Grav17

April 3th–7th, 2017, La Falda, Argentina

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
9:00-9:50	Registration	R. Wald	J. Pullin	H. Friedrich	J. Frauendiener
10:00-10:30	COFFEE				
10:30-11:20	A. Pérez	L. Lehner	A. Ashtekar	G. González	G. Vila
11:30-12:20	M. Ghezelbash	F. Beyer	M. Reiris	R. Ferraro	L. Smestad
12:20-14:00	LUNCH				
14:00-14:30	A. Aceña	L. Trombetta	*enjoy your free afternoon*	O. Moreschi	M. Socolovsky
14:30-14:50	P. Anglada	E. Eiroa		B. Araneda	M. Reisenberger
14:50-15:10	M. Guzmán Monsalve	A. Paliathanasis		R. Eyheralde Sastre	F. Carrasco
15:10-15:30		C. Bejarano		J. Fernández Tío	G. Figueroa Aguirre
15:30-16:10	COFFEE			COFFEE	
16:10-16:30	F. Lopez Armengol	N. Dimakis		E. Rubín de Celis	B. Sánchez
16:30-16:50	J. Abalos	C. Kozameh		G. Crisnejo	M. De los Ríos
16:50-17:10		M. Ramírez		C. Negrelli	

MOORNING TALKS

MONDAY 3

Quantum gravity and the cosmological constant: possible phenomenological implications of Planckian discreteness

Alejandro Pérez
Université de Marseille, France.

We argue that discreteness at the Planck scale (naturally expected to arise from quantum gravity) might manifest in the form of minute violations of energy-momentum conservation of the matter degrees of freedom when described in terms of (idealized) smooth fields. In the context of applications to cosmology such 'energy diffusion' from the low energy matter degrees of freedom to the discrete structures underlying spacetime, would lead to the emergence of an effective dark energy term in Einstein's equations. We estimate this effect using a (relational) hypothesis about the materialization of discreteness in quantum gravity which is motivated by the strict observational constrains supporting the validity of Lorentz invariance at low energies.

Simple dimensional analysis predicts contributions of the order of magnitude of the observed value.

Exact solutions to Einstein-Maxwell-Dilaton Theory with Two Coupling Constants

Masoud Ghezelbash
University of Saskatchewan, Canada.

In this talk, we present a new class of solutions to the five-dimensional Einstein-Maxwell-dilaton theory with cosmological constant where the dilaton field couples to the electromagnetic field as well as to the cosmological term with two different coupling constants. We show that the five-dimensional spacetime is non-stationary and is a conformally regular spacetime, everywhere. The dilaton field and the electromagnetic field depend on time and two spatial directions and the theory can have a positive, zero or negative cosmological constant. We study the physical properties of the spacetime and show that the solutions are unique in five dimensions and can't be uplifted to higher-dimensional Einstein-Maxwell theory or Einstein gravity in presence of cosmological constant.

TUESDAY 4

You Can't Overcharge/Overspin a Black Hole

Robert Wald
The University of Chicago, USA.

The Kerr-Newman solutions are the only stationary black hole solutions of the Einstein-Maxwell equations in 4-dimensions. However, these solutions describe black holes only when the inequality $M^2 \geq (J/M)^2 + Q^2$ is satisfied, where M,J, and Q are the mass, angular momentum, and charge of the black hole. Therefore, if an extremal or nearly extremal black hole can be made to absorb matter with sufficiently large angular momentum or charge as compared with its energy, one would obtain a serious contradiction with cosmic censorship. Hubeny and others have made proposals as to how this might be done, but a proper analysis would require a calculation of all second order effects on energy, including, in particular, effects arising from self-force. We show in this work that when all of the second order effects are taken into account, no overcharging or overspinning of a black hole can ever occur, provided only that the non-electromagnetic matter satisfies the null energy condition.

Challenges and opportunities with BBH gravitational waves

Luis Lehner
Perimeter Institute for Theoretical Physics, Canada.

