Staff, Visiting Scientists and Graduate Students at the Pescara Center

December 2012

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ICRANet Faculty Staff

Belinski Vladimir	ICRANet
Bianco Carlo Luciano	University of Rome "Sapienza" and ICRANet
Einasto Jaan	Tartu Observatory, Estonia
Novello Mario	<i>Cesare Lattes-ICRANet Chair</i> CBPF, Rio de Janeiro, Brasil
Rueda Jorge A.	University of Rome "Sapienza" and ICRANet
Ruffini Remo	University of Rome "Sapienza" and ICRANet
Vereshchagin Gregory	ICRANet
Xue She-Sheng	ICRANet

Adjunct Professors Of The Faculty

Aharonian Felix Albert	<i>Benjamin Jegischewitsch Markarjan Chair</i> Dublin Institute for Advanced Studies, Dublin, Ireland Max-Planck-Institut für Kernphysis, Heidelberg, Germany
Amati Lorenzo	Istituto di Astrofisica Spaziale e Fisica Cosmica, Italy
Arnett David	Subramanyan Chandrasektar- ICRANet Chair University of Arizona, Tucson, USA
Chakrabarti Sandip P.	Centre for Space Physics, India
Chardonnet Pascal	Université de la Savoie, France
Chechetkin Valeri	<i>Mstislav Vsevolodich Keldysh-ICRANet Chair</i> Keldysh institute for Applied Mathematics Moscow, Russia
Damour Thibault	<i>Joseph-Louis Lagrange- ICRANet Chair</i> IHES, Bures sur Yvette, France
Della Valle Massimo	Osservatorio di CapodiMonte, Italy
Everitt Francis	William Fairbank-ICRANet Chair Stanford University, USA
Frontera Filippo	University of Ferrara, Italy
Jantzen Robert	AbrahamTaub-ICRANet Chair Villanova University USA
Khalatnikov Markovich Isaak	<i>Lev Davidovich Landau–ICRANet Chair</i> Landau Institute for Theoretical Physics, Russia
Kerr Roy	Yevgeny Mikhajlovic Lifshitz-ICRANet Chair University of Canterbury, New Zealand
Kleinert Hagen	<i>Richard Feynmann-ICRANet Chair</i> Freie Universität Berlin
Lee Hyung Won	Yong Duk Kim-ICRANet Chair School of Computer Aided Science, Inje, Korea
Madey John	<i>William Fairbank-ICRANet Chair</i> University of Hawaii
Misner Charles	John Archibald Wheeler-ICRANet Chair University of Maryland
Nicolai Hermann	Albert Einstein Institute – Potsdam, Germany
Pelster Axel	Institute for Advanced Study, Germany 6

Pian Elena	INAF and Osservatorio Astronomico di Trieste
Piran Tsvi	Y <i>uval Neeman-ICRAnet Chair</i> The Hebrew University - Jerusalem
Popov Vladimir	ITEP, Russia
Punsly Brian Matthew	Mathew California University, Los Angeles USA
Quevedo Hernando	Institute of Nuclear Science, UNAM
Rafelski Johann	University of Arizona, USA
Rosati Piero	European Southern Observatory, Germany
Rosquist Kjell	Karl Gustav Jacobi-ICRANet Chair Stockholm University, Sweden
t Hooft Gerard	(<i>Nobel Laureate</i>) Institut for Theoretical Physics Utrecht Universiteit, Holland
Titarchuk Lev	US Naval Laboratory, USA

Lecturers

Aksenov Alexey	Institute for Theoretical and Experimental Physics
Alekseev Georgy	Steklov Mathematical Institute-Russian Academy of Sciences
Bini Donato	CNR and ICRANet, Italy
Boccaletti Dino	ICRANet and Università di Roma "Sapienza"
Chen Pisin	National Taiwan University
Chieffi Alessandro	INAF, Rome, Italy
Coullet Pierre	Université de Nice - Sophia Antipolis, France
Di Castro Carlo	Università di Roma "Sapienza", Italy
Filippi Simonetta	ICRANet and Campus Biomedico, Italy
Jing Yi-Peng	Shangai Astronomy Observatory
Lee Chul Hoon	Hanyang University, Korea
Kim Sang Pyo	Kunsan National University, Korea
Kim Sung-Won	Institute of Theoretical Physics for Asia-Pacific, Korea
Lee Hyun Kyu	Department of Physics, Hanyang University,
Limongi Marco	INAF, Rome, Italy
Lou You Qing	Tsinghua University, Beijing
Malheiro Manuel	ITA, Brazil
Mester John	Stanford University, USA
Mignard François	Observatoire de la Côte d'Azur, Nice, France
Ohanian Hans	Rensselaer Polytechnic Institute, New York, USA
Pacheco José	Observatoire de la Côte d'Azur, Nice, France
Perez Bergliaffa Santiago	Univesidade do Estado de Rio de Janeiro, Brasil
Pucacco Giuseppe	Università di Tor Vergata Roma
Sepulveda Alonso	University of Antioquia, Colombia
Song Doo Jong	National Institute of Astronomy, Korea
Starobinsky Alexei	Landau Institute for Theoretical Physics, Russia

Vissani Francesco

Gran Sasso National Laboratories, Italy University of Canterbury, New Zealand

Wiltshire David

Research Scientists

Bernardini Maria Grazia	ICRANet and Università di Roma "Sapienza", Italy
Cherubini Christian	Campus Biomedico, Rome, Italy
Geralico Andrea	ICRANet and Università di Roma "Sapienza", Italy
Izzo Luca	ICRANet and Università di Roma "Sapienza", Italy
Lattanzi Massimiliano	University of Oxford and ICRANet
Patricelli Barbara	ICRANet and Università di Roma "Sapienza", Italy
Rotondo Michael	ICRANet and Università di Roma "Sapienza", Italy

Visiting Scientists

Abishev Medeu	Al-Farabi Kazakh National University, Kazakhstan
Bittencourt Eduardo	CBPF, Brasil
Corvino Giovanni	University of Rome La Sapienza, Italy
Gell-Mann Murray	Sante Fe Institute, USA
Kim Hyuong Yee	INJE, South Korea
Mohammadi Rohollah	Isfahan University of Technology, Pakistan
Mosquera Cuesta Herman	CBPF, Brasil
Perez Martinez Aurora	Instituto de Cibernetica Matematica Y Fisica, Cuba
Piechocki Wlodzimierz	Institute for Nuclear Studies, Poland
Qadir Asgar	National University Of Sciences And Technology, Pakistan
Raffaelli Bernard	Université de Corse, France
Romero Gustavo E.	Instituto Argentino de Radioastronomia IAR-CONICET, Argentina
Van Putten Maurice	Korean Institute for Advanced Study, South Korea

International Relativistic Astrophysics Ph. D.

First Cucle	2002-05
Peirani Sebastien	France
Second Cucle	2003-06
Bernardini Maria Grazia	Italv
Mattei Alvise	Italy
Mercuri Simone	Italy
	5
Third Cycle	2004-07
Chiappinelli Anna	France
Cianfrani Francesco	Italy
Guida Roberto	Italy
Rotondo Michael	Italy
Yegoryan Gegham	Armenia
Fourth Cuelo	2005-08
Pottisti Marsa Valeria	Z005-00
Dainotti Maria Ciouanna	Italy
Vhashatman Hamituun	Armonia
Logian Orchidae Maria	Armenia
Pizzi Marco	Italy
Pizzi Marco	Italy
rompi Francesca	Italy
Fifth Cycle	2006-09
Caito Letizia	Italy
De Barros Gustavo	Brasil
Minazzoli Olivier	Switzerland
Patricelli Barbara	Italy
Rangel Lemos Luis Juracy	Brazil
Rueda Hernandez Jorge Armando	Colombia
Sixth Cucle	2007-2010
Ferroni Valerio	Italy
	Italy
Kanaan Chadia	Lebanon
Pugliese Daniela	Italy
Sigismondi Costantino	Italy
0	j.
Seventh Cycle	2008-2011
Belvedere Riccardo	Italy
Ceccobello Chiara	Italy
Ferrara Walter	Italy
Han Wen-Biao	China
Luongo Orlando	Italy
Pandolfi Stefania	Italy

Eighth Cycle	2009-2012
Boshkayev Kuantay	Kazakhstan
Bravetti Alessandro	Italy
Ejlli Damian	Albania
Haney Maria	Germany
Lombardi Caterina Antonietta	Italy
Menegoni Eloisa	Italy
Sahakyan Narek	Armenia
Sahini Sahil	India
Ninth Cycle	2010-2013
Arguelles Carlos	Argentina
Benetti Micol	Italy
Muccino Marco	Italy
Tenth Cucle	2011-2014
Cáceres Uribe, Diego Leonardo	Colombia
Wang Yu	China
Eleventh Cycle	2012-2015
Barbarino Cristina	Italv
Cipolletta, Federico	Italy
Dichiara, Simone	Italy

IRAP Ph. D. Erasmus Mundus Students

First Cycle	2010-2013
Baranov Andrey	Russia
Benedetti Alberto	Italy
Dutta Parikshit	India
Fleig Philipp	German
Machado De Oliveira Fraga Bernardo	Brazil
Gruber Christine	Austria
Liccardo Vincenzo	Italy
Martins De Carvalho Sheyse	Brazil
Penacchioni Ana Virginia	Argentina
Valsan Vineeth	India
Second Cycle	2011-2014
Begue Damien	France
Dereli Husne	Turkey
Gregoris Daniele	Italy
Iyyani, Shabnam Syamsunder	India
Pereira, Jonas Pedro	Brazil
Pisani Giovanni	Italy
Rakshit Suvendu	India
Sversut Arsioli Bruno	Brazil
	DIazii
Wu Yuanbin	China

Third Cycle Bardho, Onelda Enderli, Maxime Filina, Anastasia Galstyan, Irina Gomes De Oliveira, Fernanda Khorrami, Zeinab Ludwig, Hendrik Sawant, Disha Strobel, Eckhard 2012-2015 Albania France Russia Armenia Brazil Iran Germany India Germany

Administrative and Secretarial Staff

ICRANet - Pescara

Adamo Cristina	Administrative Office
Del Beato Annapia	Documentation Office
Di Berardino Federica	Head of the Secretarial Office
Latorre Silvia	Administrative Office
Regi Massimo	System Manager (till September 2012)
ICRANet – Nice	
Barbaro Pina	
ICRANet Br – Rio de Janeiro	
London Luzia	

ICRANet Faculty Staff

Belinski Vladimir

Position: ICRANet, Faculty Member Period covered: December 2011-December 2012



I. Scientific Work

1. Exact solutions in General Relativity. 1. The explicit analytical resolution of the problem of a physical equilibrium state for two charged rotating masses in General Relativity have been achieved and the final results have been published in papers (Ref.1, Ref.2) where it was constructed the exact analytic solution of the Einstein-Maxwell equations for two charged rotating sources separated by the well defined positive distance and free of struts or of any other pathologies.

2. It was found the new and more solid way (with respect to our past investigations) of derivation of the Kerr solution by adding to the Schwarzchild black hole a solitonic whirl. The main problem here were to integrate the Lax pair equations for the Schwarzchild background in order to find the background spectral matrix. The corresponding calculations were performed (this was the main technical achievement) and with this approach we can have a new interpretation of the distribution of energy of the Kerr black hole between its rotational and rest parts (Ref.3).

3. Cosmology. The work on the book "Cosmological Singularity" has been continued. The project is in progress and an official agreement with Cambridge University Press will be accomplished soon (Ref.4).

4. Quantum Fields. The previous work (V.Belinski, 2009) on the problem of particle creation by the physical Schwarzschild black hole created by the collapse have been elaborated and supplemented by the exact analysis of what is going on in case of the eternal black hole. It was shown that also for such case there are no way for appearing of any particle creation phenomenon (Ref.5).

2012 List of Publications

[1]. G.Alekseev and V.Belinski "Equilibrium of two charged rotating sources in General Relativity", arXiv:1211.3964 [gr-qc] (2012).

[2] G. Alekseev and V. Belinski "Soliton Nature of Equilibrium State of Two Charged Masses in General Relativity", IMJP, **12**, 10 (2012).

[3]. V. Belinski and H. W. Lee "Kerr rotation as solitonic vortex around the static black hole", Proceedings of M.Novello's 70th anniversary symposium, Editora Livraria da Física, ISBN 978-7861-164-4 (2012).

[4]. V. Belinski "Gravitational Solitons", manuscript, available through the Editorial Management (Physical Sciences) of Cambridge University Press (2012).

[5]. V.Belinski "On tunneling through the black hole horizon", arXiv:0910.3934v2, 15 June 2012.

Conferences and educational activity

Conferences. The Thirteenth Marcel Grossmann Meeting (MG13), Stockholm University, Sweden, July, 2012.

Educational activity. V.Belinski "Application of the Inverse Scattering Method to the General Relativity" the course of 4 lectures for Erazmus Mundus Joint Doctorate Program, Nice University "Sophia Antipolis", Nice, 4-7 September, 2012.

Rueda Hernández Jorge Armando

Position: Assistant Professor at ICRANet Period covered: 2012

I Scientific Work



- Nuclear and Atomic Astrophysics: We study the nuclear and atomic physics needed to describe the interior of compact stars as white dwarfs and neutron stars. We focus on the properties of nuclear matter under extreme conditions of density and pressure found in these objects. The equation of state of the matter in compact star interiors is studied in detail taking into account all the interactions between the constituents within a full relativistic framework.
- White Dwarf and Neutron Star Physics and Astrophysics: The aim is to construct a self-consistent theory of self-gravitating systems obeying relativistic quantum statistics, electromagnetic, weak and strong interactions within the framework of general relativity. Particular attention is given to the study of the effects of the electromagnetic interactions coupled to gravity, which lead for instance to macroscopic gravito-polarization in neutron stars. In the case of white dwarfs, we study the macroscopic influence of the microphysical charge screening between the nuclei lattice and the electronic fluid. The structure properties e.g. the mass-radius relations of both white dwarfs and neutron stars are studied within the above framework. The effects of rotation as well as of high-temperatures on the structure of white dwarfs and neutron stars are also investigated.
- Emission-Radiation Mechanisms of White Dwarfs and Neutron Stars: The magnetospheres of magnetized white dwarfs and neutron stars are studied in detail. Both energetics and spectrum of different radiation mechanisms operating in the magnetosphere of compact objects are analyzed and applied to the observations of white dwarfs and neutron star pulsars, soft gamma ray repeaters, anomalous X ray pulsars, and other similar systems.
- Critical Fields in Neutron Stars and Black Holes: We study the conditions under which critical electromagnetic fields can develop in neutron stars. The subsequent evolution of the electromagnetic fields during the gravitational collapse of a neutron star to a black hole is also investigated and applied to the physics of extreme astrophysical phenomena like Gamma-Ray-Bursts. The general properties of electrovacuum spacetimes e.g. the Kerr-Newman one are also studied from the theoretical point of view. In particular, the physics and astrophysics related to the dyadosphere of the Reissner-Nordstrom black hole and the dyadotorus of the Kerr-Newman black hole are addressed.
- Critical fields and Non Linear Electrodynamics Effects in Neutron Stars and Black Holes: The effects of non-linear electrodynamics minimally coupled to gravity are investigated. New analytic and numeric solutions to the Einstein-Maxwell equations representing black holes or the exterior field of a compact star are obtained and analyzed. Some astrophysical applications are studied in detail e.g. the magnetosphere of a neutron star or the extractable energy of black holes and its role in the emission of Gamma Ray Bursts.
- Exact Electrovacuum Solutions of the Einstein-Maxwell equations in Astrophysics: We analyze the ability of analytic exact solutions of the Einstein-Maxwell equations to describe the exterior spacetime of compact stars like white dwarfs and neutron stars. The problem of matching between interior and exterior spacetimes is addressed in detail. The effect of the quadrupole moment on the properties of the spacetime is also investigated. Particular attention is given to the application of

exact solutions in astrophysics, e.g. the dynamics of particles around compact stars and its relevance in astrophysical systems like X ray binaries.

• Physics and Astrophysics of Gamma Ray Bursts: The progenitors and emission mechanisms leading to the most energetic radiation observed in astrophysics, the Gamma Ray Bursts (GRBs), are studied. Focus is given to the termed GRB-Supernova connection and to Short GRBs. The binary progenitors of these systems are studied in detail with particular emphasis on the role played by neutron stars.

II Conferences and educational activities

II a. Conferences and Other External Scientific Work

- 3rd Colombian Meeting of Astronomy and Astrophysics, November 5-9, 2012 Bucaramanga (Colombia).
- IRAP Ph. D. Erasmus Mundus School, September 3-21, 2012 Nice (France).
- 39th COSPAR Scientific Assembly, July 14-22, 2012 Mysore (India).
- 13th Marcel Grossmann Meeting, July 1-7, 2012 Stockholm (Sweden).

II b. Work With Students

- With Riccardo Belvedere (IRAP Ph. D student 3rd year): We construct neutron star equilibrium configurations by integrating numerically the set of self-consistent ground-state equilibrium equations for neutron taking into account quantum statistics, electromagnetic, weak, and strong interactions, within the framework of general relativity. The mass-radius of neutron stars is obtained for selected parameterizations of the nuclear model. Uniformly rotating neutron stars are also constructed. The stability limits of rotating configurations are investigated: the boundaries of mass-shedding and secular axisymmetric instabilities are obtained. Explicit comparisons of globally and locally neutral neutron stars are made.
- With Kuantay Boshkayev (IRAP Ph. D student 3rd year): We study the equilibrium configurations of uniformly rotating white dwarfs and neutron stars within the Hartle formalism. Particular attention is given to the rotation instabilities of rapidly rotating stars e.g. mass-shedding and axisymmetric (secular) instabilities.
- With Sheyse Martins de Carvalho (Erasmus Mundus Ph. D student 3nd year): We study the influence of the temperature on the properties of white dwarfs and neutron stars. The extension of the relativistic Feynman-Metropolis-Teller equation of state to the case of finite temperatures is studied. The results are applied to both white dwarfs and neutron stars. The effect of high-temperatures relevant to newly born neutron stars and to neo-neutron stars is also investigated. We study as well the effects of the temperature on the structure and on the gravito-polarization effects studied in the degenerate approximation of neutron stars.
- With Jonas Pedro Pereira (Erasmus Mundus Ph. D student 2nd year): The effects of non-linear electrodynamics minimally coupled to gravity are investigated. New analytic and numeric solutions to the Einstein-Maxwell equations representing black holes or the exterior field of a compact star are obtained and analyzed. Some astrophysical applications are studied in detail e.g. the magnetosphere of a neutron star or the extractable energy of black holes and its role in the emission of Gamma Ray Bursts. The equations of motion of particles in these spacetimes are also investigated.
- With Yuanbin Wu (Erasmus Mundus Ph. D student 2nd year): As a consequence of global neutrality, the core-crust interface of neutron stars develops a very strong electric field thousands of times the critical field for vacuum polarization. The equilibrium conditions of such an interface boundary are investigated, the relation between surface and Coulomb energy, as well as the generalization of the Bohr-Wheeler equilibrium condition of the nucleus for macroscopic giant nucleus as a neutron star is, are investigated.
- With Diego Leonardo Cáceres Uribe (IRAP Ph. D. Student 2nd year): The magnetospheres of magnetized white dwarfs and neutron stars are investigated. The luminosity and spectrum of different radiation mechanisms operating in the magnetosphere of compact objects are analyzed and applied to the observations of white dwarfs and neutron star pulsars, soft gamma ray repeaters, anomalous X ray pulsars, and other similar systems.

II c. Diploma thesis supervision

- Riccardo Belvedere (IRAP Ph. D student 3rd year): Ph. D Thesis: "On non-rotating and rotating neutron stars with strong, weak, electromagnetic, and gravitational interactions"
- Kuantay Boshkayev (IRAP Ph. D student 3rd year): Ph. D Thesis: "On rotating white dwarfs and neutron stars"
- Sheyse Martins de Carvalho (Erasmus Mundus Ph. D student 3rd year): Ph. D Thesis: "On finite temperature effects in white dwarfs and neutron stars"
- Jonas Pedro Pereira (Erasmus Mundus Ph. D student 2nd-year): Ph. D Thesis: "Non-linear electrodynamics minimally coupled to general relativity"
- Yuanbin Wang (Erasmus Mundus Ph. D student 2nd -year): Ph. D Thesis: "On the surface and Coulomb energy of neutron stars"
- Diego Leonardo Cáceres Uribe (IRAP Ph. D student 2nd -year): Ph. D Thesis: "Radiation mechanisms of white dwarf and neutron star pulsars"

2012 List of Publications

a. Refereed Journals

- R. Belvedere, K. Boshkayev, Jorge A. Rueda, R. Ruffini, On globally neutral uniformly rotating neutron stars, to be submitted.
- Jorge A. Rueda, G. Aznar-Siguán, K. Boshkayev, E. García-Berro, L. Izzo, P. Lorén-Aguilar, R. Ruffini, White Dwarf Binaries as the Progenitors of SGRs and AXPs: the case of 4U 0142+61, to be submitted.
- K. Boshkayev, L. Izzo, Jorge A. Rueda, R. Ruffini, SGR 0418+5729 and Swift J1822.3-1606 as massive fast rotating highly magnetic white dwarfs, to be submitted.
- J. Pereira, H. Mosquera-Cuesta, Jorge A. Rueda, R. Ruffini, The mass-formula of black holes in general relativity minimally coupled to non-linear electrodynamics, to be submitted.
- R. Mohammadi, Jorge A. Rueda, R. Ruffini, S-S. Xue, The relativistic Thomas-Fermi equation in presence of strong magnetic fields, to be submitted.
- S. Martins de Carvalho, Jorge A. Rueda, R. Ruffini, The relativistic Feynman-Metropolis-Teller equation of state at finite temperatures, to be submitted.
- S. Martins de Carvalho, Jorge A. Rueda, R. Ruffini, On the mass-radius relation of general relativistic white dwarfs at finite temperatures, to be submitted.
- Jorge A. Rueda, R. Ruffini, Gravitational waves versus electromagnetic emission in Gamma-Ray Burst, to be submitted; arXiv:1205.6915.
- K. Boskhkayev, Jorge A. Rueda, R. Ruffini, I. Siutsou, On general relativistic uniformly rotating white dwarfs, Astroph. J. (2012), in press; arXiv:1204.2070.
- Jorge A. Rueda, R. Ruffini, On the general relativistic Thomas-Fermi theory of white dwarfs and neutron stars, Il Nuovo Cimento C (2012); in press.
- Jorge A. Rueda, R. Ruffini, On the Einstein-Maxwell-Thomas-Fermi equations for white dwarfs and neutron stars, Int. J. Mod. Phys. D (2012); in press.

- Jorge A. Rueda, R. Ruffini, From nuclei to white dwarfs to neutron stars, Int. J. Mod. Phys. D (2012); in press.
- Jorge A. Rueda, R. Ruffini, Fundamental interactions in neutron stars, Int. J. Mod. Phys. D (2012), in press.
- L. Izzo, Jorge A. Rueda, R. Ruffini, GRB 090618: A Candidate of a Neutron Star Gravitational Collapse to a Black Hole Induced by a Type Ib/c Supernova, A&A Lett. (2012), in press.
- Jorge A. Rueda, R. Ruffini, On the Induced Gravitational Collapse of a Neutron Star to a Black Hole by a Type Ib/c Supernova, ApJ 758, L7 (2012).
- L. A. Pachón, Jorge A. Rueda, C. Valenzuela, On the relativistic precession and oscillation frequencies of test particles around rapidly rotating compact stars, Ap J 756, 82 (2012).
- M. Malheiro, Jorge A. Rueda, R. Ruffini, SGRs and AXPs as rotation-powered massive white dwarfs, Publ. Astron. Soc. Japan 64, 56 (2012).
- R. Belvedere, D. Pugliese, Jorge A. Rueda, R. Ruffini, S.-S. Xue, Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions, Nucl. Phys. A 883, 1 (2012).
- R. Negreiros, C. L. Bianco, Jorge A. Rueda, R. Ruffini, Cooling of young neutron stars in GRB associated to supernovae, A&A 540, A12 (2012).

b. Contributions to the Proceedings of Meetings and Workshops

- R. Belvedere, Jorge A. Rueda, R. Ruffini, S.-S. Xue, Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions, Current Issues on Relativistic Astrophysics, South Korea (2012).
- K. Boshkayev, Jorge A. Rueda, R. Ruffini, SGRs and AXPs AXPs as Massive Fast Rotating Highly Magnetized White Dwarfs, Current Issues on Relativistic Astrophysics, South Korea (2012).
- S. Martins de Carvalho, Jorge A. Rueda, R. Ruffini, On the relativistic Feynman-Metropolis-Teller equation of state at finite temperatures and low-mass white dwarfs, Current Issues on Relativistic Astrophysics, South Korea (2012).
- Jorge A. Rueda, R. Ruffini, Fundamental interactions in neutron stars, 13th Marcel Grossmann Meeting, Sweden (2012).
- S. Martins de Carvalho, Jorge A. Rueda, R. Ruffini, On the relativistic Feynman-Metropolis-Teller equation of state at finite temperatures and low-mass white dwarfs, 13th Marcel Grossmann Meeting, Sweden (2012).
- K. Boshkayev, Jorge A. Rueda, R. Ruffini, SGRs and AXPs as Massive Fast Rotating Highly Magnetized White Dwarfs: Bounds on the Mass, Moment of Inertia and Magnetic Fields, 13th Marcel Grossmann Meeting, Sweden (2012).
- K. Boshkayev, Jorge A. Rueda, R. Ruffini, On General Relativistic Uniformly Rotating White Dwarfs, 13th Marcel Grossmann Meeting, Sweden (2012).

- R. Belvedere, Jorge A. Rueda, R. Ruffini, S.-S. Xue, Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions, 13th Marcel Grossmann Meeting, Sweden (2012).
- Jorge A. Rueda, SGRs and AXPs as massive fast rotating highly magnetized white dwarfs, 39th COSPAR Scientific Assembly, India (2012).
- R. Belvedere, Jorge A. Rueda, R. Ruffini, Moment of inertia, radii, surface emission from a new theoretical understanding of Neutron Stars, 39th COSPAR Scientific Assembly, India (2012).
- K. Boshkayev, Jorge A. Rueda, R. Ruffini, Rotating white dwarfs and their stability, CompStar: the physics and astrophysics of compact stars, Tahiti (2012).
- R. Belvedere, Jorge A. Rueda, R. Ruffini, Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions, CompStar: the physics and astrophysics of compact stars, Tahiti (2012).
- K. Boshkayev, Jorge A. Rueda, R. Ruffini, Stability of Rotating Nuclear Matter Cores of Stellar Dimensions, CompStar: Equation of State for Compact Star Interiors and Supernovae, Croatia (2012).
- R. Belvedere, Jorge A. Rueda, R. Ruffini, Neutron star equilibrium configurations, CompStar: Equation of State for Compact Star Interiors and Supernovae, Croatia (2012).
- M. Rotondo, Jorge A. Rueda, R. Ruffini, S.-S. Xue, On Degenerate Compressed Atoms and Compressed Nuclear Matter Cores of Stellar Dimensions, Int. J. Mod. Phys. Conf. S. 12, 203 (2012).
- Jorge A. Rueda, R. Ruffini, S.-S. Xue, Electrostatic Configurations Crossover Neutron Star Cores, Proc. 12th Marcel Grossmann Meeting, 1042 (2012).
- Jorge A. Rueda, M. Rotondo, R. Ruffini, S.-S. Xue, A New Family of Neutron Star Models: Global Neutrality versus Local Neutrality, Proc. 12th Marcel Grossmann Meeting, 1039 (2012).
- M. Rotondo, Jorge A. Rueda, R. Ruffini, S.-S. Xue, From Compressed Atoms to Compressed Massive Nuclear Density Cores, Proc. 12th Marcel Grossmann Meeting, 1036 (2012).

