PROGRAM IN BUCARAMANGA 23-25 NOVEMBER 2015

Place: Universidad Industrial de Santander – Auditorio Ágora

2nd floor Facultad de Ciencias Humanas

Time/Day	Monday 23 Nov	Tuesday 24 Nov	Wednesday 25 Nov
8:45-9:00	OPENING		
	Relativistic astrophysics /Solution of Einstein equations Applied in Astrophysics/ Classic and Quantum Gravity	***Supernova/Neutron Stars/Numerical Simulations in astrophysics/ Future Observational Projects in High-Energy Astrophysics in Latin America***	***AGN/Cosmology/Large Scale Structure/ Solution of Einstein Equations Applied in Astrophysics***
CHAIRMAN	*L. Nuñez*	*E. Montoya*	*F. Lora*
9:00-9:50	Herrera	Lora	Mirabel
9:50-10:40	González	Ruiz	Forero
10:40-11:10	COFFEE BREAK/POSTER SESSION		
11:10-12:00	Quiroga	Rueda	Rodríguez
12:00-12:40	Pachón		Sanabria
12:40-14:30	LUNCH BREAK/POSTER SESSION		
CHAIRMAN	*J. D. Sanabria*	*J. Rueda*	*M. Ruiz*
14:30-15:20	Restuccia	Forero	Gutiérrez
15:20-16:10	Montoya	Barres	Castañeda
16:10-16:30	COFFEE BREAK/POSTER SESSION		
16:30-17:20	Mayorga	Nuñez	Dubeibe
17:20-18:10			
BREAK			
19:00-20:00	Concierto Grupo Expresión Musical EMUIS	Public Conference Luis Herrera Cometta	

TITLES AND ABSTRACTS PER DAY

Monday (November 23)

Relativistic astrophysics /Solution of Einstein equations Applied in Astrophysics/ Classic and Quantum Gravity

- Luis Herrera Cometta (USAL-Salamanca, Spain; UCV-Caracas, Venezuela):

Title: Sources of gravitational radiation

Abstract:
The main purpose of this work is to establish the relationship between gravitational radiation and source properties. As an emblematic example of this relationship we recall that gravitational radiation is an irreversible process, accordingly there must exist an entropy production factor in the equation of state (dissipation) of the source. We review a recently proposed framework for studying axially symmetric dissipative fluids. Some general results are discussed at the most general level. We then proceed to analyze some particular cases, e.g. the shear-free case, the perfect fluid case under the geodesic condition, and a dissipative, geodesic fluid. We shall consider the quasi-static approximation, which consists in assuming that the system is evolving, but is always in equilibrium (the characteristic time scale is much larger than the hydrostatic time). We finally analyze the very early stages of the non-equilibrium, assuming that all characteristic times under consideration are smaller than the hydrostatic, the thermal adjustment and the thermal relaxation time scales. We conclude by bringing out the attention to some open issues.

- Guillermo González (UIS-Bucaramanga, Colombia):

Title: Stationary Axially Symmetric Relativistic Thin Discs with Nonzero Radial Pressure

Abstract:
A detailed analysis of the surface energy-momentum (SEMT) tensor of stationary axially symmetric relativistic thin discs with nonzero radial pressure is presented. The physical content of the SEMT is analyzed and expressions for the velocity vector, energy density, principal stresses and heat flow are obtained. We also present the Counterrotating Model (CRM) interpretation for these discs by considering the SEMT as the superposition of two counterrotating perfect fluids. We analyze the possibility of counter rotation along geodesics as well as counter rotation with equal and opposite tangential velocities and explicit expressions for the velocities are obtained in both of the cases. By assuming a given choice for the counterrtotating velocities, explicit expressions for the energy densities and pressures of the counterrotating fluids are then obtained. Some simple thin disc models obtained from the Kerr solution are also presented.

- Gonzalo Quiroga (UIS-Bucaramanga,Colombia):

Title: Center of Mass and spin for isolated sources of gravitational radiation

Abstract:
We define the center of mass and spin of an isolated system in General Relativity. The resulting relationships between these variables and the total linear and angular momentum of the gravitational system are remarkably similar to their Newtonian counterparts, though only variables at the null boundary of an asymptotically flat spacetime are used for their definition. We also derive equations of motion linking their time evolution to the emitted gravitational radiation. The results are then compared to other approaches. In particular one obtains unexpected similarities as well as some differences with results obtained in the Post Newtonian literature. These equations of motion should be useful when describing the radiation emitted by compact sources such as coalescing binaries capable of producing gravitational kicks, supernovas, or scattering of compact objects.