LIGO's recent detection of gravitational waves from binary black holes has brought to the front, among other prospects, the possibility to test GR. In this talk I'll discuss a few challenges, opportunities and speculative ideas to extract the most physics in the coming years.

Self-gravitating Gowdy-symmetric fluids near the big bang singularity

Florian Beyer[1] and Philippe G LeFloch[2]
[1] University of Otago, Dunedin, New Zealand,
[2] Laboratoire Jacques-Louis Lions, Université Pierre et Marie Curie, Paris, France.

In this talk we present new results about the construction and analysis of singular Gowdy-symmetric self-gravitating fluid solutions by means of the Fuchsian method. A crucial role is played by a critical phenomenon which is induced by the competition between the (by definition) isotropic internal fluid forces and the highly anisotropic gravitational forces. Einstein's equations are written in some particular (generalized) wave gauge which both renders the evolution equations hyperbolic and allows us to handle the constraints. For this we make significant use of further new results regarding the vacuum Einstein equations in generalized wave gauges by E. Ames, F.B., J. Isenberg and P.G. LeFloch.

WEDNESDAY 5

Hawking radiation in a quantum space-time

Jorge Pullin
Lousiana State University, USA.

We consider Hawking radiation in the geometric optics approximation on the quantum space-time corresponding to a collapsing null shell. We show that deviations from thermality occur that have the imprint of the initial state chosen for the shell, suggesting that information could leak out through the radiation.

Implications of a positive cosmological constant for general relativity

Abhay Ashtekar
IGC & Physics Department, Penn State University, USA.

Most of the literature on general relativity over the last century assumes that the cosmological constant Λ is zero. However, by now independent observations have led to a consensus that the dynamics of the universe is best described by Einstein's equations with a small but positive Λ. Interestingly, this requires a drastic revision of conceptual frameworks commonly used in general relativity, *no matter how small* Λ *is.* I will first explain why, and then summarize the current status of generalizations of these frameworks to include a positive Λ, focusing on gravitational waves.

Applications of comparison geometry a la Bakry-Emery to static and stationary problems in GR

Martín Reiris
Universidad de Montevideo, Uruguay.

Comparison Geometry a la Bakry-Emery, (as developed for instance by Wei and Wylie), is by now a stablished powerful technique with multiple applications in differential geometry. In this talk I will explain how this technique can be successful too to solve several fundamental problems of static and stationary solutions of the Einstein equations, among which are,
1. the classification of geodesically complete solutions of the Einstein/Klein-Gordon system.
2. the classification of vacuum static solutions with compact but not necessarily connected horizons (with no a priori asymptotic like asymptotic flatness).
3. the classification of axially symmetric solutions of the vacuum stationary Einstein equations.

THURSDAY 6

Gravitational radiation and space-like infinity

Helmut Friedrich
Max Planck Institute for Gravitational Physics, Germany.

The precise fall-off conditions imposed on Cauchy data for asymptotically flat solutions to the Einstein equations at space-like infinity have consequences for the behaviour of gravitational fields in all asymptotic domains. They are usually motivated by wishes for mathematical generality, the definability of physical concepts, and the calculability of data related to physical observations. In this talk we discuss the ambiguities in prescribing these fall-off conditions, some of their consequences, and various open questions.

"Searching for—and finding! gravitational waves"

Gabriela Gonzalez
Louisiana State University, for the LIGO Scientific Collaboration and the Virgo Collaboration

On September 14 2015, the two LIGO gravitational wave detectors in Hanford, Washington and Livingston, Louisiana registered a nearly simultaneous signal with time-frequency properties consistent with gravitational-wave emission by the merger of two massive compact objects. Further analysis of the signals by the LIGO Scientific Collaboration and the Virgo Collaboration revealed that the gravitational waves detected by LIGO came from the merger of a binary black hole system. This observation, followed by another one in December 2015, marked the beginning of gravitational wave astronomy. I will describe some details of the observation, the status of LIGO and Virgo ground-based interferometric detectors, and prospects for future observations.