Ruffini Remo

Position: Director ICRANet

Curriculum Vitae:

- Doctorate in Physics, University of Rome, 1966.
- Postdoctoral fellow Mainz Academy of Sciences. Hamburg, Fed. Republic, Germany, 1967.
- Postdoctoral fellow Palmer Physics Lab. Princeton University, N.J., 1967-68.
- Member Institute for Advanced Study, Princeton, N.J., 1968-70.
- Instructor, Princeton Univ., 1970-71.
- Assistant Professor, Princeton University, 1971-74.
- Member Institute for Advanced Study, Princeton, N.J. 1974-76.
- Visiting professor Kyoto University (Japan), 1975.
- Visiting professor University of Western Australia, Nedlands (Australia), 1975.
- Professor University of Catania, Italy, 1976-78.
- Professor, Chair of Theoretical Physics, University of Rome "la Sapienza", 1978-2012
- Member Council of Center. International Physics, Bogotà, Colombia, 1984-
- President International Center Relativistic Astrophysics (ICRA), 1985-
- Director of ICRANet, 2005-present
- Member of Task Force Scientific Use of Space Station NASA, Washington, 1986-88.
- Chairman International Organizing Committee of Marcel Grossmann Meetings, 1984-
- Member International Forum on the Scientific Use of Space Station, Washington, 1986-90.
- Member of Consiglio Ricerche Astronomiche, Rome, 1987-91.
- Co-Chairman Italian-Korean Meetings on Relativistic Astrophysics, Rome and Seoul, 1987-
- Chairman William Fairbanks Meetings, 1990-
- President of the Scientific Committee of the Italian Space Agency, Rome, 1989-93.
- Member of the Board of ENEA, 2004-
- Co-Director Advanced Series in Astrophysics and Cosmology-World Scientific, Singapore, 1986
- Editor Internat. Jour. Modern Phys. D World Scientific Singapore, 1992-
- Editor of the series "The Marcel Grossmann meetings on relativistic Field Theories", 1985-
- Co- Editor of the Series" Italo-Korean meetings on Relativistic Astrophysics".
- Member Sigma Xi.
- Member Italian Physical Society.
- Founding Member of European Physical Society.
- Member of Euroscience
- Fellow recipient:
 - o Cressy Morrison award of the New York Academy of Sciences , 1972.
 - o Fellow of the American Physical Society 1974-
 - Alfred P. Sloan Foundation fellow, 1974-76.
 - Space Scientist of the Year Award, 1992.
 - o Honorary Professor of University of Kirghizia 1998-

Main Scientific Publications:

Coauthor, among others, of the following books:

1. (with J. Bardeen, B. Carter, H. Gursky, S. Hawking, I. Novikov and K. Thorne) "Black holes", Ed. B. and C. de Witt, Gordon and Breach, New York, 1973,



 (with M. Rees and J.A. Wheeler) "Black Holes, Gravitational Waves and Cosmology", Gordon and Breach N.Y. 1974, also translated in Russian as "Cernie Diri Gratazionnie Volni I Kosmologia", Mir, Moscow 1974,
(with H.Gursky) "Neutron Stars, Black Holes and Binaries Sources", D. Reidel, Dordrecht, 1975,
(with R. Giacconi et al.) "Physics and Astrophysics of Neutron Stars Black Holes", North Holland Pub. Co. Amsterdam 1978
(with Humitaka Sato) "Black Holes", in japanese, Chuo Koron-Sha, Tokyo 1976,

6. (with Fang Li Zhi) "Basic Concepts in Relativistic Astrophysics", in chinese, Science Press, Beijing 1981, also translated into english, World Scientific, Singapore 1983,

7. (with Francesco Melchiorri) "Gamow Cosmology", North Holland Pub. Co., Amsterdam, 1986,

8. (with H. Ohanian) "Gravitation and Spacetime" W.W. Norton and Co., New York 1976,

9. (with H. Ohanian) "Gravitazione e Spazio-Tempo" Zanichelli, Bologna 1997

10. (with H. Ohanian) "Gravitation and Spacetime" W.W. Norton and Shin Won Agency Co., Seoul 2001

2012 List of Publication

Evidence for a proto-black hole and a double astrophysical component in GRB 101023 A.V. Penacchioni, R. Ruffini, L.Izzo, M. Muccino, C.L. Bianco, L. Caito, B. Patricelli, L. Amati Astronomy and Astrophysics, 2012, v. 538, p. A58(1)

Cooling of young neutron stars in GRB associated to supernovae R. Negreiros, R. Ruffini, C.L. Bianco, J.A. Rueda Astronomy and Astrophysics, 2012, v. 540, p. A12(1)

A double component in GRB 090618: a proto-black hole and a genuinely long gamma-ray burst L.Izzo, R. Ruffini, C.L. Bianco, L. Caito, S. K. Chakrabarti, J.A. Rueda, A. Nandi, B. Patricelli Reference Astronomy and Astrophysics, 2012, v. 543, p A10(1)

Analysis of GRB 080319B and GRB 050904 within the fireshell model: evidence for a broader spectral energy distribution

B. Patricelli, M.G. Bernardini, C.L. Bianco, L. Caito, G. de Barros, L. Izzo, R. Ruffini, G.V. Vereshchagin Reference The Astrophysical Journal, 2012, v. 756, p. 16(1)

Electron and Positron pair production in gravitational collapse W. B. Han, R. Ruffini, S. S. Xue Reference Physical Review D, 2012, v. 86, Issue 8, id. 084004

Phase space evolution of pairs created in strong electric fields A. Benedetti, R. Ruffini and G.V. Vereshchagin Reference accepted in Physics Letters A, 2012

Gravitational field of compact objects in general relativity Boshkayev K., Quevedo H., and Ruffini Reference Physical Review D, 2012, v. 86, p. 064043

GRB 090618: *A Candidate of a Neutron Star Gravitational Collapse to a Black Hole Induced by a Type Ib/c Supernova* L. Izzo, Jorge A. Rueda, R. Ruffini Reference Astronomy and Astrophysics, 2012, in press

On the Induced Gravitational Collapse of a Neutron Star to a Black Hole by a Type Ib/c Supernova Rueda, Jorge A.; Ruffini, Remo Reference The Astrophysical Journal Letters, 2012, v. 758, Issue 1, article id. L7

SGRs and AXPs as Rotation-Powered Massive White Dwarfs

Malheiro, Manuel; Rueda, Jorge A.; Ruffini, Remo Reference Astronomical Society of Japan, 2012, v. 64, n. 3, Article No.56

Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions Belvedere, Riccardo; Pugliese, Daniela; Rueda, Jorge A.; Ruffini, Remo; Xue, She-Sheng Reference Nuclear Physics A, 2012, v. 883, p. 1

Grb 090227*b*: *The Missing Link Between The Genuine Short And Long Grbs* M. Muccino, R.Ruffini, C.L. Bianco, L. Izzo, A.V. Penacchioni Reference The Astrophysiocal Journal, 2012 IN PRESS

Space-Time Evolution of Electric Fields in Cores of Compact Stars W. B. Han, R. Ruffini, S. S. Xue Reference International Journal of Modern Physics, 2012, v. 12, p. 193

Vereshchagin Gregory

Position: researcher Period covered: 2012

I. Scientific Work

The work focused on mainly the following aspects:

• Monte Carlo simulations of the photospheric emission in GRBs (with D. Begue and I.A. Siutsou) We studied the decoupling of photons from ultra-relativistic spherically symmetric outflows expanding with constant velocity by means of Monte-Carlo (MC) simulation. For outflows with finite width we confirm the existence of two regimes: photon thick and photon thin introduced recently by Ruffini, Siutsou, Vereshchagin (2011). The probability density function of photon last scattering is shown to be very different in these two cases. We also obtained spectra as well as light curves. In photon thick case, the time integrated spectrum is much broader than the Planck function and its shape is well described by the fuzzy photosphere approximation. In the photon thin case we confirm the crucial role of photon diffusion, hence the probability density of decoupling has a maximum near the diffusion radius, well below the photosphere. Its spectrum has Band shape. It is produced when the outflow is optically thick and its peak is formed at diffusion radius.

• Electron-positron plasma in GRBs and in cosmology (with R. Ruffini)

Analogy and difference between electron-positron plasma in the early Universe and in sources of GRBs are discussed. We focus on a) dynamical differences, namely thermal acceleration of the outflow in GRB sources vs. cosmological deceleration; b) nuclear composition differences as synthesis of light elements in the early Universe and possible destruction of heavy elements in GRB plasma; c) different physical conditions during last scattering of photons by electrons in both cases leading to nearly perfect black body spectrum of the microwave background radiation vs. non thermal spectrum of the photospheric emission in GRBs.

• Evolution of the pair plasma generated by a strong electric field (with A. Benedetti and R. Ruffini) Creation, acceleration and interactions of electron-positron pairs are studied numerically using the relativistic kinetic Boltzmann equation. We focus on long term evolution of the created uniformly distributed optically thick plasma, its thermalization and interaction with photons. Instead of spherical symmetry in the phase space traditionally used in kinetic theory, we adopt cylindrical symmetry, which appears to be more convenient in the problem under consideration.

• Bose enhancement and Pauli blocking in the pair plasma (with I.A. Siutsou, A.G. Aksenov and R. Ruffini)

Interactions in homogeneous electron-positron-photon plasma are studied numerically using the relativistic kinetic Boltzmann equation, with collision integrals including Bose enhancement and Pauli blocking corrections. The new method of computing collision integrals is developed.

• Photospheric emission from ultrarelativistic outflows (with I.A. Siutsou and R. Ruffini)

Emission from expanding spherically symmetric plasma becoming optically thin to Compton scattering is studied with particular attention to relativistic effects. Observed flux and spectra are obtained. These results find applications in the theory of Gamma Ray Bursts.

• Dynamics and emission from mildly relativistic plasma (with A.G. Aksenov and R. Ruffini) Interactions and emission in a spherical region with optically thick relativistic plasma is studied using kinetic Boltzmann equations. High initial optical depth are considered, which results in radial self acceleration giving mildly relativistic velocities of expansion. Results of this work may be applied for future laboratory experiments aimed in creation of optically thick electron-positron pairs.

• Comptonization of photons near the photosphere of GRBs (with A.G. Aksenov and R. Ruffini) We consider the formation of photon spectrum at the photosphere of ultrarelativistically expanding outflow. We use the Fokker-Planck approximation to the Boltzmann equation, and obtain the generalized Kompaneets equation which takes into account anisotropic distribution o of photons developed near the photosphere. This equation is solved numerically in two interesting examples, and the results are discussed and compared to those obtained by alternative methods.

II. Conferences and educational activities

II a. Conferences and Other External Scientific Works

• Review talk "Physics of non-dissipative ultrarelativistic photospheres" at GRB1 parallel session, XIII Marcel Grossmann Meeting, Stockholm, 1-7 July 2012.

II b. Work With Students Marco Muccino

II c. Diploma thesis supervision

- Ivan Siutsou (IRAP PhD student, Belarus)
- Alberto Benedetti (Erasmus Mundus IRAP PhD student, Italy)
- Damien Begue` (Erasmus Mundus IRAP PhD student, France)

II d. Other Teaching Duties

- "First light from Gamma Ray Bursts", 3 lectures at IRAP Ph.D. Erasmus Mundus September school, Nice, 3 – 21 September, 2012
- "Relativistic kinetic theory and its applications in astrophysics and cosmology", 5 lectures at XV Brazilian School of Cosmology and Gravitation, Mangaratiba Rio de Janeiro Brazil, August 19 September 1, 2012

III. Service activities

III a. Within ICRANet

- Member of the IRAP PhD Faculty
- Organized parallel session GRB1 Photospheric Emission in GRBs at MGXIII in Stockholm, 1-7 July, 2012
- Editing the proceedings of the 12th Italian-Korean Symposium on Relativistic Astrophysics held in ICRANet, Pescara, Italy on July 4-8, 2011

III b. Outside ICRANet

- Served as expert in the PhD commission of Chiara Ceccobello, University of Ferrara, 15 March 2012
- Served as expert in the PhD commission of Valentina Mantovani Sarti, University of Ferrara, 15 March 2012
- Referee for Astrophysical Journal

2012 List of Publications

- G. V. Vereshchagin, "Relativistic kinetic theory and its applications in astrophysics and cosmology", to be published in Proceedings of XV Brazilian School of Cosmology and Gravitation, Mangaratiba Rio de Janeiro Brazil, August 19 September 1, 2012, Cambridge Scientific Publishers, 2013.
- R. Ruffni, I. A. Siutsou and G. V. Vereshchagin, "Theory of photospheric emission from relativistic outflows", submitted to the Astrophysical Journal, 2011.
- D. Begue, I. A. Siutsou, G. V. Vereshchagin, "Monte Carlo simulations of the photospheric emission in GRBs", submitted to the Astrophysical Journal, 2012.
- A. Benedetti, R. Ruffini, G. V. Vereshchagin, "Phase space evolution of pairs created in strong electric fields", submitted to Physics Letters A, 2012.
- A.G. Aksenov, R. Ruffini, I.A. Siutsou, G.V. Vereshchagin, Dynamics and emission of mildly relativistic plasma, IJMP: Conference Series 12 (2012) 1.
- R. Ruffini, G. V. Vereshchagin, Electron-positron plasma in GRBs and in cosmology, submitted to Nuovo Cimento C, 2012.

- A.G. Aksenov, R. Ruffini and G.V. Vereshchagin, Radiative transfer near the photosphere of ultrarelativistic outflows, in preparation (2012).
- Monte Carlo simulations of the photospheric emission in GRBs (with D. Begue and I.A. Siutsou)

We studied the decoupling of photons from ultra-relativistic spherically symmetric outflows expanding with constant velocity by means of Monte-Carlo (MC) simulation. For outflows with finite width we confirm the existence of two regimes: photon thick and photon thin introduced recently by Ruffini, Siutsou, Vereshchagin (2011). The probability density function of photon last scattering is shown to be very different in these two cases. We also obtained spectra as well as light curves. In photon thick case, the time integrated spectrum is much broader than the Planck function and its shape is well described by the fuzzy photosphere approximation. In the photon thin case we confirm the crucial role of photon diffusion, hence the probability density of decoupling has a maximum near the diffusion radius, well below the photosphere. Its spectrum has Band shape. It is produced when the outflow is optically thick and its peak is formed at diffusion radius.

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II. Conferences and educational activities

II a. Conferences and Other External Scientific Works

• Review talk "Physics of non-dissipative ultrarelativistic photospheres" at GRB1 parallel session, XIII Marcel Grossmann Meeting, Stockholm, 1-7 July 2012.

II b. Work With Students

Marco Muccino

II c. Diploma thesis supervision

- Ivan Siutsou (IRAP PhD student, Belarus)
- Alberto Benedetti (Erasmus Mundus IRAP PhD student, Italy)
- Damien Begue` (Erasmus Mundus IRAP PhD student, France)

II d. Other Teaching Duties

• "First light from Gamma Ray Bursts", 3 lectures at IRAP Ph.D. Erasmus Mundus September school, Nice, 3 – 21 September, 2012

• "Relativistic kinetic theory and its applications in astrophysics and cosmology", 5 lectures at XV Brazilian School of Cosmology and Gravitation, Mangaratiba - Rio de Janeiro – Brazil, August 19 -September 1, 2012

III. Service activities

III a. Within ICRANet

• Member of the IRAP PhD Faculty

• Organized parallel session GRB1 - Photospheric Emission in GRBs at MGXIII in Stockholm, 1-7 July, 2012

• Editing the proceedings of the 12th Italian-Korean Symposium on Relativistic Astrophysics held in ICRANet, Pescara, Italy on July 4-8, 2011

III b. Outside ICRANet

• Served as expert in the PhD commission of Chiara Ceccobello, University of Ferrara, 15 March 2012

• Served as expert in the PhD commission of Valentina Mantovani Sarti, University of Ferrara, 15 March 2012

• Referee for Astrophysical Journal

2012 List of Publications

• G. V. Vereshchagin, "Relativistic kinetic theory and its applications in astrophysics and cosmology", to be published in Proceedings of XV Brazilian School of Cosmology and Gravitation, Mangaratiba - Rio de Janeiro – Brazil, August 19 - September 1, 2012, Cambridge Scientific Publishers, 2013.

• R. Ruffni, I. A. Siutsou and G. V. Vereshchagin, "Theory of photospheric emission from relativistic outflows", submitted to the Astrophysical Journal, 2011.

• D. Begue, I. A. Siutsou, G. V. Vereshchagin, "Monte Carlo simulations of the photospheric emission in GRBs", submitted to the Astrophysical Journal, 2012.

• A. Benedetti, R. Ruffini, G. V. Vereshchagin, "Phase space evolution of pairs created in strong electric fields", submitted to Physics Letters A, 2012.

• A.G. Aksenov, R. Ruffini, I.A. Siutsou, G.V. Vereshchagin, Dynamics and emission of mildly relativistic plasma, IJMP: Conference Series 12 (2012) 1.

• R. Ruffini, G. V. Vereshchagin, Electron-positron plasma in GRBs and in cosmology, submitted to Nuovo Cimento C, 2012.

• A.G. Aksenov, R. Ruffini and G.V. Vereshchagin, Radiative transfer near the photosphere of ultrarelativistic outflows, in preparation (2012).

Xue She-Sheng

Position: Staff Period covered: 2011 – 2012



I. Scientific Work

The self-consistent general relativistic solution for a system of degenerate neutrons, protons and electrons in beta-equilibrium, Rotondo, Michael, Jorge A. Rueda, Remo Ruffini, and She-Sheng Xue. Physics Letters B, Volume 701, Issue 5, p. 667-671 (2011).

The relativistic Feynman-Metropolis-Teller theory for white-dwarfs in general relativity, M. Rotondo, Jorge A. Rueda, Remo Ruffini, and She-Sheng Xue. To be published by Phys. Rev. D.

On the relativistic and electro-dynamical stability of massive nuclear density cores, V. S. Popov, M. Rotondo, R. Ruffini and S.-S. Xue, submitted to Phys. Rev. C, (2011); arXiv:astroph/0903.3727

On the relativistic Thomas-Fermi treatment of compressed atoms and compressed nuclear matter cores of stellar dimensions, M. Rotondo, Jorge A. Rueda, Remo Ruffini, and She-Sheng Xue, Phys. Rev. C 83 (2011) 045805.

The Klein first integrals in an equilibrium system with electromagnetic, weak, strong and gravitational interactions, Jorge A. Rueda, Remo Ruffini, and She-Sheng Xue, Nuclear Physics A 872 (2011) 286

On the equilibrium of self-gravitating neutrons, protons and electrons in β -equilibrium, M. Rotondo, Jorge A. Rueda, Remo Ruffini, and She-Sheng Xue. Phys. Rev. D84 (2011) 084007.

Electron-positron pairs production in a macroscopic charged core Remo Ruffini, and She-Sheng Xue, Phys. Lett. B 696 (2011) 416-412.

Electron-positron pairs in physics and astrophysics, from heavy nuclei to black holes Remo Ruffini, Gregory Vereshchagin, She-She Xue , Phys. Rep. Vol 487 (2010) 1,

Electron-positron pair oscillation in spatially inhomogeneous electric field and radiation Wen-Biao Han, Remo Ruffini, and She-Sheng Xue Phys. Lett. B691 (2010) 99.

Detailed Discussions and Calculations of Quantum Regge Calculus of Einstein-Cartan theory She-Sheng Xue , Phys. Rev. D82 (2010) 064039.

Neutrino oscillations in nuclear media Iman Motie and She-Sheng Xue, submitted to journal of Physics G: Nuclear and Particle Physics.

Euler-Heisenberg Lagrangian and photon circular polarization Iman Motie and She-Sheng Xue, European Physics Letter (EPL) 100 (2012) 17006

On the self-consistent equilibrium equations of neutron stars, Jorge A. Rueda, Remo Ruffini, and She-Sheng Xue. Submitted to Phys. Rev Lett.

Neutrinos and photons travel in a discrete space-time

She-Sheng Xue, Phys. Lett. B 706 (2011) 213.

The phase and critical point of quantum Einstein–Cartan gravity She-Sheng Xue , Phys. Lett. B 711 (2012) 404.

High Energy Neutrino Oscillation at the Presence of the Lorentz Invariance Violation Motie Iman, She-Sheng Xue, Int. J. Mod. Phys. A 27 (2012) 1250104. Electron and positron pair production in gravitational collapse Wen-Biao Han, Remo Ruffini, and She-Sheng Xue, Phys. Rev. D86 (2012) 084004.

Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions

R. Belvedere, D. Pugliese, J. Rueda, R. Ruffini, and S.-S. Xue, Nucl. Phys. A 883 (2012) 1.

II. Conferences and educational activities

International Conferences, ICRANet meetings Presenting talks and posters in international ICRANet meetings: 3rd Galileo-Xu Guangqi meeting (Beijing, China, Oct 2011) 12th Italian-Korean meeting (Pescara, July 2012) The meeting for Italian-Korean cooperation, Seoul 5-6, Nov 2012 The first LeCosPA Symposium: Towards Ultimate Understanding of the Universe, Taipei Taiwan Feb 6-9, 2012

The Fang symposium: relativistic astrophysics and modern cosmology. Tucson, Arizona Oct 6-10, 2012

Diploma thesis supervision

IRAP PhD. Faculty, thesis supervision and reading and examination Ivan, Siutsou, Han Wenbiao, Christine Gruber, Yuanbin Wu, Wang Yu, Handrik Ludwig, Eckhard Strobel and Iranian students: Rohoollah Mohammadi, Iman Moti, and Ehsan Bavarsad

Outside ICRANet External Professor of Chinese Academy and University Controrelatore for thesis Diploma, Physics Department, University of Rome, La Sapienza

Other Teaching and working Duties

Teaching courses in Nice and Les Houches schools for IRAP Ph.D. Erasmus Mundus students Discussion and Work With the Director R. Ruffini, V. Belinski and other Faculty members, Carlo Luciano Bianco, G. Vereshchagin, and Jorge Rueda, and other students on Gamma Ray Bursts and Neutron stars... Discussion and work with External Professors

H. Kleinert, Pascal Chardonnet, Lou Yu Qing and other ICRANet visitors.

III. Service activities

Within ICRANet

Participating organization of ICRANet meetings: the 12th Italian-Korean meeting (July, 2011, Pescara, Italy),2nd Galileo - Xu Guangqi Meeting, July 12-18, 2010 Ventimiglia-Nice, Italy-France and 3rd Galileo-Xu Guangqi meeting (Oct. 11-16, 2011, Beijing, China), acting as a chair of the parallel section in MG13 Stockhom, July 2012.

Editor of three conference proceedings: 5th Italian-Chinese meeting on Cosmology and Relativistic Astrophysics", published by American Institute of Physics, 1st and 3rd Galileo –Xu Guangqi meeting, published by the International Journal of Modern Physics D, World scientific.

Participating organization of ICRANet Seminars

Give a public lecture in ICRANet Pescara center.

Adjunct Professors of the Faculty
Aharonian Felix A.

Positions: Professor of the Cosmic School of the Dublin Institute for Advanced Studies (DIAS) and Director of the Center for Astroparticle Physics and Astrophysics at DIAS, Dublin, Ireland and Head of High Energy Astrophysics Theory Group, MPI for Nuclear Physics, Heidelberg, Germany



Fields of Research: High Energy Astrophysics, Astroparticle Physics, Cosmology

Projects:

Involvement in major Projects: Member (representative of ESA) of the Science Working Group of the JAXA-NASA X-ray mission ASTRO-H (X-ray Astronomy) Member of the H.E.S.S. Collaboration Board (gamma-ray astronomy) Member of the KM3NeT Consortium Board (neutrino astronomy)

Panels, Committees, Schools

Vice-President of the IAU Division D "High Energy Phenomena and Fundamental Physics" Co-director of LEA - European Associated Laboratory on High Energy Astrophysics jointly supported by CNRS (France) and MPG (Germany) Adjunct Professor, School of Physics, University College Dublin (USD)

Adjunct Professor and member of the International Center for Relativistic Astrophysics, Rome/Pescara, Italy

Member ("Supervisor") of the Heidelberg Graduate School of Fundamental Physics, Member of the International Review Board of the Helmholtz Association on Astroparticle Physics Member of the European ASTRONET Infrastructure Roadmap Panel A:

"High energy astrophysics, astro-particle physics and gravitational waves" Editor of the International Journal of Modern Physics D

PostDocs and Students:

DIAS/Dublin: one postdoctoral fellows and two PhD students MPIK/Heidelberg: seven postdoctoral fellows and four PhD students ICRANET/Pescara: one PhD student

<u>Organization of International Workshops, Symposia, Schools (2012)</u> 5th International Gamma Ray Symposium on High Energy Gamma Ray Astronomy, Heidelberg, Germany, June 9-13, 2011 (together with F. Hofmann and F. Rieger)

Publications: approximately 400 papers in peer review journals – approximately 18,000 citations

Papers published in 2012 (in peer-reviewed journals)

- 1. Interpretation of the flares of M87 at TeV energies in the cloud-jet interaction scenario, Astrophysical Journal 755, 170 (2012): Barkov, M., Bosch-Ramon, V., Aharonian, F.A.
- 2. On the spectral shape of radiation due to Inverse Compton Scattering close to the maximum

cut-off, Astrophysical Journal 753, 176 (2012): Lefa, E., Kelner, S.R., Aharonian, F.A.

3. Time structure of gamma-ray signals generated in line-of-sight interactions of cosmic rays from distant blazars, Astrophysical Journal, in press (2012): Prosekin, A., Essey, W., Kusenko, A., Aharonian, F.A.

4. Cosmic Rays in Galactic and Extragalactic Magnetic Fields, Space Science Reviews, Space Science Reviews, 166, 9 (2012): Aharonian, F., Bykov, A., Parizot, E., Ptuskin, V., Watson, A.

5. Deep observation of the giant radio lobes of Centaurus A with the Fermi Large Area Telescope, Astronomy and Astrophysics, 542, A19 (2012): Yang, R.-Z., Sahakyan, N., de Ona Wilhelmi, E., Aharonian, F.A., Rieger, F.

6. Post-periastron Gamma-Ray Flare from PSR B1259-63/LS 2883 as a Result of Comptonization of the Cold Pulsar Wind, Astrophysical Journal (Letters), 752, L17 (2012): Khangulyan D., Aharonian, F. A., Bogovalov, S.V., Ribo, M.

- Abrupt acceleration of a 'cold' ultrarelativistic wind from the Crab pulsar, Nature, 482, 507 (2012): Aharonian, F. A., Bogovalov S. V., Khangulyan D.
- 8. Magnetic substructure in the northern Fermi Bubble revealed by polarized microwave emission, Astrophysical Journal (Letters), 747, L12 (2012): Jones, D.I., Crocker, R.M., Reich, W., Ott, J., Aharonian, F. A.

9. Nuclear reactions in hot astrophysical plasmas with T>1010 K, International Journal of Modern Physics D, 21, 1 (2012): Kafexhiu, E., Aharonian, F.A., Villa, G.

10. Rapid TeV variability in Blazars as result of Jet-Star Interaction, The Astrophysical Journal, 749, 119 (2012): Barkov, M.V., Aharonian, F. A., Bogovalov, S.V., Kelner, S.R., Khangulyan, D. V.

11. Modelling the between relativistic and non-relativistic winds in the binary system PSR B1259-63/SS2883- II. Impact of the magnetization and anisotropy of the pulsar wind, Monthly Notices of the Royal Astronomical Society, 419, 3426 (2012): Bogovalov S. V., Khangulyan D., Koldoba A. V., Ustyugova G. V., Aharonian F. A.

12. Probing the Central Black Hole in M87 with Gamma-Rays, Modern Physics Letters A, 27, id. 1230030 (2002): Rieger, F., Aharonian, F.A.

13. Cold ultrarelativistic pulsar winds as potential sources of galactic gamma-ray lines above 100 GeV, Astronomy and Astrophysics, 547, A114 (2012): Aharonian, F., Khangulyan, D., and Malyshev, D.

HESS collaboration papers:

10 papers in Astronomy and Astrophysics

Invited review papers:

F.A Aharonian: Gamma-Ray Emission of Supernova Remnants and the Origin of Cosmic Rays, Chapter in the book: Planets, Stars, and Stellar Systems, Springer Verlag, 2012

F.A. Aharonian, Gamma Rays from Supernova Remnants, Astroparticle Physics, in press

Amati Lorenzo

Position: ICRANet external collaborator (researcher at INAF – IASF Bologna)



Short CV

Lorenzo Amati was born in Modena, Italy, in 1966. He graduated in Astronomy at the University of Bologna in 1991 and received the PhD degree in astronomy from University "La Sapienza" of Rome in 1999. Since 1998, Lorenzo Amati is a research staff member at the Institute of Space Astrophysics and Cosmic Physics (IASF) in Bologna, which is part of the Italian National Institute for Astrophysics (INAF). He is also Adjunct Professor of the Faculty of the International Center for Relativistic Astrophysics Network (ICRANet) and member of the Faculty of the PhD course in Physics at the University of Ferrara. In 2011 Lorenzo Amati was elected member of the Board for Relativistic and Particle Astrophysics of the Italian National Institute for Astrophysics (INAF).

His field of research is high energy astrophysics, with particular emphasis on Gamma-Ray Bursts (GRB) studies. Under this respect, his research highlights include the discovery (in 2000) of a transient X-ray absorption edge in the first 13 s of GRB 990705, leading to the first estimate fo a GRB redshift based on X-ray data, and the discovery of a strong correlation between the photon energy at which GRB spectra peaks and their radiated energy (known as "Amati relation"), which has relevant implication for the physics and possible cosmological use of these phenomena. Lorenzo Amati is also involved in the study (science case and instrument concept) of future missions for GRB studies and dedicates a minor part of his research work to the study of X-ray binaries.

I Scientific Work

My scientific collaboration with ICRANet is focused on Gamma-Ray Burst (GRB) astrophysics, with particular emphasis on the testing of the fireshell model against X-ray and gamma-ray data of the prompt emission. In particular, in 2012 we concentrated on the identification and interpretation of "disguised" short GRBs (e.g., Bianco, Amati et al., Mem. Sait. S., 2012), based also on their location and evolution in the Ep,i – Eiso plane, the evidence and explanation of thermal components in prompt emission spectra, the investigation within the fireshell model of GRBs showing a prompt emission characterized by a double component, the first of which dominated by thermal emission (e.g., GRB 101023, Penacchioni et al., A&A, 2012).

Besides my collaboration with ICRANet, my main scientific activity includes: spectral, timing and correlation properties of GRBs (e.g., Frontera, Amati et al., ApJ, 2012), investigation of the cosmological use of GRBs (e.g., Amati, IJMPS, 2012), X-ray spectral and timing properties of X-ray binaries (e.g., Farinelli, Amati et al., MNRAS, 2012), study of the scientific case and concept design of GRB detectors for future missions (e.g., Feroci et al., Exp. Astron., 2012). Under this last respect, in particular, in 2012 I continued to collaborate with Prof. Braga (Director of INPE, Brazil) on the possibility of putting an Italian payload devoted to GRB studies on board future Brazilian satellites, I was the p.i. of the GAME (GRB and All-sky Monitor Experiment) for the ESA Call for Smal Mission (again, also in collaboration with Brazil), and I continued coordinating the GRB Science Working Group of the LOFT mission (in the framework of the ESA/M3 assessment phase).

