magnetized WD with super Chandrasekhar masses because the values of the magnetic field needed for them are higher than this bound.
Secondly we show structure equations in a cylindrical metric which are appropriate for the anisotropies. The solutions of these equations confirm the same bound for $B \sim 10^{13}G$, since beyond this value no physical solutions are possible. Our tentative conclusion is that massive WD, with masses well beyond the Chandrasekhar limit do not constitute stable solutions and should not exist.

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Track Classification: SMFNS2015

Contribution ID: **80** Type: **Talk**

Propagation of photon in a diluted medium moving parallel to the magnetic field: Faraday rotation angle

Thursday, 14 May 2015 11:45 (15 minutes)

The dispersion equations for photons moving parallel to a constant magnetic field are solved for diluted magnetized gas. The quantum Faraday
angle is obtained for a quantum relativistic diluted gas in the strong field limit as well as in the weak field approximation. Applications to the photon propagation in the magnetosphere of neutron stars are discussed.

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Presenters: Dr PÉREZ MARTÍNEZ, Aurora (ICIMAF); CRUZ RODRÍGUEZ, Lidice (Havana University)

Track Classification: STARS2015

Contribution ID: **83** Type: **Talk**

Mass measurements with the Pierre Auger Observatory

Monday, 11 May 2015 16:20 (30 minutes)

The Pierre Auger Observatory is the largest ultra-high energy cosmic ray experiment built so far. It is a hybrid detector, since it measures both the fluorescence light emitted while the air-showers develop in the atmosphere and the particles reaching the ground. We present the results related to the mass composition of ultra-high energy cosmic rays as obtained from both types of measurements. The depth at which the maximum of the electromagnetic development takes places and its fluctuations are the most sensitive parameters to infer the nature of the cosmic rays. The surface detector gives complementary variables as the depth at which the production of muons is maximal, the signal rise times and their asymmetries. We address the evolution of these parameters with energy, their systematic uncertainties and how they can also be used to constrain models of hadronic interactions at energies larger than those reached at LHC.

Primary author: MOLINA BUENO, Laura (Universidad de Granada)

Presenter: MOLINA BUENO, Laura (Universidad de Granada)

Track Classification: STARS2015

Contribution ID: **85** Type: **Talk**

The stellar explosion threats during the evolution of a habitable planet

Thursday, 14 May 2015 15:30 (30 minutes)

Habitable planets,
stellar explosions,
the role of O2/O3 system,
biological implications

Primary author: MARTIN, Osmel

Co-author: HORVATH, Jorge (IAG-USP)

Presenter: MARTIN, Osmel

Track Classification: STARS2015

Contribution ID: **86** Type: **Poster**

Coleman-Weinberg Potential in Dimensional Regularisation

Spontaneous symmetry breaking is essential for giving masses to non-Abelian gauge fields. It appears to be the only method which is available which is unitary and renormalizable in 4 dimensions. Sidney Coleman and Erick Weinberg investigate how radiative corrections, otherwise the loop corrections, can produce spontaneous symmetry breaking, in the kind of theory for which the semiclassical (tree) approximation does not indicate such breakdown. In particular for theories which have no initial mass scale. The simplest model in which this phenomenon in principle could occur is the massless phi four theory. They obtained the effective renormalized potential for this theory over four decades ago. And found that while there are non-trivial minima of the 1-loop effective potential those minima lie outside the validity of the approximation being used.
Coleman and Weinberg use the cut-off method to obtain the potential but we know that this method does not respect gauge invariance (even though in that model one does not have a gauge symmetry). Our present work is to obtain the same form of the potential but using the techniques of Dimensional Regularization, we obtain the same result. We also clarify the uses of this method, more convenient for several reasons, likes the preservation of local symmetries (gauge invariance) in classical action.

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Presenter: SUAREZ CORTINA, Jose Carlos (Higher Institute of Technologies and Applied Sciences, Havana, Cuba)

Track Classification: STARS2015

Contribution ID: **87** Type: **Talk**

Chiral Magnetic Effect in QED induced by longitudinal photons

Thursday, 14 May 2015 11:30 (15 minutes)

We demonstrate the existence of the chiral magnetic effect inan electron-positron magnetized gas. A pseudo-vector(conserved)Ohm current is induced by the electric field related to the longitudinal QED mode propagating parallel to the external magnetic field and separating opposite charges of the same heliticity. From a relation between axial and electromagnetic currents we obtain a non-conserved current leading to an expression close to the usual axial anomaly. The effect is interesting
in connection to the QCD chiral magnetic case reported in current literature.