Relational mechanics as a gauge theory

Rafael Ferraro
IAFE (UBA-CONICET), Argentina.

Mach's criticism to Newtonian mechanics triggered Einstein's first steps towards general relativity. Leibniz had also claimed for the abolition of the absolute space, and a relational reformulation of the laws of mechanics. It will be shown that classical mechanics can be formulated as a relational theory that satisfies Mach's principle by applying the tools of gauge theories.

FRIDAY 7

Gravitational waves and black holes: a global computational approach

Jörg Frauendiener
University of Otago, New Zeland.

It is well known that gravitational waves interact in a non-linear way. This makes it difficult to describe them rigourously. The cleanest description is based on a certain conformal invariance of the Einstein equations — a fact which was established by R. Penrose and was used by H. Friedrich to prove several important global results for general relativistic space-times. The conformal field equations implement this conformal invariance on the level of partial differential equations. They provide various well-posed initial (boundary) value problems for use in different situations. The talk will give a computational perspective on the non-linear interaction of plane gravitational waves and also present preliminary results of a simulation of the behaviour of an initially spherically symmetric black hole under the impact of a gravitational wave burst.

Black holes in astrophysics, accretion and jets
Gabriela Vila
Instituto Argentino de Radioastronomía, Argentina.

I will present an overview of the central role of black holes in astrophysics. I will briefly survey the current evidence on the existence of black holes and the methods available to measure their mass and spin. The rest of the talk will be devoted to describe the accretion-powered astrophysical sources that host black holes and launch jets, where the most energetic processes in the Universe take place.

Antimatter research with the AEgIS experiment—probing gravity with a beam of cold antihydrogen
Lillian Smestad on behalf of the AEgIS Collaboration.
CERN, Switzerland.

Antimatter remains one of the biggest mysteries of physics. There is still much to be learned about the nature of this elusive component —in particular, which differences between matter and antimatter renders the observable universe possible. The AEgIS experiment, located at the Antiproton Decelerator of CERN, aims for a first precise direct measurement of the gravitational behaviour of antimatter; to test the Weak Equivalence Principle with antihydrogen in Earth's gravitational field. The measurement will be performed with a beam of cold antihydrogen passing through a classical moiré deflectometer. An outline of the steps needed to create cold antihydrogen, through a charge-exchange process between trapped antiprotons and a burst of positronium, will be given. The current status—including transport, cooling, compression and imaging of antiprotons, as well as formation and laser excitation of positronium and tests of the deflectometer and sensitive detectors—and developments under investigation will be presented. Improved sensitivity will mainly stem from colder antihydrogen in larger quantities: a technique in development to cool antiprotons will briefly be outlined.

Afternoon Talks

Monday 3

Extremal black hole initial data deformations
Andrés Aceña[1] and María E. Gabach Clément[2,3]
[1] FCEN, UNCuyo, CONICET, Mendoza, Argentina.
[2] FaMAF, UNC, Córdoba, Argentina.
[3] IFEG, CONICET, Córdoba, Argentina.

We present recent results concerning axially symmetric initial data for electro-vacuum extremal black-holes.

For initial data, there seems to be a close relation between the presence of a cylindrical end and certain extremality condition suggested in part, by the behavior of stationary solutions like Kerr-Newman and also by the fact that given a mono-parametric family of conformally flat initial data having a wormhole structure, with given angular momentum and charges, then there exists a singular limit as the parameter goes to zero, where the asymptotic structure changes to trumpet-like and the angular momentum and charges are maximal for given mass. This reinforces the interest in studying initial data with cylindrical ends in an attempt to understand cosmic censorship issues, black hole formation, conical singularities appearing in stationary multi-black hole solutions, etc.

We study deformations of axially symmetric initial data for Einstein-Maxwell equations within the positive Yamabe class, containing one asymptotically cylindrical end and one asymptotically flat end. We find that the Yamabe condition implies the existence of a family of deformed data having the same horizon structure. This result allows us to measure how close solutions to Lichnerowicz equation are when arising from nearby free data.