II Conferences and educational activities

Conferences and Other External Scientific Work

October 2012: XX SIGRAV Conference, Napoli, Italy (invited oral presentation) September 2012: Second LOFT Science Meeting, Toulouse, France (oral presentation) September 2012: Third Italian National Workshop on GRBs - "Lampi su Napoli," Napoli, Italy (oral presentation)

July 2012: 13th Marcel Grossmann Meeting - MG13, Stockholm, Sweden (solicited oral presentation)

June 2012: 9th Workshop on Science with the New Generation of High Energy Gamma-ray Experiments, Lecce, Italy (invited oral presentation)

June 2012: First National Meeting on Science and Technology with SKA - The Italian pathway to SKA Rome, Italy (invited oral presentation)

May 2012: Gamma-Ray Bursts 2012 Conference, Munich, Germany (oral presentation)

Work With Students

Discussions and joint data analysis of GRBs with some of the ICRANet IRAP Ph.D. students (e.g., collaboration with A. Penacchioni on data analysis and interpretation of the "double component" GRB 101023A).

Lecturer at the IRAP Ph.D. Erasmus Mundus School, September 2012, University of Nice, France

III Service activities

Within ICRANet

- Chairperson of the parallel session "Cosmology from GRBs" at the 13th Marcel Grossmann Meeting (Stockholm, July 2012)

- Member of Commissions for the Discussion of the Thesis of IRAP PhD Students at Rome University "La Sapienza".

Outside ICRANet

- Reviewer of several articles for the main astrophysical journals (ApJ, A&A, MNRAS, PASJ)

- Member of the Editorial Board of "ISRN Astronomy & Astrophysics" (HINDAWI), "Galaxies" (MDPI) and

- Member of the Board for Relativistic and Particle Astrophysics of the Italian National Institute for Astrophysics (INAF)

- Member of the of the Faculty of the PhD course in Physics at the University of Ferrara

2012 list of Publications

Refereed

R. Farinelli, L. Amati, F. Frontera, R. Landi, E. Palazzi, N. Shaposhnikov, L. Titarchuk, N. Masetti, C. Lombardi, M. Orlandini, 2012, " Spectral evolution of the X-ray nova XTE J1859+226 during its outburst observed by BeppoSAX and RXTE ", Monthly Notices of the Royal Astronomical Society, in press

A. Melandri, E. Pian, P. Ferrero, P. D'Avanzo, E. S. Walker, G. Ghirlanda, S. Covino, L. Amati, V. D'Elia, P. A. Mazzali, M. Della Valle, C. Guidorzi, L. A. Antonelli, M. G. Bernardini, F. Bufano, et al., 2012, "The Optical SN 2012bz Associated with the Long GRB 120422A ", Astronomy & Astrophysics, 547, A82

A. Rossi, S. Klose, P. Ferrero, J. Greiner, L. A. Arnold, E. Gonsalves, D. H. Hartmann, A. C. Updike, D. A. Kann, T. Kruhler, E. Palazzi, S. Savaglio, S. Schulze, P. M. J. Afonso, L. Amati, et al., 2012, "A deep search for the host galaxies of GRBs with no detected optical afterglow ", Astronomy & Astrophysics, 545, A77

F. Frontera, L. Amati, C. Guidorzi, R. Landi, J. in 't Zand, 2012, " Broad band time-resolved Ep,i - Liso correlation in GRBs ",

The Astrophysical Journal, 754, 138

F. Bufano, E. Pian, J. Sollerman, S. Benetti, G. Pignata, S. Valenti, S. Covino, P. D'Avanzo, D. Malesani, E. Cappellaro, M. Della Valle, J. Fynbo, J. Hjorth, P.A. Mazzali, D.E. Reichart, R.L.C. Starling, M. Turatto, S.D. Vergani, K. Wiersema, L. Amati, et al., 2012, " The Highly Energetic Expansion of SN 2010bh Associated with GRB 100316D ", The Astrophysical Journal, 753, 67

L. Titarchuk, R. Farinelli, F. Frontera, L. Amati, 2012, " An upscattering spectral formation model for the prompt emission of Gamma-Ray Bursts ", The Astrophysical Journal, 752, 116

C. Guidorzi, R. Margutti, L. Amati,S. Campana, M. Orlandini, P. Romano, M. Stamatikos, G. Tagliaferri, 2012, "Average power density spectrum of Swift long gamma-ray bursts in the observer and in the source rest frames", Monthly Notices of the Royal Astronomical Society, 422, 1785

A.V. Penacchioni, R. Ruffini, L. Izzo, M. Muccino, C.L. Bianco, L. Caito, B. Patricelli, L. Amati, 2012, " Evidence for a proto-black hole and a double astrophysical component in GRB 101023 ", Astronomy & Astrophysics, 538, A58

M. Feroci, L. Stella, M. van der Klis, T. Corvousier, M. Hernanz, R. Hudec, A. Santangelo, D. Walton, A. Zdziarski, ..., M. Abramowicz, A. Alpar, D. Altamirano, J. M. Alvarez, L. Amati, et al., 2012, "The Large Observatory for X-ray Timing (LOFT)", Experimental Astronomy, 34, 415

J.W. den Herder, L. Piro, T. Ohashi, C. Kouveliotou, D.H. Hartmann, J.S. Kaastra, L. Amati, M. Andersen, M. Arnaud, J.L. Atteia, et al., 2012, " ORIGIN: Metal Creation and Evolution from the Cosmic Dawn ", Experimental Astronomy, 34, 519

Conference proceedings

F. Frontera, L. Amati, F. Farinelli, C. Guidorzi, R. Landi, L. Titarcuk, J.J.M. in't Zand, 2012, "Time Resolved Spectra of GRBs Simultaneously Detected with BATSE andBeppoSAXWFCs ", International Journal of Modern Physics: Conference Series, Vol. 12, issue 01, p. 136

C.L. Bianco, L. Amati, M.G. Bernardini, L. Caito, G. De Barros, L. Izzo, B. Patricelli, R. Ruffini, 2012, " The class of ``disguised" short GRBs and its implications for the Amati relation ", Memorie della Societa Astronomica Italiana Supplement, v.21, p.139

Y. Evangelista, M. Feroci, A. Argan, R. Campana, E. Costa, E. Del Monte, I. Donnarumma, F. Lazzarotto, F. Muleri, L. Pacciani, M. Rapisarda, A. Rubini, P. Soffitta, L. Amati, et al. 2012, " A Proposed Italian Contribution for the Mirax Scientific Payload ", International Journal of Modern Physics: Conference Series, Vol. 12, issue 01, p. 110

L. Amati, 2012, "Cosmology with the Ep,i-Eiso Correlation of Gamma-Ray Bursts", International Journal of Modern Physics: Conference Series, Vol. 12, issue 01, p. 19

Chakrabarti Sandip Kumar

Position:

Dean (Academic Programme), Head (Astrophysics and Cosmology) and Senior Professor, S.N. Bose National Centre for Basic Science, Kolkata and

In Charge (Academic Affairs), Indian Centre for Space Physics, Kolkata Period covered: 1.1.2012 – 31.12.2012



I Scientific Work

His main research work consists of study of the Astrophysical Flows around black holes. He studies the spectral and temporal properties of black holes, from quasars to nano-quasars. However he is also spending some time on formation and evolution of bio-molecules in star-forming region. He has published about 200 papers in International Refereed journal and a similar number of papers in Proceedings. He has written a book and edited several volumes.

II Conferences and educational activities

Doctorate Students Supervision

He has produced 20 Ph. D. scholars and another 10 students are registered for PhD. Five students are submitting their thesis soon. Three more students have joined since last year. One student from Nigeria are presently working under his supervision. The students mainly worked on (a) Monte Carlo simulations of spectral and timing properties in presence of jets and outflows; (b) Outbursting black holes; (c) Quasiperiodic Oscillations of several black holes (d) Transonic accretion flows with heating and cooling; (e) Spectral properties of accretion disks having shock waves; (f) Formation of simple bio-molecules during star formation and Grain chemistry using Monte-Carlo simulations etc. (g) Ionospheric change in presence of terrestrial and extra-terrestrial high energy phenomena including seismic activities.

III Service activities

Talks/papers Feb. 2012: ISRO RESPOND meeting lectures at Physical Research Laboratory.

March, 2012, Invited talks on "Accretion Processes around Black Holes and Physics of Jets" and "Chemical Evolution of the Universe and the Origin of Life" at "International Conference on Astrophysics and Cosmology" Kathmandu, July, 2012

at "International Conference on Astrophysics and Cosmology", Kathmandu, July, 2012.

July, 2012: Invited talks on "Towards the most complete accretion flow solution around black holes" at 13th marcel grossman meeting, Stockholm.

July, 2012: Invited talks on "Balloon programme at the Indian Centre for Space Physics", "Towards the most complete solution of accretion/winds around black holes", "VLF activities and ICSP and SNBNCBS", "Formation of Pre-biotic Molecules during the Formation of proto-stars and the Origin of Life", A 2D hydrodynamic simulations coupled to chemical evolution to study the physics and chemistry of ISM" at the 39th COSPAR meeting at Infosys Campus, Mysore, India.

July, 2012: "Trend of the Studies on Chemical Evolution and Origin of Life" at the International Conference on "Chemical Evolution in Star Forming Region" at SNBNCBS

August, 2012: "My Experiments with Astrophysics" Bose colloquium at SNBNCBS

2012 List of Publication

Papers in Journals:

S. Ray, S. K. Chakrabarti, S. Sasmal, 2012, Precursory Effects in the night time VLF signal Amplitude for the 18th Jan. 2011 Pakistan Earthquake, Ind. J. Physics, 86, 85

S.K. Chakrabarti et al. 2012, VLF signals in summer and winter in the Indian sub-continent using multistation campaigns, Ind. J. Physics, 86, 323.

S.K. Chakrabarti, S. Pal, S. Sasmal, S. K. Mondal, S. Ray, T. Basak,

S. K. Maji, B. Khadka, D. Bhowmick, A. K. Chowdhury, 2012, VLF campaign during the total eclipse of 22nd July, 2009: observational results and interpretations, J. Atmos. Solar Terr. Physics, 86, 65

S. K Maji, S. K Chakrabarti, S. K. Mondal, 2012,

Unique observation of a Solar Flare by Lunar Occultation during the 2010 Annular Solar Eclipse through ionospheric disturbances in VLF waves, EMP, 108, 243

K. Giri and Sandip K. Chakrabarti, 2012, Hydrodynamic simulations of viscous accretion flows around black holes, MNRAS 421, 666

S.K. Chakrabarti, Fundamental Concepts in Transonic Flow Paradigm of Black Hole Astrophysics, 2012, IJMPD, 20, 1723

Das, A., Majumdar, L., S.K. Chakrabarti and S. Chakrabarti, 2012, Study of the formation of proto-stars by a two dimensional hydrodynamic simulation and the chemical evolution during these processes, RAA (in press).

A. Nandi, D. Debnath, S. Mandal, S.K. Chakrabarti, 2012, Accretion flow dynamics during the evolution of timing and spectral properties of GX 339-4 in 2010-11

Accretion flow dynamics during the evolution of timing and spectral properties of GX 339-4 in 2010-1 outburst,

A & A, 542, 56

L. Izzo, R. Ruffini, A. V. Penacchioni, C. L. Bianco, L. Caito, S. K. Chakrabarti, J.A. Rueda, A. Nandi, B. Patricelli A double component in GRB 090618: a proto-black hole and a genuine long GRB 2012, 543, 10

S. Pal, S.K. Chakrabarti and Mondal, S.K., 2012, Modeling of subionospheric VLF signal perturbations associated with Total Solar Eclipse-2009 in Indian sub-continent, Advances of Space Research, 50, 196

S. K. Mondal, S.K. Chakrabarti, S. Sasmal, Detection of Ionospheric perturbation due to a soft gamma ray repeater

SGR J1550-5418 by VLF waves, 2012, AP & SS, 341, 259

C.B. Singh and S.K. Chakrabarti, 2012, On the nature of the parameter space in the presence of dissipative standing shocks in accretion flows around black holes 421, 1666.

S.K. Pal, S. Maji, S.K. Chakrabarti, 2012, Unique Observation and Modeling of the D-region electron density profile due to a Solar Flare occulted by Lunar Disc during the 2010 Annular Solar Eclipse, Planetary and Space Science (In press)

Garain, S. K., Ghosh, H., Chakrabarti, S. K., 2012, Effects of Compton Cooling on Outflow in a Twocomponent Accretion Flow around a Black Hole: Results of a Coupled Monte Carlo Total Variation Diminishing Simulation, ApJ, 758, 114 *Papers in Proceedings:*

Ghosh, Himadri; Garain, Sudip K.; Giri, Kinsuk; Chakrabarti, Sandip K., 2012,

Monte-Carlo Simulations of Comptonization Process in a Two Component Accretion Flow around a Black Hole in Presence of an Outflow, Proceedings of the Twelfth Marcel Grossmann Meeting on General Relativity, edited by Thibault Damour, Robert T. Jantzen and Remo Ruffini. ISBN 978-981-4374-51-4. Singapore: World Scientific, p. 985

Pal, P. S., Chakrabarti, S. K., Nandi, A, Sequencing the Variability Classes of GRS 1915+105, 2012, Proceedings of the Twelfth Marcel Grossmann Meeting on General Relativity, edited by Thibault Damour,

Robert T. Jantzen and Remo Ruffini. ISBN 978-981-4374-51-4. Singapore: World Scientific, p. 969 Chakrabarti, Sandip K.; Pal, Partha S., 2012, Dynamical Evolution of Spectral and Timing Properties of Compact Objects: Some Examples, International Journal of Modern Physics: Conference Series, v. 12, 01, p. 68

Chechetkin Valery

Position: Keldysh Institute of Applied Mathematics RAS Main Scientific Researcher, Professor RAS; 1998-2011. M I PH U , Moscow, Russia , Professor Period covered: : Keldysh Institute of Applied Mathematics RAS 1994 –2011; 1998-2011. M I PH U , Moscow, Russia



I. Scientific Work

1. Numerical simulation of formation of cyclone vortex flows in the intratropical zone of convergence and their early detection

Mingalev, I. V.; Astaf'eva, N. M.; Orlov, K. G.; Chechetkin, V.M. et al. Source: COSMIC RESEARCH Volume: 50 Issue: 3 Pages: 233-248 DOI: 10.1134/S0010952512020062 Published: MAY 2012

2. Possibility of explaining the existence of vortexlike hydrodynamic structures based on the theory of stationary kinetic equations

Belotserkovskii, O. M.; Fimin, N. N.; Chechetkin, V. M.

COMPUTATIONAL MATHEMATICS AND MATHEMATICAL PHYSICS Volume: 52 Issue: 5 Pages: 815-824 DOI: 10.1134/S096554251205003X Published: MAY 2012

3. Dynamics of an ultra-relativistic, collisionless astrophysical plasma

Chechetkin, V. M.; Dyachenko, V. F.; Ginzburg, S. L.; et al.

ASTRONOMY REPORTS Volume: 56 Issue: 5 Pages: 329-335 DOI: 10.1134/S1063772912040026 Published: MAY 2012

4. Computations of the Collapse of a Stellar Iron Core Allowing for the Absorption, Emission, and Scattering of Electron Neutrinos and Anti-Neutrinos

Aksenov, A. G.; Chechetkin, V. M.

ASTRONOMY REPORTS Volume: 56 Issue: 3 Pages: 193-206 DOI: 10.1134/S1063772912030018 Published: MAR 2012

5. Magneto-rotational Instability in the Accreting Envelope of a Protostar and the Formation of the Large-Scale Magnetic Field

Velikhov, E. P.; Sychugov, K. R.; Chechetkin, V. M.; et al.

ASTRONOMY REPORTS Volume: 56 Issue: 2 Pages: 84-95 DOI: 10.1134/S106377291201009X Published: FEB 2012

6. The Development of Large-Scale Instability in Keplerian Stellar Accretion Disks Lugovskii, A. Yu.; Chechetkin, V. M.

ASTRONOMY REPORTS Volume: 56 Issue: 2 Pages: 96-103 DOI: 10.1134/S1063772912020047 Published: FEB 2012

II. Conferences and educational activities

II a. Conferences and Other External Scientific Works

1.Chechetkin V.M., MRI instability in stars and accretion disks, "10th Inter national Seminar on Mathematical Models and Modeling in Laser-Plasma Processes & Advanced Science Technologies", Montenegro. Perovac, 26 May -1 June, 2012

2. CHECHETKIN V.M. Did the SN 1987A outburst leave a compact remnant?, , , 12-th International Gamow Summer School "Astronomy and beyond: Astrophysics, Cosmology and Gravitation, Cosmomicrophysics, Radio-astronomy and Astrobiology", международная, (Ukraine, Odessa, Chernomorka, 22-28 August, 2012)

II b. Work With Students

1. Filina Anastasija, Explosive burning in stellar condition, M I PH U, Moscow, Russia

2. Blokhin Konstantin, Remnant of supernova arouud compact nreutron star, M I PH U , Moscow, Russia

II c. Diploma thesis supervision Sychugov Konstantin, MRI in young stars.

Damour Thibault

Position: Professeur Permanent Institut des Hautes Etudes Scientifiques. Period covered: 2012

<u>Conferences and educational activities</u> ICRANET-related Collaborations with Donato BINI Alessandro NAGAR Hermann NICOLAI

2012 List of publications



1.

Gravitational radiation reaction along general orbits in the effective one-body formalism. Donato Bini, Thibault Damour. Oct 2012. 43 pp.

e-Print: arXiv:1210.2834 [gr-qc]

Abstract:

We derive the gravitational radiation-reaction force modifying the Effective One Body (EOB) description of the conservative dynamics of binary systems. Our result is applicable to general orbits (elliptic or hyperbolic) and keeps terms of fractional second post-Newtonian order (but does not include tail effects). Our derivation of radiation-reaction is based on a new way of requiring energy and angular momentum balance. We give several applications of our results, notably the value of the (minimal) 'Schott' contribution to the energy, the radial component of the radiation-reaction force, and the radiative contribution to the angle of scattering during hyperbolic encounters. We present also new results about the conservative relativistic dynamics of hyperbolic motions.

2.

Gravitational self-force and the effective-one-body formalism between the innermost stable circular orbit and the light ring.

Sarp Akcay, Leor Barack, Thibault Damour, Norichika Sago. Sept 2012. 43 pp.

e-Print: arXiv:1209.0964 [gr-qc]

Abstract:

We compute the conservative piece of the gravitational self-force (GSF) acting on a particle of mass m1 as it moves along an (unstable) circular geodesic orbit between the innermost stable circular orbit (ISCO) and the light ring of a Schwarzschild black hole of mass m2>m1. More precisely, we construct the function huu(x)≡hµvuµuv (related to Detweiler's gauge-invariant 'redshift' variable), where hµv is the regularized metric perturbation in the Lorenz gauge, uµ is the four-velocity of m1, and x[Gc−3(m1+m2)Ω]2/3 is an invariant coordinate constructed from the orbital frequency Ω . In particular, we explore the behavior of huu just outside the 'light ring' at x=1/3, where the circular orbit becomes null. Using the recently discovered link between huu and the piece a(u), linear in the symmetric mass ratio nu, of the main radial potential A(u,v) of the Effective One Body (EOB) formalism, we compute a(u) over the entire domain $0 \le u \le 1/3$ (extending previous results for $u \le 1/5$). We find that a(u) {\it diverges} like $\approx 0.25(1-3u)-1/2$ at the light-ring limit, explain the physical origin of this divergent behavior, and discuss its consequences for the EOB formalism. We construct accurate global analytic fits for a(u), valid on the entire domain 0<u<1/3 (and possibly beyond), and give accurate numerical estimates of the values of a(u) and its first 3 derivatives at the ISCO. In previous work we used GSF data on slightly eccentric orbits to compute a certain linear combination of a(u) and its first two derivatives, involving also the O(v) piece d(u) of a second EOB radial potential D(u,v). Combining these results with our present global analytic representation of a(u), we numerically compute (d) on the interval 0<u≤1/6.

3.

Measurability of the tidal polarizability of neutron stars in late-inspiral gravitational-wave signals. Thibault Damour, Alessandro Nagar, Loic Villain. Mar 2012. 28 pp. Published in Phys.Rev. D85 (2012) 123007 e-Print: arXiv:1203.4352 [gr-qc]

Abstract:

The gravitational wave signal from a binary neutron star inspiral contains information on the nuclear equation of state. This information is contained in a combination of the tidal polarizability parameters of the two neutron stars and is clearest in the late inspiral, just before merger. We use the recently defined tidal extension of the effective one-body formalism to construct a controlled analytical description of the frequency-domain phasing of neutron star inspirals up to merger. Exploiting this analytical description we find that the tidal polarizability parameters of neutron stars can be measured by the advanced LIGO-Virgo detector network from gravitational wave signals having a reasonable signal-to-noise ratio of *Q*=16. This measurability result seems to hold for all the nuclear equations of state leading to a maximum mass larger than 1.97M⊙. We also propose a promising new way of extracting information on the nuclear equation of state from a coherent analysis of an ensemble of gravitational wave observations of separate binary merger events.

4.

Theoretical Aspects of the Equivalence Principle. Thibault Damour. Feb 2012. 21 pp. Published in Class.Quant.Grav. 29 (2012) 184001 e-Print: arXiv:1202.6311 [gr-qc]

Abstract:

We review several theoretical aspects of the Equivalence Principle (EP). We emphasize the unsatisfactory fact that the EP maintains the absolute character of the coupling constants of physics while General Relativity, and its generalizations (Kaluza-Klein,..., String Theory), suggest that all absolute structures should be replaced by dynamical entities. We discuss the EP-violation phenomenology of dilaton-like models, which is likely to be dominated by the linear superposition of two effects: a signal proportional to the nuclear Coulomb energy, related to the variation of the fine-structure constant, and a signal proportional to the surface nuclear binding energy, related to the variation of the light quark masses. We recall the various theoretical arguments (including a recently proposed anthropic argument) suggesting that the EP be violated at a small, but not unmeasurably small level. This motivates the need for improved tests of the EP. These tests are probing new territories in physics that are related to deep, and mysterious, issues in fundamental physics.

5.

Effective action approach to higher-order relativistic tidal interactions in binary systems and their effective one body description.

Donato Bini, Thibault Damour, Guillaume Faye. Feb 2012. 29 pp.

Published in Phys.Rev. D85 (2012) 124034

e-Print: arXiv:1202.3565 [gr-qc]

Abstract:

The gravitational-wave signal from inspiralling neutron-star-neutron-star (or black-hole--neutron-star) binaries will be influenced by tidal coupling in the system. An important science goal in the gravitational-wave detection of these systems is to obtain information about the equation of state of neutron star matter via the measurement of the tidal polarizability parameters of neutron stars. To extract this piece of information will require to have accurate analytical descriptions of both the motion and the radiation of tidally interacting binaries. We improve the analytical description of the late inspiral dynamics by computing the next-to-next-to-leading order relativistic correction to the tidal interaction energy. Our calculation is based on an effective-action approach to tidal interactions, and on its transcription within the effective-one-body formalism. We find that second-order relativistic effects (quadratic in the relativistic

gravitational potential u=G(m1+m2)/(c2r)) significantly increase the effective tidal polarizability of neutron stars by a distance-dependent amplification factor of the form $1+\alpha 1u+\alpha 2u2+...$ where, say for an equal-mass binary, $\alpha 1=5/4=1.25$ (as previously known) and $\alpha 2=85/14\simeq6.07143$ (as determined here for the first time). We argue that higher-order relativistic effects will lead to further amplification, and we suggest a Padé-type way of resumming them. We recommend to test our results by comparing resolution-extrapolated numerical simulations of inspiralling-binary neutron stars to their effective one body description.

6.

Energy versus Angular Momentum in Black Hole Binaries.

Thibault Damour, Alessandro Nagar, Denis Pollney, Christian Reisswig. Oct 2011. 4 pp.

Published in Phys.Rev.Lett. 108 (2012) 131101

e-Print: arXiv:1110.2938 [gr-qc]

Abstract:

Using accurate numerical relativity simulations of (nonspinning) black-hole binaries with mass ratios 1:1, 2:1 and 3:1 we compute the gauge invariant relation between the (reduced) binding energy E and the (reduced) angular momentum j of the system. We show that the relation E(j) is an accurate diagnostic of the dynamics of a black-hole binary in a highly relativistic regime. By comparing the numerical-relativity ENR(j) curve with the predictions of several analytic approximation schemes, we find that, while the usual, non-resummed post-Newtonian-expanded EPN(j) relation exhibits large and growing deviations from ENR(j), the prediction of the effective one-body formalism, based purely on known analytical results (without any calibration to numerical relativity), agrees strikingly well with the numerical-relativity results.

Future research plans of T. Damour

The main topics I intend to investigate in the near future are:

1. Development of the Effective One Body (EOB) formalism in several directions: improvement in the treatment of non spinning bodies, new ways of dealing with spinning bodies,...

2. Study of the quantum dynamics of Bianchi universes in supergravity

3. Development of the Gravity/Coset conjecture of Damour-Henneaux-Nicolai, and, in particular, further study of the tower of constraints (hopefully representing a generalization of the algebra of diffeomorphisms).

Frontera Filippo

Position: Full Professor University of Ferrara Period covered: 2012

I Scientific Work

Experimental and observational X-/gamma-ray astronomy, in parti

- a. Gamma-ray lens development with long focal length (LAUE project);
- b. Preparation of the mission proposal GAME submitted to ESA in response to the ESA call for small missions;
- c. Observational studies of GRB prompt emission;
- d. Observational studies of Compact objects in binary systems

II Conferences and educational activities

II a Conferences and Other External Scientific Work

- a. EMJD IRAP-PhD school, Nice, Sept 2012
- b. Workshop on "Positrons in Astrophysics", Muerren, Swiss, March 2012.
- c. Workshop on X-ray diffraction in the Centennial from its discovery by Max von Laue, Accademia Lincei, Rome, May 2012
- d. 13th Marcel Grossmann Meeting, July 2012
- e. 3rd National Conference on GRBs, Naples, Sept 2012
- f. 20th Conference of the Italian Society of Gravitation and General Relativity, Naples, Oct 2012

II b Work With Students

yes, with

- a) 1 PhD student in Physics (Caterina Lombardi), University of Ferrara-IRAPP-PhD program
- b) 2 PhD students (Vincenzo Liccardo, Vineeth Valsan), EMJD-IRAP-PhD program
- c) 1 PhD student (Disha Sawant), EMJD-IRAP-PhD program

II c Other Teaching Duties

Two courses at UNIFE, one "Astronomical Observations" to undergraduate students in Physics, the other "Measures and Observations of Celestial X- and gamma-rays" to Master Students in Physics.

II d. Work With Postdocs

Yes, with two PostDocs E.Virgilli and R. Farinelli, at Physics Department, University of Ferrara

III. Service activities

III a. Within ICRANet Lectures to PhD students

III b. Outside ICRANet

Director of the PhD program in Physics, University of Ferrara

2012 List of Publications

1. Evangelista, Y.; Feroci, M.; Argan, A.; Campana, R.; Costa, E.; Del Monte, E.; Donnarumma, I.; Lazzarotto, F.; Muleri, F.; Pacciani, L.; Rapisarda, M.; Rubini, A.; Soffitta, P.; Amati, L.; Labanti, C.; Fuschino, F.;

Maiorano, E.; Marisaldi, M.; Masetti, N.; Morelli, E.; Nicastro, L.; Orlandini, M.; Palazzi, E.; Traci, A.; Frontera, F.; Drago, A.; Farinelli, R.; Titarchuk, L.; Vacchi, A.; Rashevski, A.; Zampa, G.; Zampa, N.; Ruffini, R.; Bertuccio, G.; Bombaci, I.; Ghisellini, G.; Grassi, M.; Malcovati, P.; Picolli, L.; Lazzati, D.; Pian, E.; Salvaterra, R.; Braga, J., A Proposed Italian Contribution for the Mirax Scientific Payload, International Journal of Modern Physics: Conference Series, vol. 12, issue 01, p. 110 (2012)

2. Frontera, Filippo; Amati, Lorenzo; Farinelli, Ruben; Guidorzi, Cristiano; Landi, Raffaella; Titarchuk, Lev; in't Zand, Jean J. M., Time Resolved Spectra of GRBs Simultaneously Detected with BATSE and BeppoSAX/WFCs, International Journal of Modern Physics Conference Series (IJMPCS), vol. 12, issue 01, pp. 136-145 (2012)

3. Frontera, F.; Virgilli, E.; Liccardo, V.; Valsan, V.; Carassiti, V.; Evangelisti, F.; Squerzanti, S.; Risaliti, G., Gamma-ray Laue lenses under development for deep AGN observations, Journal of Physics: Conference Series, Volume 355, Issue 1, pp. 012005 (2012).

4. Orlandini, Mauro; Frontera, Filippo; Masetti, Nicola; Sguera, Vito; Sidoli, Lara, BeppoSAX Observations of the X-Ray Pulsar MAXI J1409-619 in Low State: Discovery of Cyclotron Resonance Features, The Astrophysical Journal, Volume 748, Issue 2, article id. 86, 11 pp. (2012).

5. Titarchuk, Lev; Farinelli, Ruben; Frontera, Filippo; Amati, Lorenzo, An Upscattering Spectral Formation Model for the Prompt Emission of Gamma-Ray Bursts, The Astrophysical Journal, Volume 752, Issue 2, article id. 116, 14 pp. (2012).

6. Frontera, F.; Amati, L.; Guidorzi, C.; Landi, R.; in't Zand, J., Broadband Time-resolved E p, i -L iso Correlation in Gamma-Ray Bursts, The Astrophysical Journal, Volume 754, Issue 2, article id. 138, 10 pp. (2012).