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Presenter: ACOSTA AVALO, Jorge Luis (INSTEC)

Track Classification: SMFNS2015

Contribution ID: **88** Type: **Poster**

Emission of Gravitational Waves by Precession of Slim Accretion Disks Dynamically Driven by the Bardeen-Petterson Effect

The electromagnetic radiation emitted from some astrophysical objects such as active galactic nuclei (AGNs), micro-quasars (M-QSRs), and central engines of gamma-ray burst (GRBs), seems to have a similar physical origin: a powerful jet of plasma ejected from a localized system, presumably composed of an accretion disk encircling a compact object. This radiation is generally beamed in the polar directions and in some cases, it appears to have a spiral-like structure that could be explained if the central system itself precesses.

In this work, we use the slim disk accretion model, presented by Popham et. al. (1999), to study the gravitational waves (GWs) emitted by the precession of the accretion disk around a solar-mass Kerr black hole (KBH). For practical purposes, this model describes the central engine of a class of GRBs when: a transient stationary state is reached, the accretion rates are in the range (0.1 - 10) $M_{\odot}$ s^{-1} (also called hyperaccretion), the energy of the disk is efficiently radiated by neutrino emission, and its radial extent is less than $R \sim 10^8$ cm.

Based on current information on the parameters of these systems, we present a model for computing the induced precession by the combination of viscous effects in such disks and the relativistic frame-dragging effect (or Lense-Thirring effect). The astrophysics of such combination is collectively known as the Bardeen-Petterson (BP) effect, and it has been useful to describe both AGNs and M-QSRs.

The chosen slim disk model is found to be consistent with the hydrodynamic simulations of the BP effect, obtained by Nelson & Papaloizou (1999). In addition, we compute the precession periods on these disks, related with the BP effect, and we found that they are also in agreement with the available data for GRBs.

In light of these results, the model that we propose for computing the GWs emitted by the central engines of such class of GRBs, is based on an accretion disk, reaching a stationary slim disk structure, and with quasi-rigid precession determined by the Bardeen-Petterson effect.

We evaluate the feasibility of direct detection of the GWs computed for such a model and for the quoted range of accretion rates, and we compare our results with two recent papers that are based on more complex disk models. We find that the precession of hyperaccretion slim disks could be detected by gravitational wave observatories like advanced-LIGO, ET, BBO, DECIGO, and ultimate-DECIGO. The outcome agrees with the results obtained by the quoted papers, and are more likely to be detected if such a class of sources are placed at distances less than 1˜Mpc, corresponding to the Local Group. We conclude that being our results quite close to those having been reported for more complex disk models, it allows us to characterize similar sources in a simpler way.

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Track Classification: STARS2015

Contribution ID: **89** Type: **Talk**

On the large field stability in the electroweak model

Thursday, 14 May 2015 09:30 (30 minutes)

The magnetic field dependence of vacuum energy of the Weinberg-Salam model (WSM) is investigated. It follows that the W particles contribution makes the full potential positive for extremely large fields. This changes the situation with respect to QED. Thus, the asymptotic freedom of this theory helps to solve the undesirable negative values of the Heisenberg-Euler potential at large magnetic fields in QED. The one loop potential monotonically grows up to a critical magnetic field corresponding to a non abelian instability associated to the W fields.

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Presenter: CABO MONTES DE OCA, Alejandro (ICIMAF)

Track Classification: SMFNS2015

Contribution ID: **90** Type: **Talk**

Latest results from the Pierre Auger Observatory

Monday, 11 May 2015 15:20 (40 minutes)

The Pierre Auger Observatory addresses the most fundamental questions about the nature and origin of the highest-energy cosmic rays. The data taken with the Pierre Auger Observatory have already led to a number of major breakthroughs in the field contributing to the advance of our understanding of these extremely energetic particles. The spectrum and the arrival direction distribution are key observables to search for sources or source regions of ultra-high energy cosmic rays, and for the transition from Galactic to extragalactic cosmic rays. In this talk we address the results obtained by the Pierre Auger Observatory on the studies of these observables, after having recently completed ten years of continuous data taking. We present the latest results on the energy spectrum, and of the studies of anisotropies performed on the ten-year data set of arrival directions of cosmic rays at large and small angular scales. We also address the plans and motivations for the future upgrade of the Pierre Auger Observatory.