- Leonardo A. Pachón (UdeA-Medellín, Colombia):

Title: Dynamical Consequences of Frame Dragging around Astrophysical Objects

Abstract:

- Alvaro Restuccia Nuñez (Un. Antofagasta-Antofagasta, Chile):

Title: The space-time and the relativistic symmetry in General Relativity and Quantum Gravity

Abstract:
It is well known the great significance of Einstein achievement in obtaining a relativistic formulation of the gravitational interaction through a theory, General Relativity, describing the geometric evolution of spacetime in terms of a pseudo Riemannian manifold. The theory is intrinsically background independent. The Einstein's equations may be formulated in a Hamiltonian form by using the ADM formulation. We emphasize the geometrical structure of the constraints and the well posedness of the initial value problem of the Hamiltonian formulation of Einstein's equations. The initial data are the starting point to analyze the quantum formulation of General Relativity. It is well known the difficulties in obtaining a perturbative quantum formulation of it. However, there have been interesting developments on the perturbative quantization of the maximal supersymmetric extension of General Relativity in four dimensions: N=8 Supergravity, as well as advances on the non-perturbative quantization of M-theory and the role of supersymmetry on it. They provide non-perturbative aspects to the well-established perturbative quantization of Superstring theory. In this context, a new proposal to quantum gravity has been recently introduced. It is known as Horava - Lifshitz gravity. The idea is to abandon the relativistic symmetry at high energies with the hope to recover it at low energies. The approach allows the introduction of higher order derivative terms, compared to GR, as new interaction terms in the potential. There are a finite number of them compatible with the symmetry of the formulation. These terms improve the quantum behavior of the propagator at UV energies while reduces it to the relativistic propagator when the theory flows to IR energies. The theory becomes power counting renormalizable*. We will discuss the state of the art of this proposal and we will compare it to the already mentioned approaches to quantum gravity.*

- Edison Montoya (UIS-Bucaramanga, Colombia):

Title: Loop Quantum Cosmology: Effective dynamics

Abstract:
It is presented a brief overview of Loop Quantum Cosmology and its effective theory, which describes the full quantum dynamics of semiclassical states. This effective theory is studied from the numerical point of view. Solutions to the Bianchi A universes are shown in order to illustrate the resolution of the big bang singularity.

- Bernardo Mayorga (UIS-Bucaramanga, Colombia):

Title: Julio Garavito Armero and the reception of the new science in Colombia

Abstract:
Julio Garavito Armero was a Colombian engineer, as well as a self-taught astronomer and mathematician, in the late nineteenth and early twentieth centuries. He just had undergraduate studies at the Universidad Nacional de Colombia, in Bogotá, but his concerns and love of science led him to stand out significantly in all fields he got into. Garavito witnessed the most dramatic revolutions of the two last centuries in scientific thinking: on the one hand, the foundation of mathematics driven by the non-Euclidean geometry and set theory, and on the other the appearance of the theory of relativity in physics. Like many other scientists of his time, he was reluctant to accept new ideas. In his case, perhaps due to lack of direct contact with European centers of thought in which the new theories were being developed.

- 7 pm: Concierto Grupo Expresión Musical EMUIS

Tuesday (November 24)

Supernova/Neutron Stars/Numerical Simulations in astrophysics/ Future Observational Projects in High-Energy Astrophysics in Latin America

- Fabio Lora Clavijo (UIS-Bucaramanga, Colombia):

Title: A jungle of general relativistic numeric codes?

Abstract:
To describe astrophysics scenarios involving compact objects, Numerical Relativity has played an important role. In this talk, we focus on the different approaches to solve the GR equations as well as the different codes developed to evolve numerically systems like BHBH, BHNS and NSNS binaries.