7. Frontera, F.; Amati, L.; Guidorzi, C.; Landi, R.; in't Zand, J., Erratum: "Broadband Time-resolved ep,i -l iso Correlation in Gamma-Ray Bursts" (2012, ApJ, 754, 138), The Astrophysical Journal, Volume 757, Issue 1, article id. 107, 1 pp. (2012).

8. Frontera, F.; Virgilli, E.; Liccardo, V.; Valsan, V.; Carassiti, V.; Chiozzi, S.; Evangelisti, F.; Squerzanti, S.; Statera, M.; Guidi, V.; Ferrari, C.; Zappettini, R. A.; Caroli, E.; Auricchio, N.; Silvestri, S.; Camattari, R.; Cassese, F.; Recanatesi, L.; Pecora, M.; Mottini, S.; Negri, B., Development status of the LAUE project, Space Telescopes and Instrumentation 2012: Ultraviolet to Gamma Ray, Proceedings of the SPIE, Volume 8443, id. 84430B-84430B-9 (2012).

9. Valsan, Vineeth; Frontera, Filippo; Virgilli, Enrico; Liccardo, Vincenzo, Expected performance of a Laue lens based on bent crystals, Space Telescopes and Instrumentation 2012: Ultraviolet to Gamma Ray. Proceedings of the SPIE, Volume 8443, id. 844331-844331-7 (2012).

10. Liccardo, V.; Virgilli, E.; Frontera, F.; Valsan, V., Characterization of bent crystals for Laue lenses, Space Telescopes and Instrumentation 2012: Ultraviolet to Gamma Ray. Proceedings of the SPIE, Volume 8443, id. 844332-844332-10 (2012).

11. Feroci, M.; Stella, L.; van der Klis, M.; Courvoisier, T. J.-L.; Hernanz, M.; Hudec, R.; Santangelo, A.; Walton, D.; Zdziarski, A.; Barret, D.; Belloni, T.; Braga, J.; Brandt, S.; Budtz-Jørgensen, C.; Campana, S.; den Herder, J.-W.; Huovelin, J.; Israel, G. L.; Pohl, M.; Ray, P.; Vacchi, A.; Zane, S.; Argan, A.; Attinà, P.; Bertuccio, G.; Bozzo, E.; Campana, R.; Chakrabarty, D.; Costa, E.; De Rosa, A.; Del Monte, E.; Di Cosimo, S.; Donnarumma, I.; Evangelista, Y.; Haas, D.; Jonker, P.; Korpela, S.; Labanti, C.; Malcovati, P.; Mignani, R.; Muleri, F.; Rapisarda, M.; Rashevsky, A.; Rea, N.; Rubini, A.; Tenzer, C.; Wilson-Hodge, C.; Winter, B.; Wood, K.; Zampa, G.; Zampa, N.; Abramowicz, M. A.; Alpar, M. A.; Altamirano, D.; Alvarez, J. M.; Amati,

L.; Amoros, C.; Antonelli, L. A.; Artigue, R.; Azzarello, P.; Bachetti, M.; Baldazzi, G.; Barbera, M.; Barbieri, C.; Basa, S.; Baykal, A.; Belmont, R.; Boirin, L.; Bonvicini, V.; Burderi, L.; Bursa, M.; Cabanac, C.; Cackett, E.; Caliandro, G. A.; Casella, P.; Chaty, S.; Chenevez, J.; Coe, M. J.; Collura, A.; Corongiu, A.; Covino, S.; Cusumano, G.; D'Amico, F.; Dall'Osso, S.; De Martino, D.; De Paris, G.; Di Persio, G.; Di Salvo, T.; Done, C.; Dovčiak, M.; Drago, A.; Ertan, U.; Fabiani, S.; Falanga, M.; Fender, R.; Ferrando, P.; Della Monica Ferreira, D.; Fraser, G.; Frontera, F.; Fuschino, F.; Galvez, J. L.; Gandhi, P.; Giommi, P.; Godet, O.; Göğ üş, E.; Goldwurm, A.; Götz, D.; Grassi, M.; Guttridge, P.; Hakala, P.; Henri, G.; Hermsen, W.; Horak, J.; Hornstrup, A.; in't Zand, J. J. M.; Isern, J.; Kalemci, E.; Kanbach, G.; Karas, V.; Kataria, D.; Kennedy, T.; Klochkov, D.; Kluźniak, W.; Kokkotas, K.; Kreykenbohm, I.; Krolik, J.; Kuiper, L.; Kuvvetli, I.; Kylafis, N.; Lattimer, J. M.; Lazzarotto, F.; Leahy, D.; Lebrun, F.; Lin, D.; Lund, N.; Maccarone, T.; Malzac, J.; Marisaldi, M.; Martindale, A.; Mastropietro, M.; McClintock, J.; McHardy, I.; Mendez, M.; Mereghetti, S.; Miller, M. C.; Mineo, T.; Morelli, E.; Morsink, S.; Motch, C.; Motta, S.; Muñoz-Darias, T.; Naletto, G.; Neustroev, V.; Nevalainen, J.; Olive, J. F.; Orio, M.; Orlandini, M.; Orleanski, P.; Ozel, F.; Pacciani, L.; Paltani, S.; Papadakis, I.; Papitto, A.; Patruno, A.; Pellizzoni, A.; Petráček, V.; Petri, J.; Petrucci, P. O.; Phlips, B.; Picolli, L.; Possenti, A.; Psaltis, D.; Rambaud, D.; Reig, P.; Remillard, R.; Rodriguez, J.; Romano, P.; Romanova, M.; Schanz, T.; Schmid, C.; Segreto, A.; Shearer, A.; Smith, A.; Smith, P. J.; Soffitta, P.; Stergioulas, N.; Stolarski, M.; Stuchlik, Z.; Tiengo, A.; Torres, D.; Török, G.; Turolla, R.; Uttley, P.; Vaughan, S.; Vercellone, S.; Waters, R.; Watts, A.; Wawrzaszek, R.; Webb, N.; Wilms, J.; Zampieri, L.; Zezas, A.; Ziolkowski, J., The Large Observatory for X-ray Timing (LOFT), Experimental Astronomy, Volume 34, Issue 2, pp.415-444 (2012).

12. von Ballmoos, Peter; Alvarez, Jose; Barrière, Nicolas; Boggs, Steve; Bykov, Andrei; Del Cura Velayos, Juan Manuel; Frontera, Filippo; Hanlon, Lorraine; Hernanz, Margarita; Hinglais, Emmanuel; Isern, Jordi; Jean, Pierre; Knödlseder, Jürgen; Kuiper, Lucien; Leising, Mark; Pirard, Benoît; Prost, Jean-Pierre; da Silva, Rui M. Curado; Takahashi, Tadayuki; Tomsick, John; Walter, Roland; Zoglauer, Andreas, A DUAL mission for nuclear astrophysics, Experimental Astronomy, Volume 34, Issue 2, pp.583-622 (2012).

13. Farinelli, R.; Amati, L.; Shaposhnikov, N.; Frontera, F.; Masetti, N.; Palazzi, E.; Landi, R.; Lombardi, C.; Orlandini, M.; Brocksopp, C., Spectral evolution of the X-ray nova XTE J1859+226 during its outburst observed by BeppoSAX and RXTE, Monthly Notices of the Royal Astronomical Society, in press (2012).

Jantzen Robert

Position: Professor Period covered: Summer 2011 through Summer 2012

I. Scientific Work

Continuing collaboration with Donato Bini and Andrea Geralico on mathematical properties of stationary spacetimes and with Remo Ruffini on Fermi and electromagnetic mass.

II. Conferences and educational activities

Continuing MG13 organizational and editorial duties



2012 List of Publication

Separable geodesic action slicing in stationary spacetimes D. Bini, A. Geralico and R.T. Jantzen Gen. Rel. Grav. 44, 603-621 (2012).

On Fermi's resolution of the ``4/3 problem" in the classical theory of the electron: hidden in plain sight D. Bini, A. Geralico, R.T. Jantzen and R. Ruffini, in book Fermi, Einstein, Heisenberg and Relativistic Astrophysics: Personal Reflections, Edited by R. Ruffini, to appear (2012).

Fermi and Electromagnetic Mass R.T. Jantzen and R. Ruffini Gen. Relativ. Grav. 44, 2063-2070 (2012).

Proceedings of the Twelfth Marcel Grossmann Meeting on General Relativity (2009) T. Damour, R.T. Jantzen, R. Ruffini, Eds., World Scientific, Singapore, 2012.

On the Mathematics of Income Inequality: Splitting the Gini Index in Two R.T. Jantzen and K. Volpert American Mathematical Monthly 119, 824-837 (2012).

Scattering of particles by radiation fields: a comparative analysis D. Bini, A. Geralico, M. Haney and R.T. Jantzen Phys. Rev. D 86, 064016 (20pages) (2012).

Khalatnikov Isaak

Position: Visiting Professor Period covered: 22 October – 22 November 2012

I Scientific Work

- 1. Discussions on the Euler- Tricomi problem in Relativistic Hydrodynamics (with V. Belinski)
- 2. Discussions on the quantum creation of the universe by gravitational instanton of Wheeler- De Witt equation (with G. Vereshchagin)

II Conferences and educational activities

13th Marcel Grossmann Meeting (Stockholm, July 2012)



Lee Hyung Won

Position: Professor, Inje University Period covered: 8 July 2012 – 22 July 2012

I Scientific Work

- 1. Dark energy
- 2. Exact solution of Einstein equations
- 3. Numerical Relativity
- 4. Neutrino Physics

II Conferences and educational activities

II a Conferences and Other External Scientific Work

- 1. The 13th MG meeting, Stokholm, 1 July 2012 ~ 7 July 2012.
- 2. The current issues on Relativistic Astrophysics, Seoul, 5 November 2012 6 November 2012.

2012 List of Publication

- 1. Hyung Won Lee, Yun Soo Myung, "The absence of the Kerr black hole in the Hořava–Lifshitz gravity", Eur. Phys. J. **C72**, 1865(2012).
- 2. Hyung Won Lee, Kyoung Yee Kim, and Yun Soo Myung, "Massive gravitons dark matter scenario revisited", Mod. Phys. Lett. **A27**, 1250146(2012).
- 3. Sang Pyo Kim, Hyung Won Lee, and Remo Ruffini, "Schwinger Pair Production in Pulsed Electric Fields", Phys. Rev. D (submitted).



Quevedo Hernando

Position: Full Profesor (Universidad Nacional Autónoma de México) Adjunct Professor (ICRANet) Period covered: December 2011 – November 2012

I. <u>Scientific Work</u>

Topics

- Exterior and interior solutions of Einstein's equations and applications in relativistic astrophysics.
- The physics of naked singularities.
- Geometrothermodynamics of black holes.
- Applications of geometrothermodynamics in cosmology.
- Topological quantization of classical field theories.

II. Conferences and educational activities

II a. Conferences and Other External Scientific Works Visiting Professor at the Kazakh National University (Almaty, Kazakhstan, March-May, 2012) 13th Marcel Grossman Meeting (Stockholm, Sweden, July, 2012)

II b. Work With Students

ICRANet students:

- Kuantay Boshkayev
 - Topic: Exact and approximate metrics in relativistic astrophysics

II c. Diploma thesis supervision

ICRANet students:

- Orlando Luongo (PhD) Topics: Geometrothermodynamics in general relativity and cosmology
- Alessandro Bravetti (PhD) Topic: Topological and geometric properties of the thermodynamic phase space

UNAM students:

- Lorena Campuzano (MSc)
 Topic: Geometrothermodynamics of cosmological models
- Francisco Nettel (PhD) Topic: Topological quantization in string theory
- Diego Tapias (PhD) Topic: Geometric description of thermodynamic processes
- Saken Toktarbay (PhD) Topic: Relativistic compact objects
- David Garcia (PhD)
 Topic: Sasakian metrics in geometrothermodynamics
- Daniel Soto (MSc)
 - Topic: Topological quantization of the Reissner-Nordström black hole
- Antonio Ramirez (BSc)
- Topic: Geometrothermodynamics of the van der Waals gas
- Edgar Gasperín (BSc) Topic: Motion of test particles in the field of naked singularities
- Sasha Zaldivar (BSc) Topic: Geometothermodynamics of quantum gases

II d. Other Teaching Duties

- Geometrothermodynamics: An introduction (graduate students course - KazNU)

II e. Work With Postdocs

- Dr. Alberto Sanchez (UNAM)
 Topic: Geometrothermodynamics and statistics of black holes
- Dr. Cesar Lopez (UNAM) Topic: Relativistic and non-equilibrium thermodynamics
- Dr. Calixto Gutierrez (UNAM)
 Topic: Disk-halo systems in relativistic astrophysics
- Orlando Luongo (UNAM) Topic: Applications of geometrothermodynamics in cosmology
- Daniela Pugliese (Queen Mary College)
 Topic: Motion of test particles in the Kerr-Newman spacetime

2012 List of Publications

-"An expanding Universe with Constant Pressure and no Cosmological Constant" (O. Luongo and H. Quevedo), Astrophysics and Space Science, **338** 345 – 349 (2012).

- "Geometrothermodynamics in Horava-Lifshitz Gravity" (H. Quevedo, A. Sánchez, S. Taj, A. Vazquez), Journal of Physics A: Mathematical and Theoretical **45**:055211 (2012).

- "Geometrothermodynamics of Five Dimensional Black Holes in Einstein-Gauss-Bonnet-Theory" (S. Taj, H. Quevedo and A. Sánchez), General Relativity and Gravitation, **44** 1489 - 1523 (2012).

-"Extending the generalized Chaplygin gas model by using geometrothermodynamics" (A. Aviles, A. Bastarrachea, L. Campuzano and H. Quevedo), Physical Review D 86:063508 (2012).

-"On the gravitational field of compact objects in general relativity" (K. Boshkayev, H. Quevedo and R. Ruffini), Physical Review D 86:064043 (2012).

- "Thermodynamics of topological black holes in Horava–Lifshitz gravity" (H. Quevedo, A. Sánchez and S. Taj) Journal of Physics, Proceedings of the 3rd. Italian-Pakistani Workshop on Relativistic Astrophysics (IPWRA2011) (Lecce, Italy 20 – 22 June, 2011) Journal of Physics: Conference Series **354** 012015 (2012).

- "Topological Quantization of Bosonic Strings" (G. Arciniega, F. Nettel, L. Patiño and H. Quevedo), International Journal of Pure and Applied Mathematics (2012) accepted.

Rafelski Johann

Position: Professor of Physics and Member of the Theoretical Astrophysics Program at The University of Arizona, Tucson, Arizona



Scientific Areas of Interest Include

a) Study of Early Universe in the Era of Quark-Hadron Phase of Matterb) Quantum Vacuum State in Strong Fields and Particle Productionc) Properties of Compact Ultra Dense Objects (CUDO)

Selected Conferences

SpacePart12: Particle Physics in Space Conference, CERN Nov. 5-7, 2012, Invited Lecture on: *Connecting QGP-RHI physics to the Early Universe*

Krakow School of Theoretical Physics, Zakopane, May, 2012 three lectures on: *From Quark-Gluon Plasma to Neutrino Decoupling*

Rome Symposium in Honor of Remo Ruffini, University Rome La Sapienza, May 18, 2012 Solar System Signatures of Impacts by Compact Ultra Dense Objects

Leung Center for Cosmology and Particle Astrophysics, National University, Taipei, Taiwan, Symposium, "Towards Ultimate Understanding of the Universe", February 6-9, 2012 on *Critical Acceleration*

Work With ICRAnet Associates and Students

<u>Lecture Series</u> presented on March 5,6,7, 2012 Discovery of Quark-Gluon Plasma Quark-Gluon Plasma in the Early Universe Renaissance of Strong Field Physics: Critical Acceleration and Laser Pulses

<u>Discussions With Faculty and Associates on</u> Effort to formulate particle production in time dependent supercritical fields Search for improved understanding of Nonlinear Electromagnetism Models of ultra-dense matter

ICRAnet Service activities Member of Steering Committee of ICRAnet

Session organization and session chair at MG13 Marcel Grossmann Meeting, Stockholm, Sweden July 1-7 2012

Selected 2012 Publication

M.J. Fromerth, I. Kuznetsova, L. Labun, J. Letessier and J. Rafelski, ``*From Quark-Gluon Universe to Neutrino Decoupling*: 200<*T*<2*MeV*,'' arXiv:1211.4297.

C. Dietl, L. Labun and J. Rafelski, *``Properties of Gravitationally Bound Dark Compact Ultra Dense Objects,''* Phys. Lett. B 709, 123 (2012), arXiv:1110.0551.

I. Kuznetsova and J. Rafelski, *``Electron-Positron Plasma Drop Formed by Ultra-Intense Laser Pulses,''* Phys. Rev. D 85, 085014 (2012), arXiv:1109.3546.

Rosati Piero

Position: Full Astronomer at the European Southern Observatory (Garching b. München) Period covered: Jan-Nov 2012 http://ww.eso.org/~prosati



I Scientific Work

Most of my scientific activity this year focused on the *CLASH* project: *Cluster Lensing and Supernova survey with Hubble,* as PI of the ESO Large Programme:

Dark Matter Mass Distributions of Hubble Treasury Clusters and the Foundations of ACDM Structure Formation Models". Publication of science results from this project, including several press releases, have been ramping up this year (see publications below) and will continue to expand in 2013. Other scientific work was devoted to a) the discovery and study of distant galaxy clusters, and their implication for Cosmology; b) the development of the Wide Field X-ray Telescope mission (see <u>http://www.wfxt.eu</u>).

II Conferences and educational activities

II a Conferences and Other External Scientific Work

- *"First results from CLASH: calibrating cluster masses"* <u>Invited Talk</u> presented at "Clusters as Cosmological probes", Ringberg Castle (Germany), Nov 20, 201
- "Present and Future Surveys of Galaxy Clusters" <u>Invited Review</u> presented at "X-ray Astronomy: Towards the Next 50 years", Milano (Italy), Oct 1-6, 2012
- *"High-z Lensed Galaxies from CLASH"* <u>Invited Talk</u> presented at "Bologna High-z Workshop", Bologna, June 5-6, 2012
- "CLASH-VLT: First Results" Talk presented at Beyond ΛCDM, Sexten (Italy), July 2-6, 2012
- *"Probing Structure Formation and Cosmology with Galaxy Clusters"* <u>Invited Talk</u> presented at "Annual Danish Astrophysics Meeting 2012", Island of Hven, May 30-31, 2012
- *"Testing the ACDM scenario with galaxy clusters across cosmic time"* JHU <u>Colloquium</u> presented at Johns Hopkins University, Baltimore (MD), 10 May 2012
- Organized Conference (SOC co-Chair) of "Growing-up at high redshift: from proto-clusters to galaxy clusters" ESAC, Spain, Sept 10-13, 2012
- Organized workshop "Beyond ACDM" at the Sesto Center for Astrophysics, July 2012, Sexten, Italy

II b Work With Students

Ulricke Kuchner (Univ. of Vienna) "Galaxy populations in CLASH clusters" (started in Sept 2012)

II c Other Teaching Duties

Series of Lectures at XVIIAG/USP Advanced School on Astrophysics Radio-astronomy, Galaxies and clusters at high-z: "*Structure Formation and Cosmology with High-z Clusters*", 4-9 November, 2012 - Itatiba/SP, Brazil (http://www.astro.iag.usp.br/~xvieaa/

II d. Work With Postdocs: documented in several publications below

III. Service activities

III a. Within ICRANet: N/A this year

III b. Outside ICRANet:

• Telescope Allocation Committee for NASA/Chandra (Boston, Jun 25-27 2012)

- Junior PI in Cluster of Excellence ``Origin and Structure of the Universe'' (Garching) Research Area E
- European Lead and deputy PI of the Wide Field X-ray Telescope mission (new NASA/RFI proposal submitted in Oct 2011)
- Member of the *Euclid* consortium
- Referee for the Italian Evaluation of Research Quality (ANVUR)

2012 List of Publication (refereed only, accepted as of 31 Oct 2012)

As of Oct 26, 2012: 227 refereed publications, 14149 citations, H-index: 66

1. D. Coe et al. (23 coauthors including P. Rosati) 2012

CLASH: Three Strongly Lensed Images of a Candidate z ~ 11 Galaxy, ApJ, in press

2. W. Zheng et al. (36 coauthors including P. Rosati) 2012

A magnified young galaxy from about 500 million years after the Big Bang, Nat, 489, 406

3. Bonzini, M., Mainieri, V., Padovani, P., Kellermann, K.I., Miller, N., Rosati, P., Tozzi, P., Vattakunnel, S., Balestra, I., Brandt, W.N. et al. 2012

The sub-mJy radio population of the E-CDFS: optical and infrared counterpart identification, ApJS, in press (arXiv:1209.4176)

4. Tundo, E., Moretti, A., Tozzi, P., Teng, L., Rosati, P., Tagliaferri, G., Campana, S. 2012 *The Swift X-ray Telescope Cluster Survey: data reduction and cluster catalog for the GRB fields*, A&A, in press (arXiv:1208.2272)

5. J. Kurk et al. (15 coauthors including P. Rosati) 2012 GMASS ultradeep spectroscopy of galaxies at $z \sim 2$ - VII. Sample selection and spectroscopy, A&A, in press (arXiv:1209.1561)

6. Vanzella E., Nonino M., Cristiani C., Rosati P, Zitrin A., Bartelmann M., Grazian A., Broadhurst T, Meneghetti M., Grillo C. 2012

Probing ionizing radiation of L < 0.1L* star-forming galaxies at z > 3 with strong lensing, A&A, in press (arXiv:1205.4028)

7. M. Moresco et al. (68 coauthors including P. Rosati) 2012 Improved constraints on the expansion rate of the Universe up to $z \sim 1.1$ from the spectroscopic evolution of cosmic chronometers, JCAP08(2012)006, (arXiv:1201.3609)

8. K. Umetsu et al. (21 coauthors including P. Rosati) 2012 CLASH: Mass Distribution in and around MACS J1206.2-0847 from a Full Cluster Lensing Analysis, ApJ, 755, 56

9. S. Mei et al. (21 coauthors including P. Rosati) 2012 Early-type Galaxies at z = 1.3. I. The Lynx Supercluster: Cluster and Groups at z = 1.3. Morphology and Color-Magnitude Relation, ApJ, 754, 141

10. B. Sartoris, S. Borgani, P. Rosati & Weller, J. 2012 Probing dark energy with the next generation X-ray surveys of galaxy clusters, MNRAS, 423, 2503

11. J.S. Santos, P. Tozzi, P. Rosati, M.Nonino, G. Giovannini 2012 Deep Chandra observation of the galaxy cluster WARPJ1415.1+3612 at z = 1: an evolved cool-core cluster at high-redshift, A&A, 539, 10

12. Zitrin, P. Rosati, M. Nonino, C. Grillo, M. Postman et al. 2012 CLASH:

New Multiple-Images Constraining the Inner Mass Profile of MACS J1206.2-0847, ApJ, 749, 97

13. Talia, M. et al. (16 coauthors including P. Rosati) 2012 GMASS ultradeep spectroscopy of galaxies at $z \sim 2$ VII. Star formation, extinction, and gas outfows from UV spectra, A&A, 539, 61

14. Postman, M. et al. (43 coauthors including P. Rosati) 2012 *Cluster Lensing And Supernova survey with Hubble (CLASH): An Overview*, ApJS, 199, 25

15. Coe, D. et al. (46 coauthors including P. Rosati) 2012 *CLASH: Precise New Constraints on the Mass Profile of Abell 2261*, ApJ, 757, 22

- 16. Zitrin, A. et al. (25 coauthors including P. Rosati) 2012 CLASH: Discovery of a Bright z ~ 6.2 Dwarf Galaxy Quadruply Lensed by MACS J0329.6–0211, ApJ, 749, 97
- 17. Pierini, A. et al. (31 coauthors including P. Rosati) 2012 First simultaneous optical/near-infrared imaging of an X-ray selected, high-redshift cluster of galaxies with GROND: the galaxy population of XMMU J0338.7+0030 at z = 1.1, A&A, 540, 45

18. A. Raichoor, S. Mei, S.A. Stanford, B.P. Holden, Nakata, F., Rosati, P. et al. 2012 *Early-type Galaxies at z~1.3. IV. Scaling Relations in Different Environments*, ApJ, 745, 130

19. Meyers, J. et al. (39 coauthors including P. Rosati) 2012 *The Hubble Space Telescope Cluster Supernova Survey: III. Correlated Properties of Type Ia Supernovae and Their Hosts at* 0.9 < z < 1.46, ApJ, 750, 1

20. Suzuki, N. et al. (66 coauthors including P. Rosati) 2012 The Hubble Space Telescope Cluster Supernova Survey. V. Improving the Dark-energy Constraints above z > 1 and Building an Early-type-hosted Supernova Sample, ApJ, 746, 85

21. Barbary, K. et al. (44 coauthors including P. Rosati) 2012 The Hubble Space Telescope Cluster Supernova Survey. II. The Type Ia Supernova Rate in High-redshift Galaxy Clusters, ApJ, 745, 32

22. Barbary, K. et al. (44 coauthors including P. Rosati) 2012 *The Hubble Space Telescope Cluster Supernova Survey. VI. The Volumetric Type Ia Supernova Rate,* ApJ, 745, 31

Lecturers

Aksenov Alexey

Position: Senior scientific staff member Dep. of Comp. Methods, Information and Management Institute for Computer-Aided Design, RAS, Moscow



Scientific Work

Collapse of stars cores, neutrino transport, multidimensional multi-temperature hydrodynamic simulations, simulations of the countercurrent in a gas centrifuge, one dimensional radiative transfer codes, a numerical modeling of electron-positron pairs and photons transfer, etc.

II Conferences and educational activities

2012: 13th Marcel Grossmann Meeting :: Stockholm July 2012; High Energy Astrophysics Dec Moscow

III Service activities

Within ICRANet 2012 Visitor at Icranet 2 months *Outside ICRANet*

1989—1992 engineer, Laboratory for Astrophysics and Plasma Physics of the Institute for Theoretical and Experimental Physics (ITEP); 1992—1999 Junior sci. staff member, ITEP; 1999—2008 scientific staff member, ITEP; 2008—now Senior scientific staff member, department for mathematical modeling and turbulence, Institute for Computer-Aid design, Russian academy of Sciences.

1993, 1997 2–3 months Visitor at Max-Planck Institute for Astrophysics, Garching, FRG; 2000/11–2001/10 Postdoc Fellow, Cond. Matt. Dept., Weizmann Institute of Science, Rehovot, Israel; 2002–2008 Visitor at Weizmann Institute of Science, Rehovot, Israel 1–3 months per a year

2012 List of Publications

Aksenov, A. G.; Chechetkin, V. M., "Computations of the collapse of a stellar iron core allowing for the absorption, emission, and scattering of electron neutrinos and anti-neutrinos", Astron. Rep., v 56, p. 193

Aksenov, A. G.; Ruffini, R.; Siutsou, I. A.; Vereshchagin, G. V. "Dynamics and Emission of Mildly Relativistic Plasma", International J. of Mod. Phys., Conf. Ser., v 12, p. 1

Aksenov A.G., Ruffini R., Vereshchagin G.V. "Plasma Thermalization: Electron-Positron Pairs and Baryons", Proc. of the Twelfth Marcel Grossmann Meeting on General Relativity, edited by Thibault Damour, Robert T Jantzen and Remo Ruffini, World Scientific, Singapore, pp. 859–861

Alekseev George A.

Position: Leading researcher, Steklov Mathematical Institute of the Russian Academy of Sciences Moscow, Russia Period covered: 1975 – present time



I. Scientific Work

Further development of the theory of integrable reductions of Einstein's field equations and its applications in General Relativity and gravity, string gravity and supergravity models in four and higher dimensions.

This work includes a collaboration with Prof. V.A. Belinski on various aspects of soliton theory, construction and physical interpretation of exact solutions of Einstein and Einstein - Maxwell equations including he studies of equilibrium configurations of the fields of two massive charged rotating sources of the Kerr-Newman type.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

International conference: MG-13

Talk-1: G.A.Alekseev, "Exact solutions in four and higher dimensions. State of the Art."

Abstract In this short communication, various mathematical aspects of constructing exact solutions of Einstein's field equations for various gravity, string gravity and supergravity models were described: a large existing experience of development and applications of different solution generating methods for vacuum Einstein equations and electrovacuum Einstein – Maxwell equations in four dimensions and, on the other hand, the lack of similar systematic methods for generating solutions for integrable reductions of different (symmetry reduced) gravity models in higher dimensions. Some related results and specific difficulties concerning constructing solutions in space-times of five dimensions are also mentioned and briefly discussed.

Talk-2: G.A.Alekseev, "Monodromy transform and the integral equation method for solving the string gravity and supergravity equations in four and higher dimensions"

Abstract The monodromy transform and corresponding integral equation method described here give rise to a general systematic approach for solving integrable reductions of field equations for gravity coupled bosonic dynamics in string gravity, supergravity and pure vacuum gravity in four and higher dimensions. For string gravity in space-times of \$D\ge 4\$ dimensions with \$d=D-2\$ commuting isometries and any number \$n\$ of Abelian vector gauge fields the equivalent spectral problem allows to parameterize the infinite-dimensional space of local solutions by two pairs of \cal{arbitrary} coordinate-independent holomorphic \$d∖times d\$and \$d∖times n\$matrix functions $\lambda_{\mathbb{W}} = \mathbb{W},$ $\mathbf{v}_{\mathbf{v}} = \mathbf{v}_{\mathbf{v}}$ of the spectral parameter $\mathbf{w} = -$ the monodromy data for the fundamental solution of our spectral problem. We construct the linear singular integral equations which determine the solutions for any choice of these monodromy data. For any \emph{rational} and \emph{analytically matched} (the_{u_-} and the_{v_-} monodromy data the solutions can be found explicitly. Simple reductions of the space of monodromy data lead to solutions for \$5D\$ minimal supergravity and vacuum gravity in \$D\ge 4\$ dimensions.