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Presenter: DOBRIGKEIT, Carola (UNICAMP, Brazil)

Track Classification: STARS2015

Contribution ID: **91** Type: **Talk**

The effects of superhigh magnetic fields on equation of state of a neutron stars

Friday, 15 May 2015 10:00 (30 minutes)

Based on our previous work, we deduce a general formula for pressure of degenerate and relativistic electrons, P_e, which is suitable for superhigh magnetic fields, discuss the quantization of Landau levels of electrons, and consider the quantum electrodynamic(QED) effects on the equations of states (EOSs) for different matter systems. The main conclusions are as follows: P_e is related to the magnetic field B, matter density ρ, and electron fraction Y_e; the stronger the magnetic field, the higher the electron pressure becomes; the high electron pressure could be caused by high Fermi energy of electrons in a superhigh magnetic field; compared with a common radio pulsar, a magnetar could be a more compact oblate spheroid-like deformed neutron star due to the anisotropic total pressure; and an increase in the maximum mass of a magnetar is expected because of the positive contribution of the magnetic field energy to the EOS of the star.

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Track Classification: SMFNS2015

Contribution ID: **92** Type: **Talk**

From cold to hot nuclear matter

Tuesday, 12 May 2015 09:40 (40 minutes)

We discuss the properties of nuclear matter at different conditions:
from “cold” at normal nuclear density to the very “hot” and
compressed state of Quark-Gluon-Plazma. Those conditions are realized
at relativistic proton-nucleus and heavy-ion collisions.
As a “tool” for our study we use the Parton-Hadron-String Dynamics (PHSD)
microscopic transport approach, which elaborates the partonic and hadronic dynamics,
and investigate the constraints which can be obtained from experimental observables on the
EoS (equation-of-state) of nuclear matter, the baryon potential
and in-medium properties of the hadrons.

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Presenter: BRATKOVSKAYA, Elena (FIAS)

Track Classification: STARS2015

Contribution ID: **94** Type: **Talk**

Gas-induced Mergers of Massive Black Holes

Sunday, 10 May 2015 18:00 (30 minutes)

Black Hole Astrophysics -
Gravitational Radiation -
Galactic Mergers

Primary author: ESCALA, Andres (Universidad de Chile)

Co-author: DEL VALLE, Luciano (Universidad de Chile)

Presenter: ESCALA, Andres (Universidad de Chile)

Track Classification: STARS2015

Contribution ID: **95** Type: **Talk**

LHCb results in proton-nucleus collisions at the LHC

Monday, 11 May 2015 10:40 (40 minutes)

The production of J/ψ and Y-mesons decaying into dimuon final state is studied at the LHCb experiment, with rapidity 1.5 < y < 4.0 or -5.0 < y < -2.5 and transverse momentum pT < 15 GeV/c, in proton-lead collisions at a proton-nucleon centre-of-mass energy of 5 TeV. The analysis is based on a data sample corresponding to an integrated luminosity of 1.6/nb. The forward-backward production ratio and the nuclear modification factor are determined for J/ψ and Y(1S). Indication of forward backward production asymmetry is observed. There is also an indication of J/ψ and Y(1S) production suppression with respect to proton-proton collisions in forward region and anti-shadowing effect in backward region. Results on vector boson production are also presented.

Primary author: MUELLER, Katharina (Universitaet Zuerich (CH))

Presenter: MUELLER, Katharina (Universitaet Zuerich (CH))

Track Classification: STARS2015

Contribution ID: **96** Type: **Talk**

General relativity as a canonical gauge theory

Sunday, 10 May 2015 14:00 (40 minutes)

It is widely accepted that the fundamental laws of nature should follow from an action principle. This holds in particular for the laws determining the dynamics of the space-time geometry. The general principle of relativity requires the action principle to be maintained in its form under the transition from one reference frame to another, possibly non-inertial frame of reference. The particular subset of transformations of a system's dynamical variables that maintain the form of the action principle
comprises the group of canonical transformations. By their construction, canonical transformations are defined by "generating functions".