- Milton Ruiz (UIS-Bucaramanga, Colombia):

Title: Numerical relativity: from vacuum to matter spacetimes

Abstract:
Numerical relativity has reached a stage of maturity that allows to study realistic astrophysical scenarios involving compact objects such as the inspiral and coalescence of binary black holes, binary black hole-neutron stars, binary neutron stars, etc. These studies are extremely important for our understanding of the physics of compact objects and, more generally, the physics of matter under extreme conditions. These systems are also prominent sources of both gravitational waves and electromagnetic signals. Combining the information from gravitational waves and the electromagnetic radiation ("multi-messenger astronomy") lets us fully understand the physics of compact objects. In this talk, I will summarize the current status and prospects of current research in numerical relativity. The talk will focus on multi-messenger sources of gravitational waves.

- Jorge A. Rueda H. (ICRANet-Rome, Italy):

Title: Neutron stars in relativistic astrophysics: the case of gamma-ray bursts and supernovae

Abstract:
I will give a review of the salient properties of the interior equation of state and structure of rotating neutron stars (NSs) as well as the consequent exterior spacetime properties. Then, I will discuss an application of the knowledge of the NS properties in an extreme astrophysical system: the energetic long-duration gamma-ray bursts (GRBs) associated with type Ic supernovae (SNe). For this I focus on the induced gravitational collapse (IGC) scenario that introduces a binary system as the progenitor of GRB-SNe: a carbon-oxygen (CO) core forming a compact binary with NS. The explosion of the CO core triggers a massive accretion process onto the NS bringing it to the critical mass value, inducing its gravitational collapse to a black hole with consequent emission of the GRB. I will show our most updated results from numerical simulations in full general relativity of the entire process from the SN explosion all the way up to the collapse of the NS.

- Yeinzon Rodríguez (UIS-Bucaramanga, Colombia):

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 the Ostrogradsky's instability, 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.

- Jaime Forero (Uniandes-Bogotá, Colombia):

Title:
Abstract:

- Ulisses Barres de Almeida (CBPF-Rio de Janeiro, Brazil):

Title: Astroparticle Physics in South America: CTA and the synergy with current and future facilties.

Abstract:
In this talk I will introduce the current scenario for astroparticle physics in South America, a field which is strongly developing in the continent. The talk will concentrate on a detailed presentation of the status of the Cherenkov Telescope Array (CTA) project, which is the main dedicated observatory in the field, to be installed in the Chilean Andes, near Paranal, and with installation of prototypes planned to start in 2017. A number of other astroparticle physics projects are either in activity or planned for the continent in the next decade, and I will discuss some of them and the potential synergies these could have with CTA. A background to the whole presentation is the potential network of faciltiies and collaborations in astroparticle physics which is building up in the continent and which should mature and further develop to respond to the great scientific potential present for the field in this special corner of the world.

- Luis A. Nuñez (UIS-Bucaramanga, Colombia):

Title: Launching Cosmogeophysics at Eastern Colombia

Abstract:
We present updated panorama of Astroparticle at Eastern Colombia describing several ongoing projects. Particularly we shall show recent advances in using astroparticle techniques to study volcanos in Colombia. We shall also present recent advances concerning Latin American Giant Observatory, LAGO-Collaboration.

- 7pm: Public Conference (General Audience):

Prof. Dr. Luis Herrera Cometta (Universidad de Salamanca, Spain; UCV-Caracas, Venezuela)

Título: RELATIVIDAD Y SENTIDO COMÚN

Resumen:
Se demuestra que los resultados que emergen tanto de la relatividad especial como de la relatividad general, no solo no contradicen el sentido común, sino que dichas teorías se obtienen a partir de una aplicación sistemática de dicho sentido.

Wednesday (November 25)

AGN/Cosmology/Large Scale Structure/ Solution of Einstein Equations Applied in Astrophysics

- Félix Mirabel (CEA Saclay Service d'Astrophysique-France, IAFE-U. Buenos Aires, Argentina):

Title: Black holes in the Universe in the last decades

Abstract:
It was obtained observational evidences on the existence of black holes, of stellar mass as well as with masses equivalent to millions, even billion solar masses. These astrophysical black holes are sources of phenomena of very high energies in the universe, and constitute unique laboratories to confront with observations the theories at the frontier of physics. I shall show that, besides being objects of interest for physics, black holes of various sizes played an important role in the evolution of the cosmos, and in the formation and the evolution of the galaxies, since the “Dark Ages” of the Universe more than 13 billion years ago, until our days.