Visits: 1. ICRA (Pescara): 29.05.2012-07.06.2012

2. IHES (Paris, France): 15.10.2012 – 27.10.2012

2012 List of Publication

G.A. Alekseev, ``Monodromy transform and the integral equation method for solving the string gravity and supergravity equations in four and higher dimensions'', arXiv:1205.6238v1 [hep-th] 28 May 2012

Abstract The monodromy transform and corresponding integral equation method described here give rise to a general systematic approach for solving integrable reductions of field equations for gravity coupled bosonic dynamics in string gravity and supergravity as well as for pure vacuum gravity in four and higher dimensions. For physically different types of fields in space-times of $D \ge 4$ dimensions with d = D-2commuting isometries – stationary fields with spatial symmetries, interacting waves or evolution of partially inhomogeneous cosmological models, the string gravity equations govern the dynamics of interacting gravitational, dilaton, antisymmetric tensor and any number $n \ge 0$ of Abelian vector gauge fields (all depending only on two coordinates). The equivalent spectral problem constructed earlier allows to parameterize the entire infinite-dimensional space of (normalized) local

solutions of these equations by two pairs of arbitrary coordinate-independent holomorphic $d\ times d\ and d\ times n\-- matrix functions <math>\ u_{m}(w), v_{pm}(w)$ of a spectral parameter w which constitute a complete set of monodromy data for normalized fundamental solution of this spectral problem. The "direct" and "inverse" problems of such monodromy transform — calculating the monodromy data for any local solution and constructing the field configurations for any chosen monodromy data always admit unique solutions. We construct the linear singular integral equations which solve this inverse problem. For any rational and analytically matched (i.e. $u_+(w) \ u_-(w)$ and $v_+(w) \ v_-(w)$) monodromy data the solution of these integral equations and corresponding solution for string gravity equations can be found explicitly. Simple reductions of the space of monodromy data leads to the similar constructions for solving of other integrable symmetry reduced gravity models, e.g. 5D minimal supergravity or vacuum gravity in $D \ge 4$ dimensions.

Bini Donato

Position: Reasercher at

Istituto per le Applicazioni del Calcolo, "M. Picone," CNR Viale Manzoni, 30 I-00185 Roma Period covered: 1995 -today.



I Scientific Work

The main topic of my interest is General Relativity with special attention to several classical aspects, like the analysis and the interpretation of exact solutions of Einstein's field equations.

In particular, I'm interested in spacetime splitting techniques, measurement process and the role of the observer in General Relativity, particle dynamics in certain fixed gravitational backgrounds (either test particles with scalar structure: the mass or particles with internal structure: spinning test particles and particles with quadrupolar structure), gravitational perturbations, gravitational waves. Recently I started also research activities in PN approximation, with applications to astrometry and binary systems. I'm an expert user of MAPLETM tensor calculus package.

II Conferences and educational activities

Conferences and Other External Scientific Work

Since 1988 I have participated in all the international meetings of the Marcel Grossmann series as well as all the conferences of the ICRA- ICRANet series.

Diploma thesis supervision

I've been supervisor of the Diploma thesis of many students at the University of Rome "La Sapienza", since 1995:

G. Spoliti, A. Merloni, C. Germani, C. Cherubini, G. Miniutti, G. Cruciani, A. Geralico, A. Lunari, M. De Mattia.

Ph.D thesis supervision

Dr. V. Montaquila, Physics departments of the University of Naples "Federico II."

Other Teaching Duties

I'm Contract Professor of Physics since 2004 at the faculty of Medicine of the University Campus Biomedico, in Rome. From 2007-2009 I have also been Contract Professor of Physics at the Nursery School of the same university.

Work With Postdocs

A Geralico, post-doc student at the University of Rome "La Sapienza."

III Service activities

Scientific collaboration with: Prof. R. Ruffini (University of Rome, Italy and ICRANet); Prof. R.T. Jantzen (Villanova University, USA and ICRANet); Prof. S. Filippi (University Campus Biomedico, Rome, Italy and ICRANet). Dr. C. Cherubini (University Campus Biomedico, Rome, Italy and ICRANet).

Outside ICRANet

Scientific collaboration with: Prof. F. de Felice (University of Padova, Italy); Prof. L. Lusanna (INFN Florence, Italy); Prof. P. Fortini (University of Ferrara); Dr. A. Ortolan (INFN Legnaro, Padova); Prof. O. Semerak (University of Prague);

Prof. T. Damour (IHES, paris).

Other

I'm currently doing referee activity for a large number of international journals in the field of General Relativity and I'm a reviewer for Mathreview.

For the years 2002-2004 I have been the leader of a collaboration project between the Italian Research Council (CNR) and the analogous institution in Venezuela. Title of the project: *Construction of 3d numerical models for the study of magnetohydrodynamics in gravitational physics and astrophysics*.

For the years 2007-2008 I have been the leader of young researchers projects of INDAM (Istituto Nazionale di Alta Matematica). Title of the project: *Light coordinates and spacetime topography*.

For the years 2008-2009 I have been the leader of young researchers projects of INDAM (Istituto Nazionale di Alta Matematica). Title of the project: *Sistemi di Posizionamento Globale relativistici*

2012 List of publications

Published papers
1) Bini D., Geralico A., Jantzen R. T.
Separable geodesic action slicing in stationary spacetimes
General Relativity and Gravitation,
vol. 44, 603-621, 2012

2) Bini D., Esposito G., Geralico A. de Sitter spacetime: effects of metric perturbations on geodesic motion General Relativity and Gravitation, vol. 44, 467-490 2012.

3) Bini D. and Geralico A. Scattering by an electromagnetic radiation field Physical Review D, vol. 85, 044001, 2012.

4) Bini D., Falanga M., Geralico A. and Stella L. The signal from an emitting source moving in a Schwarzschild spacetime under the influence of a radiation field Classical and Quantum Gravity, vol. 29, 065014, 2012.

5) Bini D., Gregoris D. and Succi S. Radiation pressure vs friction effects in the description of the Poynting-Robertson scattering process Europhysics Letters, vol. 97, 40007, 2012.

6) Bini D., Geralico A. and Succi S.

Particle scattering by a test fluid on a Schwarzschild spacetime: the equation of state matters The European Physical Journal C, vol. 72, Issue 3, 1913, 2012.

7) Bini D. and Geralico A. Observer-dependent tidal indicators in the Kerr spacetime

Class. Quantum Grav., vol. 29, 055005, 2012.

8) Bini D., Damour T. and Faye G.

Effective action approach to higher-order relativistic tidal interactions in binary systems and their effective one body description Physical Review D, vol. 85, 124034, 2012.

9) Bini D., Gregoris D., Rosquist K. and Succi S. Particle motion in a photon gas: friction matters Gen. Rel. Grav., vol. 44, 2669-2680, 2012.

10) Bini D., Chicone C. and Mashhoon B. Spacetime Splitting, Admissible Coordinates and Causality Physical Review D, vol. 85, 104020, 2012.

11) Bini D., Kuantay B. and Geralico A. Tidal indicators in the spacetime of a rotating deformed mass Class. Quantum Grav., vol. 29, 145003, 2012.

12) Bini D., Geralico A., Haney M. and Jantzen R.T. Scattering of particles by radiation fields: a comparative analysis Phys. Rev. D., vol 86, 064016, 2012.

Submitted papers

1) Bini D., Gregoris D., Rosquist K. and Succi S. Effects of friction forces on the motion of objects in smoothly matched interior/exterior spacetimes Class. Quantum Grav., submitted, 2012.

2) Bini D., Damour T.

Gravitational radiation reaction along general orbits in the effective one-body formalism Phys. Rev. D, submitted 2012

3) Donato Bini, Mariateresa Crosta, Fernando de Felice, Andrea Geralico, Alberto Vecchiato The Erez-Rosen metric and the role of the quadrupole on light propagation Classical and Quantum Gravity, submitted 2012

Papers in conference proceedings

1) Bini D., Geralico A.

Equilibrium Orbits of Particles Undergoing Poynting-Robertson Effect in Schwarzschild Spacetime International Journal of Modern Physics: Conference Series, vol. 12, issue 01, p. 247, 2012.

2) Bini D., Boshkayev K., Ruffini R. and Siutsou I. Equatorial Circular Geodesics in the Hartle-Thorne Spacetime Proceedings of the 12th Italian-Korean meeting July 4-8, 2011. Pescara (Italy). Il Nuovo Cimento, 2012, to appear

Bini D., Geralico A.
 Slicing black hole spacetimes
 Proceedings of the 13th Marcel Grossmann Meeting, July 2-8, 2012, Stockholm (Sweden)
 Series Ed. R. Ruffini, to appear.

4) Bini D.

Observers, observables and measurements in general relativity Proceedings of the meeting " Relativity and Gravitation 100 Years after Einstein in Prague" June 25–29, 2012, Prague (Czech Republic).

Perez Bergliaffa Santiago Esteban

Position: Professor, Department of Physics University of the State of Rio de Janeiro Period covered: 2011-2012



I Scientific Work

An analysis of a regular black hole interior. Daniela Perez, Camila A. Correa, Santiago E. Perez-Bergliaffa, Gustavo E. Romero. arXiv:1111.0690 [astro-ph.CO] Manuscript being reviewed for publication in Gravitation and Cosmology

A Born-Infeld-like f(R) gravity. J.C. Fabris, R.S. Perez, N. Pinto-Neto, Santiago Esteban Perez Bergliaffa arXiv:1205.3458 [gr-qc] Accepted for publication in PRD

Accretion disks around black holes in modified strong gravity Daniela Perez, Gustavo Esteban Romero, Santiago E. Perez Bergliaffa Accepted for publication in Astronomy & Astrophysics

II Conferences and educational activities

II a Conferences and Other External Scientific Work

Static and spherically symmetric black holes with nonlinear electromagnetic source, talk given at the parallel session BH3 of the 13th Marcel Grossmann Meeting on General Relativity, held in Stockholm on July 1-7, 2012.

(Yet) another view of the effective metric, talk given at the Mario Novello's 70th anniversary symposium, held at CBPF (Rio de Janeiro, on August 15-17, 2012.

Dark energy and inhomogeneous cosmological models, talk given at the 55th meeting of the Asociación Argentina de Astronomia, Mar del Plata (Argentina), September 2012.

The Dark Side of the Universe, colloquium given at the Department of Physics of the CINVESTAV (Mexico City), on February 29, 2012.

Member of the Organizing Committee of the Mário Novello's 70th Anniversary Symposiu, held at CBPF, (Rio de Janeiro), on August 15-17, 2012.

II b Work With Students

Introduction to scientific research (program for advanced bachelor students) Vitor Silva Tavares, Inhomogeneous Cosmology (UERJ).

Diana Fernandes Carelli Gomes, Black Holes and gravity in the strong-curvature regime (UERJ).

Daiana Silva, Compact Objects, (UERJ).

II c Diploma thesis supervision

Claudia Isabel Azucena P. Rivasplata, "Applications of the effective metric", PhD in Physics, co-advisor: José Salim (CBPF).
Florencia Anabella Teppa Pannia, "Cosmology and inhomogeneous models", PhD in Astronomy (University of La Plata, Argeitnia) – advisor.

Márcio Oliveira Pinheiro, "Limits on theories of gravity in the strong-field regime", MSc in Physics (UERJ), advisor.

Ana Paula Cardozo Correia, "Observable effects of Bohmian Mechanics", MSc in Physics, (UERJ), advisor.

II d Other Teaching Duties

I taught several courses at the graduate and post-graduate level in the Institute of Physics of the UERJ.

III Service activities

Outside ICRANet Vice-coordinator of the Post-graduation programme of the Instituto de Física (UERJ).

IV Other

Reviewer of Classical and Quantum Gravity.

Reviewer of International Journal of Theoretical Physics. Reviewer of Physical Review D.

2012 List of Publication

See above.

Wiltshire David L.

Position: Associate Professor, Department of Physics & Astronomy, University of Canterbury, Christchurch, New Zealand Period covered: 29 July 2008 – 30 October 2008



2012 List of Publications

D.L. Wiltshire, "Dark energy from cosmic structure", in T. Damour, R.Ruffini and R. Jantzen (eds.), Proceedings of the 12th

Marcel Grossmann Meeting on General Relativity, (World Scientific, Singapore, 2012), pp. 434-452.

D.L. Wiltshire,

" Gravitational energy as dark energy: Cosmic structure and apparent acceleration", in J.A. Auping (ed.), *Proceedings of the International Conference on Two Cosmological Models*, (Plaza y Valdés, Mexico City, 2012) pp. 361-384. Also available on Google e-books: http://books.google.es/books?printsec=frontcover&id=MBjkuQAoyZIC#v=onepage&q&f=false

Research Scientists

Bernardini Maria Grazia

Position: Postdoctoral Research Fellow Period covered: 2012



I Scientific Work

I mainly worked on the analysis and interpretation of the observational data of the Swift/X-Ray Telescope (XRT; 0.3-10 keV) and of the Burst Alert Telescope (BAT; 15-150 keV). I was involved in the analysis of all the Swift/XRT GRB observations until December 2010, with the morphological and spectral characterisation of the X-ray light curves (Margutti et al., 2012). The entire data set and analysis will be soon available online for further investigations and for a direct comparison with theoretical models. One of the major outcomes of the X-ray analysis is the identification on a new three-parameter correlation involving X-ray late time and gamma-ray prompt emission parameters, shared by both short and long GRBs (Bernardini et al., 2012). The physical origin of this correlation lies in what is common to the two classes, and likely independent of the progenitors and environment since both are thought to be different. We speculate that the ultimate physical parameter that regulates the GRB properties is the outflow Lorentz factor. Currently I am also working on the XMM Serendipitous Source Catalog (2XMMi-DR3) to develop algorithms able to identify transient emissions among the XMM detections that can be associated either to orphan GRB afterglows or to Supernova shock breakout.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

- "Lampi su Napoli, III congresso nazionale sui GRB", Napoli (Italy), September 20-22, 2012.
- "XIII Marcel Grossmann Meeting on General Relativity", Stockholm (Sweden), July 1-7, 2012.
- "Gamma-Ray Bursts 2012 Conference", Munich (Germany), May 7-11, 2012.

II b Work With Students

• Co-supervisor of the Ph.D. student Elena Zaninoni at University of Padova, Padova (Italy), January 2010 – December 2012.

II c Other Teaching Duties

• Lecturer for the IRAP Ph.D. school: "The prompt-afterglow connection: a universal scaling for short and long GRBs", Nice (France), September 2012.

2012 List of Publications

REFEREED JOURNALS

1. Raffaella Margutti, Elena Zaninoni, Maria Grazia Bernardini, Guido Chincarini, Francesco Pasotti, Cristiano Guidorzi, Lorella Angelini, David N. Burrows, Milvia Capalbi, Phil A. Evans, Neil Gehrels, Jamie Kennea, Vanessa Mangano, Alberto Moretti, Jay Nousek, Julian P. Osborne, Kim L. Page, Matteo Perri, Judith Racusin, Patrizia Romano, Boris Sbarufatti, Sam Stafford, Michael Stamatikos, "The prompt-afterglow connection in Gamma-ray bursts: a comprehensive statistical analysisof Swift X-ray light curves", MNRAS (2012), accepted (arXiv:1203.1059).

2. Andrea Melandri et al., "The optical SN 2012 bz associated with the long GRB120422A", A&A 547 (2012) 82

3. Daniela Pugliese, Giovanni Montani, Maria Grazia Bernardini, "On the Polish doughnut accretion disk via the effective potential approach", MNRAS (2012) accepted (arXiv:1206.4009).

4. Maria Grazia Bernardini, Raffaella Margutti, Elena Zaninoni, Guido Chincarini, "A universal scaling for short and long Gamma-ray bursts: Ex,iso-Egamma,iso-Epk", MNRAS 425 (2012) 1199.

5. Barbara Patricelli, Maria Grazia Bernardini, Carlo Luciano Bianco, Letizia Caito, Gustavo de Barros, Luca Izzo, Remo Ruffini, Gregory Vereshchagin, "Analysis of GRB080319B and GRB050904 within the fireshell model: evidence for a broader spectral-energy distribution" ApJ 756 (2012) 16.

6. Drejc Kopac, Paolo D'Avanzo, Andrea Melandri, Sergio Campana, Andreja Gomboc, Jure Japelj, Maria Grazia Bernardini, Stefano Covino, Susanna Vergani, Ruben Salvaterra, Gianpiero Tagliaferri, "On the environment of short Gamma-ray bursts", MNRAS 424 (2012) 2392.

7. Paolo D'Avanzo, Ruben Salvaterra, Boris Sbarufatti, Lara Nava, Andrea Melandri, Maria Grazia Bernardini, Sergio Campana, Stefano Covino, Dino Fugazza, Giancarlo Ghirlanda, Gabriele Ghisellini, Valentina La Parola, Matteo Perri, Susanna Vergani, Giampiero Tagliaferri, "A complete sample of bright Swift Gamma-ray bursts: X-ray afterglow luminosity and its correlation with the prompt emission", MNRAS 425 (2012) 506

8. Maria Grazia Bernardini, Raffaella Margutti, Jirong Mao, Elena Zaninoni, Guido Chincarini, "The X-ray light curves of Gamma-ray bursts: clues to the central engine", A&A 539 (2012) A3.

CONFERENCE PROCEEDINGS

1. Guido Chincarini, Raffaella Margutti, Maria Grazia Bernardini, Elena Zaninoni, "Highlights From The Comprehensive Analysis Of 650 Gamma Ray Bursts (Nov 2004 - Dic 2010)", in the Proceeding of the "220th American Astronomical Society Meeting" in Anchorage, Alaska, USA, July 10-14, 2012

2. Maria Grazia Bernardini, Raffaella Margutti, Elena Zaninoni, Guido Chincarini, "X-ray emission of GRBs: what is the light curve morphology telling us?", in the Proceedings of "GRBs as probes" in Como, Italy, May 16-20, 2011, Memorie della SAIT 21 (2012) 226

3. Carlo Luciano Bianco, Lorenzo Amati, Maria Grazia Bernardini, Letizia Caito, Gustavo de Barros, Luca Izzo, Barbara Patricelli, Remo Ruffini, "The class of disguised short GRBs and its implications for the Amati relation", in the Proceedings of "GRBs as probes" in Como, Italy, May 16-20, 2011, Memorie della SAIT 21 (2012) 139.

4. Maria Grazia Bernardini, Raffaella Margutti, Elena Zaninoni, Guido Chincarini, "A universal scaling for short and long Gamma-ray bursts: Ex,iso-Egamma,iso-Epk", in the Proceedings of "The Gamma-Ray Bursts 2012 Conference (GRB 2012)", in Munich, Germany, May 7-11, 2012.

5. Carlo Luciano Bianco, Maria Grazia Bernardini, Letizia Caito, Gustavo de Barros, Marco Muccino, Luca Izzo, Barbara Patricelli, Ana Virginia Penacchioni, Giovanni Battista Pisani, Remo Ruffini, "Needs for a new GRB classification following the fireshell model: genuine short, disguised short and long GRBs", in the Proceedings of "The Gamma-Ray Bursts 2012 Conference (GRB 2012)", in Munich, Germany, May 7-11, 2012.

6. Maria Grazia Bernardini, Carlo Luciano Bianco, Letizia Caito, Luca Izzo, Barbara Patricelli, Remo Ruffini, "The X-Ray Flares of GRB 060607A within the Fireshell Model", in the Proceedings of the "XII Marcel Grossmann Meeting", in Paris, France, July 12-18, 2009, ed. T. Damour, R. Jantzen and R. Ruffini, World Scientific (2012) 1600.

7. Luca Izzo, Maria Grazia Bernardini, Carlo Luciano Bianco, Letizia Caito, Barbara Patricelli, Remo Ruffini, "GRB 090423 in the Fireshell Scenario: A Canonical GRB at Redshift 8.2", in the Proceedings of the "XII Marcel Grossmann Meeting", in Paris, France, July 12-18, 2009, ed. T. Damour, R. Jantzen and R. Ruffini, World Scientific (2012) 1610.

8. Maria Grazia Bernardini, Carlo Luciano Bianco, Letizia Caito, Luca Izzo, Barbara Patricelli, Remo Ruffini, Gregory Vereshchagin, "A New Spectral Energy Distribution of Photons in the Fireshell Model of GRBs", in the Proceedings of the "XII Marcel Grossmann Meeting", in Paris, France, July 12-18, 2009, ed. T. Damour, R. Jantzen and R. Ruffini, World Scientific (2012) 1627.

Cherubini Christian

Position: University Researcher (permanent) in Theoretical Physics

Integrated Center for Research (C.I.R.)

Engineering faculty,

University "Campus Bio-Medico",

Via A. del Portillo 21, I-001285 Rome, Italy.

Period covered: 1st November 2007-today

I Scientific Work

- Astrophysics of self-gravitating fluids.
- General relativistic perturbation theory.
- Cosmology.
- Numerical Relativity.
- Fluid dynamics
- Theoretical biophysics.

II Teaching activities and conference participation

Courses

- 2011/12 Lecturer "Physics" (Alimentation and Human Nutrition Sciences, Medicine Faculty, University Campus Bio-Medico of Rome).
- 2011/12 Lecturer "Mathematical Physics Models for Engineering" (Engineering Faculty, University Campus Bio-Medico of Rome).

Conferences

- The Heart Tissue: Modeling and Equations workshop, Brescia (ITALIA)

- 13th Marcel Grossman Meeting, Stoccolma (Svezia)

III. Service activities

-Participation to the "Collegio di Dottorato" of the INTERNATIONAL RELATIVISTIC ASTROPHYSICS PH.D." by University of Rome "La Sapienza".

-Participation to the "Collegio di Dottorato" of the INGEGNERIA BIOMEDICA PH.D." by University Campus Bio-Medico" of Rome.

<u>Other</u>

Dr Cherubini has a longstanding collaboration with other ICRANET scientists. In particular in collaboration with Dr Andrea Geralico, Dr Donato Bini, Prof. Robert T Jantzen and Prof. Remo Ruffini he has written plenty articles in various areas of General Relativity. With Prof. Simonetta Filippi he is involved in research activities in the fields of Stellar and Galactic Structures, Effective Geometries and Complex Systems in Nature.

2012 List of Publications

- 1) Cherubini C, Gizzi A, Bertolaso M, Tambone V, Filippi S (2012). A Bistable Field Model of Cancer Dynamics. COMMUNICATIONS IN COMPUTATIONAL PHYSICS, vol. 11, p. 1-18, ISSN: 1815-2406
- 2) Gizzi A, Cherubini C, Pomella N, Persichetti P, Vasta M, Filippi S (2012). Computational modeling and stress analysis of columellar biomechanics. JOURNAL OF THE MECHANICAL BEHAVIOR OF BIOMEDICAL MATERIALS, vol. 15, p. 46-58, ISSN: 1751-6161
- 3) Cherubini C, Filippi S, Gizzi A (2012). Electroelastic unpinning of rotating vortices in biological excitable media. PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS, vol. 85, p. 031915-1-031915-8, ISSN: 1539-3755.



Geralico Andrea

Position: Postdoc Period covered: October 1st, 2006 – present



I Scientific Work

- 1 \$3+1\$ splitting of spacetime: measurement processes and the role of observers in general relativity;
- 2 test particle dynamics in black hole spacetimes; motion of small extended bodies (neutral or charged test particle endowed with an internal structure described by its spin and quadrupole moment);
- 3 general relativistic perturbation theory of Einstein-Maxwell systems;
- 4 exact solutions of Einstein's field equations;
- 5 gravitational lensing techniques in strong gravitational fields;

II Conferences and educational activities

Conferences and Other External Scientific Work XIIIth Marcel Grossmann Meeting (Stockholm, SE, 2012)

2012 List of publications

- Bini D., Esposito G. and Geralico A., de Sitter spacetime: effects of metric perturbations on geodesic motion, Gen. Relativ. Gravit., vol. 44, 467, 2012.
- Bini D., Geralico A. and Jantzen R. T., Separable geodesic action slicing in stationary spacetimes, Gen. Relativ. Gravit., vol. 44, 603, 2012.
- Geralico A. and Luongo O., Neutrino oscillations in the field of a rotating deformed mass, Physics Letters A, vol. 376, 1239, 2012.
- Bini D. and Geralico A., Scattering by an electromagnetic radiation field, Physical Review D, vol. 85, 044001, 2012.
- 5) Bini D. and Geralico A., *Observer-dependent tidal indicators in the Kerr spacetime*, Classical and Quantum Gravity, vol. 29, 055005, 2012.
- 6) Bini D., Falanga M., Geralico A. and Stella L., *The signal from an emitting source moving in a Schwarzschild spacetime under the influence of a radiation field,* Classical and Quantum Gravity, vol. 29, 055014, 2012.

- 7) Bini D., Geralico A. and Succi S., Particle scattering by a test fluid on a Schwarzschild spacetime: the equation of state matters, European Physical Journal C, vol. 72, 1913, 2012.
- 8) Bini D., Boshkayev K. and Geralico A., *Tidal indicators in the spacetime of a rotating deformed mass*, Classical and Quantum Gravity, vol. 29, 145003, 2012.
- 9) Bini D., Geralico A., Haney M. and Jantzen R. T., *Scattering of particles by radiation fields: a comparative analysis*, Physical Review D, vol. 86, 064016, 2012.

Rotondo Michael

Position: Post-doctoral researcher Period covered: 2011-2012

<u>I Scientific Work</u> Supercritical electric fields in nuclei and neutron stars Electrodynamical properties of white dwarfs and neutron stars

II Conferences and educational activities

II a Conferences and Other External Scientific Work

1) Italian-Korean Symposium on Relativistic Astrophysics, 4-8 July 2011, Pescara (Italy): participant with the talk *The relativistic Feynman-Metropolis-Teller treatment for finite temperatures*.

2) IRAP Ph.D. and Erasmus Mundus Workshop: Recent news from MeV, GeV and TeV gamma rays domain: results and interpretations, 21-26 March 2011, Pescara (Italy): participant with the talk *From atoms to nuclear matter cores of stellar dimensions: a unified approach based on the relativistic Thomas-Fermi model.*

II B Other Teaching Duties

Teacher assistant of the course "Collasso gravitazionale, buchi neri, polarizzazione del vuoto e cosmologia" held by Prof. Remo Ruffini at Physics Department of the University "Sapienza", Rome, Italy, academic year 2010/2011.

Member of the examining committee chaired by Prof. Remo Ruffini at Physics Department of the University "Sapienza", Rome, Italy, academic year 2010/2011.

2011-2012 List of Publication

1) Rotondo M., Rueda J. A., Ruffini R. and S.-S. Xue, *The relativistic Thomas-Fermi treatment for compressed atoms at finite temperatures*, accepted for publication in Il Nuovo Cimento C, 2012.

2) Rotondo M., Rueda J. A., Ruffini R. and S.-S. Xue, *On degenerate compressed atoms and compressed nuclear matter cores of stellar dimensions*, in Proceedings of the second Galileo-Xu Guangqi meeting, IJMPD, Vol.12, 203-212, 2012.

3) Rotondo M., Rueda J. A., Ruffini R., Xue S.-S., *From compressed atoms to compressed massive nuclear density cores*, in the Proceedings of the twelfth Marcel Grossmann meeting, T. Damour, R. Janzen, R. Ruffini (eds.), World Scientific, p.1036, 2012.

4) Boskhayev K., Rotondo M. and Ruffini R., *On magnetic fields on rotating nuclear matter cores of stellar dimensions*, in Proceedings of the Galileo-Xu Guangqi meeting, IJMPD, Vol. 12, 58-67, 2012.

5) Boskhayev K., Rotondo M., Ruffini R., *On Nuclear Matter Cores and Their Applications*, in Advances in Computational Astrophysics: Methods, Tools and Outcomes, R. Capuzzo-Dolcetta, M. Limongi, A. Tornambè (eds.), Astronomical Society of Pacific, Vol. 453, p. 347, 2012.

6) Rueda J. A., Rotondo M., Ruffini R., Xue S.-S., *A new family of neutron star models: global neutrality versus local neutrality*, in the Proceedings of the twelfth Marcel Grossmann meeting, T. Damour, R. Janzen, R. Ruffini (eds.), World Scientific, p.1039, 2012



7) Rotondo M., Rueda J. A., Ruffini R., Xue S.-S., Phys. Rev. D, *Relativistic Feynman-Metropolis-Teller theory for white dwarfs in general relativity.*, Vol. 84, 084007, 2011

8) Rotondo M., Rueda J. A., Ruffini R., Xue S.-S., Phys. Lett. B, *The self-consistent general relativistic solution for a system of neutron, protons and electrons in beta equilibrium*, Vol. 701, 667, 2011.

9) Rotondo M., Rueda J. A., Ruffini R., Xue S.-S., Phys. Rev. C, On the relativistic Thomas-Fermi treatment of compressed atoms and compressed nuclear matter cores of stellar dimensions, Vol. 83, 045805, 2011.

Visiting Scientists

Bittencourt Eduardo

Position: PhD student Period covered: from 3 october to 19 october of 2012

<u>I Scientific Work</u> General relativity and gravitation Analogue models of gravity and effective geometries Equivalence between dynamics from field theory formulation

<u>II Conferences and educational activities</u> *II a Conferences and Other External Scientific Work* 13th Marcel Grossmann Meeting – 1-7 july Stockhlom

II B Other Teaching Duties Didatic Laboratory – CBPF Lectures on general relativity – IX CBPF' school

<u>III. Service activities</u> *III a. Within ICRANet* Long-term visiting of Prof. Mario Novello

III b. Outside ICRANet Ph.D student at Brazilian Center of Physics Research

2012 List of Publication

What is the origin of the mass of the Higgs boson, *Physical Review D 86*, 063510 (2012)

Gordon Metric Revisited, to be published in Phys. Rev. D.