In this talk, a generating function will be presented that defines the given mapping of the connection coefficients ("Christoffel symbols"). In conjunction with the associated transformation rules for their
canonical conjugates, this *unambiguously* yields a Hamiltonian that is form-invariant under a general transition to another reference frame. Thereby, a description of the dynamics of space-time is established that is not postulated but *derived from basic principles*, namely the action principle and the general principle of relativity. No further assumptions are incorporated. Neither a torsion of space-time is excluded *a priori*, nor a specific correlation of the Christoffel symbols with the metric is postulated. Moreover, the resulting theory satisfies the principle of scale invariance and is renormalizable.

Remarkably, the corresponding Lagrangian of the presented formalism was already proposed in 1918 by A. Einstein in a personal letter to H. Weyl, reasoning analogies with other classical field theories.

Primary author: STRUCKMEIER, Jürgen (GSI)

Presenter: STRUCKMEIER, Jürgen (GSI)

Track Classification: STARS2015

Contribution ID: **97** Type: **Talk**

Black hole imaging as GR tests in the Galactic Center

Sunday, 10 May 2015 09:40 (40 minutes)

modified theory of gravitation,
observational test, black hole imaging

Primary author: BOLLER, Thomas (M)

Presenter: BOLLER, Thomas (M)

Track Classification: STARS2015

Contribution ID: **98** Type: **Talk**

Effect of a primordial magnetic field on the dissipation coefficient in a warm inflation scenario

Sunday, 10 May 2015 16:20 (30 minutes)

Magnetic fields appear everywhere in the universe. Their widespread presence at high redshifts and very large scales suggests that their origin could be primordial. In particular, their presence during the inflationary epoch can certainly not be ruled out. In the warm inflation scenario, the coupling of the inflaton to other bosonic and fermionic fields gives rise to dissipative effects that modify the inflationary dynamics. Since primordial magnetic fields could have an effect on both the effective inflationary potential and the inflaton decay process, their contribution must be considered together with the finite temperature corrections. We review here their effect on the inflationary potential and present preliminary results of their intervention in the dissipation process.

Primary author: PICCINELLI, Gabriella (Centro Tecnológico, FES Aragón, UNAM, México)

Co-authors: BASTERO GIL, Mar (Departamento de Física Teórica y del Cosmos, Universidad de Granada, España); SÁNCHEZ, Ángel (Facultad de Ciencias, UNAM, México)

Presenter: PICCINELLI, Gabriella (Centro Tecnológico, FES Aragón, UNAM, México)

Track Classification: SMFNS2015

Contribution ID: **99** Type: **Talk**

How to construct credible cosmic structures with exact solutions of General Relativity

Sunday, 10 May 2015 11:20 (40 minutes)

We provide specific examples of how a class of exact solutions of Einstein's equations (the Szekeres models) can be worked out to describe the evolution of a collection of over-densities and voids in assorted directions. The resulting structures can be used to study the full relativistic non-linear effects in the dynamics of structure formation and growth suppression, in gravitational lensing and in fitting observations in the galactic cluster and super-cluster scale.

Primary author: SUSSMAN, Roberto (ICN-UNAM, Mexico)

Co-author: DELGADO, Ismael (Autonomus University of Morelos State, Mexico)

Presenter: SUSSMAN, Roberto (ICN-UNAM, Mexico)

Track Classification: STARS2015

Contribution ID: **100** Type: **Talk**

Galileons and Black Holes

Sunday, 10 May 2015 17:30 (30 minutes)

I will discuss spherically symmetric solutions of hypothetical scalar field "galileon" models, first in flat space-time, and then in the context of general relativity. For the latter, using numerical methods, I find both censored and naked solutions arising from physically reasonable boundary conditions. Both types of solutions are of comparable non-zero measure in terms of the initial conditions. Censored solutions exhibit event horizons, more or less as expected, while naked solutions have curvature singularities without horizons.