- Jaime Forero (Uniandes-Bogotá, Colombia):

Title: The Cosmic Web as a Cosmological Probe

Abstract:
I will review recent advances in the techniques to observe and simulate the large scale structure of the Universe as traced by galaxies in large spectroscopic surveys. In this context I will show how the redshift dependence of the Alcock-Paczynski test can be used to measure the expansion history of the Universe. I will close by summarizing future observational prospects to measure cosmological parameters in the high redshift Universe, focusing on the Dark Energy Spectroscopic Instrument (DESI), a new spectroscopic survey planned to start in 2018.

- José David Sanabria Gómez (UIS-Bucarmanga, Colombia):

Title: Stationary black diholes

Abstract:
We present a stationary black diholes solution representing two counter-rotating Kerr-Newman black holes endowed with opposite electric charges, constructed on the basis of one of the Ernst-Manko-Ruiz equatorially antisymmetric solutions of the Einstein-Maxwell equations. We also demonstrate that each dihole constituent satisfy identically the well-known Smarr’s mass formula.

- Framsol López Súspes (USTA-Bucarmanga, Colombia):

Title:
Abstract:

- Antonio C. Gutiérrez (UTB-Cartagena, Colombia; UNAM-México DF, México):

Title: The physics of relativistic disks, an up-to-date report

Abstract:
We present the current status of what is known about the thin disks model in general relativity, discuss some novel perceptions and present some future prospects. We discuss a relativistic model describing a thin disk surrounded by a halo in the presence of a non-trivial electromagnetic field. We interpret the model in two ways. First, the physical properties of the halo and disk are described by the distributional energy-momentum tensor of a general fluid in canonical form. Second, the variational multifluid thermodynamics formalism is used, allowing us to determine all the thermodynamic variables associated with the matter content of the disk. Both of the interpretations are not contradictories. However, the asymptotic behavior of the relevant physical quantities indicates that the dynamics encoded in the multifluid scenario gives a richer physical content to the solution.

- Leonardo Castañeda (UNAL-OAN-Bogotá, Colombia):

Title: Cosmological Perturbation Theory and Precision Cosmology

Abstract:
Modern cosmology has been one of the branches where the General Theory of Relativity (GR) has found a deep development on both theoretical and observational level. Cosmology has passed in a few decades to become one of the most precise science and and it is a favorable scenario, perhaps the only today, to be the real laboratory not only for theories of gravitation, but for various areas of physics, such as the case of particle physics, astrophysics and many others. During this talk some results from the Gravitation and Cosmology Group of the Observatorio Astronomico concerning to the relativistic cosmological perturbation theory at second-order and its consequences are discussed. A new proposal for the evolution of cosmic magnetic fields synthesized in a cosmic dynamo equation at second order, is shown. Some observable effects of such magnetic fields in the power spectrum of cosmic background (CMB) are explicitly computed. Also, results of the cosmological perturbation theory in modified theories of gravity (in particular f (R) gravity) are addressed.

- Fredy Dubeibe (U. Los Llanos-Villavicencio, Colombia):

Title: Geodesic chaos in general relativity

Abstract:
In this talk, I will present some tools for the determination and analysis of the dynamics of time-like geodesics in General Relativity. With special emphasis, the Poincaré section method, Lyapunov exponents and its applicability in this context are discussed. Finally, an overview of recent results and the possible consequences of the regular (or chaotic) behavior of the orbits in the detection of gravitational waves are presented.

POSTER CONTRIBUTIONS

- Jorge García-Farieta (UdeA-Medellín, Colombia):

Title: Effect of observational holes in the multifractal characterization of the galactic clustering using SDSS mask

Abstract:
Some observational estimates suggest that the universe behaves as a multifractal object where the galaxy clustering is based on the generalization of the dimension of metric space. We study from this point of view, the spatial distribution of matter, a large scale in the universe with galaxy catalogs and using masks Sloan Digital Sky Survey of Galactic redshift (SDSS) including observational holes, particularly samples DR7, DR10 and DR11. Homogeneous catalogs were built with a radial selection function by a uniform distribution and "shuffle" method for a main sample of 486078 galaxies limited in redshift $0.002<z<0.2$. Additionally we build a random distribution of observational holes in right ascension and declination in the footprint of SDSS-BOSS that containing all points of the aforementioned masks sampling. Using the sliding window technique was determined the fractal dimension and lacunarity spectrum to characterize the hierarchical clustering in these catalogs as well as its dependence on the radial distance. Preliminary results show that the clustering of galaxies exhibits behavior that depends on the radial distance, with a transition to homogeneity below 180 Mpc/h.

