# STARS2013 - 2nd Caribbean Symposium on Cosmology, Gravitation, Nuclear and Astroparticle Physics / SMFNS2013 - 3rd International Symposium on Strong Electromagnetic Fields and Neutron Stars

# Report of Contributions

Contribution ID: **5** Type: **Talk**

# Astronomical tests of General Relativity and the pseudo–complex field theory

*Saturday 4 May 2013 14:30 (45 minutes)*

Gravitation is very well described by Einstein's General Gelativity. However, several theoretical predictions like the existence of curvature singularities and event horizons are under debate. This motivated to modify the standard theory of gravity. Here, we contrast predictions made by General Relativity with the pseudo–complex field theory proposed recently. Among them we study the gravitational redshift effect, perihelion shift, orbital motion, timing measurements and spectral lines. We consider supermassive black holes as ideal testbeds to test the theoretical predictions in the regime of strong gravity. In particular, we investigate the innermost centers of active galaxies and the Galactic Centre. This involves high–performance astronomical instruments of the next generation. We present feasibility studies for existing X-ray missions and with the upcoming GRAVITY near-infrared instrument to be mounted at the Very Large Telescope.

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**Presenter:** BOLLER, Thomas (Max-Planck-Institute for extraterrestrial physics, Garching, Germany)

**Track Classification:** STARS2013

Contribution ID: **6** Type: **Poster**

# Field equations for spinning cosmic strings in Brans-Dicke theory of gravitation

The Brans-Dicke theory of gravitation is a scalar-tensor theory, which foresees the gravitational interaction being mediated not only by the graviton, but also by a scalar field. The theory is recently being studied, because it seems to be more appropriate for understanding the early formation of the Universe and has contributed to the development of unified theories of fundamental interactions. The Brans-Dicke gravitation indicates the possibility of the existence of objects called cosmic strings, approximately one-dimensional and very dense lines, which connect different regions created nanoseconds after the Big Bang, reaching the length of the known Universe. They are considered topological defects, which arose from a spontaneous symmetry breaking. There is a kind of cosmic string poorly understood, called spinning cosmic string, whose dynamics is associated with Gödel's solution to the equations of general relativity, which suggests the theoretical possibility of closed timelike curves. In Brans-Dicke gravitation, attempts to find solutions for spinning cosmic strings always restricted for approximations with an unique form field, previously defined, leading to not very significant scenarios. In this work, we present a model for spinning cosmic strings, developed from the Brans-Dicke theory of gravitation, where the field equations admit a general form. The model consists of a 6 coupled nonlinear differential equations system. The analytical solutions found so far for this system will be shown and an initial discussion on the contribution of these solutions to better understand the dynamics of spinning cosmic strings will be held.

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**Track Classification:** STARS2013

Contribution ID: **8** Type: **Talk**

# The geometry of the pseudo-complex General Relativity

*Saturday 4 May 2013 17:15 (30 minutes)*

The coordinates of standard General Relativity are extended to pseudo-complex variables. In the eight dimension space the geometric differential structure is investigated. Mapping to the physical subspace with real coordinates leaves a remnant of the pseudo-complex structure, which adds terms to the Lagrangian. The Einstein equations are modified, adding the contributions of an energy-momentum tensor, describing repulsive dark energy. As a consequence, the event horizon of the black hole vanishes and transforms it into a gray hole.

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**Track Classification:** STARS2013

Contribution ID: **9** Type: **Talk**

# Neutron stars within the pseudo-complex General Relativity

*Wednesday 8 May 2013 11:15 (45 minutes)*

The properties of neutron stars within the pseudo-complex General Relativity are investigated. We show that the accumulation of dark energy, with its repulsive effects, permits neutron stars with larger mass.

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**Track Classification:** SMFNS2013

Contribution ID: **10** Type: **Talk**

# Non-detection in Fermi-LAT observations of magnetars: physical implications

*Monday 6 May 2013 12:00 (30 minutes)*

We have analyzed the physical implications of Fermi-LAT observations of magnetars. Observationally, no significant detection is reported in Fermi-LAT observations of all magnetars. We point out that there are conflicts between outer gap model in the case of magnetars and Fermi observations. One solution is that anomalous X-ray pulsars and soft gamma-ray repeaters are actually accretion systems. Another possible explanation is that magnetars are wind braking instead of magnetic dipole braking. In the wind braking scenario, magnetars are neutron stars with strong multipole field. A strong dipole field is no longer required. Future deeper Fermi-LAT observations will help us to distinguish between the magnetar model and the accretion model for AXPs and SGRs.

**Authors:** TONG, Hao (Xinjiang Astronomical Observatory, Chinese Academy of Sciences, Urumqi, China); XU, Renxin (Peking University, Beijing, China)

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**Track Classification:** STARS2013

Contribution ID: **11** Type: **Talk**

# Dipole magnetic field of magnetars: the effect of magnetar wind

*Thursday 9 May 2013 15:30 (30 minutes)*

Considering recent observations challenging the traditional magnetar model, we explore the wind braking of magnetars. In the wind braking scenario, magnetars are neutron stars with strong multipole field. A strong dipole field is no longer necessary. Recent challenging observations of magnetars may be explained naturally in the wind braking scenario: (1) The supernova energies of magnetars are of normal value; (2) The non-detection in Fermi observations of magnetars; (3) The problem posed by the low-magnetic field soft gamma-ray repeaters; (4) The relation between magnetars and high magnetic field pulsars; (5) A decreasing period derivative during magnetar outbursts. For low luminosity transient magnetars, they may still be magnetic dipole braking. This may explain why low luminosity magnetars are more likely to have radio emissions. A magnetism-powered pulsar wind nebula and a braking index smaller than three are the two predictions of the wind braking model. Current observations are consistent with the predictions of wind braking of magnetars.

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**Track Classification:** SMFNS2013

Contribution ID: **13** Type: **Talk**

# Weighed scalar averaging over inhomogeneous cosmological models

*Saturday 4 May 2013 16:45 (30 minutes)*

Averaging the fully tensorial Einstein equations and their solutions (spacetimes) is an open problem in General Relativity. I present and discuss the proper 3-volume scalar averaging formalism endowed with a non-trivial weight factor, and its application to inhomogeneous cosmologies (LTB and Szekeres models). This formalism leads to a fully determined system of evolution equations for the averaged covariant scalars and their fluctuations and perturbations, allowing for a deeper coordinate independent theoretical understanding of the deviation from FLRW homogeneity, either in terms of a rigorous formalism of exact perturbations over an FLRW abstract background, or through a definition of gravitational entropy in a phase space made by weighed averages of the density and Hubble scalar velocity. I discuss how this weighed scalar averaging can be applied to more general geometries and to various theoretically relevant issues in GR.