Size, angular momentum and mass for objects
Pablo Anglada[1,2], M.E. Gabach-Clement[1,2], Omar E. Ortiz[1,2]
[1] FaMAF, Universidad Nacional de Córdoba, Argentina,
[2] Instituto de Física Enrique Gaviola, IFEG, CONICET.

We present a new geometrical inequality involving the ADM mass, the angu- lar momentum and the size of an ordinary axially symmetric object. The main tool we use to use to prove it is the monotonicity of the Geroch quasi-local energy along the inverse mean curvature flow. We also compute numerical examples to test the robustness of our hypotheses and results.

Hamiltonian formulation of the teleparallel equivalent of general relativity
Rafael Ferraro[1,2] and **María José Guzmán**[1]
[1] Instituto de Astronomía y Física del Espacio (IAFE, CONICET-UBA), Argentina,
[2] Departamento de Física, FCEyN, Universidad de Buenos Aires, Argentina.

The teleparallel equivalent of general relativity is an alternative description of gravity, which uses the tetrad field, instead of the metric tensor, as the dynamical variable. Its Lagrangian depends on the torsion of the Weitzenböck connection, which is curvatureless and represents a spacetime with absolute parallelism. We write the Lagrangian as a quadratic form of the coefficients of anholonomy of the orthonormal frames (vielbeins), in order to study the algebra of constraints. It is analyzed the structure of eigenvalues of the multi-index matrix entering the linear relation between canonical velocities and momenta to obtain the set of primary constraints. The canonical Hamiltonian is then built with the Moore-Penrose pseudo-inverse of that matrix, to then derive the secondary constraints. All the set of constraints completes a first class algebra; and it is obtained the ADM algebra of general relativity as a sub-algebra.

Strong field effects of Scalar-Tensor-Vector Gravity
Federico G. Lopez Armengol[1], Gustavo E. Romero[1,2]
[1] IAR, CONICET, [2] FCAGLP, Universidad Nacional de La Plata, Argentina.

Scalar-Tensor-Vector Gravity (STVG) is a new theory for the gravitational interaction. Its weak field regime has been successfully applied to describe observations of the Solar System, galaxy rotation curves, dynamics of clusters of galaxies, and cosmological data without the imposition of dark components. The theory was constructed to differ from General Relativity (GR) far from the gravitational source, where phenomena related to dark matter usually occur. We have investigated the predictions of the strong field regime of STVG to find that it differs from GR as well. In this talk we shall present results about the effects of STVG on the structure of neutron stars, the formation and collimation of relativistic jets, and accretion disks.

Diagonalization theory using singular values decomposition with application to strongly hyperbolic theory.
F. Abalos[1], O. Reula[1]
[1] FaMAF, Universidad Nacional de Córdoba, Argentina.

We study strong hyperbolicity of first order partial differential equations for systems with differential constraints. In those cases, the number of equations is larger than the unknown fields, therefore, the standard hyperbolicity does not directly apply. To deal with this problem one introduces a new tensor, called a hyperbolizer, which selects a subset of equations so that they might be used as evolution equations for the unknowns. Different hyperbolizers, may or may not lead to strongly hyperbolic evolution systems.

To sort-out this issue, we look for a condition which is independent of the hyperbolizers but which, if satisfied, implies the non-existence of strongly hyperbolic reductions. We look at the singular value decomposition of the whole system and show that if the principal symbol is appropriately perturbed (via a parameter ε), we obtain perturbed characteristic surfaces with given perturbed singular values. If any of the singular values is order $O\left(\varepsilon^2\right)$, hyperbolicity breaks down. In addition, we notice that the calculations at orders $O\left(\varepsilon^0\right)$ and $O\left(\varepsilon^1\right)$ can be done in a covariant way.

These results are reached by connecting the perturbation of singular values with the diagonalization of square matrices (with complex eigenvalues), leading to a different and simpler proof of Kreiss's matrix theorem. We then extend these conclusions to systems with constraints.