Primary author: CURTRIGHT, Thomas

Presenter: CURTRIGHT, Thomas

Track Classification: STARS2015

Contribution ID: **101** Type: **Talk**

Natural background radiation and mutagenesis in bacteria

Thursday, 14 May 2015 15:00 (30 minutes)

We suggest a possible correlation between the ionization events caused by the natural background radiation and the experimental data on mutations with damage in the DNA repair mechanism, coming from the Long Term Evolution Experiment in E. Coli populations.

Primary author: GONZÁLEZ, Augusto (Instituto de Cibernética, Matemática y Física, La Habana)

Presenter: GONZÁLEZ, Augusto (Instituto de Cibernética, Matemática y Física, La Habana)

Track Classification: STARS2015

Contribution ID: **102** Type: **Talk**

Natural and artificial radiation dose and its correlation with carcinogenesis

Thursday, 14 May 2015 12:15 (15 minutes)

We include, in the observed correlation [1] between lifetime cancer risk and the accumulative number of steem cell divisions in a tissue, a new variable related to the effective radiation dose received by that tissue. Computed natural radiation dose is compared with data contained in the Report [2], whereas the artificial (man made) radiation dose is taken from [2].

[1] C. Tomasetti and B. Vogelstein, Science 2 JANUARY 2015, VOL 347, ISSUE 6217, pag 78.

[2] Ionizing Radiation Exposure of the Population of the United States, NCRP REPORT No. 160, March 3, 2009

Primary author: LEÓN, Dario (Facultad de Física, Universidad de La Habana)

Co-author: Dr GONZÁLEZ, Augusto (Instituto de Cibernética., Matemática y Física (ICIMAF))

Presenter: LEÓN, Dario (Facultad de Física, Universidad de La Habana)

Track Classification: STARS2015

Contribution ID: **103** Type: **Talk**

Revisited Magnetized White Dwarfs

Thursday, 14 May 2015 12:00 (15 minutes)

We discuss the structure of Magnetized White Dwarfs by considering anisotropic equations of state (EoS) as well as the anisotropic equation of hydrostatic equilibrium. Specifically, we examine the weak and strong magnetic field limits.

For weak magnetic field values ($B < B_c \sim 10^{13} G$) we obtain the EoS through an Euler-MacLaurin expansion of the thermodynamic potential. Whereas in the strong field regime ($B > B_c$) we use a polytropic parametrization of the numerical relativistic EoS.

Our approach aims to have more treatable EoS and therefore facilitate the study of:
1) microscopic effects such as beta inverse decay and the pycnonuclear fusion reaction,
2) macroscopic consequences related to solutions of anisotropic structure equations, and
3) bound on the magnetic field imposed by the scalar Virial theorem.

Primary authors: ALVEAR TERRERO, Diana (Facultad de Física, Universidad de La Habana); CASTILLO GARCÍA, Miguel (Facultad de Física, Universidad de la Habana)

Co-authors: PÉREZ MARTÍNEZ, Aurora (ICIMAF); MANREZA PARET, Daryel (Facultad de Física, Universidad de La Habana)

Presenters: ALVEAR TERRERO, Diana (Facultad de Física, Universidad de La Habana); CASTILLO GARCÍA, Miguel (Facultad de Física, Universidad de la Habana)

Track Classification: SMFNS2015

Contribution ID: **104** Type: **Talk**

Constraining Globular Cluster Intermediate-Mass Black Hole masses with Crowded Field 3D Spectroscopy –an update from the ESO VLT

Friday, 15 May 2015 11:30 (30 minutes)

Over the last 10-15 years there has been a rapid development of the technique of integral field spectroscopy (IFS) in the optical and NIR at 4-8m telescopes, with high impact on the study of the evolution of galaxies, e.g. surveys like SAURON, ALTAS3D, CALIFA. Beyond the mere 2-dimensional mapping of extended objects, we have begun to explore the potential of IFS for PSF-fitting 3D spectrophotometry in crowded fields, an area harboring one of the most competitive edges of future extremely large telescopes. As shown with a previous pilot study at Calar Alto Observatory, observations of globular clusters with high multiplex gain using 3D spectroscopy has allowed us to determine velocity dispersions in the innermost region, i.e. within radii of 1.5 arcsec, which is the crucial region to constrain Jeans models and, thereby, the mass of a hypothetical intermediate mass black hole (IMBH). With the commissioning of the MUSE instrument at the ESO Very Large Telescope Observatory in 2014, these opportunities have grown to unprecedented capabilities. The latest developments for extremely high multiplex spectroscopy in globular clusters to constrain IMBH masses will be reported.