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**Track Classification:** STARS2013

Contribution ID: **14** Type: **Talk**

# Revisiting stability windows for quark and protoquark stars

*Monday 6 May 2013 14:30 (45 minutes)*

We have calculated stability windows at zero [1] and finite temperature [2] for different models that are generally applied to describe quark stars: the MIT bag model, the quark mass density dependent model (QMDD) and the Nambu-Jona-Lasinio model. The quantity that has to be investigated in the search for stable strange matter at finite temperature is the free energy per baryon and we analyze stability windows up to temperatures of the order of 40 MeV, which are typical during the process of the star evolution. The QMDD model can generally explain larger star masses. The effects of strong magnetic fields on the stability windows are also computed.

[1] J.R. Torres and D.P.Menezes, Eur. Phys. Lett. (2013), in press, arXiv:1210.2350[nucl-th];

[2] D.F.T. Agudelo, J.R. Torres, D.P. Menezes and V. Dexheimer, in preparation.

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**Track Classification:** STARS2013

Contribution ID: **15** Type: **Talk**

# Fermi gas in a magnetic field and related anisotropy in quark stars

*Thursday 9 May 2013 10:15 (30 minutes)*

We present the number density, energy density, transverse pressure, longitudinal pressure, and magnetization of an ensemble of spin one-half particles in the presence of a homogenous background magnetic field. The magnetic field direction breaks spherical symmetry causing pressure anisotropy in the system. Explicit expressions for both charged and uncharged particles including the effect of the anomalous magnetic moment at zero and finite temperature are obtained. The resulting expressions satisfy the canonical relations Ω = - P_parallel and P_perp = P_parallel - M B, where M = - ∂Ω/∂B is the magnetization of the system. The pressure anisotropy for a gas of protons and a gas of neutrons are shown. The inclusion of the anomalous magnetic moment increases the level of pressure anisotropy in both cases [1].

Next, we have chosen the MIT bag model and analyzed different stages of magnetized quark star evolution. The first stages of the evolution are simulated through the inclusion of trapped neutrinos and fixed entropy per particle, while in the last stage the star is taken to be deleptonized and cold. Magnetic field effects, measured by the difference between the parallel and perpendicular pressures, are more pronounced in the beginning of the star evolution when there is a larger number of charged leptons and up quarks. Within the model employed, large magnetic fields appear only at high densities, where the longitudinal matter pressure is large enough to partially compensate for the negative magnetic field longitudinal pressure [2].

[1] M. Strickland, V. Dexheimer and D.P. Menezes, Phys. Rev. D 86, 125032(2012), arXiv:1209.3276[nucl-th].

[2] V. Dexheimer, D.P. Menezes and M. Strickland, arXiv:1210.4526[nucl-th].

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**Track Classification:** SMFNS2013

Contribution ID: **16** Type: **Talk**

# Stellar Black Holes at the Dawn of the Universe

*Saturday 4 May 2013 09:30 (45 minutes)*

The 'final frontier' in studies of cosmic structure formation is the epoch of cosmic reionization, when the cold neutral Intergalactic Medium (IGM) was heated and reionized by primordial galaxies, a few hundred million years after the Big Bang. I propose that a large fraction of the first generations of massive stars in primordial galaxies ended as black holes and neutron stars in High Mass X-ray Binaries, and that besides the ultraviolet radiation from their massive stellar progenitors, feedback from accreting stellar black holes was an additional, important source of heating and reionization of the IGM. X-rays and relativistic jets from the large populations of HMXBs, determined the early thermal history of the universe and maintained it ionized over large volumes of space. This has a direct impact on the properties of the faintest galaxies at high redshifts, the smallest dwarf galaxies in the local universe, and on the existing and future surveys at radio wavelengths of atomic hydrogen in the early universe.

**Author:** MIRABEL, I. F. (CEA-Saclay, France and CONICET, Argentina)

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**Track Classification:** STARS2013

Contribution ID: **17** Type: **Talk**

# An Effective Theory for Nuclear Matter with Genuine Many-Body Forces

*Saturday 4 May 2013 10:15 (30 minutes)*

Nuclear science has developed many excellent descriptions that embody various properties of the nucleus, and nuclear matter at low, medium and high densities. However, a full microscopic understanding of nuclear systems is still lacking. The aim of our theoretical research group is to shed some light on such challenges and particularly on open questions facing the high density nuclear many-body problem. Here we focus our attention on the conceptual issue of naturalness and its role in shaping the baryon-meson phase space dynamics in the description of the equation of state (EoS) of nuclear matter. In particular, in order to stimulate possible new directions of research, we discuss relevant aspects of a recently developed relativistic effective theory for nuclear matter with natural parametric couplings and genuine many-body forces. Among other topics we discuss in this work the connection of this theory with other known effective QHD models of the literature and its potentiality in describing a new physics for dense matter.

**Author:** VASCONCELLOS, César A. Z. (Instituto de Física, Universidade Federal do Rio Grande do Sul, Brazil)

**Presenter:** VASCONCELLOS, César A. Z. (Instituto de Física, Universidade Federal do Rio Grande do Sul, Brazil)

**Track Classification:** STARS2013

Contribution ID: **18** Type: **Talk**

# Bouncing models and inflation

*Saturday 4 May 2013 16:15 (30 minutes)*

After making a review on the possible scenarios for the early Universe, I will make a critical comparison among viable inflationary and bouncing models for the primordial Universe which I will describe, and discuss how the usual problems of the standard cosmological model are addressed by them in order to investigate if they can be distinguished by future observations.

**Author:** PINTO-NETO, Nelson (Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil)

**Presenter:** PINTO-NETO, Nelson (Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil)

**Track Classification:** STARS2013

Contribution ID: **19** Type: **Talk**

# Re-accelerating expansion of the Universe revealed by type IA supernovae and Planck data

*Sunday 5 May 2013 12:00 (30 minutes)*

The possibility that we are living in an expanding underdensed region has made many to debate if dark energy is needed to explain the apparent over-dimming of distant Type Ia supernovae (SNe Ia). In this report, we first show that the currently best measured local Hubble constant is larger than the cosmological Hubble constant, i.e., our local universe is expanding faster than the distant universe. We then show that this local Hubble bubble is significantly underdensed due to the low peculiar velocities of Type Ia supernovae hosts within it, compared to galaxies outside it. Finally we demonstrate that the existence of this bubble is consistent with the concordance cosmological model dominated by dark energy.

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**Track Classification:** STARS2013

Contribution ID: **20** Type: **Talk**

# Why do the braking indices of pulsars span a range of more than 100 millions?

*Wednesday 8 May 2013 12:00 (30 minutes)*

Here we report that the observed braking indices of the 366 pulsars in the sample of Hobbs et al. range from about -10ˆ8 to about +10ˆ8 and are significantly correlated with their characteristic ages. Using the model of magnetic field evolution we developed previously based on the same data, we derived an analytical expression for the braking index, which agrees with all the observed statistical properties of the braking indices of the pulsars in the sample of Hobbs et al. Our model is, however, incompatible with the previous interpretation that magnetic field growth is responsible for the small values of braking indices (<3) observed for "baby" pulsars with characteristic ages of less than 2x10ˆ3 yr. We find that the "instantaneous" braking index of a pulsar may be different from the "averaged" braking index obtained from fitting the data over a certain time span. The close match between our model-predicted "instantaneous" braking indices and the observed "averaged" braking indices suggests that the time spans used previously are usually smaller than or comparable to their magnetic field oscillation periods. Our model can be tested with the existing data, by calculating the braking index as a function of the time span for each pulsar. In doing so, one can obtain for each pulsar all the parameters in our magnetic field evolution model, and may be able to improve the sensitivity of using pulsars to detect gravitational waves.