Finally we apply the results to examples in physics, such as Force-Free Electrodynamics in standard and Euler potential form and Fluids with finite conductivity. We find that the first case is strongly hyperbolic, while the last two are only weakly hyperbolic.

TUESDAY 4

Infrared effects in de Sitter spacetime: Non-perturbative treatments

Diana López Nacir[1], Francisco D. Mazzitelli[2] and **Leonardo G. Trombetta**[2]
[1] Theoretical Physics Department, CERN, Genève, Switzerland.
[2] Centro Atómico Bariloche, Instituto Balseiro and CONICET, CNEA, Bariloche, Argentina.

The study of interacting quantum fields in de Sitter geometry is of interest for a variety of reasons. In inflationary models, interactions could lead to non-Gaussianities in the cosmic microwave background. Quantum effects could also contribute to the dark energy, and explain, at least partially, the present acceleration of the universe. In this geometry, the exponential expansion of the metric produces an effective growth in the couplings, producing a break down of perturbative methods for light ($m^2 \ll H^2$) fields and late times. Furthermore, for massless and minimally coupled scalar fields the two-point functions do not respect the symmetries of the classical theory and do not decay at large distances.

We point out that a partial resummation of the leading secular terms is required to obtain a decay at large distances for massless fields. We implement this resummation for a $O(N)$ scalar field model with quartic interaction in Euclidean de Sitter space, where IR effects can be traced to the zero mode. We study the feasibility of the resummation in both the large-N limit and for $N = 1$. We also discuss the restoration of symmetry induced by the IR effects.

Optical effects in the vicinity of braneworld black holes

Ernesto F. Eiroa[1,2], Leonardo Amarilla, and Carlos M. Sendra [1,2]
[1] Instituto de Astronomia y Fisica del Espacio (IAFE, CONICET-UBA), Argentina,
[2] Departamento de Fisica, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina.

In braneworld cosmological models, the geometries corresponding to black holes are different than in the standard scenario. As a consequence, the optical properties of black holes change. In this talk, braneworld black holes are analyzed as gravitational lenses and the feasibility of observation of the images is discussed. For rotating braneworld black holes, the deformation of the shadow is also considered. The size and the shape of the shadow depend on the mass and the angular momentum, and they can also depend on other parameters specific of the particular model adopted.

Algebraic Solutions in Scalar Field Cosmology with Applications in inflationary potentials

Andronikos Paliathanasis
Universidad Austral de Chile (UACh).

An algebraic solution for arbitrary potential is presented in the context of scalar field cosmological models. That result is used to generate new solutions of the scalar field equations in homogeneous and isotropic universes. A series of generalizations of the Chaplygin gas and bulk viscous cosmological solutions for inflationary universes are found. Finally, we show how the Hubble slow-roll parameters can be calculated using the solution algorithm and we compare these inflationary solutions with the observational data provided by the Planck 2015 collaboration to constraint and rule out some of these models.

Based on: 1604.05168; 1609.01126 & 1611.06680

Metric-affine non-singular black holes sourced by anisotropic fluids in quadratic $f(R)$ gravity

C. Bejarano[1], G. J. Olmo[2,3], D. Rubiera-Garcia[4]
[1] Instituto de Astronomía y Física del Espacio (IAFE, CONICET-UBA), Buenos Aires, Argentina
[2] Departamento de Física Teórica (Universidad de Valencia) & Instituto de Física Corpuscular (IFIC, CSIC-UV), Valencia, España
[3] Departamento de Física, Universidade Federal da Paraíba, João Pessoa, Paraíba, Brasil
[4] Instituto de Astrofísica e Ciências do Espaço, Faculdade de Ciências da Universidade de Lisboa, Lisboa, Portugal.

In a metric-affine (Palatini) framework, we obtain and analyze black hole solutions generated by anisotropic fluids with various equations of state. In particular, we study the inner structure of the black holes and the geodesic completeness of these spacetimes in the context of quadratic $f(R)$ gravity. We find that, depending on the matter model parameters, the standard point-like singularity can be replaced by a wormhole, which makes the spacetime non-singular. This work throws further evidence on the fact that the metric-affine formulation in theories beyond General Relativity represents an encouraging approach to tackle the shortcomings posed by classical singularities.

