Third Argentinian-Brazilian Meeting on Gravitation, Astrophysics, and Cosmology - GrACo III

Rio de Janeiro, 26-29 April 2016

Invited speakers

Filipe Batoni Abdalla (University College of London)
Gabriela Soledad Vila (IAR – CONICET)
Jaílson Alcaniz (Observatório Nacional)
Luis Lehner (Perimeter Institute)
María Clementina Medina (IAR-CONICET)
María Victoria del Valle (IAR-CONICET)
Sandro Dias Pinto Vitenti (IAP / CBPF)
Vitório Alberto de Lorenci (Universidade Federal de Itajubá)

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Oscar Reula (FAMAF/UNC, chair)
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Filipe Batoni Abdalla
Title: Cosmology from cross correlaiton methods in optical surveys

Gabriela Soledad Vila
Title: High-velocity and hyper-velocity stars and their interaction with the medium

Jaílson Alcaniz
Title: Baryon acoustic oscillations from the angular correlation function of SDSS luminous galaxies

Luis Lehner
Title: Surprises in (nonlinear/strong) Gravity?

María Victoria del Valle
Title: Bombing the Galaxy: the impact of high velocity clouds

María Clementina Medina
Title: The neutrino high-energy gamma-rays connection revisited by CTA and GRAND

Sandro Dias Pinto Vitenti
Title: Combining probes with NumCosmo

Vitório Alberto de Lorenci
Title: Campos quânticos no espaço de uma corda cósmica com deslocamento

List of Talks

Felix Mirabel - A1
Title: **Black Holes at the Dawn of the Universe**
Abstract: I will review the role of black hole feedback in the form of X-rays and relativistic jets during the reionization epoch of the universe, which is one of the main current frontiers in cosmology. Feedback from the first black holes determine the early thermal history of the universe over large volumes of space in regions of low density. 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.

Luigi Spinoglio - A2
Title: **Unveiling the physical processes that regulate Galaxy Evolution through space observations**
Abstract: To study the dust obscured processes of both star formation and black hole accretion at the peak of the Star Formation density and Black Hole Accretion density functions (z=1-3) during galaxy evolution and establish their role, as well as their mutual feedback processes, rest frame mid-to-far IR spectroscopy is needed. At these frequencies dust extinction is at its minimum and a variety of atomic and molecular transitions, tracing most astrophysical domains, occur. The future IR space telescope mission, SPICA, fully redesigned with its 2.5m telescope cooled down to T<8K, will be able to perform such surveys. Strong complementarities and synergies of SPICA with the X-ray mission Athena from ESA include the study of the BH accretion rate history along cosmic time and the study of violent outflows from AGN. Deep mid-far-infrared photometric and spectroscopic surveys, matched with sensitive X–ray surveys, which could be performed with SPICA and Athena working together, are needed to formulate a complete understanding of SMBH and galaxy evolution.

Marcelo Leigui de Oliveira - A3
Title: **The astroparticle physics results from the Pierre Auger Observatory**
Abstract: The Pierre Auger Observatory is a hybrid detector covering 3000 km2, built for detecting and studying ultra-high energy cosmic rays. It is an international effort of several research groups from 18 countries and which been taken data for more than ten years. Important results have been published in the last years: the energy spectrum — with the so-called “ankle” and a suppression at the highest energies —, the primary mass composition — with a trend towards heavier nuclei at the highest energies —, upper limits on the searches for primary photons and neutrinos and studies on the anisotropy of

arrival directions, among others. In this paper, the main recent results and a brief discussion of the future plans for the observatory upgrades are presented.

Cheng-Yang Lee - A4
Title: **Neutrino production by Gamma ray bursts**
Abstract: We show that when there is a significant rotation between the neutrino source, and the detector, a negative helicity state emitted by the former acquires a non-zero probability amplitude to be perceived as a positive helicity state by the latter. The electroweak interaction cross sections for such helicity-flipped states are suppressed by a factor of (m_nu/E_nu)^2, where m_nu is the expectation value of the neutrino mass, and E_nu is the associated energy. Thus, if the detecting process is based on electroweak interactions, and the neutrino source is a highly rotating object, the rotation-induced helicity flip becomes very significant in interpreting the data. Motivated by these observations, we present discuss its relevance in the context of data obtained by the IceCube neutrino telescope.