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**Track Classification:** SMFNS2013

Contribution ID: **21** Type: **Talk**

# Constraining braking indices of magnetars by their associated supernova remnants

*Thursday 9 May 2013 15:00 (30 minutes)*

From observations, more than one-third of the detected candidate magnetars with magnetic field strengths in excess of the quantum critical value are associated with the known supernova remnants (SNRs), suggestive of an origin in massive star explosions. To date, the observational determination of braking indices of magnetars is still an open question due to strong timing noise and lake of long-term radio emission (expect for 3 candidates). Based on the assumption that the real ages of magnetars is the ages of their associated SNRs, we deduce a general formula for magnetar braking indices n, and compute the values of n for 10 candidates with SNRs. According to our model, the magnetar braking indices n different from three expected for pure magnetic-dipole radiation model will be in the range of 10ˆ{-1}-10ˆ2 assuming the measurements of SNRs are reliable. We also investigate the relationship between the characteristic ages of magnetars and the ages of their SNRs, and explain why some magnetars associated with SNRs look older than their real ages, whereas other magnetars associated with SNRs appear younger than they are. It is important that our method can also be applied to constrain braking indices of common neutron stars by their associated SNRs in spite of the observational errors on the measurements of SNRs.

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**Track Classification:** SMFNS2013

Contribution ID: **22** Type: **Talk**

# Discriminating hadronic and quark stars through gravitational waves of the P1 pulsation mode

*Monday 6 May 2013 15:15 (30 minutes)*

We investigate non-radial oscillations of hadronic and pure self-bound quark stars with maximum masses above the mass of the recently observed pulsar PSR J1614-2230 with M ≈ 2MȮ. For quark stars we include the effect of strong interactions and color superconductivity. We look for features in the pulsation modes that allow a clear differentiation between hadronic and quark stars. The equations of non-radial oscillations are integrated within the Cowling approximation in order to determine the frequency of the fundamental mode and of the first and second pressure modes. For the hadronic equation of state we employ different parametrizations of a relativistic mean-field model with nucleons and electrons, and for self-bound quark stars we use the MIT bag model. We find that the frequency of the fundamental mode is typically 1 − 3 kHz for both hadronic and quark stars. For hadronic stars the fundamental mode grows roughly linearly with the square root of the average density in approximate accordance with fitting formulae previously found in the literature. For quark stars the fundamental frequency has an approximate parabolic dependence with the gravitational redshift z although it varies very little for a wide range of z. For these stars we find that strong interactions and color superconductivity have an appreciable effect on the fundamental frequency. The first and second pressure modes have a very different behavior for hadronic and quark stars. For hadronic stars the frequencies are smaller than ~ 8 kHz and for quarks stars they are larger than ~ 8 kHz and diverge at small masses. This may allow an observational differentiation of both kinds of stars if the mass is below ~ 2MȮ. The observation of the p1-mode frequency of a nascent neutron star, together with the determination of its mass or gravitational redshift, may allow to determine whether a compact object is a hadronic or a self-bound quark star.

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**Track Classification:** STARS2013

Contribution ID: **23** Type: **Talk**

# Thermal evolution of of rotating neutron stars

*Monday 6 May 2013 10:15 (30 minutes)*

Driven by the loss of energy, isolated rotating neutron stars (pulsars) are gradually slowing down to lower frequencies, which increases the tremendous compression of the matter inside of them. This increase in compression changes both the global properties of rotating neutron stars as well as their hadronic core compositions. Both effects may register themselves observationally in the thermal evolution of such stars, as demonstrated in this work. The rotation-driven particle process which we consider here is the direct Urca (DU) process, which is known to become operative in neutron stars if the number of protons in the stellar core exceeds a critical limit of around 11% to 15%. We find that neutron stars spinning down from moderately high rotation rates of a few hundred Hertz may be creating just the right conditions where the DU process becomes operative, leading to an observable effect (enhanced cooling) in the temperature evolution of such neutron stars. As it turns out, the rotation-driven DU process could explain the unusual temperature evolution observed for the neutron star in Cas A, provided the mass of this neutron star lies in the range of 1.5 to 1.9 MΘ and its rotational frequency at birth was between 40 (400 Hz) and 70% (800 Hz) of the Kepler (mass shedding) frequency, respectively. We will also show the thermal evolution of neutron stars whose spherical symmetry has been broken due to rotation.

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**Presenter:** NEGREIROS, Rodrigo (Universidade Federal Fluminense, Brazil)

**Track Classification:** STARS2013

Contribution ID: **25** Type: **Poster**

# Fermion field evolution in regular black holes

Several regular black holes solutions have been constructed since 1968 afther Bardeen's proposal of coupling gravity with external form of matter. In the present work a detailed study of massless fermion perturbations outside somke regular black hole solutions is carried out. We present the object picture of the complete time evolution and compute the quasinormal frecuencies at intermediate times using two diferent methods: a semianalytical WKB expansion at sixth order beyond eikonal approximation and a numerical fitting of the time domain integration data. We show that both methods give close results.

**Author:** BERNAL CASTILLO, José Luis (Universidad de Cienfuegos, Cuba)

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**Presenter:** BERNAL CASTILLO, José Luis (Universidad de Cienfuegos, Cuba)

**Track Classification:** STARS2013

Contribution ID: **26** Type: **Talk**

# Parton-hadron dynamics in heavy-ion collisions

*Sunday 5 May 2013 09:30 (45 minutes)*

The dynamics of partons and hadrons in relativistic nucleus-nucleus collisions is analyzed within the novel Parton-Hadron-String Dynamics (PHSD) transport approach, which is based on a dynamical quasiparticle model for partonic phase (DQPM) including a dynamical hadronization scheme. The PHSD model reproduces a large variety of observables from SPS to LHC energies, e.g. as quark-number scaling of elliptic flow, transverse mass and rapidity spectra of charged hadrons, dilepton spectra, direct photon spectra, collective flow coefficients etc., which are associated with the observation of a sQGP. The 'highlights' of the latest results will be presented and open questions/perspectives will be discussed.