Mini-superspace Quantization of the Reissner - Nordström geometry

N. Dimakis[1]
[1] Universidad Austral de Chile, Valdivia, Chile

We start from a static, spherically symmetric space-time in the presence of an electrostatic field and construct the mini-superspace Lagrangian that reproduces the well known Reissner - Nordström solution. We identify the classical integrals of motion that are to be mapped to quantum observables and which are associated with the mass and charge. Their eigenvalue equations are used as supplementary conditions to the Wheeler-DeWitt equation and a link is provided between the existence an horizon and to whether the spectrum of the observables is fully discrete or not. For each case we provide an orthonormal basis of states as emerges through the process of canonical quantization.

Asymptotic Structure of NSF and the non linear graviton

Melina Bordcoch, **Carlos N. Kozameh**, Teresita A. Rojas

The dynamical equations for the Null Surface Formulation of General Relativity for pure ra- diatively space times are derived. Those asymptotically flat space times describe the non linear evolution of gravitational radiation and represent a classical graviton. The evolution equations constitute a set of three partial diferential equations in a six dimensional space and the source term is the free initial data of incoming gravitational radiation. The Huygens part of the wave propagation, back reaction terms and source terms are identified in the resulting equations. An analysis of the range of validity of these equations based on the development of caustics is also given.

Using the available asymptotic quantization scheme originally derived by A. Ashtekar we introduce quantum observables representing the spacetime points and obtain non trivial commutation relations.

Vacuum thin shells in EGB brane-world cosmology

Marcos A. Ramirez
INENCO (UNSa-CONICET), Salta, Argentina,
IFEG (UNC-CONICET), Córdoba, Argentina.

In this talk we present new solutions of the EGB field equations in a SMS brane-world setting which represent a couple of Z_2-symmetric vacuum thin shells splitting from the central brane, and explore the main properties of the dynamics of the system. The matching of the separating vacuum shells with the brane-world is as smooth as possible and all matter fields are restricted to the brane. Several implications for the effective Friedmann equations on the brane are discussed, and compared with standard cosmology. We also comment on the relation of this system with the thermodynamic instability of highly symmetric vacuum solutions of Lovelock theory.

Balanced equations of motion for black holes and the GW190514 Ligo observations

Osvaldo M. Moreschi
FaMAF, IFEG, Argentina.

We present recent advances in our program for constructing balanced equations of motion for compact objects in GR.

The explicit form of the back reaction gravitational radiation force is presented for the harmonic gauge.

The GW190514 Ligo signals are analyzed with a minimal set of filtering to give light on possible hidden physical information.

We apply the composite equations of motion model to these type of systems and argue that our tools could help in studying new points of view on the nature of the astrophysical systems that generated those signals.

On the symmetry structure of linear fields on black hole spacetimes

Bernardo Araneda[1,2]
[1]FaMAF, Universidad Nacional de Cordoba, Cordoba, Argentina
[2]IFEG-CONICET, Argentina.

For the class of vacuum spacetimes of Petrov type D with cosmological constant (which includes the Kerr-(A)dS solution as a particular case), we show the existence of a general pattern of off shell operator equalities relating linear field equations to decoupled, scalar equations for the spin-weighted components of the fields. The off shell validity allows transposition of operators, which leads to reconstruction formulae for spinor/tensor fields in terms of scalar potentials. We also analyze the role of hidden symmetries associated to Killing spinors and Killing-Yano tensors in the case of spin weight zero. Teukolsky-like equations and Debye potentials previously known are shown to be a particular case of our general results.