Medeu Abishev

Position: Head of Theoretical and nuclear physics department, al-Farabi Kazakh National university Period covered: 7.07.2012-29.07.2012

<u>I Scientific Work</u> GR mechanics, general relativistic N-body problem

2012 List of Publication

1 Abdildin, Meirkhan M.; Abishev, Medeu E.; Beissen, Nurzada A.; Taukenova, Aliya S. On Optical-Mechanical Analogy in General Relativity Proceedings of the Twelfth Marcel Grossmann Meeting on General Relativity, edited by Thibault Damour, Robert T. Jantzen and Remo Ruffini. ISBN 978-981-4374-51-4. Singapore: World Scientific, 2012, p.1518

2 Abdildin, Meirkhan M.; Abishev, Medeu E.; Boshkayev, Kuantay A.; Taukenova, Aliya S. Transformation Law of the Gravimagnetic Field in Harmonic Coordinates Proceedings of the Twelfth Marcel Grossmann Meeting on General Relativity, edited by Thibault Damour, Robert T. Jantzen and Remo Ruffini. ISBN 978-981-4374-51-4. Singapore: World Scientific, 2012, p.709



Mohammadi Rohoollah

PhD. in High Energy Physics Graduated from Department of Physics, Isfahan University of Technology, Iran Gender: Male Dationality: Iranian D.O.B: 06/05/1981 <u>Position:</u> Collaboration with ICRANet as Researcher Period covered: One year



Scientific Work: High Energy Physics and Astrophysics

Conferences and educational activities

Academic background:

- 1999-2003: B.Sc in physics in Tarbieat-e-Moallem university, Karaj, Iran.
- 2003-2005: M.Sc.in high energy physics in Tehran University, Tehran, Iran. Thesis title: Study of structure function of neutron in the impulse approximation.
- 2005-2010: PhD in high energy physics in Isfahan University of Technology, Isfahan, Iran. Thesis title: The interactions of elementary particles in background magnetic field.

Courses passed in PhD:

- Field theory (main references: Introduction with field theory by Peskin).
- Introduction with supersymmetry (specially MSSM)
- Introduction with standard model and grand unified theory (GUT).
- Introduction with neutrino physics (main references: Massive neutrinos in Physics and Astrophysics by R. N. Mohapatra and Palash B. Pal).
- Fairly good introduction with numerical calculations (FORTRAN programming).

Participation in international conferences:

- Summer school on particle physics, 15 June- 15 July 2009, the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy.
- School of particles and Accelerators (IPM), Isfahan, Iran (2009).
- Collaboration with ICRANet as visitor, March-August 2010, Pescara, Italy.
- Second Galileo-XuGuangqi meeting 11-16 July 2010, Ventimiglia- Italy
- 13th Marcel Grossmann meeting 1-7 July 2012, Stockholm-Sweden.
- A few international conferences held in Iran.

Diploma thesis supervision: No

Work With Students: No

Diploma thesis supervision: No

Other Teaching Duties: Teaching in Department of Physics, Isfahan University of Technology, Iran (2005-2010)

Work With Postdocs: No

Service activities Within ICRANet:

- Collaboration with ICRANet as visitor, March-August 2010, Pescara, Italy.
- Collaboration with ICRANet as visitor, November 2011 -December 2013, Pescara, Italy.

Collaboration of Iranian student within ICRANet:

Up to now (in during 2010-1012) three PhD Iranian students have visited ICRANet who finished their thesis (now they are working in Iranian universities) while they keep their collaboration with ICRANet. Iman Moti and Ehsan Bavarsad have visited here for six months. Meanly they worked with Profs. Ruffini and Xue in High Energy Physics and Astrophysics.

2012 <u>List of Publication</u>

1. M. M. Etefaghi, M. Hagheghat, R. Mohammadi, "Noncommutative QED+QCD and corresponding beta-function", Phys. Rev. D 82, 105017 (2010).

2. E. Bavarsad, M. Hagheghat and R. Mohammadi, "Generation of circular polarization of the CMB", Phys. Rev. D 81, 084035 (2010).

3. E. Bavarsad, M. Hagheghat and R. Mohammadi, Necleon-Necleon scattering in back ground magnetic field , Phys. Rev. D 82, 105015 (2010).

4. Mohammadi R., Remo Ruffini and She-Sheng Xue, "Neutron stars in the presence of the strong magnetic Field", (Second Galileo-XuGuangqi meeting 11-16 July 2010, Ventimiglia- Italy)

5. Mohammadi R., Jorge A. Rueda, Remo Ruffini and She-Sheng Xue, "The solution of Thomas-Fermi equation in the presence of the strong magnetic Field", (13th Marcel Grossmann meeting 1-7 July 2012, Stockholm-Sweden).

6. Mohammadi R., Remo Ruffini and She-Sheng Xue," Decuple neutrinos from beta process", (13th Marcel Grossmann meeting 1-7 July 2012, Stockholm-Sweden), [arXiv:1206.0431].

Mosquera Cuesta Herman J.

Position: Visiting Professor Universidade Estadual Vale de Acarau, Sobral - CE, Brazil Period covered: 12 May 2012 – 18 July 2012

I Scientific Work

I have continued my research duties involving Nonlinear Electrodynamics in Astrophysics and Cosmology, in particular in applications to CMB physics, and also to study the characteristics of the polarized radiation from quasars. I also concluded the editing process of two books which are listed below in this annual report.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

XIII Marcel Grossmann Meeting, Stockholm, Sweden, July, 1-7, 2012

International Conference in Numerical Analysis and Applied Mathematics, Kos, Greece, September 18-26, 2012

Mário Novello 70th Anniversary Symposium, Rio de Janeiro, August 15-17, 2012

II b Work With Students

Work with ICRANet Erasmus Mundus Ph. D. Student Jonas Pedro Pereira on Applications of Nonlinear Electrodynamics in Relativistic Astrophysics: Prepared article on "Reversible Transformations in Nonlinear Electrodynamics" (To be submitted for publication)

Adviser of Student Luis Henry Nuñez Quiroga in his work leading to Bachellor Degree in Physics – Finished in June 2012, from Department of Physics, Universidad Nacional de Colombia, Bogota

Work with M. Sc. Student Daniel Alfonso Pardo, School of Physics, Universidad Nacional de Colombia, Medellin. Theme of Dissertation: "On Gravitational Waves Astrophysics", to be presented no later than December 2012.

Adviser of "Work of Conclusion" of Course Licenciatura em Fisica, of student Reginaldo Freitas at Universidade Estadual Vale de Acarau", in Sobral, Ceara, Brazil

II c Other Teaching Duties

Delivered "Introductory Course on General Relativity" at "Course of Licenciatura em Fisica, Universidade Estadual Vale de Acarau", in Sobral, Ceara, Brazil. I also prepared the "Academic Program" for the "Course of Specialization in Astrophysics and Cosmology" to offered by Universidade Estadual Vale de Acarau, in Sobral, Ceara, Brazil, within the Sobral Astro Project.

III. Service activities

III a. Within ICRANet

Collaborating with Prof. Remo Ruffini in preparing letters of invitation for other Brazilian institutions to join ICRANet as scientific partners. Also collaborating in providing information to ICRANet Scientific Staff and Research Collaborators regarding the Brazilian Government new program: Science without Frontiers, which opens new avenues for research cooperation among most ICRANet member institutions and Brazilian universities and research centers.

III b. Outside ICRANet

Co-Manager of Sobral Astro Project, an interiorization of science program of the Government of Ceara State, Brazil, in collaboration with General Coordinator Prof. Francisco J. Amaral Vieira, ICRANet Secretary for South-America.

2012 List of Publication

1 - High-energy scalarons as a model for Dark Matter in galaxies Authors: C. Corda, Herman J. Mosquera Cuesta, Roberto Lorduy Gomez Published in Astropart.Phys. 35 (2012) 362-370

2 - Nonlinear electrodynamics effects on the evolution of the polarization angle and applications to quasar polarizations

Herman J. Mosquera Cuesta and Gaetano Lambiase Published: The Astrophysical Journal (Accepted for Publication), (2012)

3 - Farewell to black hole horizons and singularities? Authors: C. Corda, Darryl Leiter, HermanJ. Mosquera Cuesta, Scott Robertson, Ruddy Schild Published: Journ. Cosmology, 17 (2011) 13

4 - Gravitational Waves Produced by Ejection of Jet Superluminal Components, Precession and Gravito-Magnetic Distortion of Accretion Disks in Active Galactic Nuclei, Micro-Quasars, and T-Tauri Stars Dynamically Driven by Bardeen-Petterson Effect

Authors: Herman J. Mosquera Cuesta, Luis A. Sanchez, Daniel Alfonso Pardo, Anderson Caproni and Zulema Abraham

Published: The Open Astronomy Journal, vol. 4, issue 1, pp. 98-107

5 - Irreversible gravitational collapse: black stars or black holes? Authors: C. Corda, Herman J. Mosquera Cuesta Published: Hadron. Journ.34, 2011, 149-159

6 – Nonlinear electrodynamics and CMB polarization Authors: Herman J. Mosquera Cuesta, Gaetano Lambiase Published: Journ. Cosm. Astropart. Phys. 1103 (2011) 033

7 - Nonlinear Electrodynamics: Alternative Field Theory for Featuring Photon Propagation Over Weak Background Electromagnetic Fields and what Earth Receivers Read off Radio Signals from Interplanetary Spacecraft Transponders. Author:Herman J. Mosquera Cuesta

Published: Advances in spacecraft technologies, InTech (2011), Chap. 12Th

8 - Inflation from R² gravity: A new appraoch using nonlinear electrodynamics Authors: C. Corda, Herman J. Mosquera Cuesta Published: Astropart. Phys. 34 (2011) 587

9 - Gravitational Waves from Ejection of Jet Superluminal Components and Precession of Accretion Disks Dynamically Driven by Bardeen-Petterson Effect
Authors: Herman J. Mosquera Cuesta; Sánchez, Luis A.; Pardo, Daniel Alfonso; Caproni, Anderson; Abraham, Zulema; Quiroga-Nunez, Luis Henry
Published: Intern. Journ. Mod. Phys. Suppl. 3 (2011) 482

Edited Books (2012): 1 - The big challenge of gravitational waves: A new window into the universe Editors: C. Corda, Herman J. Mosquera Cuesta Published: Nova Science Publishers, Inc. New York, NY

2 - Space Science

Edited: Herman J. Mosquera Cuesta Published: InTech Publishing Company, Riejka, Croatia, Wien, Austria

Perez Martinez Aurora Maria

Position: Senior Researcher Period covered: 11-30 June



I Scientific Work

I spent my visit in icranet working in two tasks:

-Self-grativating Fermi sources in presence of magnetic field at finite temperature -Magnetized quark matter, phase transition and Astrophysical implications

II Conferences and educational activities

II a Conferences and Other External Scientific Work

-I gave a seminar entitled" Magnetized **CFL** phase: Compact Stars and strangelets", 22 June, *ICRANet*, La Sapienza Rome.

-I also participated in Marcel Grossmann Meeting in Stockholm, 1-7 July work presented: Magnetized compact stars.

II b Work With Students

Master student: Ismael Delgado from Instituto de Geofísica y Astronomía IGA, Havana Cuba, Ph D student: D. Manreza Paret from Universidad de la Habana and IAG-USP Sao Paulo.

II c Diploma thesis supervision

Ismael Delgado from Instituto de Geofísica y Astronomía IGA, Havana Cuba, thesis in preparation.

III. Service activities

I visited ICTP (from 3-10 June) to attend School on mLearning 4-7 June and the celebration of the 10 Anniversary of eJDS service. I give a talk about the relevance of eJDs for SCF, on behalf of the Cuban Physical Society (SCF), in my condition of Vice president.

IV. Other

- 1) I discussed with Dr. Herman Mosquera Cuesta the kicks of pulsars and the possible effect of magnetic field.
- 2) I discussed with Dr. Jorge Rueda the topic of global conservation of charge and its possible role in Quark stars.
- 3) I discussed with Dr. M Malheiro the role of magnetic field in pulsars and compact stars.
- 4) Work in collaboration with R. González Felipe, ISTL-Lisbon, Ernesto López Fune and D. Manreza Paret from Havana University: Role of magnetic field and temperature in the properties of Strange Quark Matter.
- 5) Collaboration with R. Sussman from ICN-UNAM, Alain Ulacia from ICIMAF Havana and Ismael Delgado from IGA from Havana in the field: Self-magnetized matter at finite temperature.

2012 List of Publication

-Gravity induced evolution of a magnetized fermion gas with finite temperature. I. Delgado, **A. Perez Martinez**, A. Ulacia and R. Sussman (to be sent JCAP nov 2012)

Piechocki Włodzimierz

Position: Professor Period covered: 16-22/01/2012



I Scientific Work

Collaboration with Prof. V. Belinski on the cosmological singularity problem.

II. Other

Talk: 'On the dynamics of the Bianchi IX model near the cosmological singularity', Pescara, Italy, ICRANet (International Center for Relativistic Astrophysisc Network), 2012-01-18

2012 List of Publication

- J. Mielczarek and W. Piechocki, 'Gaussian state for the bouncing quantum cosmology', Phys. Rev. D 86 (2012) 083508, arXiv:1108.0005 [gr-qc].
- [2] J. Mielczarek and W. Piechocki,

'Evolution in bouncing quantum cosmology', Class. Quant. Grav. 29 (2012) 065022, arXiv:1107.4686 [gr-qc].

Qadir Asghar

Position: Professor Emeritus

I Scientific Work:

A.	Research Papers:	Math./Phys.	(foreign journals)	161
		"	(local journals)	03
		Economics	(foreign journals)	01
		"	(local journals)	15
		Math./Phys.	(Int. Conf. Proc.)	22
		Math./Phys.	(Loc. Conf. Proc.)	05
		Economics	(Loc. Conf. Proc.)	03
B.	Books authored:		02	
C.	Books edited:		17	
D.	Research level articles published:		24	
E.	Teaching journal papers:		07	
F.	Popular articles:		32	
G.	Research preprints:		50	



II Conferences and educational activities

II a Conferences and Other External Scientific Work

- (a) International (held abroad) 90;
- (b) International (held locally) 35;
- (c) National 70;

in the fields of Mathematics, Physics, Economics and the History and Philosophy of Science.

II b Work With Students

- (a) Supervised 2 MS theses (at KFUPM);
- (b) Supervised 30 M. Phil. dissertations (at QAU), 1 at CAMP;
- (c) Supervised 10 Ph.D. theses (at QAU); 6 at CAMP;
- (d) Supervising 2 M. Phil. dissertation (at CAMP);
- (e) Supervising 3 Ph.D. theses (at CAMP).

III. Service activities

Within ICRANet

Visited ICRANet and attended ICRANet sponsored conferences.

2012 List of Publication

- **1.** "Extension of Hardy's class for Ramanujan's interpolation formula and master theorem with applications", M.A. Chaudhry and A. Qadir, J. Ineqs. and Appl. 52 (2012) pages 1 to 13.
- **2.** "A note on the extended complete and incomplete beta functions", K. Al-Baiyat, M.A. Chaudhry, B. Al-Humaidi and A. Qadir, International Journal of Applied Mathematics 25 (2012) 51 58.
- **3.** "CMB as a possible new tool to study the dark baryons in galaxies", F. De Paolis, G. Ingrosso, A.A. Nucita, D. Vetrugno, V.G. Gurzadyan, A.L. Kashin, H.G. Khachatryan, S. Mirzoyan, Ph. Jetzer and A. Qadir, J. Phys. Conf. Series 354 (2012) 012004, 8 pages.
- **4.** "Effect of accretion of phantom energy on initial mass of a primordial black hole", S. Naz and A. Qadir, J. Phys. Conf. Series 354 (2012) 012012, 7 pages.

- **5.** "Self-interaction of gravitational waves and their observability", A. Qadir, J. Phys. Conf. Series 354 (2012) 012014, 8 pages.
- **6.** "Noether symmetries of the area minimizing Lagrangian", A. Aslam and A. Qadir, *Journal of Applied Mathematics* (2012) ID 532690, 14 pages.
- **7.** "Linearization: Geometric, conditional and complex", A. Qadir, *Journal of Applied Mathematics* (2012) to appear.

Raffaelli Bernard

Position: Postdoctoral position Period covered:

- University of Nice, Sept. 2011 Aug. 2012
- University of Corsica, Sept. 2012 Aug. 2013

<u>I Scientific Work</u> Theoretical Physics. Works on Gravitation, Black Holes Physics, Quantum Gravity and Cosmology.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

- ICRA presentation and visit in Roma "La Sapienza" February, 6th, 7th and 9th, 2011.
- ICRANet presentation and visit, in Pescara February 8th, 2012.
- MG13 presentation Stockholm, July 2012

III. Service activities

III a. Within ICRANet Presentations, collaborations.

III b. Outside ICRANet

Teaching and research at the University of Nice (2011/2012) and at the University of Corsica (2012/2013).

- Teaching: Physics (Mechanics, Special Relativity, Quantum Mechanics, Thermodynamics, Mathematical Tools for Physicists) at undergraduate and graduate level.

- Research: works on Gravitation, Black Hole Physics, Quantum Gravity and Cosmology.

2012 List of Publication

September 2012 : J.P. Provost, B. Raffaelli, « *An unsual heuristic point of view concerning Newton constant and quantum physics* », submitted to Class. Quantum Grav.

August 2012: B. Raffaelli, « *A scattering approach to some aspects of the Schwarzschild black hole* », submitted to J. High Energy Phys.



Romero Gustavo E.

Position: Chief Researcher (CONICET), Full Professor (University of La Plata, Argentina). Period covered: 2012



I. Scientific Work

Research on black holes, magnetized plasma, AGNs, microquasars, foundations of general relativity. II Conferences and educational activities II a Conferences and Other External Scientific Work (just 2012):

Relativistic particles in magnetized media around black holes G.E. Romero, F.L. Vieyro. Expositor: G.E. Romero 13th Marcel Grossmann Meeting. Stockholm, Sweeden, July, 2012.

Accretion disks around Kerr black holes in modi_ed gravity D. Perez, G.E. Romero. Expositor: D. Perez. 13th Marcel Grossmann Meeting. Stockholm, Sweeden, July, 2012.

Non-thermal radiation from bowshocks of massive runaway stars G.E. Romero, M.V. del Valle. Expositor: G.E. Romero GAMMA2012, 5th International Heidelberg Symposium on High-Energy Gamma-Ray Astronomy. Heidelberg, Germany, July, 2012.

Radiation from black hole accretion in f(R) gravity D. P_erez, G.E. Romero. Expositor: D. Perez GAMMA2012, 5th International Heidelberg Symposium on High-Energy Gamma-Ray Astronomy. Heidelberg, Germany, July, 2012.

Episodic gamma-ray emission from the low-mass X-ray binary GRO J0422+32 F.L. Vieyro, G.E. Romero, J.M. Paredes, Y. Sestayo. Expositor: F.L. Vieyro GAMMA2012, 5th International Heidelberg Symposium on High-Energy Gamma-Ray Astronomy. Heidelberg, Germany, July, 2012.

Gamma-ray emission from massive stars interacting with AGN jets A.T. Araudo, V. Bosch-Ramon, G.E. Romero. Expositor: F.L. Vieyro GAMMA2012, 5th International Heidelberg Symposium on High-Energy Gamma-Ray Astronomy. Heidelberg, Germany, July, 2012.

High-Energy Emission from Young and Massive Stellar Objects G.E. Romero

Exploring the Non-Thermal Universe with Gamma Rays. On the occasion of Felix Aharonian 60th birthday. Universitat de Barcelona, Barcelona, Spain, November 6th - November 9th, 2012.

II. Conferences and educational activities

II a Work With Students PhD Supervision (La Plata University): 3 students.

II b Other Teaching Duties Courses on "Introduction to Black Hole Astrophysics" and "introduction to Relativistic Astrophysics", both UNLP (2012)

II c. Work With Postdocs Two posdocs (CONICET).

III. Service activities

Outside ICRANet CTA SAPO Member Advise Committee CONICET Vice-Director (IAR-CONICET) Member Directive Council, Department of Astronomy and Geophysics, University of La Plata.

IV. Other

Visiting Scientist ICRA-Pescara, July 2012.

2012 List of Publication

Gravitational entropy of black holes and wormholes G.E. Romero, R. Thomas, D. Perez. Int. J. Theoret. Phys. 51, 925-942, 2012.

An inhomogeneous lepto-hadronic model for the radiation of relativistic jets. Application to XTE J1118+480 G.S. Vila, G.E. Romero, N.A. Casco. Astron. Astrophys. 538, id.A97 , 1-12, 2012.

Parmenides reloaded G.E. Romero. Foundations of Science, 17, 291-299, 2012.

Dark matter and dark energy accretion onto intermediate-mass black holes C. Pepe, L. Pellizza, G.E. Romero. Mon. Not. Royal Astron. Soc. 420, 3298-3302, 2012.

New remarks on the Cosmological Argument. G.E. Romero, D. Perez. Int. J. Philos. Relig. 72, 103-113, 2012.

Physical processes in bowshocks from runaway stars. Application to zeta Ophiuchi. M.V. del Valle, G.E. Romero. Astron. Astrophys. 543, id.A56, 1-11, 2012.

Particle transport in magnetized media around black holes and associated radiation.

F.L. Vieyro, G.E. Romero. Astron. Astrophys. 542, id.A7, 1-13, 2012.

From change to spacetime: an Eleatic journey G.E. Romero. Foundations of Science, in press, 2012.

A model for the high-energy emission from blazars M.M. Reynoso, G.E. Romero, M.C. Medina, P. Brun. Int. J. Modern Phys. (CS) 8, 388-391, 2012.

Modeling gamma-ray emission from the high-mass X-ray binary LS 5039 S. Owocki, A.T. Okazaki, G.E. Romero. J. Astron. Space Sci. 29, 51-55, 2012.

A two-component model for the high-energy variability of blazars. Application to PKS 2155-304. M.M. Reynoso, G.E. Romero, C.M. Medina. Astron. Astrophys. 545, id.A125, 1-9, 2012.

Non-thermal processes and neutrino emission from the black hole GRO J0422+32 on bursting state.

F.L. Vieyro, Y. Sestayo, G.E. Romero, J.M. Paredes. Astron. Astrophys. 546, id.A46, 1-12, 2012.

AE Aurigae: _rst detection of non-thermal X-ray emission from a bow shock produced by a runaway star. J. Lopez-Santiago, M. Miceli, M.V. del Valle, G.E. Romero, R.Bonito, J.F. Albacete-Colombo, V. Pereira, E. de Castro, F. Damiani. Astrophys. J. Lett. 757, L6, 2012.

On the origin of the jet-like radio/X-ray morphology of G290.1-0.8. F. Garcia, J.A. Combi, J.F. Albacete-Colombo, G.E. Romero, F. Bocchino, J. L_opez-Santiago. Astron. Astrophys. 546, id.A91, 1-8, 2012.

Adversus singularitates: The ontology of space-time singularities G.E. Romero. Foundations of Science, in press, 2012.

Philosophical problems of space-time theories G.E. Romero. Gravitation and Cosmology, Cambridge University Press, pp. 171-184, 2012 (arXiv1105.4376).

The ontology of space-time singularities G.E. Romero. Proceedings of Mario Novello's 70th Anniversary Symposium. Livraria da Fisica, Sao Paulo, pp. 341-352, 2012.

The non-thermal broadband spectral energy distribution of radio galaxies G.E. Romero.

In: The Spectral Energy Distribution of Galaxies. IAU Symposium No. 284, Cambridge: Cambridge University Press, pp. 407-410, 2012.

IRAP Ph D Students

Argüelles Carlos Raúl

Position: PhD student Period covered: 2010 / 2013



I Scientific Work

Self-gravitating system of fermions at finite temperature as a model for galactic Dark Matter

This work is under the general supervision of Proffesor Remo Ruffini.

This research is based in a model of self-gravitating fermions at finite temperature in General Relativity to describe dark matter (DM) in galaxies. It is developed in a full FORTRAN code using NAG libraries to solve the integro-differential system of equations. The maximum possible range of the free parameter space of the model is explored, when compared with observations of central dark objects and galactic halos. In particular, it is shown that for very high values of the degeneracy parameter, central objects in galaxies with masses up to the Oppenheimer-Volkoff critical mass can be formed. Nontheless, for these cases no halo is present. Instead, low-intermediate degenerate systems are analysed, showing that a condensed central configuration can serve as an alternative to super massive Black Holes in galaxies in some cases, and at the same time, a halo is present in the outer regions in agreement with observations.

Einstein clusters and its applications to particle Dark Matter

This work is under the general supervision of Proffesor Remo Ruffini.

The clasification of Einstein Clusters based on the analysis of the stability of circular orbits according to the effective potential theory is compared with that resulting from the application of the maximum binding energy criterion. The stability properties are investigated for different choices of the energy density profile. The application of the model to the case of our Galaxy is also studied, showing that a constant energy an alternative for central massive Black Hole. density is а An analysis and review of the composition and lifetime works of dark cluster is also made. The actual constraints on the nature and mass of a particle Dark Matter candidate is studied, linking this to the former work.

Galactic phenomenology and model constarints, the baryonic and Dark Matter components

This work is under the general supervision of Proffesors Marco Merafina (Sapienza University)and Remo Ruffini.

Based on HST photometric and spectroscopic high angular resolution data , analysed in the literarure, an study of galactic velocity dispersions and surface brightness is made, to build new observables, i.e. total volumetric mass density, and volumetric luminosity mass density respectively. Then, a Dark Matter (DM)volumetric density is defined out of them in oder to be contrasted with Self-gravitating fermionic DM models in different regimes of degeneracy, and put theoretical constarints on the DM particle mass, as well as constrain the baryonic and DM mass composition in galaxies. By now, main attention on dwarf galaxies is given.

Fermi liquids and fermionic superfluidity as an application to Dark Matter

This work is under the general supervision of Proffesor Remo Ruffini.

The Landau's theory of Fermi liquids is studied, with principal attention on fermionic superfluidity. The changes in the Fermi-Dirac statistics from Fermi ideal gases to Fermi fluids (with weak effective interactions between the particles) is analysed, with main attention in the change on the thermodynamic magnitudes. The effect of this modified Fermi statistics is considered within hydrostatic equilibrium configurations, with views of applicability to big galactic cores, where new physics may appear.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

□ Astrophysics from the radio to the SubmillimetrePlanck and other experiments in temperature and polarization, Bologna-Italy. February (2012). Participant.

SIGRAV SchoolX edition: Astrophysical Black Holes, Como-Italy. May (2012). Participant.

□IRAP Ph.D Meeting (Murray GellMann visit), Nice-France. June (2012). Participant.

XIII Marcel Grossmann Meeting, StockholmSweden. July (2012). Participant/Speaker.

Talk 1: Semi-degenerate self-gravitating system of fermions as Dark Matter in Galaxies II: Core & Halo description.

Talk 2: On Einstein Clusters and Dark Matter

□IRAP Ph.D Erasmus Mundus school, NiceFrance. September (2012). Participant/Speaker. Talk: Semi-degenerate self-gravitating system of fermions as Dark Matter in Galaxies II: Core & Halo description.

□Current Issues on Relativistic Astrophysics Seoul-South Korea. November (2012). Participant/Speaker. Talk: Fermionic Dark Matter and galactic structures at all scales.

Argentinian collaboration with the theoretical-physics group of the Physics department (UNLP): An study of domain wall solutions in Horava gravity has been made in 2010/2012 (arXiv:1008.1915 [hep-th]), Under the supervision of the Dr. Nicolás Grandi.

II b Work With Students

Working with the IRAP and Erasmus Mundus PhD students, Bernardo Fraga and Ivan Siutsou respectively, in the issue of Dark Matter based on the model of Self-gravitating system of fermions.

II c Work With Postdocs

Collaboration with Andrea Geralico (ICRANet postdoc) in the work related with Self-gravitating systems of fermions in General Relativity and Einstein Clusters with Dark Matter applications.

2012 List of Publication

1. Self-Gravitating systems of fermions at finite temperature and Galactic Dark Matter, C. R. Argüelles, I. Siutsou, B. Fraga, R. Ruffini. In preparation.

2. On Einstein Clusters and Dark Matter, C. R. Argüelles, A. Geralico, R. Ruffini. In preparation.

3. Self-Gravitating fermionic Dark Matter and galactic structures: constraining the model with NGC205, C. R. Argüelles, M. Merafina, R. Ruffini. In preparation.

4. Semi-degenerate self-gravitating systems of fermions as Dark Matter in galaxies, C. R. Argüelles, B. Fraga. To appear in the proceeding of the XIII Marcel Grossmann Meeting.

Belvedere Riccardo

Position: Post-Doc Period covered: may 2012-april 2013

I Scientific Work

Working with Professor Ruffini to introduce rotation on the new neutron stars model, following the slow rotation approximation in the Hartle-Thorne formalism. The aim is understand the effect on momentum of inertia, on the energy of the system, eventually on pulsar glitches and so on. Moreover, I'm studying the problem of phase transition between core and crust, again in this new approach.



II Conferences and educational activities

II a Conferences and Other External Scientific Work

- CompStar: the physics and astrophysics of compact stars, Tahiti, French Polynesia, June 4-8 2012.
- 13th Marcel Grossmann Meeting, Stockholm, Sweden, July 1-7 2012.
- 39th COSPAR Scientific Assembly, Mysore, India, July 14-22 2012.