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**Track Classification:** STARS2013

Contribution ID: **29** Type: **Talk**

# The dark side of stars

*Monday 6 May 2013 16:45 (30 minutes)*

I will talk about how compact stars such as white dwarfs and neutron stars can impose constraints on properties of dark matter models. Dark matter accumulation into neutron stars can change the thermal evolution of the star due to dark matter annihilation taking place inside the star. In the case of asymmetric dark matter, WIMP accumulation might lead under certain conditions to the formation of a black hole that can potentially destroy the star, thus imposing constraints on several models of dark matter.

The talk will be based on several papers, but mostly on two: Phys.Rev.Lett. 108 (2012) 191301; Phys.Rev.Lett. 107 (2011) 091301.

**Author:** KOUVARIS, Christoforos (CP3-Origins and Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark)

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**Track Classification:** STARS2013

Contribution ID: **30** Type: **Talk**

# On the metric of the space of states in a modified QCD

*Saturday 4 May 2013 12:00 (30 minutes)*

The form of the resulting Feynman propagators in the recently proposed local and gauge invariant QCD for massive fermions, suggests the existence of indefinite metric associated to quark states, a property that might relate it with the known Lee-Wick theories. Thus, the nature of the asymptotic free quark states in the theory is investigated here. For this purpose the quadratic part of the quark action is quantized. As opposite to the case in the standard QCD, the free fermion theory does not show Hamiltonian constraints. The propagation modes include a family of massless waves, which is identical to the ones in massless QCD, and a complementary set of massive oscillations. After expressing the full interacting Lagrangian in terms of new field variables, it follows that the theory can be quantized in way that the massive modes show positive metric. The massless ones on the contrary have negative norms. Thus, the massive quark states of the modified theory, in the quantization adopted, become basically the same ones as in the usual QCD. It is remarked that, since QCD is expected to not exhibit gluon or quark asymptotic states, the presence of negative metric massless modes does not not constitute a definite drawback of the theory. In addition, the fact that the positive metric quark states are massive, seem to be a positive feature of the model, being consistent with the approximate existence of asymptotically free states in high energy processes.

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**Track Classification:** STARS2013

Contribution ID: **31** Type: **Talk**

# Integral Field Spectroscopy and the Hobby Eberly Telescope Dark Energy Experiment (HETDEX)

*Saturday 4 May 2013 15:15 (30 minutes)*

The discovery of dark energy as a mysterious force that is accelerating the expansion of the universe has become one of the most exciting problems of modern astrophysics. Not coincidentally, the Nobel Price for Physics in 2011 was awarded to Saul Perlmutter, Brian P. Schmidt, and Adam G. Riess, whose work on distant supernova distance determinations eventually lead to this discovery. Yet the very nature of Dark Energy is not understood at all. Various groups worldwide are trying to measure the way the expansion of our universe changes with cosmic time in order to test theories of dark energy. Amongst those efforts, the Hobby Eberly Telescope Dark Energy Experiment attempts to map the spatial distribution of 0.8 million Lyman-alpha emitting galaxies (LAE) with redshifts 1.9 < z < 3.5 over a 420 sq. deg. area (9 Gpcˆ3) in the north Galactic cap to constrain the expansion history of the Universe to 1% and provide significant constraints on the evolution of dark energy. As opposed to targeted redshift surveys, emission line surveys that are planned to discover LAE with integral field spectroscopy (IFS) offer significant gains over conventional narrowband imaging techniques, and provide greater sensitivity and wavelength coverage, as well as true spectroscopy. I shall present a general overview over IFS, discuss different competing IFS technologies, and explain the unique features of VIRUS, the Visible Integral-field Replicable Unit Spectrograph, which is currently being built for the Hobby-Eberly-Telescope at McDonald Observatory, Texas.

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**Track Classification:** STARS2013

Contribution ID: **32** Type: **Talk**

# Constraining Globular Cluster Intermediate-Mass Black Hole masses with Crowded Field 3D Spectroscopy

*Wednesday 8 May 2013 10:15 (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 PSF-fitting integral field spectrophotometry in crowded fields, an area harboring one of the most competitive edges of future extremely large telescopes. I shall demonstrate the potential of this technique with pilot studies even at 4m/8m telescopes and show initial results from observations of globular clusters, from which we were able 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). As these regions are not reliably accessible by conventional spectroscopy, we show that for the first time we can put tight upper limits on the masses of IMBH for three clusters that were observed in the pilot study. I shall give an outlook to future applications of this novel technique using the upcoming MUSE instrument at the ESO VLT.

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**Track Classification:** SMFNS2013

Contribution ID: **33** Type: **Talk**

# Neutrino emissivity under influence of strong magnetic field and its effects under cooling of neutron stars

*Friday 10 May 2013 10:15 (30 minutes)*

Direct Urca process is an extremely efficient mechanism for cooling a proto neutron star after its formation. It is believed to be the process responsible for the cooling of young neutron stars after the first 100 years of life. One of the most interesting kind of neutron stars are the pulsars, which are highly magnetized neutron stars, with fields up to 10ˆ14 G at the surface. It is natural then to inquiry about the modifications in the cooling due to Urca process in pulsars. In this work we investigate the influence of strong magnetic fields on the cooling of pulsars due to the neutrino emissivity coming from direct Urca process. The matter is described using a relativistic mean-field model at zero temperature. We calculate numerically the emissivity of neutrinos for different magnetic fields as a function of the baryon density and compare the results for the case without a magnetic field.

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**Presenter:** LENHO COELHO, Eduardo (Universidade do Estado do Rio de Janeiro, Brazil)

**Track Classification:** SMFNS2013

Contribution ID: **34** Type: **Talk**

# Hybrid stars in a strong magnetic field

*Thursday 9 May 2013 11:15 (45 minutes)*

We study the effects of high magnetic fields on the particle population and equation of state of hybrid stars using an extended hadronic and quark SU(3) non-linear realization of the sigma model. In this model the degrees of freedom change naturally from hadrons to quarks as the density and/or temperature increases. The effects of high magnetic fields and anomalous magnetic moment are visible in the macroscopic properties of the star, such as mass, adiabatic index, moment of inertia, and cooling curves. Moreover, at the same time that the magnetic fields become high enough to modify those properties, they make the star anisotropic.

**Author:** NEGREIROS, Rodrigo (Universidade Federal Fluminense, Brazil)

**Co-authors:** SCHRAMM, Stefan (Frankfurt Institute for Advanced Studies, Germany); DEXHEIMER, Veronica (Kent State University, USA)

**Presenter:** NEGREIROS, Rodrigo (Universidade Federal Fluminense, Brazil)

**Track Classification:** SMFNS2013

Contribution ID: **35** Type: **Talk**

# The many lives of magnetized neutron stars

*Wednesday 8 May 2013 09:30 (45 minutes)*

The magnetic field strength at birth is arguably one of the most important properties to determine the evolutionary path of a neutron star. Objects with very high fields, collectively known as magnetars, are characterized by high X-ray quiescent luminosities, outbursts, and, for some of them, sporadic giant flares. While the magnetic field strength is believed to drive their collective behaviour, however, the diversity of their properties, and, especially, the observation of magnetar-like bursts from 'low-field' pulsars, has been a theoretical puzzle. In this talk, I will discuss results of long-term MHD simulations which, by following the evolution of magnetic stresses within the neutron star crust, have allowed to relate the observed magnetar phenomenology to the physical properties of the neutron stars, and in particular to their age and magnetic field strength and topology. The dichotomy of 'high-B' field pulsars versus magnetars is naturally explained, and occasional outbursts from old, low B-field neutron stars are predicted. I will conclude speculating on the fate of old magnetars.