Corrections to Hawking radiation in the quantum space-time of a collapsing shell

Rodrigo Eyheralde[1], Miguel Campiglia[1], Rodolfo Gambini[1], Jorge Pullin[2]
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We study corrections to Hawking radiation due to the quantum nature of the space-time of a collapsing null-shell. Motivated by recent studies of this system in the context of Loop-Quantum Gravity we incorporate ADM mass and the position of the shell as quantum observables. We show this corrections posses information about the initial state of the shell and therefore are relevant to the issue of information loss. In this talk we will present the formalism in some detail and apply it to the computation of relevant observables.

Black hole nonmodal linear stability: the Reissner-Nordström case

Gustavo Dotti[1], **Julián M. Fernández Tío**[1]
[1] FaMAF, Universidad Nacional de Córdoba, Córdoba, Argentina

Following a program on black hole nonmodal linear stability we study odd linear perturbations of the Einstein-Maxwell equations around a Reissner-Nordström (A)dS black hole. We show that all the gauge invariant information in the metric and Maxwell field perturbations is encoded in two spacetime scalars and that the linearized Einstein-Maxwell equations are equivalent to a coupled system of wave equations for the scalars. For nonnegative cosmological constant we prove that the scalars are pointwise bounded on the outer static region.

Electrostatic self-force in non trivial spacetimes

E. Rubín de Celis[1,2], C. Simeone[1,2] and O. Santillán[1,3]
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Global aspects in non trivial spacetimes are studied by the electromagnetic self-interaction of a point charge. The considered manifolds are constructed with a thin-shell of matter that joins two geometries with spherical or cylindrical symmetry, in such a way to have one or two asymptotic regions. Electrostatic Maxwell equations are solved and the potential is renormalized at the position of the charge. Topologic and geometric properties of the background spacetime are manifested in the electrostatic force measured by a local observer at the position of the point charge. Results are analyzed in terms of the spatial curvature of the embedded surface of the shell (codified in the extrinsic curvature tensor), and the manifold's topology.

Lentes gravitacionales a segundo orden

Gabriel Crisnejo[1] y Emanuel Gallo[1,2]
[1] Facultad de Matemática, Astronomía, Física y Computacion (FaMAF), UNC [2] Instituto de Física Enrique Gaviola (IFEG), CONICET

Este trabajo busca extender la bibliografia referida al fenómeno de lentes gravitacionales. Obtenemos expresiones para los escalares ópticos a segundo orden en los escalares de curvatura sobre un background plano sin hacer mensión ni de la extensión ni de la forma de la lente. Luego, obtenemos el ángulo de deflección también a segundo orden para el caso de lentes delgadas (situación típica en muchas situaciones astrofísicas de interés) y axialmente simétricas alrededor de la línea de visión. Finalmente, damos una expresión explícita de los escalares ópticos en el gauge generalizado de Poisson considerando tanto perturbaciones escalares como vectoriales y tensoriales.

Testing the MOG Theory with the rotation curve of the Milky Way

C. Negrelli[1], M. Benito[2], F. Iocco[2], L. Kraiselburd[1], S. J. Landau[3]
[1] FCAGLP, Universidad Nacional de La Plata, Buenos Aires, Argentina
[2] ICTP-SAIFR, Instituto de Física Teórica - UNESP, Sao Paulo, Brazil
[3] Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina.

The aim of this talk is to present an introduction to the MOdified Gravity Theory (also called Scalar-Vector-Tensor Gravity) proposed by Moffat in 2006. The MOG is capable of explaining -without postulating a dark matter component - cosmological data, galaxy clusters dynamics, rotation curves of galaxies and solar system observations, while still leaving unsolved some issues. In particular we are analyzing in detail the predictions of the theory for the rotation curve of the Milky Way. In order to do this we use a new compilation of kinematic measurements that trace the rotation curve of our galaxy and an exhaustive array of observation-based baryonic models that set the contribution of the stellar bulge, stellar disc and gas to the total gravitational potential.