- Sindy Rocío Mojica Gómez (University of Oldenburg, Germany):

Title: Neutron Stars Universal Relations in Einstein-Gauss-Bonnet-dilaton

Abstract:
Motivated by string theory, we studied neutron stars in Einstein Gauss Bonnet dilaton theory (EGBD). Neutron stars are considered laboratories to test general relativity and theories beyond. We calculated observables such that: mass, angular momentum, moment of inertia and quadrupole moment for rapidly rotating neutron stars in EGBD gravity. We are also interested in obtain quasinormal modes for neutron stars by using realistic equations of state. In order to determine the dependence on neutron stars matter constituents and the coupling parameter from the EGBD approximation, we have proven that universal relations for neutron stars may exist in EGBD theory, when the angular momentum is fixed and the moment of inertia and quadrupole moment are scaled.

- Maria José Guzmán Monsalve (Instituto de Astronomía y Física del Espacio, Universidad de Buenos Aires, Argentina):

Title: Teleparallelism: a different insight of gravity

Abstract:
Teleparallel gravity, a gauge theory for the translation group, turns up to be fully equivalent to general relativity. Due to this equivalence, it provides a whole new insight into gravitation. It breaks several paradigms related to the geometric approach of general relativity, and introduces new concepts in the description of the gravitational interaction. The action that describes this theory depends on the torsion scalar T, which differs from the Ricci scalar by a surface term. This scalar is made up of the Weitzenböck connection, which depends only in the only dynamical field in the theory: the tetrad field. In this work we will review the internal consistency of the theory through the Hamiltonian formalism, and we will present an extension of this theory: modified teleparallel gravity (best known as f(T) gravity), and its main accomplishments in cosmology, together with black hole solutions.

- Andrés Felipe Vargas Sánchez (Universidad de Los Andes-Bogotá, Colombia):

Title: Charged Regular Black Hole and its Maximal Extension (PART I)

Abstract:
In this work a simple static, spherically symmetric regular black hole solution satisfying the weak energy condition is obtained within non-linear electrodynamics theory. We show that for most cases there exists a unique event horizon which is located almost at the Schwarzschild radius. Asymptotically we recover the Reissner-Nordstrom solution and in the limit case when q=0 the black hole is reduced to the Schwarzschild one. We then construct the maximal or Kruskal extension and study the dynamics of the Einstein-Rosen bridge generated. Finally, a family of black hole solutions which remain to be studied are presented.

- Nicolás Morales-Durán (Universidad de Los Andes-Bogotá, Colombia):

Title: Charged Regular Black Hole and its Maximal Extension (PART II)

Abstract:
In this work a simple static, spherically symmetric regular black hole solution satisfying the weak energy condition is obtained within non-linear electrodynamics theory. We show that for most cases there exists a unique event horizon which is located almost at the Schwarzschild radius. Asymptotically we recover the Reissner-Nordstrom solution and in the limit case when q=0 the black hole is reduced to the Schwarzschild one. We then construct the maximal or Kruskal extension and study the dynamics of the Einstein-Rosen bridge generated. Finally, a family of black hole solutions which remain to be studied are presented.