**Author:** PERNA, Rosalba (Department of Astrophysical and Planetary Sciences and JILA, University of Colorado, USA)

**Co-author:** PONS, Jose (University of Alicante, Spain)

**Presenter:** PERNA, Rosalba (Department of Astrophysical and Planetary Sciences and JILA, University of Colorado, USA)

**Track Classification:** SMFNS2013

Contribution ID: **36** Type: **Talk**

# Gravity induced evolution of a magnetized fermion gas with finite temperature

*Wednesday 8 May 2013 15:00 (30 minutes)*

We examine the near collapse dynamics of a self–gravitating magnetized electron gas at finite temperature, taken as the source of a Bianchi-I spacetime described by the Kasner metric. The set of Einstein–Maxwell field equations reduces to a complete and self–consistent system of non–linear autonomous ordinary differential equations. By considering a representative set of initial conditions, the numerical solutions of this system show the gas collapsing into both, isotropic (”point–like”) and anisotropic (”cigar–like”) singularities, depending on the intensity of the magnetic field. We also examined the behavior during the collapse stage of all relevant state and kinematic variables: the temperature, the expansion scalar, the magnetic field, the magnetization and energy density. We notice a significant qualitative difference in the behavior of the gas for a range of temperatures between the values T ˜10ˆ4 K and T ˜ 10ˆ7 K.

**Author:** DELGADO GASPAR, Ismael (Instituto de Geofísica y Astronomía, La Habana, Cuba)

**Co-authors:** ULACIA REY, Alain (Instituto de Cibernética, Matemática, y Física (ICIMAF), La Habana, Cuba); PÉREZ MARTÍNEZ, Aurora (Instituto de Cibernética, Matemática, y Física (ICIMAF), La Habana, Cuba); SUSSMAN, Roberto A. (Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México (ICN-UNAM), Mexico D.F., Mexico)

**Presenter:** DELGADO GASPAR, Ismael (Instituto de Geofísica y Astronomía, La Habana, Cuba)

**Track Classification:** SMFNS2013

Contribution ID: **37** Type: **Talk**

# Poloidal Field Instability in Magnetized Neutron Stars

*Friday 10 May 2013 09:30 (45 minutes)*

We investigate the instability of purely poloidal magnetic fields in nonrotating neutron stars by means of three-dimensional general-relativistic magnetohydrodynamics simulations. Our aim is to draw a clear picture of the dynamics associated with a hydromagnetic instability in a neutron star and to obtain indications on possible equilibrium configurations from the final state reached by the system. Furthermore, the internal rearrangement of magnetic fields is a highly dynamical process, which has been suggested to be behind magnetar giant flares. Our simulations can provide realistic estimates on the electromagnetic and gravitational-wave emission which should accompany the flare event. In particular, we find that (1) the electromagnetic emission matches the duration of the initial burst in luminosity observed in giant flares, giving support to the internal rearrangement scenario, and that (2) only a small fraction of the energy released during the process is converted into f-mode oscillations and in the consequent GW emission, thus resulting in very low chances of detecting this signal with present and near-future ground-based detectors.

**Author:** CIOLFI, Riccardo (Max Planck Institute for Gravitational Physics, AEI Potsdam, Germany)

**Co-author:** REZZOLLA, Luciano (Max Planck Institute for Gravitational Physics, AEI Potsdam, Germany)

**Presenter:** CIOLFI, Riccardo (Max Planck Institute for Gravitational Physics, AEI Potsdam, Germany)

**Track Classification:** SMFNS2013

Contribution ID: **38** Type: **Poster**

# Evolution of Proto Neutron Stars and Nuclear Pasta

A protoneutron star is believed to be born from the collapse of a very massive star and a supernova explosion. During the first few seconds of the star evolution, almost all the binding energy is taken away by the neutrinos. The neutrino luminosity is controlled mainly by the total protoneutron star mass and the neutrino opacity. In this work we show that an important difference in the evolution of a protoneutron star is seen if a pasta phase is present in its inner crust. The deleptonization and cooling processes take longer than if the crust would be made of homogeneous matter only. This statement results from the smaller diffusion coefficients obtained with the inclusion of the pasta phase. The diffusion coefficients present in the transport equations determine the temporal behavior associated with the deleptonization and cooling processes. The nuclear pasta was calculated by the coexistence phases method. We have assumed total charge neutrality, β-equilibrium and neutrino trapping in the equation of state. The surface energy coefficient was obtained with three different parameterizations and one of them practically reproduces results obtained with the more sophisticated Thomas-Fermi method, yielding credibility to our method.

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**Co-author:** MENEZES, Debora (Universidade Federal de Santa Catarina, Florianópolis, Brazil)

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**Track Classification:** STARS2013

Contribution ID: **39** Type: **Talk**

# LOFT and the hunt for the Neutron Stars EOS

*Thursday 9 May 2013 09:30 (45 minutes)*

The Large Observatory For x-ray Timing (LOFT) is a proposed space mission intended to answer fundamental questions about, among others, the state of matter in neutron stars. LOFT was recently selected by ESA (M3) as one of the four space missions concepts of the Cosmic Vision programme that will compete for a launch opportunity at the start of the 2020s. In this talk an overview of the dense matter Working Group activities will be presented, with particular emphasis on the ways the neutron star equation of states can be studied thanks to the unprecedented capabilities of the LOFT instruments.

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**Track Classification:** SMFNS2013

Contribution ID: **40** Type: **Talk**

# The centrality dependence of multiplicity and of the spectra of identified particles is a core-corona effect

*Sunday 5 May 2013 11:15 (45 minutes)*

To understand the centrality dependence of measured observables, like the multiplicity < pt^2 > and the elliptic flow of identified particles at midrapidity as well as the elliptic flow of charges hadrons, has been a challenge for theory since many years. Although the multiplicity of different particles in central collisions corresponds exactly to the expectation for a completely thermalized source the centrality dependence is incompatible with this assumption.

A while ago it has been realized that even in the most central collisions there remain particles (usually close to the surface of the interaction zone) which do not come to equilibrium (corona particles) whereas others come to a local equilibrium (core particles). Corona particles produce hadrons like pp collision. The relative fraction of corona particles can be calculated in the Glauber approach. It increases with decreasing centrality and this is the origin of the centrality dependence of the observables. In this core-corona model [1] there is no free parameter. Later this model has been extended to dynamical variables like the centrality dependence of < pt > of identified particles. Even more important, it has reproduced quantitatively the centrality dependence of the elliptic flow of charged particles without any new parameter [2].