Martin Makler - A5
Title: **Towards Gravitational Arcs as Probes of Gravity and Cosmology**
Abstract: Bundles of null geodesics originating from distant galaxies (sources), when deflected by massive objects such as galaxies and galaxy clusters (lenses) closely aligned with the source and observer may originate gravitational arcs. These arcs are thus probes of the gravitational potential of the source, the large-scale geometry of the Universe, and gravity itself. In particular, the combination of information on the lens from arcs and other probes (such as x-ray, Sunyaev Zel'dovich effect, etc.) may lead do constraints on dark matter, modified gravity, and/or the background cosmological model. On the other hand, systems with gravitational arcs are very rare. Therefore, the use of arcs as gravity probes requires at the same time wide-field surveys of the sky and multi-wavelength observations. In this talk we describe a set of observational projects that fulfill these requirements. In particular, we focus on multi-wavelength surveys in the so-called SDSS Stripe 82 area, a ~200 sq-deg stripe in the celestial equatorial region. This region has an impressive coverage, from radio to X-rays and constitutes the largest field in the sky with such a wide and dense wavelength coverage at medium depths, in addition to a dense spectroscopic coverage from various surveys. We describe our search for gravitational arcs in the CFHT Stripe 82 Survey (CS82) – the highest resolution survey in the optical on that region – and in the VISTA-CFHT Stripe 82 survey (VICS82) ¬– the deepest near infra-red survey covering that area. The challenge of having multi-wavelength observations in wide fields to find relevant arc systems for constraining gravity is beginning to be addressed. We also describe progresses on addressing a second challenge: understanding and controlling the systematics.

Maria Elidaiana da Silva Pereira - A20-1
Title: **Weak lensing signal of Voronoi-selected galaxy clusters undetected by red-sequence algorithm**
Abstract: The detection and the mass measurements of galaxy clusters are essential steps to understand the material content of the universe and its implications for cosmology. Some of the most popular methods to find clusters rely on the assumption that all such objects are formed by an agglomeration of red galaxies (a red sequence), i.e., a high regular population of early-type (elliptical and lenticular) galaxies. These red sequence methods, however, will have diminished performance for clusters with a large blue-to-red fraction of galaxies and lacking the red-sequence feature. The non-red sequence clusters are expected to be a small fraction of the total number of clusters, but the derived cosmological parameters may be significantly biased if this selection effect is not taken into account. To quantify this selection effect we measured the stacked weak lensing signal of galaxy clusters selected with the Voronoi-Tesselation algorithm (Soares-Santos et al. 2011) - a color independent cluster finding -, but undetected by a red sequence based method, Redmapper (Rykoff et al. 2012). The clusters were identified on the Stripe 82 region of Sloan Digital Sky Survey, where both Voronoi-Tesselation and Redmapper cluster catalogs overlap. We performed a membership matching of the catalogs and we identified 30 unmatched clusters. We measured the weak lensing signal for this sample and the preliminary results shows that it might be possible these clusters are real. However, we will analyse them in details to confirm or not if they are in fact real clusters.

Vanessa Pacheco de Freitas - A20-2
Title: **Singular isothermal lens models: analytical solutions for gravitational arcs and applications**
Abstract: Gravitational arcs are highly distorted images of distant galaxies due to the light deflection produced by clusters or galaxies, which work as lenses. These arcs may be used to probe the mass distribution of the lens, to investigate high-redshift galaxies and to constrain cosmological models. In this work we consider the case of Singular Isothermal lens models, which provide an accurate description of the matter distribution on galaxy scales. Remarkably, these models allow for the obtention of analytical solutions for arcs, which can be employed in several applications, such as computing the magnification cross section for finite sources. Analytical solutions are also useful to interpret and test the accuracy of computational methods, which are developed for more generic models. We use the analytical solutions for arcs originating from elliptical sources to compute the length (L), width (W), area and curvature center of the arcs, either in closed form or in terms of simple integrals. From these solutions we derive the cross sections of magnification and arc formation, which can be used to predict the abundance of distant sources and arcs, respectively. These cross sections are usually computed using either the circular infinitesimal source approximation or fully numerical ray tracing simulations. In this work we compare our exact solutions to the afore mentioned approximation and to numerical approaches.