• CompStar 2012 School-Equation of State for Compact Star Interiors and Supernovae, Zadar, Croatia, September 24-28 2012.

• Invited talk to the Catania INFN section, by Prof. Fiorella Burgio, Catania, Italy, October 28-31 2012.

III. Service activities

Outside ICRANet

Assistent professor of the "Thermodynamic and laboratory" course held by Professor Tullio Scopigno at Sapienza-University of Rome, Physics Department, from October 2012 to February 2013 (in progress).

2012 List of Publication

(with R. Ruffini, J. Rueda, S.-S. Xue and D. Pugliese) *Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions.* Published on *Nuclear Physics A* Volume 883.

Benetti Micol

Position: Ph..D Student, IX IRAP Period covered: from November 1st 2011 to 31 October 2012



Scientific Work

In the second year of Ph.D, I worked on updating the constraints on possible features in the primordial inflationary density perturbation spectrum using the latest data from Cosmic Microwave Background (*CMB*) esperiment, like Wilkinson Microwave Anisotropy Probe at 7years (*WMAP7*), Atacama Cosmology Telescope (*ACT*) and | South Pole Telescope (*SPT*), and Luminous Red Galaxies (*LRG*) data from the Sloan Digital Sky Survey (*SDSS*). Non-standard large scale features are allowed by data and it is possible to generate them in a cosmological way introducing a sharp step in the inflation potential. Using cosmological data we derived constraints on the position, magnitude and gradient of a possible step; the inclusion of new data significantly improves the constraints respect to older work, especially to smaller angular scales. While we found no clear statistical evidence in the data for extensions to the simplest inflationary model, models with a step provide a significantly better fit than standard featureless power-law spectra.

We have also studied how that step in the inflationary potential could be verified using forthcoming temperature and polarization data from the Euclid satellite mission.

Conferences and educational activities

- <u>P</u>artecipated in XIth School of Cosmology, Gravitational Lenses: their impact in the study of galaxies and Cosmology Ph.D School, September 17-22 2012, Cargèse, France
- Working relationship with Excellence Cluster Universe and Ludwig-Maximiliam University -Munich, Germany, June - July 2012. Research project: Features Inflation Model and Galaxy Survey, new constraints from MaxBCG. Advisor: Jochen Weller
- Partecipated in Euclid Mission Conference 2012 International Conference, May 14-17 2012, Copenhagen, Denmark
- Presented poster in Essential Cosmology for the Netx Generation Ph.D School, Jenuary 16-21 2012, Cancun, Mexico

Within ICRANet

Work with Massimiliano Lattanzi and Stefania Pandolfi on the update of constraints on models with oscillatory features in the primordial power spectrum of scalar perturbations. The results will be publish in *Phys. Rev. D*

Outside ICRANet:

Work with Jochen Weller and Tommaso Giannantonio on the constraints of Features Inflation Model from the Galaxy Survey and MaxBCG dataset. The work is in progress. Member of Euclid Collaboration, Science Programme European Space Agency.

2011 List of Publications

Featuring the primordial power spectrum: new constraints on interrupted slow-roll from CMB and LRG data. <u>Micol Benetti, S. Pandolfi, M. Lattanzi, M. Martinelli, A. Melchiorri</u> <u>ArXiv:1210.3562</u>, pending acceptance of publication on *Phys. Rev. D.*

Boshkayev Kuantay

Position: Ph.D. student Period covered: 2009-2012

I Scientific Work

- Exact and approximate solutions;
- Rotating white dwarfs and neutron stars;
- Description of SGRs and AXPs as massive fast rotating highly magnetized white dwarfs.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

- Kuantay Boshkayev, Jorge A. Rueda and Remo Ruffini (a talk). Rotating White Dwarfs and Their Stability. CompStar: the physics and astrophysics of compact stars. Tahiti, June 4-8, 2012
- Kuantay Boshkayev, Jorge A. Rueda and Remo Ruffini (a talk). SGRs and AXPs as Massive Fast Rotating Highly Magnetized White Dwarfs: Bounds on the Mass, Moment of Inertia and Magnetic Fields. XIII Marcel Grossmann Meeting July 1-7, 2012 Stockholm - SWEDEN
- Kuantay Boshkayev, Jorge Rueda, Remo Ruffini and Ivan Siutsou (a talk). On General Relativistic Uniformly Rotating White Dwarfs. XIII Marcel Grossmann Meeting July 1-7, 2012 Stockholm SWEDEN
- Kuantay Boshkayev, Jorge A. Rueda and Remo Ruffini (a talk). Fast Rotating White Dwarfs as Precursors of Type Ia supernovae and Millisecond Pulsars. 39th Cospar Scientific Assembly, July 14-22, 2012 Mysore, India
- Kuantay Boshkayev, Michael Rotondo and Remo Ruffini (a short presentation and a poster). Stability of Rotating Nuclear Matter Cores of Stellar Dimensions. CompStar 2012 School in Zadar -September 24-28, 2012, Zadar (Croatia)
- Kuantay Boshkayev, Jorge A. Rueda and Remo Ruffini (a talk). SGRs and AXPs AXPs as Massive Fast Rotating Highly Magnetized White Dwarfs . Current Issues on Relativistic Astrophysics 2012, November 5-6, 2012 Seoul, South Korea

III. Service activities

III a. Within ICRANet

Lectures at IRAP Ph.D. Erasmus Mundus school September 3rd - 21st, 2012

- Non-rotating and slowly rotating stars in the Newtonian gravitational theory (Hartle's approach);
- Non-rotating and slowly rotating relativistic stellar models and their applications.

2012 List of Publication

- D. Bini, K. Boshkayev, and A. Geralico. Tidal indicators in the spacetime of a rotating deformed mass. Classical and Quantum Gravity, 29(14):145003, July 2012.
- K. Boshkayev, H. Quevedo, and R. Ruffini. Gravitational field of compact objects in general relativity. Phys. Rev. D, 86(6):064043, September 2012.


- K. Boshkayev, M. Rotondo, and R. Ruffini. On Magnetic Fields in Rotating Nuclear Matter Cores of Stellar Dimensions. International Journal of Modern Physics Conference Series, 12:58, 2012.
- K. Boshkayev, J. A. Rueda, R. Ruffini, and I. Siutsou. On general relativistic uniformly rotating white dwarfs. ApJ, in press. ArXiv e-prints, 2012.
- D. Bini, K. Boshkayev, R. Ruffini, and I. Siutsou. . Nuovo Cimento B, in press, 2012.
- K. Boshkayev, L. Izzo, and R. Rueda, J. and Ruffini. In preparation. 2012.

Bravetti Alessandro

Position: IRAP Ph.D. Student Period covered: November 1st, 2009 – to date

I Scientific Work

Geometrothermodynamics and applications to ordinary systems, black holes and cosmological solutions

II Conferences and educational activities

II a Conferences and Other External Scientific Work Visiting researcher from February 2012 to August 2012 at the National Autonomous University of Mexico, Mexico City, Mexico.

II b Work With Students Collaboration with Dr. Orlando Luongo on a project about applications of cosmography to cosmological models

III. Service activities

III a. Within ICRANet Writing of my thesis

III b. Outside ICRANet

Participation to the Geometrothermodynamics seminar at the National Autonomous University of Mexico, Mexico City, Mexico.

2012 List of Publication

1. A. Bravetti, F. Nettel, Second order phase transitions and thermodynamic geometry: a general approach (2012) [arXiv:1208.0399v2].

2. A. Aviles, A. Bravetti, S. Capozziello, O. Luongo, Updated constraints on f(R) gravity from cosmography (2012) [arXiv:1210.5149].

3. A. Aviles, A. Bravetti, S. Capozziello, O. Luongo, Cosmographic reconstruction of f(T) gravity (2012), in preparation.

4. A. Bravetti, C. S. L. Monsalvo, F. Nettel, H. Quevedo, Change of representation in geometrothermodynamics (2012), in preparation.

5. A. Bravetti, D. Momeni, R. Myrzakulov, H. Quevedo, Geometrothermodynamics of higher dimensional black holes (2012), in preparation.

6. A. Bravetti, D. Momeni, R. Myrzakulov, H. Quevedo, Geometrothermodynamics of black rings (2012), in preparation.



Cáceres Uribe Diego Leonardo

Position: PhD. Student Period covered: 2011 – 2014



I Scientific Work

I am focused in studying the model of white dwarfs for soft gamma ray repeaters and anomalous X-ray pulsars. We are currently considering the standard theory of pulsars and the proposed models of pulsar magnetospheres, intending to use them later to model the so called white dwarf pulsars. We are specifically interested in the description of the high energy emission in X-ray and Gamma-ray bands. We also consider the efficiency problem of the rotational energy conversion into electromagnetic radiation, both in white dwarfs and neutron star pulsars.

II Conferences and educational activities

II a Conferences and Other External Scientific Work Assistance to meetings organized by Icra such as:

- 1. 13th Marcel Grossmann Meeting. July 1-7, 2012 Stockholm, Sweden.
- 2. IRAP Ph.D. Erasmus Mundus School. September 3 21, 2012. Nice, France.

I am collaborating with Luca Izzo on the analysis and data reduction of X-ray and Gamma-ray spectra of Soft Gamma Ray Repetears and Anomalous X-ray pulsars.

Lecian Orchidea Maria

Position: Visitor Period covered: 2012



<u>I Scientific Work</u> Theoretical Astrophysics, General relativity, Early cosmology

II Conferences and educational activities

The dynamics of the Early Universe under the BKL hypothesis in the Misner variables is investigated in the case when a discretized nature of space is hypothesized for the Bianchi IX asymptotical (toward the singularity) model.

2012 List of Publication

O.M. Lecian, G. Montani, R. Moriconi, The quantum implementation of the Mixmaster model in the polymer representation, in preparation.

Menegoni Eloisa

Position: Ph.D student Period covered: November 2009 – October 2012

I Scientific Work

II Conferences and educational activities

II a Conferences and Other External Scientific Work

• 'VIII Mexican School of the Gravitation and Mathematical Physics Division of the Mexican Physical Society:Speakable and Unspeakable in Gravitational Physics', held in Playa del Carmen, Mexico, 6-12 December 2009.

• 'Cosmology on the Beach: Essential Cosmology for the Next Gene- ration' organized by Berkeley Center for Cosmological Physics (USA) and Istituto Avanzado de Cosmologia (Mexico) -Playa del Carmen, Qroo., Mexico, January 11-15,2010.

• 'IRAP Ph.D Lectures' Nice Observatoire de la Cote d'Azur, Nice, France, February 1-5, 2010.

• 'X-/gamma-rayobservationalastrophysicsandprospects', IRAPSchool in Ferrara, Italy, March 23-24, 2010.

• '5th Iberian Cosmology Meeting' in Porto, Portugal, from 29th to 31th of March,2010, and organized by the 'Centro de Astrofisica da Universidade do Porto'.

• 'HORIBA INTERNATIONAL CONFERENCE COSMO/CosPA2010' at the University of Tokyo, Japan, from 27th of September to 1th of October, 2010.

• Miami2010: A topical conference on elementary particles, astrophy-sics, and cosmology' held in Fort Lauderdale (FL), USA, from 14th to 19th of December, 2010.

- Planck:LFI-Core Team' held in Bolognue, Italy, from 17th to 18th of January, 2011.
- Planck:LFI-Core Team' held in Pasadena, California (USA), from 14th to 18th of February, 2011.
- Planck:LFI-Core Team' held in Bolognue, Italy, from 7th to 10th of March, 2011.

• IRAP Ph.D and Erasmus mundus workshop: Recent News from the Mev, GeV and TeV Gamma-Ray Domains' held in Pescara, Italy, from 21th to 26th of March, 2011.

• IRAP Ph.D and Erasmus Mundus workshop:From Nuclei to White Dwarfs and Neutron Stars' held in Les Houches, France, from 3th to 8th of April, 2011.

• 'Planck Joint Core Team meeting' held in Paris at the Laboratoire de l'Accelarateur Lineaire Orsay , France, from 2th to 4th of May, 2011.

• 'School of Astrophysics 'Francesco Lucchin', XI Cycle, III Course' held in Bertinoro, Italy, from 8th to 13th of May, 2011.

• Azores School on Observational Cosmology', held in Angra do He- roi'smo, Azores, Portugal from 1th– 5th of September, 2011.

• Erasmus mundus-IRAP PhD Lectures Universite de Nice Sophia An- tipolis', held in Nice, France, from 13th – 15th of September, 2011.

• '3rd Galileo-Xu GuangQi Meeting,', held at National Astronomical Observatory of the Chinese Academy of Sciences, in Beijing, China, from 11th – 15th of October, 2011.

• 'Planck:JCT-Core Team' held in Bolognue, Italy, from 14th to 18th of November, 2011.

• 'Scientific and Technical Computing in C++' held at CASPUR-HPC Department in Rome, Italy, from 29th of November to 2th of Decem- ber, 2011.

• 'Cosmology on the Beach: Essential Cosmology for the Next Gene- ration' organized by Berkeley Center for Cosmological Physics (USA) and Istituto Avanzado de Cosmologia (Mexico) Cancun, Mexico, Ja- nuary 16-20,2012.

- 'Planck:CTP-meeting' held in Ferrara, Italy, from 7th to 10th of Fe- bruary, 2012.
- 'Planck Conference' held in Bolougne, Italy, on the 16th of February, 2012.

• 'Scientific and Technical Computing in Fortran95' held at CASPUR- HPC Department in Rome, Italy, from 17th – 20th of April, 2012.

- 'Planck: JCT-meeting' held in Paris, France, on the 9th–11th of May, 2012.
- EUCLID Consortium Conference held in Copenhagen, Denmark, on the 14th 18th of May, 2012.

• '13rd Marcel Grossmann Meeting -MG13,', held at 'Stockholms Uni- versitet', in Stockholm, Sweden, from 1th – 7th of July, 2012.

• 'XI Cosmology School', held at 'IESC', in Cargese, France, from 17th-21th of September, 2012.

II b Diploma thesis supervisior and title

"CONSTRAINTS ON FUNDAMENTAL PHYSICS FROM COSMIC MICROWAVE BACKGROUND DATA ANALYSIS" Advisor Prof. Alessandro Melchiorri

II c Other Teaching Duties

TALKS in conferences:

• Poster and Talk 'New constraints on variations of the fine structure constant from CMB anisotropies' at XIst Cosmology School, held at IESC, in Cargese, France, from 17th to 21th of September, 2012.

• 'The Fine Structure Constant and the CMB Damping Scale' at '13rd Marcel Grossmann Meeting -MG13,', held at 'Stockholms Universitet', in Stockholm, Sweden, from 1th – 7th of July, 2012.

• Poster 'New constraints on variations of the fine structure constant from CMB anisotropies' at 'Cosmology on the Beach: Essential Co- smology for the Next Generation', conference organized by Berke- ley Center for Cosmological Physics (USA) and Istituto Avanzado de Cosmologia (Mexico) Cancun, Mexico, January 16 20, 2012.

• 'Constraining variations on the fine structure constant from next sur- vey experiment' at '3rd Galileo-Xu GuangQi Meeting,', held at Natio- nal Astronomical Observatory of the Chinese Academy of Sciences, in Beijing, China, from 11th – 15th of October, 2011.

• 'Cosmological constraints on variations of fundamental constants from CMB data' at Azores School on Observational Cosmology', held in Angra do Heroi'smo, Azores, Portugal from 1th – 5th of September, 2011.

• 'Cosmological constraints on variations of fundamental constants from CMB data' at IRAP Ph.D and Erasmus Mundus Workshop: 'Recent News from the Mev, GeV and TeV Gamma-Ray Domains' held in Pescara, Italy, from 21th – 26th of March, 2011.

• 'Cosmological constraints on variations of fundamental constants' at Miami2010: A topical conference on elementary particles, astrophy- sics, and cosmology' held in Fort Lauderdale (FL), USA, from 14th– 19th of December, 2010.

• 'Cosmological constraints on variations of fundamental constants' at 'Horiba International conference COSMO/CosPA2010' held at the Uni- versity of Tokyo, Japan, from 27th of September to 1th of October, 2010.

• 'New constraints on variations of fundamental constants from CMB anisotropies' at 'Iberian Cosmology Meeting' held in Porto, Portugal, from 29th to 31th of March, 2010.

• 'New constraints on the fine structure constant from CMB anisotro- pies' at the Observatoire de la Cote d'Azur, Nice, France (Febrauary 4, 2010).

III. Service activities

III a. Within ICRANet: Ph.D lessons

III b. Outside ICRANet

• Member of Planck-LFI Core Team.

• Member of Euclid collaboration.

• Visiting Student at the JPL (Jet Propulsion Laboratory), Pasadena, California, from 27 of July to 20 of August, 2012, under the supervision of Dr. Graca Rocha and Dr. Loris Colombo.

• Visiting Student at the Institut fu r Theoretische Physik University of Heidelberg, Germany, from 6th to 10th of December, 2011, under the supervision of Professor Luca Amendola.

• Visiting Student at JPL (Jet Propulsion Laboratory), Pasadena, Ca- lifornia, from 13 of June to 13 of July, 2011, under the supervision of Dr. Graca Rocha.

• Junior Specialist with fellowship for the Department of Physics and Astronomy at the University of California, Irvine, from June 21 to September 20, 2010 under the supervsion of Prof. Asantha Cooray, Full Professor in the Department of Physics and Astronomy.

IV. <u>Other</u>

Prize of the Wolfram Mathematica 8 for the best talk at the conference Miami2010: A topical conference on elementary particles, astrophysics, and cosmology' held in Fort Lauderdale (FL), USA, from 14th to 19th of December, 2010.

2012 List of Publication

• 'Future constraints on variations of the fine structure constant from combined CMB and weak lensing measurements'; Matteo Martinelli, Eloisa Menegoni, Alessandro Melchiorri ; Physical Review D, Vol.85, No.12, id. 123526 (2012).

• 'The Fine Structure Constant and the CMB Damping Scale'; Eloisa Menegoni, Maria Archidiacono, Erminia Calabrese, Silvia Galli, C. J. A. P. Martins, Alessandro Melchiorri; PhysRevD vol. 85, id. 107301 (2012).

• 'Constraining Variations in the Fine Structure Constant in the pre- sence of Early Dark Energy'; Erminia Calabrese, Eloisa Menegoni, C.J.A.P. Martins, Alessandro Melchiorri, Graca Rocha.Phys.Rev.D84:023518 (2011).

• 'Varying couplings in the early universe: correlated variations of *α* and G'; C.J.A.P. Martins, E. Menegoni, S. Galli and A. Melchiorri; Physical Review D, vol. 82, Issue 2, id. 023532, (2010).

• 'Constraints on the dark energy equation of state in presence of a varying fine structure constant'; E. Menegoni, S. Pandolfi, S. Galli, M. Lattanzi, A. Melchiorri; IJMPD, International Journal of Modern Physics D, Volume 19, Issue 04, pp. 507-512 2010.

• 'Constraints on the dark energy equation of state in presence of a varying fine structure constant'; E. Menegoni, S. Pandolfi, S. Galli, M. Lattanzi, A. Melchiorri; IJMPD, International Journal of Modern Physics D, Volume 19, Issue 04, pp. 507-512 2010.

• 'New Constraints on variations of the fine structure constant from CMB anisotropies'; E. Menegoni, S. Galli, J. Bartlett, C. Martins, A. Melchiorri; arXiv.org:0909.3584, Phys. Rev. D80:087302,2009.

In preparation:

• 'Cosmological parameter estimations with simulated Planck polariza- tion data'; E. Menegoni, P.Natoli, A. Gruppuso, M. Migliaccio (in preparation).

Conference Proceedings

• 'New limits on the fundamental constants from the CMB data' Eloisa Menegoni, Alessandro Melchiorri, Erminia Calabrese, Silvia Galli, to be published as a proceedings for '3rdGalileo-Xu Guangqi meeting' held in Beijing, China.

• 'New Limits on the Neutrino Mass from Cosmology Melchiorri, A. ;de Bernardis F.; Menegoni, E.. International Journal of Modern Physics: Conference Series, vol. 12, issue 01, p. 36; 368 (2012). DOI: 10.1142/S2010194512006575 [2012IJMPS..12..368M].

• 'Testing the Variation of Fundamental Constants with the CMB' Galli, Silvia; Martins, C. J. A. P.; Melchiorri, Alessandro Eloisa Menegoni. From Varying Couplings to Fundamental Physics, Astrophysics and Space Science Proceedings, ISBN 978-3-642-19396-5. Springer-Verlag Berlin Heidelberg, 2011, p. 59 SPRINGER.

• E. Menegoni, New Constraints on Variations of Fine Structure Con- stant from Cosmic Microwave Background Anisotropies, GRAVITA- TIONAL PHYSICS: TESTING GRAVITY FROM SUBMILLIME- TER TO COSMIC: Proceedings of the VIII Mexican School on Gra- vitation and Mathematical Physics. AIP Conference Proceedings, Volume 1256, pp. 288-292 (2010).

• A. Melchiorri, F. De Bernardis, E. Menegoni, Limits on the neutri- no mass from cosmology, GRAVITATIONAL PHYSICS: TESTING GRAVITY FROM SUBMILLIMETER TO COSMIC: Proceedings of the VIII Mexican School on Gravitation and Mathematical Physics. AIP Conference Proceedings, Volume 1256, pp. 96-106 (2010).

Muccino Marco

Position: PhD student Period covered: 2010/2012



I Scientific Work

Gamma Ray Bursts (GRBs)

1) High Energy emission in GRBs, with L. Izzo and Prof. R. Ruffini

2) Genuine Short GRBs, with C.L. Bianco, L. Izzo, A.V. Penacchioni and Prof R. Ruffini

3) Double component GRBs, with C.L. Bianco, L. Izzo, A.V. Penacchioni, G. Pisani and Prof R. Ruffini

4) Accretion processes in the IGC scenario, with C.L. Bianco, L. Izzo, A.V. Penacchioni, G. Pisani, Jorge A. Rueda and Prof R. Ruffini

II Conferences and educational activities

II a Conferences and Other External Scientific Work

1)IRAP Ph.D. Erasmus Mundus Workshop Recent News from the Mev, GeV and TeV Gamma-Ray Domains March 21-26, 2011 Pescara (Italy)

2) IRAP Ph.D. Erasmus Mundus school, May 25th - June 10th, 2011 Nice (France)

3) HEPRO (High Energy Phenomena in Relativistic Outflows) III June 27 - July 1, 2011 Barcelona (Spain)

4) 12th Italian-Korean Symposium on Relativistic Astrophysics, July 4-8, 2011 Pescara (Italy)

5) IRAP Ph Erasmus Mundus School, September 5th - 16th, 2011 Nice (France)

6) IRAP Ph.D. Erasmus Mundus Workshop, Gamma Ray Bursts, their progenitors and the role of thermal emission October 2-7, 2011 Les Houches (France)

7) Third Galileo - Xu Guangqi meeting THE SUN, THE STARS, THE UNIVERSE and GENERAL RELATIVITY October 11-15, 2011 Beijing (China)

8) 9th AGILE Science Workshop, Astrophysics with AGILE: Five Years of Surprises, April 16th – 17th, 2012 ESA-ESRIN, Frascati (Italy)

9) Thirteenth Marcel Grossmann Meeting (MG 13), On Recent Developments on Theoretical and Experimental General Relativity, Astrophysics and Relativistic Field Theories, July 1st - 7th, 2012 Stockholm (Sweden)

10) IRAP Ph.D. Erasmus Mundus School, September 3rd - 21st, 2012 Nice (France)

II. Service activities

Within ICRANet

- 1. Lecture: IRAP Ph.D. Erasmus Mundus School, September 5th 16th, 2011 Nice (France) "High Energy emission in GRBs: the case of GRB 090902B"
- Lecture: IRAP Ph.D. Erasmus Mundus School, September 3rd 21st, 2012 Nice (France) "GRB090227B: the missing link between genuine short and long GRBs" III b. Outside ICRANet

2012 List of Publication

- Penacchioni, A. V., Ruffini, R., Izzo, L., Muccino, M., Bianco, C. L., Caito, L., Patricelli, B., Amati, L., "Evidence for a proto-black hole and a double astrophysical component in GRB 101023", 2012, A&A, 538, A58
- 2. Muccino, M., Ruffini, R., Bianco, C. L., Izzo, L., Penacchioni, A. V., "GRB 090227B: the missing link between the genuine short and long GRBs ", 2012 ApJ (in press)

Sigismondi Costantino

Position: Professor Period covered: 1/11/2011-6/11/2012



I Scientific Work

High resolution measurements of solar diameter, with a special mission to China in collaboration with OCA to observe the transit of Venus

IRAP/PhD Thesis discussed on 12 december 2011 in cotutele with Nice-Sophia Antipolis University.

Thesis under publication with LAP-LAMBERT obtained CNPq grant as visiting professor at the Observatorio Nacional, Rio de Janeiro, Brasil dec 2012-dec2013 granted by FAPERJ as visiting professor at the Observatorio Nacional, Rio de Janeiro nov2011-nov2012 not used for italian burocratical reasons.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

Science and Faith among the three monotheistic religions, Jerusalem 4-8 dec 2011

The transit of Venus, history and opportunities, Beijing 7 june 2012

Measurement of the diameter of the Sun with the transit of Venus, Rome EWASS 2012 29 june 2012; Stockholm MGXIII 3 july 2012; Naples SIF 19 september 2012, Frascati UAI 28 september 2012, Padova University 9 october 2012 and Asiago Observatory 11 october 2012.

The Cassini tercennial celebrations, Paris 14 september 2012 and Albano Laziale 6 october 2012 SIA congress. Clavius fourthcentennial conference, Pescara ICRANet, 24-27 august 2012.

II b Work With Students

Professor of Physics and Laboratory at Galileo Ferraris Institute of Rome with 140 students Astrophysics Lab trainer, Sapienza University of Rome prof. De Bernardis

II c Diploma thesis supervision Two thesis at University Regina Apostolorum on Anthropic Principle in philosophy and cosmology

II d Other Teaching Duties Philosophy of astronomy, 3ECTS Pontifical University Regina Apostolorum

II e. Work With Postdocs with Eugênio Reis Neto, Obs. Nacional and MAST, Rio de Janeiro

III. Service activities

III a. Within ICRANet
Organization of Clavius fourthcentennial meeting in Pescara, August 2012
Professore a comando at ICRANet september 2012- august 2013
I
II b. Outside ICRANet

Organization of Gerbert of Aurillac meetings in Rome, Biblioteca Vallicelliana 12 may 2012 and Sapienza University 7 december 2012

IV. Other

Student of Shroud of Turin Studies Diploma (Regina Apostolorum University, Rome)

2012 List of Publication

1) 2012arXiv1211.0448S Sigismondi, Costantino Gerberto e le fistulae: tubi acustici ed astronomici

2) 2012arXiv1211.0438S Sigismondi, Costantino Gerberto e la misura delle canne d'organo

3) 2012DPS....4450807T Tanga, Paolo; Widemann, T.; Ambastha, A.; Babcock, B. A.; Berthier, J.; Bouley, S.; Braga-Ribas, F.; Brasch, K.; Burke, W.; Colas, F.; C. Sigismondi and 14 coauthors, *The Venus Twilight Experiment: Probing The Mesosphere In 2004 And 2012*

4) 2012arXiv1210.8451X Xie, Wenbin; Sigismondi, Costantino; Wang, Xiaofan; Tanga, Paolo, Venus transit, aureole and solar diameter

5) 2012arXiv1210.8286W Wang, Xiaofan; Sigismondi, Costantino, *Geometrical information on the solar shape: high precision results with SDO/HMI*

6) 2012SoPh..278..269R Raponi, A.; Sigismondi, C.; Guhl, K.; Nugent, R.; Tegtmeier, A., The Measurement of Solar Diameter and Limb Darkening Function with the Eclipse Observations

7) 2012EAS....55..393S Sigismondi, C., Solar diameter with 2012 Venus Transit

8) 2012EAS....55..389R Raponi, A.; Sigismondi, C.; Guhl, K.; Nugent, R.; Tegtmeier, A., Solar limb darkening function and solar diameter with eclipse observations

9) 2012EAS....55..381S Sigismondi, C.; Raponi, A.; De Rosi, G.; Bianda, M.; Ramelli, R.; Caccia, M.; Maspero, M.; Negrini, L.; Wang, X., *Atmospheric fluctuations below 0.1 Hz during drift-scan solar diameter measurements*

10) 2012arXiv1206.0712S Sigismondi, Costantino, Solar diameter with 2012 Venus transit: history and opportunities

11) 2012arXiv1203.0476S Sigismondi, Costantino, Christopher Clavius astronomer and mathematician

12) 2012arXiv1202.1071S Sigismondi, Costantino, *The astrometric recognition of the solar Clementine gnomon* (1702)

13) 2012IJMPS..12..229S Sigismondi, Costantino, Sunsets and Solar Diameter Measurement

14) 2012arXiv1201.6463S Sigismondi, C., Low frequency seeing and solar diameter measurements

15) 2012arXiv1201.6094SSigismondi, Costantino, Gerbert of Aurillac: astronomy and geometry in tenthcentury Europe

16) 2012arXiv1201.4012S Sigismondi, Costantino, Solar astrometry: the status of art in 2011

17) 2012arXiv1201.1261S Sigismondi, Costantino, Astronomia di Posizione per Muoni, Algoritmi per foglio elettronico (Positional Astronomy for Muons, Algorithms for electronic spreadsheet)

18) 2012arXiv1201.0707R Raponi, Andrea; Sigismondi, Costantino; Guhl, Konrad; Nugent, Richard; Tegtmeier, Andreas, *Eclipse*, *solar limb darkening function and diameter measurements: toward a unified approach*

19) 2012arXiv1201.0510S Sigismondi, Costantino, Measuring the position of the center of the Sun at the Clementine Gnomon of Santa Maria degli Angeli in Rome

20) 2012IJMPS..12..405S Sigismondi, Costantino; Raponi, Andrea; Bazin, Cyril; Nugent, Richard, *Towards a Unified Definition of Solar Limb during Central Eclipses and Daily Transits*

21) 2012IJMPS..12..400S Sigismondi, Costantino, The Picard Satellite Mission for Solar Astrometry

22) 2011arXiv1112.63985Sigismondi, Costantino, The partial asteroidal occultation of Betelgeuse on Jan 2,2012

23) 2011arXiv1112.6348S Sigismondi, Costantino, The CLAVIUS Four Centennial Meeting and XXXI ESOP

24) 2011arXiv1112.5878S Sigismondi, Costantino, High precision ground-based measurements of solar diameter in support of Picard mission

25) 2011arXiv1112.5871D d'Avila, Victor; Reis Neto, Eugenio; Coletti, Alissandro; Oliveira, Luis Carlos; Matias, Victor; Humberto Andrei, Alexandre; Lousada Penna, Jucira; Calderari Boscardin, Sergio; Sigismondi, Costantino, A new approach for the heliometric optics

26) 2011arXiv1112.4873S the Italian mission	Sigismondi, Costantino, Airborne observation of 2011 Draconids meteor outburst:
27) 2011arXiv1112.2356S periastron	Sigismondi, Costantino, Differential photometry of delta Scorpii during 2011
28) 2011arXiv1112.0403R Baily's Beads Observations	Raponi, Andrea; Sigismondi, Costantino, Solar Limb Darkening Function from

29) 2011arXiv1112.0401S Sigismondi, Costantino; Raponi, Andrea; Wang, Xiaofan; De Rosi, Giulia; Bianda, Michele; Ramelli, Renzo, *The power spectrum of the seeing during solar observations*

30) 2012arXiv:1211.0677A Alexandre H. Andrei, Victor A. D'Avila, Eugenio Reis Neto, Jucira L. Penna, Sergio C. Boscardin, Alissandro Coletti, Luiz C. Oliveira, Costantino Sigismondi, *Development and first year of results from the heliometer of Observatorio Nacional*

IRAP Ph D Erasmus Mundus Students

Baranov Andrey

Position: Ph. D. student (Erasmus Mundus Program), LAPTH, Universite de Savoie, Annecy-le-Vieux, France Period covered: 09/2010-09/2013



I Scientific Work

In our group under supervision of Prof. Pascal Chardonnet we study evolution and fate of very massive stars. These stars should end their life as pair-instability supernovae, so we perform numerical analysis of pair-instability explosion. The first stars in the Universe, called Population III stars, since they are metal free, should produce pair-instability supernovae with a rate greater than what is observed now. So we also study influence of explosions of massive stars on early Universe.