Recently we have extended the core-corona model to describe the centrality dependence of spectra of identified particle from the low energy RHIC 7.7 AGeV to LHC energies. Surprisingly we find that all spectra are in good agreement with the core-corona model. This agreement includes the centrality dependence of the spectral slope which varies for some particles by a factor of two or more between central and peripheral collisions. In the presentation we will display the model and make comparisons with the EPOS event generator which is based as well on the distinction between core and corona particles and describes the rapidity dependence of many observables. Then we demonstrate that the centrality dependence of the spectra. The interpretation of the results in physical terms concludes the presentation.

[1] J. Aichelin and K. Werner, Phys. Rev. C 79 (2009) 064907 [Erratum-ibid. C 81 (2010) 029902] [arXiv:0810.4465 [nucl-th]].

[2] J. Aichelin and K. Werner, J. Phys. G 37 (2010) 094006 [arXiv:1008.5351 [nucl-th]].

**Author:** AICHELIN, Joerg (SUBATECH, University of Nantes)

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**Presenter:** AICHELIN, Joerg (SUBATECH, University of Nantes)

**Track Classification:** STARS2013

Contribution ID: **41** Type: **Talk**

# Superfluidity in Neutron Stars

*Monday 6 May 2013 11:15 (45 minutes)*

The year (1958) after the publication of the BCS theory, Bohr, Mottelson & Pines showed that nuclei should also contain superfluid neutrons and superconducting protons. In 1959, A. Migdal proposed that neutron superfluidity should also occur in the interior of neutron stars. Pairing in nuclei forms Cooper pairs with zero spin, but the relevant component of the nuclear interaction becomes repulsive at densities larger than the nuclear matter density. It has been proposed that neutron-neutron interaction in the spin-triplet state, and L = 1 orbital angular momentum, that is known to be attractive from laboratory experiments, may result in a new form of neutron superfluidity in the neutron star interior. I will review our present understanding of the structure of neutron stars and describe how superfluidity strongly affects their thermal evolution. I will show how a "Minimal Model"that excludes the presence of "exotic" matter (Bose condensates, quarks, hyperons, etc...) is compatible with most observations of the surface temperatures of young isolated neutron stars in the case this neutron superfluid exists. Compared to the case of isotropic spin-zero Cooper pairs, the formation of anisotropic spin-one Cooper pairs results in a strong neutrino emission that leads to an enhanced cooling of neutron stars after the onset of the pairing phase transition and allows the Minimal Cooling scenario to be compatible with most observations. In the case the pairing critical temperature Tc is less than about 6x10ˆ8 K, the resulting rapid cooling of the neutron star may be observable. It was recently reported that 10 years of Chandra observations of the 333 year young neutron star in the Cassiopeia A supernova remnant revealed that its temperature has dropped by about 5%. This result indicates that neutrons in this star are presently becoming superfluid and, if confirmed, provides us with the first direct observational evidence for neutron superfluidity at supra-nuclear densities.

**Author:** PAGE, Dany (Instituto de Astronomía, Universidad Nacional Autónoma de México, Mexico D.F., Mexico)

**Presenter:** PAGE, Dany (Instituto de Astronomía, Universidad Nacional Autónoma de México, Mexico D.F., Mexico)

**Track Classification:** STARS2013

Contribution ID: **42** Type: **Talk**

# Neutron Stars Hidden Magnetic Fields

*Friday 10 May 2013 11:15 (45 minutes)*

The paradigm that pulsars are neutron stars has been established decades ago. The reverse statement, that all neutron star should appear, at least when they are young, as pulsars has been seriously challenged recently. Among the two dozens of known young (<10ˆ4 yrs) neutron stars, less than ten actually are pulsars. Evidence for the presence of a pulsar in the remnant of SN 1987A is still lacking. I will describe a possible scenario, late hypercritical accretion in core collapse supernovae, that may temporarily hide the magnetic field of a new born neutron star. On a long time scale, thousands to millions of years, the hidden field may comes back, resulting in a delayed switch-on of a pulsar.

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**Track Classification:** SMFNS2013

Contribution ID: **43** Type: **Talk**

# Gravitational waves from the cosmological QCD phase transition

*Sunday 5 May 2013 14:00 (30 minutes)*

We study the evolution of turbulence in the early universe at the QCD epoch using a state-of-the-art equation of state derived from lattice QCD simulations. Since the transition is a crossover we assume that temperature and velocity fluctuations were generated by some event in the previous history of the Universe and survive until the QCD epoch due to the extremely large Reynolds number of the primordial fluid. The fluid at the QCD epoch is assumed to be non-viscous, based on the fact that the viscosity per entropy density of the quark gluon plasma obtained from heavy-ion collision experiments at the RHIC and the LHC is extremely small. Our hydrodynamic simulations show that the velocity spectrum is very different from the Kolmogorov power law considered in studies of primordial turbulence that focus on first order phase transitions. This is due to the fact that there is no continuous injection of energy in the system and the viscosity of the fluid is negligible. Thus, as kinetic energy cascades from the larger to the smaller scales, a large amount of kinetic energy is accumulated at the smallest scales due to the lack of dissipation. We have obtained the spectrum of the gravitational radiation emitted by the motion of the fluid finding that, if typical velocity and temperature fluctuations have an amplitude (Δv) /c ≥ 10ˆ(-2) and/or (ΔT)/Tc ≥ 10ˆ(-3), they would be detected by eLISA at frequencies larger than ˜ 10ˆ(-4) Hz.

Reference: V. R. C. M. Roque and G. Lugones, to appear in Phys. Rev. D

**Author:** LUGONES, German (Federal University of ABC, Santo André, Brazil)

**Presenter:** LUGONES, German (Federal University of ABC, Santo André, Brazil)

**Track Classification:** STARS2013

Contribution ID: **44** Type: **Talk**

# Thermal and magnetic effects on the warm inflationary scenario

*Monday 6 May 2013 16:15 (30 minutes)*

We discuss the possible effects that primordial magnetic fields and finite temperatures can have on the warm inflation scenario. This work is motivated by two considerations: first, In view of the accumulating observational evidence for their presence on all scales, the idea of a truly primordial origin of cosmic magnetism gains strength; second, the recent emergence of inflationary models where the inflaton is not assumed to be isolated but instead it is taken as an interacting field during the whole inflationary process.