Yeinzon Rodríguez García - C1
Title: **From Scalar Galileons to Generalized and Covariantized (non-Abelian) Vector Galileons**
Abstract: With the purpose of building cosmological inflationary models whose field equations are second order or less, getting rid of possible instabilities and the Ostrogradsky ghost, we elaborate on the construction of the scalar Galileons and find the generalized and covariantized action both for a vector field that is not subject to any gauge invariance and for a multiplet of vector fields that enjoys a global non-Abelian gauge invariance. This paves the way for a systematic study of anisotropies both in the cosmic expansion and in the statistical distribution of fluctuations during inflation.

Giovanni Marozzi - C2
Title: **Precision cosmology via the time of flight of ultra-relativistic particles**
Abstract: In this talk, I will reconsider an earlier suggestion that measuring the relative time-of-flight of ultra-relativistic particles can provide interesting constraints on fundamental cosmological and/or particle physics parameters. Using convenient properties of the geodetic light-cone gauge I will first compute, to leading order in the Lorentz factor and for a generic (inhomogeneous, anisotropic) space-time, the relative arrival times of two ultra-relativistic particles as a function of their masses and energies as well as of the details of the large-scale geometry. To conclude, I will then show the irreducible scatter of the expected data-points due to first-order metric perturbations on top of a FLRW universe, and discuss, for an ideal source of ultra-relativistic particles, the resulting attainable precision on the determination of particle physics and cosmological parameters. Based on: G. Fanizza, M. Gasperini, G. Marozzi and G. Veneziano, arXiv:1512.08489 [astro-ph.CO].

Morgan Le Delliou - C3
Title: **Dark Energy-Dark Matter interaction detection in Non-virialised clusters**
Abstract: In this talk we investigate the possibility of detection of Dark matter–Dark energy interaction. In particular, we try to detect the effects from such interaction in the balance of general clusters and for that purpose, we evaluate the departure from virial equilibrium of unbalanced clusters. We extend the use, from previous works, of the Layzer–Irvine equation for dynamical virial evolution of a simple model of interacting dark sector, with weak lensing and X-ray observations giving respectively the mass profiles and the intracluster gas temperatures. Selecting a set of clusters, we generate measurements, through a Monte Carlo method, of observed virial ratios, interaction strength, rest virial ratio and departure from equilibrium factors. We found a compounded interaction strength for the set of clusters of $−1.61^+2.23_−16.34$, compatible with no interaction, but a compounded rest virial ratio of $−0.78 ± 0.13$, which would entail a 2σ detection. We confirm quantitatively that clusters of galaxies are out of equilibrium but further investigation is needed to constrain a possible interaction in the dark sector.

Miguel Quartin - C4
Title: **The Cosmic Supernova Recycling Program**
Abstract: Type Ia supernovae distance measurements revolutionized cosmology and are still one of the main dark energy probes. But I will NOT focus on that. Instead, I will show that there is much more information on what is often considered the noise in the supernova data. I will discuss how to recycle this noise into signal, in particular into weak-lensing and velocity flows information. This allows the use of supernovae to measure both the present large-scale matter distribution and its evolution along the recent billions of years.

Edison Montoya - C5
Title: **Qualitative Approach to Loop Quantum Cosmology**
Abstract: We presented a brief overview of Loop Quantum Cosmology. It is explained the new picture of the origin of our universe that emerges from this theory. Additionally, we show the effective theory that comes from the construction of the full quantum theory, which can give some insights about the full quantum dynamics of semiclassical states. This effective theory is studied from the qualitative point of view using the methods for dynamical systems in cosmology.