Primary author: ROTH, Martin

Presenter: ROTH, Martin

Track Classification: SMFNS2015

Contribution ID: **105** Type: **Talk**

Collapsing quantum relativistic electron gas. A model for some jets?

Thursday, 14 May 2015 10:00 (30 minutes)

For critical and supercritical magnetic fields electrons and even photons behave as one dimensional particles, leading to vanishing transverse pressures. The outcome suggests a collapsing behavior orthogonal to the magnetic field, leading to long objects. We conjecture they may have a connection with jets in astrophysics.

Primary author: PÉREZ ROJAS, Hugo (Institute of Cybernetics, Mathematics and Physics)

Co-authors: PEREZ MARTINEZ, Aurora (ICIMAF); RODRIGUEZ QUERTS, Elizabeth (ICIMAF)

Presenter: PÉREZ ROJAS, Hugo (Institute of Cybernetics, Mathematics and Physics)

Track Classification: STARS2015

Contribution ID: **106** Type: **Talk**

Status of the LHC experiments and Standard Model results

Monday, 11 May 2015 09:00 (40 minutes)

The talk will report on selected Standard Model (SM) physics highlights obtained by the ATLAS and CMS experiments in the first 3 years of data taking at the new Large Hadron Collider in Geneva. By far the most important and exciting result of LHC Run1 has been the observation of a new boson with a mass of 125 GeV, consistent with the properties of the SM Higgs boson. The discovery of the Higgs boson has brought the last missing piece of the Standard Model but the talk will give also an overview of the main results on di-boson production, heavy flavour physics (b-quark rare decays and CP violation; top-quark mass and properties) and QCD. Finally a brief discussion on LHC future program. LHC is just now restarting operation at higher energy. New data will certainly give more detailed informations on the Higgs boson and by the end of this decade LHC experiments will have collected ten times more proton proton collisions. The Standard Model processes have been holding up to scrutiny over several orders of magnitude in production cross section but we are just at the beginning of the TeV scale exploration.

Primary author: BIINO, Cristina (INFN Torino (IT))

Presenter: BIINO, Cristina (INFN Torino (IT))

Track Classification: STARS2015

Contribution ID: **107** Type: **Talk**

Tomography of a quark gluon plasma, created in heavy ion collisions, by heavy mesons

Tuesday, 12 May 2015 09:00 (40 minutes)

During a ultrarelativistic heavy ion collisions a plasma of quarks and gluons (QGP) may be created, a state of matter which may also be present in the center of neutron stars. The problem is to verify its existence because at the end only hadrons are present. We expose why heavy mesons may be a good tool to study the existence and the properties of the QGP and present the results we obtained in comparison with the experiments.

Primary author: AICHELIN, Joerg (Subatech/CNRS)

Presenter: AICHELIN, Joerg (Subatech/CNRS)

Track Classification: STARS2015

Contribution ID: **108** Type: **Talk**

Search for new physics at the LHC and prospects for new discoveries

Monday, 11 May 2015 09:40 (40 minutes)

The Large Hadron Collider (LHC) at CERN has allowed the ATLAS and CMS experiments to collect a large amount of proton-proton collision data at 7 TeV and 8 TeV centre-of-mass energies. This dataset was used to discover a Standard Model (SM) Higgs-like boson at a mass of about 125 GeV. Beside this, an impressive number of searches for deviations from the SM expectations have been carried out in various physics areas including: Higgs, SuperSymmetry (SUSY) and Exotics physics. Representative searches in all of these domains will be presented and their impact on theories "beyond the SM"assessed. To date, there is no evidence in the LHC data of a deviation from the SM. However, a few legacy 2-3 sigma deviations remain from both experiments, which will be reviewed. After an 18-month shutdown, the LHC is about to deliver collision data at an increased centre-of-mass energy of 13 TeV. It will be a very exciting time for both the ATLAS and CMS experiments to confirm or rule out the existing deviations from the SM. In addition, the large increase in collision energy will allow much improved sensitivity in various searches, in particular for high mass particles.