**Author:** PICCINELLI, Gabriella (Universidad Nacional Autónoma de México (UNAM), Mexico D.F., Mexico)

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**Presenter:** PICCINELLI, Gabriella (Universidad Nacional Autónoma de México (UNAM), Mexico D.F., Mexico)

**Track Classification:** STARS2013

Contribution ID: **46** Type: **Talk**

# Anomalous-Magnetic-Moment Effects in the EoS of a Magnetized Fermion System

*Thursday 9 May 2013 12:00 (30 minutes)*

We investigate the effects of the anomalous magnetic moment (AMM) in the EoS of a fermion system in the presence of a magnetic field. In the region of intermediate to large magnetic fields the AMM is found from the one-loop fermion self-energy. In contrast to the weak-field AMM found by Schwinger, in the intermediate-to-large magnetic field region, the AMM depends on the Landau level and decreases with it. We introduce this Landau level-dependent AMM in the effective Lagrangian used for the calculation of the energy and pressures of the system. We plot the medium parallel and perpendicular pressures versus the magnetic field considering the found AMM, the Schwinger AMM, or no AMM at all. The results clearly show the inconsistency of assuming the validity of the Schwinger AMM beyond the very weak field region (eB ≥ 0.1e Bc). The curves for the EoS, pressures and magnetization at different fields give rise to the well-known de Haas van Alphen oscillations, associated to the change in the number of Landau Levels (ALL) contributing at different fields.

**Authors:** PEREZ MARTINEZ, Aurora (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba); MANREZA PARET, Daryel (Facultad de Física, Universidad de La Habana, Cuba); FERRER, Efrain J. (Department of Physics, University of Texas at El Paso, USA); INCERA, Vivian de la (Department of Physics, University of Texas at El Paso, USA)

**Presenter:** MANREZA PARET, Daryel (Facultad de Física, Universidad de La Habana, Cuba)

**Track Classification:** SMFNS2013

Contribution ID: **47** Type: **Talk**

# Higgs mechanism and symmetry breaking in strong magnetic field

*Sunday 5 May 2013 16:15 (30 minutes)*

We discuss the effect of a strong magnetic field in the behavior of the symmetry of an electrically neutral electroweak plasma. We analyze the case of a strong magnetic field and low temperatures as compared with the W rest energy. If the magnetic field is large enough, it is self-consistently maintained. Charged vector bosons play the most important role, leading only to a decrease of the symmetry breaking parameter, the symmetry restoration not being possible.

**Authors:** RODRIGUEZ QUERTS, Elizabeth (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba); PEREZ ROJAS, Hugo (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba)

**Presenter:** PEREZ ROJAS, Hugo (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba)

**Track Classification:** STARS2013

Contribution ID: **48** Type: **Talk**

# A review of latest results of the Pierre Auger Observatory

*Sunday 5 May 2013 14:30 (45 minutes)*

The main goal of the Pierre Auger Observatory is to study cosmic rays with energies above 1 EeV with unprecedented statistics and learn about the origin and nature of these extremely energetic particles. We will review the latest results obtained by the Auger Observatory concerning the energy spectrum, arrival directions, mass composition and flux limits of non-charged particles and further discuss implications of these results.

**Author:** DOBRIGKEIT, Carola (Universidade Estadual de Campinas, Brazil)

**Co-author:** FOR THE, PIERRE AUGER COLLABORATION (Pierre Auger Observatory)

**Presenter:** DOBRIGKEIT, Carola (Universidade Estadual de Campinas, Brazil)

**Track Classification:** STARS2013

Contribution ID: **49** Type: **Talk**

# Ultra-Luminous X-ray sources and intermediate mass black-holes

*Monday 6 May 2013 09:30 (45 minutes)*

The extremely high X-ray luminosity of non-nuclear ultra luminous X-ray sources (ULX) may be evidence of the existence of black holes with masses intermediate between those produced by stellar evolution and those encountered in active galactic nuclei. We will review the observational properties of these ULXs and discuss their likely accretion regimes. We will show that some of them could indeed harbour an accreting intermediate-mass black hole and will shortly review mechanisms leading to the creation of these objects.

**Author:** MOTCH, Christian (Observatoire Astronomique de Strasbourg, France)

**Presenter:** MOTCH, Christian (Observatoire Astronomique de Strasbourg, France)

**Track Classification:** STARS2013

Contribution ID: **50** Type: **Poster**

# Chiral Magnetic Effect in QCD and its analogy in QED

We discuss the so-called the Chiral Magnetic Effect in in QCD in a quark magnetized plasma under the wider view supplied by the consideration of the polarization modes arising from the structure of the polarization operator of charged particles in presence of an external magnetic field. We concentrate in the search of a QED analogy in a medium to the QCD chiral magnetic case, by discussing the propagation modes in the case of symmetric and non-symmetric cases under charge conjugation. In that medium not only transverse modes, but also the longitudinal one is present. In the latter case we calculate the conductivity associated to an electromagnetic current in the direction of the magnetic field, obtaining a correspondence with the Chiral Magnetic Effect in QCD. The massless limit as well as the zero temperature case are discussed.

**Authors:** PÉREZ ROJAS, Hugo (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba); ACOSTA AVALO, Jorge Luis (Facultad de Física, Universidad de La Habana, Cuba)

**Presenter:** ACOSTA AVALO, Jorge Luis (Facultad de Física, Universidad de La Habana, Cuba)

**Track Classification:** STARS2013

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

# Pseudo-Complex Neutron Stars

*Monday 6 May 2013 14:00 (30 minutes)*

The properties of neutron stars within the theory of pseudo-complex General Relativity are investigated. It is shown that the accumulation of dark energy, with its repulsive effects, allows the presence of neutron stars with larger masses.

**Author:** RODRÍGUEZ, Isaac (FIAS, University of Frankfurt am Main, Germany)

**Co-authors:** HESS, Peter (FIAS, University of Frankfurt am Main, Germany); SCHRAMM, Stefan (FIAS, University of Frankfurt am Main, Germany); GREINER, Walter (FIAS, University of Frankfurt am Main, Germany)

**Presenter:** RODRÍGUEZ, Isaac (FIAS, University of Frankfurt am Main, Germany)

**Track Classification:** STARS2013

Contribution ID: **52** Type: **Talk**

# About the gauge-Higgs unification in warped space

*Sunday 5 May 2013 15:15 (30 minutes)*

We address the problem of gauge-Higgs unification in a Randall-Sundrum I space, extended with one compact dimension, by considering that the 4D Higgs boson is a part of the extra dimensional components of the gauge fields.

**Author:** RODRIGUEZ QUERTS, Elizabeth (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba)

**Presenter:** RODRIGUEZ QUERTS, Elizabeth (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba)

**Track Classification:** STARS2013

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

# Faraday Effect in 3D and 2D systems: Applications

*Wednesday 8 May 2013 15:30 (30 minutes)*

The aim of this work is to study Faraday rotation in the quantum relativistic limit. Starting from the polarization operator in 3D in the presence of a constant magnetic field the rotation of the polarization vector of a plane electromagnetic wave which travels along a gas electron-positron is studied. Then, its possible applications in astrophysics are discussed. The particular case of propagation along the magnetic field is considered. The massless relativistic 2D fermion limit in QED is derived using the compactification along the dimension parallel to the magnetic field. The particular case of zero temperature limit is also studied.