Marcio Eduardo da Silva Alves - C6
Title: **Primordial gravitational waves in a nonsingular $Lambda (H)$-cosmology**
Abstract: We investigate the cosmological production of gravitational waves for a nonsingular flat cosmology driven by a decaying vacuum energy density evolving as $ ho_{ ext{vac}}(H) = ho_b + H^{3}/H_I$, where $ ho_b$ is the bare vacuum energy density, H is the Hubble parameter and H_I is the primordial inflationary scale. This model can be interpreted as a particular case of the class recently discussed by Perico et al. (Phys. Rev. D 88, 063531, 2013) which is termed complete in the sense that the cosmic evolution occurs between two extreme de Sitter stages (early and late time de Sitter phases). The gravitational wave equation is derived and its time-dependent part numerically integrated since the primordial de Sitter stage. The transition from the early de Sitter to the radiation phase is smooth (no exit problem) and the generated spectrum of gravitons is compared with the standard calculations where an abrupt transition is assumed. It is found that the stochastic background of gravitons is very similar to the one predicted by the cosmic concordance model plus inflation except for the higher frequencies ($ u gtrsim 100$ kHz). This remarkable signature of a decaying vacuum cosmology combined with the proposed high frequency gravitational wave detectors of improved sensitivity may provide in the future a crucial test for inflationary mechanisms.

Omar Roldan - C20-1
Title: **Distinguishing an intrinsic from a boost-induced dipole**
Abstract: It is commonly accepted that the CMB dipole is due to our peculiar velocity with respect to the CMB rest frame. However it is possible that this dipole is intrinsic in origin. In this talk, we discuss the signatures of an intrinsic dipole and compare with those produced by a boost-induced one.

Fulvio Sbisá - C20-2
Title: **Quantum cosmology in k-essence theories**
Abstract: The late time acceleration of the universe may be due to the presence of a scalar field with non-canonical kinetic term (K-essence). Despite its importance for late cosmology, it is interesting to speculate which role it may have for the early universe, in particular when quantum gravity effects become important. Considering a minisuperspace description, this problem can be studied approximately by quantizing gravity in a canonical way. I will describe how, in a certain limit of the theory, the K-essence field can be directly used to introduce a time variable, leading to a bouncing behaviour for the universe

Alan Maciel da Silva - G1
Title: **Dual null formalism for gravitational collapse**
Abstract: We review the dual null formalism used for the study of dynamical horizons in Black Holes and we perform the adaptation of this formalism for the study of gravitational collapse with cosmological asymptotics. The separation between the expanding and contracting regions is discussed.

Osvaldo Moreschi - G2
Title: **Equations of motion for particles in particular GR gauges**
Abstract: We apply our general approach to the formulation of equations of motion for particles in general relativity to particular gauges. The first case considered is the harmonic gauge. Different possible dynamical times are mentioned. The radiation field is calculated for a particle. The explicit equations of motion is presented. We also introduce the discussion of the formulation of the equations of motion in the null gauge.

Gonzalo J. Olmo - G3
Title: **Nonsingular black holes in Palatini theories of gravity**
Abstract: Extensions of general relativity constructed in a metric-affine (or Palatini) geometric scenario offer a promising avenue to solve the problems typically associated to space-time singularities. Considering two particular examples that modify the dynamics at high energy densities, it will be shown that black holes and naked configurations can be free of singularities. The predictions of these models are indistinguishable from those of Einstein's gravity when the energy density is below the Planck scale.

Grasiele batista dos santos - G4
Title: **Thermal dimension of quantum spacetime**
Abstract: Recent results suggest that a crucial crossroad for quantum gravity is the characterization of the effective dimension of spacetime at short distances, where quantum properties of spacetime become significant. This is relevant in particular for various scenarios of “dynamical dimensional reduction” which have been discussed in the literature. We are concerned with the fact that the related research effort has been based exclusively on analyses of the “spectral dimension” of spacetime, which involves an unphysical Euclideanization of spacetime and is highly sensitive to the off-shell properties of a theory. We argue that different formulations of the same physical theory can have wildly different spectral dimensions. We propose that dynamical dimension reduction should be described in terms of the notion of “thermal dimension” which we introduce, a notion that only depends on the physical content of the theory. We analyze a few models with dynamical reduction both of the spectral dimension and of our thermal dimension, finding in particular some cases where thermal and spectral dimension agree, but also some cases where the spectral dimension has puzzling properties while the thermal dimension gives a different and meaningful picture.

Eduardo Bittencourt - G5
Title: **The many facets of disformal transformations**
Abstract: The interest in disformal transformations has increased in the last few years, mainly due to the search for alternative theories of gravitation and quantum gravity phenomenology. In this talk, we will discuss new results concerning the mathematical aspects of these transformations.