Primary author: CONTI, Geraldine (CERN)

Presenter: CONTI, Geraldine (CERN)

Track Classification: STARS2015

Contribution ID: **109** Type: **Talk**

Autonomous spacecraft navigation with pulsars

Tuesday, 12 May 2015 11:20 (40 minutes)

An external reference system suitable for deep space navigation can be defined by fast spinning and strongly magnetized neutron stars. Their beamed periodic signals have timing stabilities comparable to atomic clocks and provide characteristic temporal signatures that can be used as natural navigation beacons, quite similar to the use of GPS satellites for navigation on Earth. By comparing pulse arrival times measured on-board a spacecraft with predicted pulse arrivals at a reference location, the spacecraft position can be determined autonomously and with high accuracy everywhere in the solar system and beyond. The unique properties of pulsars make clear already today that such a navigation system will have its application in future astronautics. In my talk we will describe the basic principle of spacecraft navigation using pulsars and report on the current development status of this novel technology.

Primary author: BECKER, Werner (Max Planck fur Extraterrestrische Physik - MPE, Garching, Germany)

Presenter: BECKER, Werner (Max Planck fur Extraterrestrische Physik - MPE, Garching, Germany)

Track Classification: STARS2015

Contribution ID: **111** Type: **Talk**

Supernovae shed light on Gamma-Ray Bursts

Monday, 11 May 2015 16:50 (40 minutes)

We review the observational status of the Supernova/Gamma-Ray Burst connection. Most observations collected in the last 15 years show that long duration Gamma-ray Bursts are associated with broad lines SNe-LBC, although a few exceptions do exist. Current estimates of the SN and GRB rates yield a ratio GRB/SNe-LBC less (or much less) than 3%. We discuss the reasons for this small ratio.

Primary author: DELLA VALLE, Massimo (Osservatorio Astronomico di Capodimonte - Istituto Nazionale di Astrofisica - INAF, Napoli, Italy)

Presenter: DELLA VALLE, Massimo (Osservatorio Astronomico di Capodimonte - Istituto Nazionale di Astrofisica - INAF, Napoli, Italy)

Track Classification: STARS2015

Contribution ID: **112** Type: **Talk**

Achievements in solar neutrino physics with the Borexino detector

Tuesday, 12 May 2015 15:20 (40 minutes)

Borexino is an organic liquid scintillator detector located in the Gran Sasso National Laboratory in the central Italy. It has been designed for real-time spectroscopy of low energy solar neutrinos. In Phase I of the experiment lasting for three years, between May 2007 and May 2010, the Collaboration performed the first independent measurements of 7Be, 8B and pep solar neutrino fluxes. After a dedicated purification campaign of the liquid scintillator in 2011 Borexino entered into Phase II, which allowed to investigate the seasonal modulation in the 7Be signal. In 2014 Borexino provided the first direct real time measurement of pp neutrinos accomplishing the whole pp-cycle that powers the Sun.

Primary author: MIRAMONTI, Lino (Physics Department of Milano University and Istituto Nazionale di Fisica Nucleare - INFN, Italy)

Presenter: MIRAMONTI, Lino (Physics Department of Milano University and Istituto Nazionale di Fisica Nucleare - INFN, Italy)

Track Classification: STARS2015

Contribution ID: **114** Type: **Talk**

Binary neutron stars from gravitational radiation to R-process nucleosynthesis

Sunday, 10 May 2015 09:00 (40 minutes)

Beyond being prime targets for gravitational radiation detection Compact Binary Mergers are the likely sources of short GRBs as well as the most likely origin of heavy R-process material. The latter ideas, a 25 years old proposition, has received observational support with the discovery of a Macro-nova - an IR signal that followed the short GRB 130603B and is the hallmark of newly formed R-process material. In this short review I describe the formation of the Macro-nova from matter ejected in the merger process and I discuss recent searches for a radio flare that should follow the Macro-nova signal (the Macro-nova and the associated radio flare are the analogues of a Supernova and a subsequent supernova remnant). Recent estimates of the cosmological evolution of rate of neutron star mergers (based on observations of short GRBs) lead to predictions on the cosmic evolution of abundance of heavy R-process material. I compare those with observations. Finally I discuss the implications of the observations of a Macro-nova and the predictions of Radio Flares for the identification of the exact positions of mergers whose Gravitational Radiation signals have
been detected.