**Author:** CRUZ RODRÍGUEZ, Lídice (Facultad de Física, Universidad de La Habana, Cuba)

**Co-authors:** PÉREZ MARTÍNEZ, Aurora (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba); RODRIGUEZ QUERTS, Elizabeth (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba); PÉREZ ROJAS, Hugo (Instituto de Cibernética, Matemática y Física (ICIMAF), La Habana, Cuba)

**Presenter:** CRUZ RODRÍGUEZ, Lídice (Facultad de Física, Universidad de La Habana, Cuba)

**Track Classification:** SMFNS2013

Contribution ID: **54** Type: **not specified**

# A Mini-Review on Mini-Black Holes from the Mini-Big Bang

*Saturday 4 May 2013 11:15 (45 minutes)*

We review the main ideas behind the predictions of mini black holes for the LHC. These ideas come into discussion about 15 years ago together with the idea of a reduced Planck scale, known as TeV gravity. A main ingredient of these Models, namely the ADD model and the RS model was the idea of additional space-like dimensions which would lead to a dissolution of the gravitational interactions at large distance, but allowing for strong gravitational interactions at small distances. The main outcome, among others less prominent one, was the prediction of black hole production at LHC, the famous 'LHC as a black hole factory' prediction.

We present these ideas now in the light of the recent results from ATLAS and CMS and will conclude that the current data situation puts tight constraints on these exciting Quantum Gravity phenomena.

**Author:** BLEICHER, Marcus (Frankfurt Institute for Advanced Studies and Goethe Universität, Frankfurt am Main, Germany)

**Presenter:** BLEICHER, Marcus (Frankfurt Institute for Advanced Studies and Goethe Universität, Frankfurt am Main, Germany)

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

# Loop Quantum Gravity

*Saturday 4 May 2013 14:00 (30 minutes)*

The purpose of this talk is to give a short general introduction to Loop Quantum Gravity (LQG), beginning with some motivations for quantizing General Relativity, listing various attempts and then focusing on the case of LQG.

**Author:** PIGUET, Olivier (Universidade Federal de Viçosa, Brazil)

**Presenter:** PIGUET, Olivier (Universidade Federal de Viçosa, Brazil)

**Track Classification:** STARS2013

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

# Quark matter under strong magnetic fields in NJL type models

*Wednesday 8 May 2013 16:00 (30 minutes)*

We analyze the effect of strong magnetic fields on the phase diagram of strongly interacting quark matter in the context of NJL-type models. Special attention is paid to the corresponding dependence on the model parameters. In particular, the case of cold quark matter in the chiral limit is discussed in detail.

**Author:** SCOCCOLA, Norberto (Comisión Nacional de Energía Atómica, CONICET and Universidad Favaloro, Buenos Aires, Argentina)

**Co-author:** ALLEN, Pablo (Comisión Nacional de Energía Atómica, Buenos Aires, Argentina)

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**Track Classification:** SMFNS2013

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

# Probing flavor changing neutral currents and CP violation in the two-Higgs doublet model

*Sunday 5 May 2013 10:15 (30 minutes)*

We discuss the formulation of the general two-Higgs doublet model type III, which incorporates flavor changing neutral scalar interactions (FCNSI) and CP violation from several sources. FCNSI and CP violation can arise from Yukawa terms meanwhile Higgs potential can contribute as source of explicit or spontaneous CP violation. We discuss the case that includes CP violation with Yukawa textures to control FCNSI and evaluate the branching fractions for some Higgs scalar, which may allow to test the patterns of FCNSI and CP violation, that arises in these models.

**Author:** MONTES DE OCA, José Halim (Universidad Nacional Autónoma de México, Mexico D.F., Mexico)

**Co-authors:** DÍAZ-CRUZ, Lorenzo (Puebla University, Mexico); GAITÁN-LOZANO, Ricardo (Universidad Nacional Autónoma de México, Mexico D.F., Mexico)

**Presenter:** MONTES DE OCA, José Halim (Universidad Nacional Autónoma de México, Mexico D.F., Mexico)

**Track Classification:** STARS2013

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

# f and r-modes of slowly rotating stars: new results in the linear treatment

*Monday 6 May 2013 17:15 (30 minutes)*

Newly born neutron stars can present differential rotation, even if later it should be suppressed by viscosity or a sufficiently strong magnetic field. And in this early stage of its life, a neutron star is expected to have a strong emission of gravitational waves, which could be influenced by the differential rotation. We present here a new formalism for modelling differentially rotating neutron stars, working on the slow rotation approximation and assuming a small degree of differential rotation. After we establish our equilibrium model, we explore the influence of the differential rotation on the f and r-modes of oscillation of the neutron star in the Cowling approximation, and we also analyze an effect of the differential rotation on the emission of gravitational radiation from the f-modes. Finally, we introduce magnetic fields in our model to aiming to consider their influence in the frequencies of the oscillations.

**Author:** CHIRENTI, Cecilia (Federal University of ABC, Santo André, Brazil)

**Co-authors:** SKAKALA, Jozef (Federal University of ABC, Santo André, Brazil); REZZOLLA, Luciano (Max Planck Institute for Gravitational Physics, AEI Potsdam, Germany); YOSHIDA, Shin'ichirou (University of Tokyo, Japan)

**Presenter:** CHIRENTI, Cecilia (Federal University of ABC, Santo André, Brazil)

**Track Classification:** STARS2013

Contribution ID: **59** Type: **Poster**

# Higgs inflation on the brane

We analyze the slow-roll inflation within a brane framework with a real Higgs field confined at the brane. We prove that inflation occurs for field value below the 4- dimensional Planck scale and produces cosmological perturbations in accordance with observations. We find the dependence of the spectral index with the Higgs mass, the obtained result from running of the spectral index in the range of light Higgs masses 100 GeV < mH < 170 GeV are consistent with constraints from WMAP5.

**Author:** ESCOBAR ATIENZAR, Dagoberto (Universidad de Camagüey, Cuba)

**Presenter:** ESCOBAR ATIENZAR, Dagoberto (Universidad de Camagüey, Cuba)

**Track Classification:** STARS2013

Contribution ID: **60** Type: **Poster**

# Soft symmetry energy dependence in quark-meson-coupling model and compact stars

We investigate compact star properties within the quark meson coupling model (QMC) with a soft symmetry energy density dependence at large densities. It is shown that a softer symmetry energy gives rise to stars with less hyperons, smaller radii and larger masses, where the hyperon-meson couplings are chosen according to experimental values of the hyperon nuclear matter potentials, and possible uncertainties are considered. In addition, it is seen that the hyperon-meson couplings may also have a strong effect on the mass of the star. Fluctuations of proton over neutrons are also discussed, and the isospin content of the denser phase in the liquid-gas inhomogeneous matter in the inner crust of the star is obtained.

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# Intense magnetic fields of magnetars

*Thursday 9 May 2013 16:00 (30 minutes)*

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