Roldao da Rocha - G6

Title: **Black string viscosity and entropy in fluid/gravity correspondence**

Abstract: We study brane-world models with variable brane tension and compute corrections to the horizon of a black string along the extra dimension. We show that for some stages in the evolution of the universe, the black string warped horizon can collapses. Furthermore, we show that generalized black strings can present a throat along the extra dimension. The lower bound for the shear viscosity-to-entropy ratio fluid/gravity correspondence shall be shown to scrutinize the gravity side of the correspondence.

Willians Barreto - G7

Title: **Mass gap in the critical gravitational collapse of a kink**

Abstract: We study the gravitational collapse of a kink within spherical symmetry and the characteristic formulation of General Relativity. We explore some expected but elusive gravitational collapse issues which have not been studied before in detail, finding new features. The numerical one-parametric solution and the structure of the spacetime are calculated using finite differences, Galerkin collocation techniques, and some scripting for automated grid coverage. We study the threshold of black hole formation and confirm a mass gap in the phase transition. The spacetime has a self-similar structure.

Marcos Ariel Argañaraz - G20-1

Title: **Stable Isoperimetric Hypersurfaces in Kerr and Mean Curvature Flux**

Abstract: We study the hypersurfaces evolution for initial data of Einstein equation. Using a flux equation that involves the mean curvature of the hypersurface. We obtain the evolution numerically. We also checked the numerical solutions for some initial data, where is well known the analytical behavior. As a result of the numerical study, we find constant mean curvature hypersurfaces, presumably isoperimetric.

Emanuel Gallo - G20-2

Title: **General Formulation of equation of motion for particles in GR**

Abstract: We present a general approach for the formulation of equations of motion for compact objects in general relativity. The particle is assumed to be moving in a geometric background which in turn is asymptotically flat. By construction, the model incorporates the back reaction due to gravitational radiation generated by the motion of the particle. Our approach differs from other constructions tackling the same kind of problem.

Júlio Fabris - G20-3

Title: **Static spherically symmetric structures in theories of gravity with a non-canonical kinetic term**

Abstract: Among the theoretical proposals to describe the initial inflationary phase in the evolution of the universe, as well as the present accelerated expansion phase, the K-Essence theories have a special place. They are based on a generalisation of the kinetic expression for a scalar field, and it can lead to repulsive effects even in the absence of a potential term. Such proposal has connections with fundamental theories, like string, Galileons and Horndeski theories. We make a study of static, spherically symmetric configurations in the context of a specific class of the K-Essence theories. We find some exact solutions with horizons but having very peculiar properties. This analysis is extended to the context of scalar fields in non-conservative theories of gravity revealing structures very similar to those found in the K-Essence case.

V.H. Satheeshkumar - G20-4

Title: **A New Metric for a Radiating Star in General Relativity**

Abstract: In this talk, we present a new metric for a radiating star in General Relativity. Vaidya's original metric reduces to Schwarzschild form for a static mass and outside the radiation zone, whereas our new metric reduces to the Painleve-Gullstrand form of the Schwarzschild metric. We show that the difference between the Vaidya solution and ours lies in the choice of gauge, i.e., lapse function and shift vector, in the Arnowitt-Deser-Misner formalism of General Relativity. Based on this, we outline a new approach for finding exact solutions of Einstein Field Equations.

List of Posters

Carolina Pepe

Title: **Dark matter constraints from supermassive binary black holes systems**

Abstract: Rotation curves of galaxies indicate the presence of dark matter in them. Since many galaxies harbor massive black holes at their centers, studying the accretion of dark matter onto this black holes seems relevant. In this work we explore the effects of taking different values of the equation of state parameter (EoSp) on the accretion rate onto a supermassive binary black hole in an elliptical galaxy. The accretion rate results strongly enhanced for EoSP smaller than a critical value, placing stringent constrains on that parameter. Finally, we investigate the effects on the lifetime of the binary and the implications for gravitational waves emission.