Primary author: PIRAN, Tsvi (The Hebrew University, Jerusalem, Israel)

Presenter: PIRAN, Tsvi (The Hebrew University, Jerusalem, Israel)

Track Classification: STARS2015

Contribution ID: **115** Type: **Talk**

Tidal disruption events

Friday, 15 May 2015 15:00 (30 minutes)

A hundred years ago, when Karl Schwartzchild wrote his famous metric, he didn't imagine that a monster, a black hole, is hidden within this metric and this monster can tidally disrupt and swallow a whole star. This question, how does a stellar tidal disruption by a black hole was addressed for the first time in the eighties and recently within the last decade we begun observing such events. The observations confirmed some of the basic ideas, but posed new puzzles. I examine the recent observations of Tidal Disruption Event (TDEs) candidates. I confront the theory with the observations and present a new model for these events. I discuss new puzzles that arise and their resolutions.

Primary author: PIRAN, Tsvi (The Hebrew University, Jerusalem, Israel)

Presenter: PIRAN, Tsvi (The Hebrew University, Jerusalem, Israel)

Track Classification: SMFNS2015

Contribution ID: **116** Type: **Talk**

Braking index of Young Neutron Stars

Tuesday, 12 May 2015 14:00 (40 minutes)

Braking index of Young Neutron Stars.

Primary authors: MALLICK, Ritam (I); NEGREIROS, Rodrigo (Universidade Federal Fluminense); SCHRAMM, Stefan; DEXHEIMER, Veronica (Kent State University)

Presenter: NEGREIROS, Rodrigo (Universidade Federal Fluminense)

Track Classification: STARS2015

Contribution ID: **117** Type: **Talk**

Discoveries at GSI, FAiR, BNL and CERN

Monday, 11 May 2015 11:20 (40 minutes)

Upcoming experiments at GSI, FAiR, BNL and CERN are discussed. Special emphasis is given to the discovery potential for exotic Phases of Dense Matter. The role of the accelerator experiments for understanding Neutron Star NS and Supernova SN dynamics is critically reviewed.

Primary author: STOECKER, Horst (Frankfurt Institute for Advanced Studies - FIAS and Institut fuer Theoretische Physik - ITP, Frankfurt am Main, Germany)

Presenter: STOECKER, Horst (Frankfurt Institute for Advanced Studies - FIAS and Institut fuer Theoretische Physik - ITP, Frankfurt am Main, Germany)

Track Classification: STARS2015

Contribution ID: **118** Type: **Talk**

The SOFIA airborne observatory and its potential of magnetic field measurement in star forming regions

Monday, 11 May 2015 14:40 (40 minutes)

SOFIA, the Stratospheric Observatory for Infrared Astronomy, is a Boeing 747SP, equipped with a 2.7m telescope that flies at an altitude of 12-14 km (above the tropopause) to observe the far-infrared radiation from space which does not reach ground-based observatories due to absorption by water vapor. One of the SOFIA instruments is HAWC-pol, a far-infrared camera with 5 filters (50-200 micron) which was built to observe the far-infrared polarized dust emission in cold molecular gas clouds, particularly in star forming regions. As the dust grains align in the presence of interstellar magnetic fields, this allows to derive the structure and strength of magnetic fields in star forming regions on scales of 10 arc sec (4000 AU at the distance of the Orion nebula). This is new, because the Herschel satellite did not include a polarimetric instrument. We will describe SOFIA and its potential to make important magnetic field measurement in galactic clouds, important to understand the role of magnetic fields in star formation.

Primary author: ZINNECKER, Hans (Univ. Stuttgart)

Presenter: ZINNECKER, Hans (Univ. Stuttgart)

Track Classification: STARS2015

Contribution ID: **119** Type: **not specified**

Concluding Remarks

Friday, 15 May 2015 16:00 (30 minutes)

Presenter: HORVATH, Jorge (IAG-USP)