FRIDAY 17

Quantum scalar field behavior of the conformally flat part of the S-K-S metric

H.A. Camargo[1], E.J. Gonzalez de Urreta[2], **M. Socolovsky**[2,3]
[1] Facultad de Ciencias, Universidad Nacional Autónoma de México, México [2] Instituto de Ciencias, Universidad Nacional de General Sarmiento,Argentina [3] Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, México (with a leave of abscence)

Using Weyl geometry, we study some properties of the scalar ϕ-field representing the conformally flat part of the Schwarzschild-Kruskal-Szekeres (S-K-S) metric in the black hole region. As expected, the classical field diverges (logarithmically) at the singularity, where it is infinitely heavy, but remains finite at the horizons, where it becomes massless. The quantum propagator in the radial direction is also computed, exhibiting rapid oscillations and a divergent absolute value at the singularity.

Integrability and null canonical gravity

Andreas Fuchs[1,2], **Michael Reisenberger**[1],
[1] Facultad de Ciencias, Universidad de la República, Montevideo, Uruguay [2] Institut fur Diskrete Mathematik und Geometrie, Technische Universitat Wien, Vienna, Austria

Constraint free initial data can be given for vacuum general relativity on a pair of intersecting null hypersurfaces. Moreover, the Poisson algebra of a set of such free null initial data has been found, but it has an unfamiliar structure making its quantization difficult. We note that this algebra is essentially a sum of an infinite number of copies of the Poisson algebras of cylindrically symmetric gravity. Using the fact that cylindrically symmetric gravity is integrable we find new free data with an algebra more amenable to quantization.

A new numerical approach to force-free electrodynamics

Federico Carrasco and Oscar Reula
IFEG-CONICET, FAMAF - Universidad Nacional de Córdoba, Argentina.

Force-Free Electrodynamics (FFE) describes a particular regime of magnetically dominated relativistic plasmas, which arises on several astrophysical scenarios of interest such as pulsars or active galactic nuclei. In this talk, I will present a new numerical implementation of FFE around a Kerr black hole, which reproduces most known results regarding jet formation and energy extraction by means of a truly stationary electromagnetic configuration. The novelty of our approach is three-folded: i) We use the "multi-block" technique [1] to represent a domain with S2xR+ topology within a stable numerical scheme. ii) We employ as evolution equations those arising from a covariant hyperbolization of the FFE system [3], which we have developed using the generalized symmetric hyperbolic formalism of Geroch [2]. iii) We implement stable and constraint-preserving boundary conditions, which represents an outer region given by a uniform magnetic field aligned/misaligned with the symmetry axis.

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Stability of thin-shell wormholes with charge in F(R) gravity

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Several theories that modify General Relativity have been proposed in order to avoid the use of exotic fluids for explaining the accelerated expansion of the Universe. One class of them corresponds to F(R) gravity theories, in which Einstein-Hilbert Lagrangian is replaced by a function F(R) of the curvature scalar R. To analyse the behaviour of the of thin layers of matter in these theories, it is possible to adopt the thin-shell formalism. Such formalism allows to match different solutions across a hypersurface and provides junction conditions which are an extension of those in General Relativity. Here we offer a brief review of the thin-shell formalism in F(R) gravity and via its implementation we construct traversable wormholes with a throat at the joining shell. We consider the particular case of spherically symmetric configurations with electromagnetic charge and analyse their stability under radial perturbations. We show that static solutions can be stable for suitable values of the parameters of the model.

Searching for electromagnetic counterparts of Gravitational Waves

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In this brief talk a general picture of the observations performed during the LIGO O1 campaign in the TOROS collaboration is presented.

A description of the results in the search for electromagnetic counterparts for the Gravitational Waves events detected during 2015 is included, as the future prospects for this observational project, in Córdoba and Salta, as well as using instruments in other parts of América.

Measuring the cosmological parameters angular distribution

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In this work we present the first measurement of the spatial distribution of the cosmological parameters performed with a joined analysis of the latest Cosmic Microwave Background (CMB) data from Planck and the supernova data of JLA. In order to treat all the data in an homogeneous way and to reduce the cpu-time involved in the parameters estimation, we developed a machine learning algorithm that was trained with simulated data and tested comparing with the results of the standard MCMC estimation.