Cecilia Bejarano
Title: **McVittie solution in f(T) gravity**
Abstract: The McVittie solution could be significantly relevant in the astrophysical context since it is capable of including a black hole in a Friedmann-Robertson-Walker (FRW) universe. Describing a spherically symmetric spacetime parameterized by a constant parameter and a function of time, this solution can be reduced to a black hole geometry with constant mass m or a FRW cosmology with a scale factor a(t) in the appropriate limits. We analyze this particularly interesting solution in the light of modified teleparallelism which is also known as f(T) gravity (a generalization of the Teleparallel Equivalent of General Relativity, following the analogy with f(R) gravity).

Cláudia Buss
Title: **Study of a Scalar Field on the Maximally Extended Schwarzschild Spacetime**
Abstract: The wave equation for scalar perturbations of Schwarzschild black hole spacetime is completely separable in Schwarzschild coordinates. Indeed, much of our knowledge about scalar perturbations of Schwarzschild is owed to this fact. While Schwarzschild coordinates are widely used, they are irregular on the event horizon of the black hole. There exist other sets of coordinates, however, such as Ingoing Eddington-Finkelstein coordinates, which are regular on the (future) event horizon and for which the wave equation continues to be completely separable. These coordinates are therefore more naturally suited to the study of scalar perturbations that propagate across the horizon. In this talk, we present preliminary results about the investigation of scalar perturbations both inside and outside a Schwarzschild black hole. We express the wave equation in Ingoing Eddington-Finkelstein coordinates (explicitly showing the separability), write local series expansions for mode solutions and use them to then numerically calculate scalar perturbations inside and outside the future event horizon. Our main motivation is to calculate, in the future, the two-point quantum correlator in Schwarzschild spacetime, with points on opposite sides of the horizon.

Eduardo Sergio Santini
Title: **Is there a super-selection rule in quantum cosmology?**
Abstract: A certain approach to solving the Wheeler-DeWitt equation in quantum cosmology, which is based on a type of super-selection rule by which negative frequency solutions are discarded, is discussed. In a preliminary analysis, we recall well known results in relativistic quantum field theory, showing that adopt this approach of super-selection by discarding a sector of the frequencies, does not lead to acceptable results. In the area of quantum cosmology a qualitatively similar result is obtained: we show that by discarding solutions of negative frequencies, which is usually done in order to demonstrate ``strong' results on the resolution of the singularity, important physical processes are lost, namely the existence of cyclic solutions which, under certain reasonable assumptions, can be interpreted as processes of creation-annihilation at the Planck scale, which are typical of any relativistic quantum field theory

Florencia Teppa Pannia
Title: **A general expression for the redshift drift for z<<1**
Abstract: Among the cosmological observables, the redshift drift (that is, the rate of change of the redshift) has been studied with increasing interest due to its potential to distinguish between different cosmological models. Since there are good prospects to observe the redshift drift in the next decade, it is important to develop theoretical approaches that allow the forecast of its features in a given cosmological model. We present here an expression for the redshift drift valid for any cosmological model and for low redshifts. One of the advantages of this expression, obtained using a 1+3 covariant description, is that it does not involve the integration of the null geodesic equation. We apply the expression to several models with less symmetries than those of the FLRW case, such as Bianchi I, LTB, Stephani, and Székeres.

Maria Daniela Leite de Souza
Title: **Using the Fermi model for determinate the state equation in a gas undergoing self gravity**
Abstract: A physical theory for star formation must explain why the training process is slow. Some authors believe that the causes of this phenomenon is the primary conversion from a small fraction of the gas in stellar material into free fall. They proposed further that the supersonic turbulence may be responsible by the low formation rate to provide turbulent pressure such that supports the gravitational collapse. Thus, we did an analytical-numerical study of the propagation of hydrodynamic instabilities in a mass of gas undergoing to self-gravity similar to a white dwarf. As a starting point, we assume that the protostar is spherically symmetric and is in mechanical and thermodynamical equilibrium. We also considered high densities, so that electrons are weakly bound to the nuclei and move freely in the cloud. The model is used to find the state equation was using a relativistic model of Fermi gas at zero temperature, since we believe that atomic nuclei are heavy and electrons contribute greatly to the change depression. We found that the Chandrasekhar limit agrees with the value found for white dwarfs. This procedure takes into account the ratio of electrons to nucleons, such that it is an interesting model to determine the atomic composition of these stars. The analytical-numerical solution for distributions of pressure and density are made in the equations for momentum and continuity with a hydrodynamic perturbative term. The solution shows that we can get waves in this material.