- Camilo Delgado-Correal (Università di Ferrara, Italia):

Title: Identification of low luminosity high redshift galaxies by using galaxy clusters as cosmic telescopes

Abstract:
Current models of structure formation suggest that the first galaxies formed at z >~ 10 when the universe was < 500 Myr old, so the detection and characterization of galaxies at these early epochs is critical to estimate the star rate formation rate density and their contribution to the reionization. The CLASH project (Cluster Lensing And Supernova survey with Hubble) combines an HST Treasury program to obtain panchromatic (ACS+WFC3) imaging of 25 carefully selected massive clusters, with other multi-wavelength observations, including a large spectroscopic campaign with VLT/VIMOS. Gravitational lensing, which is particularly powerful in several CLASH clusters, improve the efficiency of finding low-luminosity (i.e. L < L*) galaxies, which are thought to play a critical role in reionizing the Universe at z~10. In this talk we will give some high-lights of the CLASH-VLT project and show the sample of ~200 magnified lensed galaxies at 3 < z <7, whose photometric and spectroscopic data can be used to characterize the physical properties of the low-luminosity population at high-z, thus complementing field studies at L > ~L*.

- Diego Felipe Muñoz Arboleda (UNAL-Bogotá, Colombia):

Title: Brick Wall Model in the ThFD Formalism

Abstract:
A detailed review of t'Hooft brick wall model is made in order to understand the Bekenstein-Hawking entropy as a thermal entropy due to quantum fields existing in the neighborhood of the event horizon of a black hole. The ground state is correctly identified (Boulware state) from the original model to eliminate the existing divergences. Finally, using the ThFD (Thermo Field Dynamics) formalism an extended brick wall model is made.

- Jesús Rodríguez Sandoval (Universidad de Los Andes-Mérida, Venezuela):

Title: Effective Equations of the Quantum FRW Flat Universe in the Radiation Dominated Era

Abstract:
We compute effective equations of the quantum FRW flat universe in the radiation dominated era at order $\hbar$, described in terms of Ashtekar variables employing methods provided by the geometrical formulation of quantum mechanics. Additional terms of quantum nature correct the classical equations of motion. As a consequence, the initial singularity of the classical model is removed and a Big Bouncing scenario takes its place. We also obtain an expression for the effective action of the model.

- Andrei Jaimes Motta (UIS-Bucaramanga, Colombia):

Title: Particle flow simulation, with geomagnetic correction, reaching Bucaramanga (956 m a.s.l.)

Abstract:
Under the project LAGO (Latin American Giant Observatory),it was born in the Guane + observatory it consist of three kind of detectors WCD (Water Cherenkov Detector), the WCD has a cylindrical geometry of diameter 1.20 m, they are distributed in an isosceles triangle of side 200 m. In order to know the flow of particles from cosmic rays reaching the city of Bucaramanga a day(24 hours), the simulation was carried out of the rain of secondary generated in the atmosphere by primary group, among which are protons, photons, particles collider type, iron nuclei and helium. The following calculation was made by means Corsika software (Cosmic Ray Simulations for Kascade), taking into account parameters such as the zenith angle of incidence of the particles in the atmosphere which is between 0 and 90 degrees, the range of energies that have (5 Gev to 1,000,000 Gev), cutting rigidity (5 Gv), the atmospheric model E1 corresponding to tropical areas, height

above sea level (95900 cm), the horizontal and vertical component of the geomagnetic field (27.23 mT and 16.89 mT) respectively. In addition to the data obtained were made a geomagnetic correction with the help of MAGCOS software (Magnetocosmics), which allows knowing the path of charged particles that reach the Earth's magnetic field, taking into account parameters such as geographical location and the altitude above sea level. The simulation was carried out in order to calibrate the Guane+ observatory located at Universidad Industrial de Santander (UIS).

- Sergio Andrés Torres Suárez (UNAL-Bogotá, Colombia):

Title: T.B.D.
Abstract: T.B.D.

- Carlos Sierra (UIS-Bucarmanga, Colombia):

Title: MOMENT TRANSPORT EQUATIONS AND ITS APPLICATION TO THE PERTURBED UNIVERSE

Abstract:
The objective of this contribution is to review an standardization procedure that allows us to calculate the parameter f_{NL}, related to a cosmological model, using the moment transport equations and some adequate gauge transformations. The motivation of this study relies on the dificulty at obtaining the non-gaussianity parameters of cosmological models by means of the δN formalism, because there does not exist a stardard analytic procedure to obtain the derivatives of the amount of expansion or number of e-folds N. To overtake this difficulty, the use of the moment transport equations is proposed so that the difficulty at obtaining the N derivatives is trade by a direct and standardized way of calculating the evolution of the correlators of the field perturbations.