Martin Richarte

Title: **Self-gravitating systems of ideal gases in the 1PN approximation**
Abstract: We obtain the Maxwell-Juttner distribution function at first order in the post-Newtonian approximation within the framework of general relativity. Taking into account the aforesaid distribution function, we compute the particle four-flow and energy-momentum tensor. We focus on the search of static solutions for the gravitational potentials with spherical symmetry. In doing so, we obtain the density, pressure and gravitational potential energy profiles in terms of dimensionless radial coordinate by solving the aforesaid equations numerically. In particular, we find the parametric profile for the equation of state p/ ho in terms of the dimensionless radial coordinate. Due its physical relevance, we also find the galaxy rotation curves using the post-Newtonian approximation. We join two different kinds of static solutions in order to account for the linear regime near the center and the typical flatten behavior at large radii as well.

Maurício Richartz
Title: **Quasinormal modes of extremal black holes**
Abstract: The continued fraction method (also known as Leaver's method) is one of the most effective techniques used to determine the quasinormal modes of a black hole. For extremal black holes, however, the method does not work (since, in such a case, the event horizon is an irregular singular point of the associated wave equation). Fortunately, there exists a modified version of the method, devised by Onozawa et al. [Phys. Rev. D 53, 7033 (1996)], which works for neutral massless fields around an extremal Reissner-Nordstrom black hole. In this work, we generalize the ideas of Onozawa et al. to charged massless perturbations around an extremal Reissner-Nordstrom black hole and to neutral massless perturbations around an extremal Kerr black hole. Similarities and differences between the results of the original continued fraction method for near extremal black holes and the results of the new continued fraction method for extremal black holes are discussed.

Santiago del Palacio
Title: **Absence of polarization in the radio emission from a colliding-wind binary**
Abstract: Several massive early-type binaries present non-thermal emission which has been attributed to synchrotron radiation from particles accelerated by Diffusive Shock Acceleration (DSA) in the wind-collision region (WCR). An immediate consequence of this is that the radio emission should be intrinsically polarized; however, such polarization has never been measured. We performed radio continuum observations at 20 cm and 5 cm of the WC6+O8 system WR 146 with the JVLA to measure the polarization degree with an accuracy better than 1%. We detected no polarized emission on a level above 0.6% along 1 to 8 GHz. The absence of polarization is analyzed under two possible scenarios. In the first one, particles accelerate through DSA in the strong shocks, and different external and instrumental depolarization effects are considered to account for the non-detection of polarized emission. Our results have implications in the search of polarized emission from other high-energy compact sources. In the second scenario, we consider that the wind shocks are debilitated due to a high degree of turbulence in the plasma. Turbulent magnetic reconnection is then responsible of the particle acceleration and the production of intrinsically unpolarized emission. Under such consideration, we show that this acceleration mechanism could be more relevant in colliding-wind binaries than expected. For both scenarios we estimate the electron injection spectral index, the magnetic field in the WCR, and the broadband emission up to gamma-rays.

Sérgio Mittmann dos Santos
Title: **Straight spinning cosmic strings in Brans-Dicke gravity**
Abstract: In this work, it is presented the exact solution of straight spinning cosmic strings in Brans-Dicke theory of gravitation. The possibility of the existence of closed timelike curves around these cosmic strings is analyzed. Furthermore, the stability about the formation of the topological defect discussed here is checked.

Sofiane Faci
Title: **On the electromagnetic radiation of moving charges**
Abstract: The problem of electromagnetic radiation of classical moving charges and its known patholo- gies is discussed. Our treatment relies on one simple hypothesis: electrodynamic interactions are not strictly instantaneous. There is an infinitesimal time delay between the action of external forces and the reaction of the charge acceleration. This leads to a new equation that extends and fixes the Lorentz-Abraham-Dirac dynamics. The radiation turns out to result from the variation of external forces and not as self-forces. Consequently the pre-acceleration behaviour is naturally absent and the runaway pathology is fixed. For constant acceleration there is no radiation for and thus no conflict holds with the Equivalence Principle.