II Conferences and educational activities

II a Conferences and Other External Scientific Work IAU Symposium 279 "The Death of Massive Stars", Nikko, Japan, 12-16 March 2012

13th Marcel-Grossmann meeting, Stockholm, Sweden, 1-7 July 2012

Erasmus Mundus schools in University of Nice 4-8 June, 2012 1-21 September, 2012

2012 List of Publication

Proceedings of the workshop 'From Nuclei to White Dwarfs and Neutron Stars', Les Houches, France, 2011. (sent for publication)

Benedetti Alberto

Position: 3rd year Erasmus Mundus PhD Student Period covered: September 2010 –



Scientific Work

We studied the entire dynamics of energy conversion from initial overcritical electric field, ending up with thermalized electron-positron-photon plasma. Our approach is based on the kinetic theory which allows to determine the time evolution of each particle distribution function including the effects due to particles interactions. Hence we solved numerically the relativistic Vlasov-Boltzmann equations for electrons, positrons and photons, with collision integrals for 2-particle interactions computed from exact QED matrix elements. The adopted numerical method is characterized by having an adaptive time step which enables us to follow physical processes occurring on very different time-scales. Firstly pair creation occurs from vacuum breakdown and secondly back reaction results in plasma oscillations. Thirdly photons are produced by electron-positron annihilation. Finally particle interactions lead to completely equilibrated thermal electron-positron-photon plasma. This work generalizes some of the results obtained up to now in this field of research. In particular, considering a more general phase space, the conversion of energy into rest mass energy of electron-positron pairs is shown to be less efficient. In fact, most of the initial energy is transformed into thermal energy of particles.

The scheme described above has been generalized and it will be applied to the study of the GRBs photospheric emission. We want to follow the photon, electron and proton distribution functions when the relativistic outflow approaches transparency in order to investigate their effects on the observed spectra.

Conferences and educational activities

- IRAP Ph.D. Erasmus Mundus Workshop, April 5, 2011, Pescara (Italy)
- IRAP Ph.D. Erasmus Mundus Workshop, April 3-8, 2011, Les Houches (France)
- Fermi Symposium, May 9-12, 2011, Rome (Italy)
- Advances in Computational Astrophysics: methods, tools and outcomes, June 13-17, 2011, Cefalù (Italy)
- Italian-Korean Meeting, July 4-9, 2011, Pescara (Italy)
- IRAP Ph.D. Erasmus Mundus School, September 7, 2011, Nice (France)
- IRAP Ph.D. Erasmus Mundus Workshop, October 6, 2011, Les Houches (France)
- Galileo-Xu Guanqui Meeting, October 12, 2011, Beijing (China)
- Marcel Grossmann meeting, Stockholm, Sweden, 1st 7th July, 2012.
- IRAP Ph.D. Erasmus Mundus School", Nice, France, 3rd 19th September, 2012.

List of Publications

- "On the frequency of oscillations in the pair plasma generated by a strong electric field"

A. Benedetti, W.-B. Han, R. Ruffini, G.V. Vereshchagin, Physics Letters B 698 (2011) 75-79

- "Phase space evolution of pairs created in strong electric fields"

A. Benedetti, R. Ruffini, G. V. Vereshchagin, proceedings of the 12th Italian-Korean Meeting to be published by the Italian Physical Society (SIF) in the Volume "Nuovo Cimento C".

- "Phase space evolution of pairs created in strong electric fields"

A. Benedetti, R. Ruffini, G.V. Vereshchagin, Physics Letters A (accepted for publication)

Fraga de Oliveira Bernardo Machado

Position: PhD Student Period covered: 11/2011-11/2012



I Scientific Work

Work with Prof. Ruffini, Carlos Arguelles and Ivan Siutsou in a unified model for dark matter halos and compact objects in the center of galaxies based on semidegenerate fermions interacting only gravitationally. This model is an alternative to the current paradigm that there is a supermassive black hole in the center of galaxies.

Work with Dr. Paolo Giommi and Bruno Arsioli in identifying blazars in the WISE survey and build a catalog of high synchrotron peaked blazars. Also use the catalog to build a correlation function and check how the Cosmic Background Radiation may be contamined by these discrete sources.

II Conferences and educational activities

II a Conferences and Other External Scientific Work Attendance to the 3rd Galileo-Xu Guangqi Meeting, Beijing, China (10/2011). **Oral presentation**: Self-Gravitating system of fermions as central objects and dark matter halos in galaxies.

Attendance to the XIII Marcel Grossman Meeting, Stockholm, Sweden (07/2012). **Oral presentation**: Semidegenerate self-gravitating system of fermions as Dark Matter on galaxies I: Universality laws.

Attendance to the Erasmus Mundus School, Nice, France (09/2012). **Oral presentation**: Self-gravitating system of fermions as Dark Matter on galaxies.

Attendance to "Current Issues on Relativistic Astrophysics", Seoul, South Korea (11/12) **Oral Presentation:** Self-gravitating system of fermions as Dark Matter on galaxies.

Gregoris Daniele

Position: Erasmus mundus Ph.D. student (2011-2014) Host Institution: Stockholm University



Scientific work:

I am studying the role of friction forces in several contexts of general relativity under the supervision of Dr. Donato Bini, Dr. Sauro Succi and Prof. Kjell Rosquist. In particular we follow the formalism of Poynting and Robertson analyzing the motion of a test particle inside a photon gas superposed to a Schwarzschild black hole, inside a photon gas in the Tolman metric and inside a massive gas in the Pant-Sah metric respectively. I am also working on a project about inhomogeneous cosmology under the supervision of prof. Kjell Rosquist. We are comparing the curvature of a regular distribution of (5-8-16-24-120-600) Schwarzschild black holes on the 3-sphere with the one of a closed Friedmann model with the same matter content. We are deriving the equations of motion for the 8 masses case from an analytic point of view and discussing the role of discrete symmetries in these models.

Oral presentations given in international meetings and schools:

"Boltzmann equations in curved space-time: formulation and applications in General Relativity", 12th Italian-Korean Symposium on relativistic astrophysics, July 2011

" Friction forces in General Relativity ", Erasmus Mundus school, June 2012

" Friction forces in General Relativity ", MG13, July 2012

" Friction forces", Erasmus Mundus school, September 2012

Other schools attended: Erasmus Mundus school, September 2011

Exams that I passed during my Ph.D.:

Swedish, Course 1 for international students and researchers (4.5 credits) Cosmology and Astroparticle Physics (7.5 credits) Path integral methods in QFT (7.5 credits) Advanced Non-relativistic Quantum Field Theory (7.5 credits) Mathematical physics (7.5 credits)

Other academic experiences:

"Percorso di eccellenza" of the faculty of natural science of "La Sapienza", academic year 2010-2011 Visiting Ph.D. student at the Albert Einstein Institute in Potsdam (October-November 2012)

Publications on journals with referees:

D. Bini, D. Gregoris, S. Succi, EPL (Europhysics Letters) 97, 40007 (2012)

Bini, Gregoris, Rosquist, Succi, *Particle motion in a friction gas: friction matters,* General Relativity and Gravitation: Volume 44, Page 2669-2680 Issue 10 (2012)

Bini, Gregoris, Rosquist, Succi, *Effects of friction forces on the motion of objects in smoothly matched interior/exterior spacetimes*, submitted to Classical and Quantum Gravity, 2012

Proceedings:

Bini, Gregoris, *Kinetic theory in curved space-times: applications to black holes*, proceeding for the 12th Italian-Korean Symposium on relativistic astrophysics Bini, Gregoris, Rosquist, *Friction forces in general relativity*, submitted as proceeding for the MG13, 2012

Gruber Christine

Position: PhD Student Period covered: September 2010 - present



I Scientific Work

- Dark energy from vacuum energy contributions of bosonic and fermionic fields in the universe;
- Improvements and extensions of cosmographical analyses of supernova data in order to obtain the parameters of the cosmographic series;
- Bose-Einstein condensation in compact astrophysical objects such as white dwarfs and neutron stars.

II Conferences and educational activities

Conferences and Other External Scientific Work

2012, September 3rd-22nd: "Dark Energy from the Vacuum Energy of Quantum Fields" and "Bose-Einstein Condensation in Astrophysical Compact Objects", talks at the Erasmus Mundus School, Université de Nice Sophia-Antipolis, Nice, France

2012, August 21st-25th: "Bose-Einstein Condensation in Astrophysical Compact Objects", poster contribution at the 514th WE-Heraeus Seminar "Quo vadis, BEC?", Bad Honnef, Germany

2012, July 3rd: ""Cosmography and constraints on the equation of state of the Universe in various parameterizations", talk at 13th Marcel Grossmann Meeting, Stockholm, Sweden

2012, January 2nd: "Dark Energy from the Vacuum Energy of Quantum Fields", talk at the New Year's Seminar of AG Kleinert, FU Berlin, Germany

2011, September 5th-17th: "Dark Energy in the Gross-Neveu model", talk at the Erasmus Mundus Summer School, Université de Nice Sophia-Antipolis, Nice, France

Work With Students

Summer internship RISE (Research Internships in Science and Engineering): supervision of a Bachelor student from Yale University for a summer internship (June – August 2011).

Other Teaching Duties

Free University Berlin: Fall term 2010/11: Tutorial for Theoretical Physics III: Electrodynamics Fall term 2011/12: Tutorial for Theoretical Physics III: Electrodynamics

2012 List of Publications

A. Aviles, C. Gruber, O. Luongo, H. Quevedo, "Cosmography and constraints on the equation of state of the Universe in various parametrizations", arXiv:[gr-qc]1204.2007, submitted to PRD; proceedings to MGXIII to be written.

Liccardo Vincenzo

Position: PhD Student Period covered: October 2010- October 2013



I Scientific Work

"The LAUE project for broadband gamma-ray focusing lenses", laboratory activity devoted to the study of the features of the X-ray facility in Ferrara (LARIX).

"Installations and commissioning at ID20, practical experiences on X-rays related instrumentations", under the scientific supervision of Roberto Verbeni at the ESRF (Grenoble, France) as Research Fellow.

II Conferences and educational activities

II a Conferences

- Attendance to the "Erasmus Mundus School", Nice, France, 4th Jun 8th Jun, 2012.
- Attendance to the SPIE Astronomical Telescopes + Instrumentation 2012 Conference, Amsterdam, Netherlands, 1st-7thJul, 2012.
- Attendance to the "Thirteenth Marcel Grossman Meeting", Stockholm, Sweden, 1st -7th Jul, 2012.
- Attendance to the "Erasmus Mundus School", Nice, France, 3rd Sep 22th Sep, 2012
- Attendance to the "X-Ray Astronomy: towards the next 50 years", Milan, Italy, 1st- 5th Oct, 2012.
- Erasmus Mundus Mobility at the "European Synchrotron Radiation Facility ESRF", Grenoble, France, 15th Oct - 15th Dec, 2012.

2012 List of Publication

Conference Proceedings:

Characterization of bent crystals for Laue lenses, V. Liccardo, F. Frontera, E. Virgilli, V. Valsan. [Society of Photo- Optical Instrumentation Engineers SPIE Conference Series], Proc. SPIE 8443, (2012);

Development status of LAUE project, F. Frontera, V. Liccardo, E. Virgilli, V. Valsan, V. Carassiti, S. Chiozzi, F. Evangelisti, S. Sqerzanti, M. Statera [Society of Photo-Optical In- strumentation Engineers SPIE Conference Series], Proc. SPIE 8443, (2012);

Expected performance of a Laue lens based on bent crystals, V. Valsan, V. Liccardo, F. Frontera, E. Virgilli. [Society of Photo- Optical Instrumentation Engineers SPIE Conference Series], Proc. SPIE 8443, (2012); Martins de Carvalho Sheyse

Position: PhD Student Period covered: 2010-2013



I Scientific Work

The Feynman-Metropolis-Teller (FMT) treatment considering a classic non-relativistic Thomas-Fermi model confined in a Wigner-Seitz cell has been recently generalized to relativistic regimes and applied to the description of non-rotating white-dwarfs in general relativity. We are extending the FMT treatment to the case of finite temperatures for white dwarfs with different nuclear compositions. Our aim is to understand the effects of finite temperatures on the structure of white dwarfs, constructing and analyzing their equation of state and mass-radius relation.

The observation of the late X-ray emission of the Gamma-Ray Bursts (GRBs) associated to Supernova explosions within the so-called GRB-Supernova connection problem has evidenced the possibility of witnessing the thermal evolution of neo-neutron stars: neutron stars just formed in the Supernova event with expected very large temperatures of tens of billion degrees. Therefore, we are exploring the effects of very large temperatures on the equation of state of nuclear matter at high densities important for neutron stars as well as on the different emission mechanisms leading to the cooling of such newly-born neutron stars.

II Conferences and educational activities

II a Conferences and Other External Scientific Work
-Erasmus Mundus School, Nice, France, 5-8 June, 2012.
-Erasmus Mundus School, Nice, France, 3rd – 19th September, 2012.
-Marcel Grossmann meeting, Stockholm, Sweeden, 1st - 7th July, 2012
-Current Issues on Relativistic Astrophysics - November 5-6, 2012 - Seoul (South Korea)

2012 List of Publication

-Title: On the Relativistic Feynman-Metropolis-Teller Equation of state at Finite Temperatures and low densities White Dwafs.

Authors: S. Martins de Carvalho, M. Rotondo, J. Rueda and R. Ruffini. In: XIII Marcel Grossmann Meeting, 2012.

-Title: The Relativistic Feynman-Metropolis-Teller Equation of State at Finite Temperatures. Authors: S. Martins de Carvalho, M. Rotondo, J. Rueda and R. Ruffini. To submitted to Phys. Rev. C.

-Title: On the Mass-Radius Relation of White Dwarfs at Finite Temperatures within the Relativistic Feynman-Metropolis-Teller Equation of State. Authors: S. Martins de Carvalho, J. Rueda and R. Ruffini. To submitted to Astronomy & Astrophysics

Strobel Eckhard

Position: PhD Student Period covered: September 1, 2012 – August 31, 2015

<u>I Scientific Work</u> Critical and Overcritical Electromagnetic Fields

II Conferences and educational activities

II a Conferences and Other External Scientific Work Nov 2012 "Current Issues on Relativistic Astrophysics", Seoul, South Korea Sep 2012 "IRAP Ph.D. Erasmus Mundus school", Nice, France Jul 2012 "13th Marcel Grossmann Meeting", Stockholm, Sweden

2012 List of Publication

Borja, Enrique F., Iñaki Garay, and Eckhard Strobel. "Revisiting the quantum scalar field in spherically symmetric quantum gravity." Classical and Quantum Gravity 29.14 (2012): 145012.



Sversut Arsioli Bruno

Position: PhD IRAP-ErasmusMundus Period covered: 2012-2014

I Scientific Work

Preparation of an complete catalog of HSP (high spectral peaked blazars) based on Wise all-sky survey.

II Conferences and educational activities

-SIGRAV Graduate School in Contemporary Relativity and Gravitational Physics, Villa Olmo, Como (Italy), 21-26 May, 2012.

-10th Agile Workshops ASDC, Rome Italy. 18, April, 2012

-Erasmus Mundus School, Nice, France, 5-8 June, 2012.

-Erasmus Mundus School, Nice, France, 3rd – 19th September, 2012. Presentation; Active Galactic Nuclei: Blazars -Marcel Grossmann meeting, Stockholm, Sweeden, 1st - 7th July, 2012

2012 List of Publication

Paper in Preparation: High spectral peaked blazars; Enhanced catalog based on Wise all-sky survey ; *To be submitted for Astronomy & Astrophysics Journal.*

Administrative and Secretarial Staff

Adamo Cristina

E mail address	cristina.adamo@icranet.org
Telephone	+39 085 23054205
Fax	+39 085 4219252
Nationality	Italian
Date and place of birth	Vibo Valentia, 12 December 1972
Work experiences	
Date	09 November 2009 \rightarrow present
Name of employer	ICRANet - International Center for Relativistic Astrophysics Network
	Administrative employee
Main activities and responsibilities	Administrative office: accountancy, preparing reimbursement and rewards for scientific visitors, on – line payments, analysis of bank statements.
Date	04 March 2007 \rightarrow 09 October 2009
Occupation or position held	Head Administrative Office
Main activities and responsibilities	Account and budget General Account. Active and passive billing cycles. Bank settlement. Treasury management and bank relations management. RI.BA. emission. Down-payment and invoice discount management. Payment and takings management. Independent management of the main civil-fiscal fulfilments with a particular attention to the periodical settling and vat statement. General account management. Assets management. Arrangement INTRA model. Arrangement of the financial year ending. Reclassification of the budget. Management of the accounting plan. Implementation of new instruments aiming at improving the efficiency of the administrative services. Administrative management of the staff: recruitment and selection interviews, drawing up of mandatory documents (matriculation and presences books), elaboration of timesheets. Management of clients and suppliers' order. Purchase and choice of suppliers to be qualified. Prices definition, deposit and shipment management.
Name and address of employer	Solaris Srl - Manoppello (PE) - Industrial Springs Production

Date	01 April 2001 - 28 January 2004
Occupation or position held	Responsible for marketing planning
Main activities and	Evaluation of markets perspective.
responsibilities	Coordination and reduction of commercial plans.
	Survey of the competition sale prices
	Coordination of marketing plans and commercial budgets

Name and address of employer	Merker SpA - Trucks production
Date	1997 - 2000
Title of qualification awarded	Trainee at a Business Consultant
Principal subjects / occupational skills covered	Ordinary and simplified account. Fiscal fulfilments. European balance. Income tax return.
	Consultant office Dott. Vincenzo Micozzi - Pescara
Date	1997 - 31/03/2001
Principal subjects / occupational skills covered	Responsible for Quality Insurance (ISO UNI EN 9002) Management Assistance Purchase management Administrative and fiscal fulfilments Definition of Marketing plans and monitoring of mix marketing elements
Name and address of employer	Solaris Srl - Industrial Springs production
Date	1997 - 1997
Occupation or position held	Stageur
Main activities and responsibilities	Implementation of check systems management
Name and address of employer	Software House Polymatic - Chieti Scalo
Education and training	
Date	November 1991 - 16 July 1996
Title of qualification awarded	Degree in Economics – Economics of financial middleman
Name and type of organisation providing education and training	University L.U.I.S.S Guido Carli – Roma – Final marks: 105/110 – Thesis: "Tax incentive for the occupational development"
Dates	1986 - 1991
Title of qualification awarded	Secondary School Degree
Name and type of organisation providing education and training	Liceo Scientifico Leonardo Da Vinci - Pescara
Dates	1997 - 2000
Title of qualification awarded	Trainee at a Business Consultant
Main Sujects	Ordinary and simplified account. Fiscal fulfilments. European balance. Income tax return.
Name and type of organisation providing education and training	Consultant office Dott. Vincenzo Micozzi - Pescara

Date	1998 - 1998
Title of qualification awarded	Brief Master on Tax Law
Name and type of organisation providing education and training	University D'Annunzio - Pescara
Date	1998 - 1998
Title of qualification awarded	Postgraduate Course on " European Union: institutional, juridical and economic aspects"
Name and type of organisation providing education and training	European Commission and University of Lyon: corse in Paris and Lyon. Success on final exams.
Dates	1997 - 1997
Title of qualification awarded	Expert in enterprise management
Main Subjects	Purchase and logistics, financing, administration and control, marketing, production, budget, bringing out of new products
Name and type of organisation providing education and training	Regione Abruzzo - CIFAP
Dates	1997 - 1997
Title of qualification awarded	Evaluator of Quality systems
Title of qualification awarded Main subjects	Evaluator of Quality systems Expert according to the ISO regulations. Qualification for leading controls according to the UNI EN 9002 regulations.
Title of qualification awarded Main subjects Personal skills and competences	Evaluator of Quality systems Expert according to the ISO regulations. Qualification for leading controls according to the UNI EN 9002 regulations.
Title of qualification awarded Main subjects Personal skills and competences Mother tongue	Evaluator of Quality systems Expert according to the ISO regulations. Qualification for leading controls according to the UNI EN 9002 regulations. Italian
Title of qualification awarded Main subjects Personal skills and competences Mother tongue English	Evaluator of Quality systems Expert according to the ISO regulations. Qualification for leading controls according to the UNI EN 9002 regulations. Italian Indipendent User
Title of qualification awarded Main subjects Personal skills and competences Mother tongue English French	Evaluator of Quality systems Expert according to the ISO regulations. Qualification for leading controls according to the UNI EN 9002 regulations. Italian Indipendent User Basic User
Title of qualification awarded Main subjects Personal skills and competences Mother tongue English French Social skills and competences	Evaluator of Quality systems Expert according to the ISO regulations. Qualification for leading controls according to the UNI EN 9002 regulations. Italian Indipendent User Basic User Communication Ability acquired during the working experiences Aptitude to learn, adaptable to new situations, different from the known ones. Ability to work under pressure. Good aptitude to work in multicultural environment thanks to the experiences spent abroad for education or personal reasons. Team spirit

Technical skills and competences

Computer skills and competences

Mastery in quality control processes in small enterprises (I was responsible for the qualily evaluation)

Good Knowledge of Microsoft Office (Word, Excel e PowerPoint) Very good knowledge of Team System – Gamma, Mult program Basic knowledge of graphic application Good knowledge of Internet and web search engines.

Barbaro Pina

Université de Nice Sophia Antipolis, EDSFA, Ecole Doctorale Parc Valrose - 28 Av. Valrose 06108 Nice Cedex 2 FRANCE

+33-4-92 07 63 91 <u>Pina.Barbaro@unice.fr</u>



Work experiences

02.11.2010	Introduction in the third functional F1 area: Administrative and Consular Officer		
15.11.2006	Introdu Adjunct	ction in the C Fu officer	unctional Area, qualification: Administrative, Consular and Social
16.05.2001	Introdu	ction in the Fun	ctional B3 area, qualification: Administrative collaborator
01.02.1983	Introduction in the Foreign Ministry, qualification: B2 Administrative Assistant		
Service in Italy	,		
04.09.2007	Press ar	d information s	ervice
01.02.2002	General Direction of the Staff		
01.09.1995	General Direction Political Affairs		
01.02.1983	General	Direction Cultu	ural Affairs
Service abroad			
From 2008		Nice – Detache	ed at the International Organization ICRANet
From 2002 to 20	007	Nice – Italian C	General Consulate
From 1990 to 19	995	Bruxelles – Per	manent Italian Representative at the Athlantic Council
Missions abroa	nd		
In the course of	2002		Alessandria d'Egitto – Italian General Consulate
In the course of	1997		New York – Permanent Italian Representative at the United Nations
In the course of	1990		New York – Permanent Italian Representative at the United Nations
In the course of 1986 – 1988 e 1989 Bruxelles – Permanent Italian Representative at the Athlantic Counci			

Education and competences

15.03.1985 Degree in Political Sciences – University of Rome "La Sapienza"

Languages:

French	Excellent
English	Good
Spanish	Elementary

Computer Skills

Word – Excel - Internet

Del Beato Annapia

P.zza della Repubblica 10 I-65122 Pescara (Italy) +39 085 23054206 +39 085 4219252 annapia.delbeato@icranet.org



Work experiences

Dates	02/2008 - present
Occupation or position held	Responsible for the Documentation Center of ICRANet
Main activities and responsibilities	meeting planning (before and during the event) proceedings publication websites contents public relations (press contact, submission of conference announcements, contacts with researchers and students, etc) collection and cataloguing of scientific publications management of the library
Name and address of employer	ICRANet
Address	P.zza della Repubblica 10 I-65122 Pescara (Italy)
Dates	13/06/2007 - 31/12/2007
Occupation or position held	Employee at the Information Point of the Azienda Speciale "D. Ferrigno"
Main activities and responsibilities	Responsible for the external relations of the Azienda Speciale Deborah Ferrigno of the Municipality of Montesilvano in the information point called "Sportello Sociale".
Name and address of employer	Azienda Speciale "D. Ferrigno" - Municipality of Montesilvano
Address	Palazzo Baldoni -P.zza I. Montanelli I-65016 Montesilvano (Italy)
Dates	04/06/2007 - 31/01/2008

Dates	04/00/2007 - 51/01/2008
Occupation or position held	English teacher
Main activities and responsibilities	English Teaching in a Training Course at the Engineering Office "Studio Proima s.r.l."
Name and address of employer	Studio Proima srl
Address	C.so Umberto I I-65016 Montesilvano (Italy)

Dates 15/02/2007 - 31/05/2007

Occupation or position held	English Teacher
Main activities and responsibilities	English teaching in courses organized by Centro Studi Stoa in the following public schools: I° Circolo "Ravizza" Chieti, Istituto comprensivo S. Giovanni Teatino (via Di Nisio, via Mazzini, via V.Emanuele)
Name and address of employer	Centro Studi Stoa
Address	V. San Paolo 2 I-65016 Montesilvano (Italy)
Dates	09/04/2006 - 31/12/2006
Occupation or position held	Employee at EURODESK
Main activities and responsibilities	Employed at Azienda Speciale "D. Ferrigno" of the Municipality of Montesilvano for the opening of a EURODESK. A particular attention was given to the social integration and assistance, as well as to the activities aiming at making easier the access and the fruition of the municipal facilities to disadvantage and needy subjects
Name and address of employer	Azienda Speciale "D. Ferrigno" - Municipality of Montesilvano
Address	P.zza I. Montanelli I-65016 Montesilvano (Italy)
Dates	09/2005 - 03/2006
Occupation or position held	English teacher
Main activities and responsibilities	English Teaching in the Project "Comunicare in Europa POR – Asse C – Misura 2 Az. 3" funded by CEE, realised by Liceo Scientifico C. D'Ascanio in Montesilvano in collaboration with Regione Abruzzo
Name and address of employer	Liceo Scientifico "C. D'Ascanio"
Address	V. Verrotti I-65016 Montesilvano (Italy)
Dates	01/2005
Occupation or position held	Hostess at a Communication Agency
Main activities and responsibilities	reception and registration assistance during the conferences
Name and address of employer	Virgola Comunicazione
Address	V. R. Sanzio I-65122 Pescara (Italy)
Education and training	
Dates	02/2006 - 12/2006
Title of suclification and 1	

Principal subjects / occupational English and German skills covered

Title of qualification awarded I° level Master "How to teach English" linguistics psycholinguistic sociolinguistic

Name and type of organisation providing education and training Address	didactics computer skills 240 training hours as English teacher at Liceo Scientifico C. D'Ascanio Montesilvano. Università degli Studi "G. D'Annunzio" V. dei Vestini, 66100 Chieti (Italy)
Dates	09/2003 - 03/2004
Title of qualification awarded	Erasmus EU-funded Scholarship
Principal subjects / occupational skills covered	Courses on: English Literature, American Literature, History and Marketing.
Name and type of organisation providing education and training	University of Warwick (UK)
Address	Coventry (United Kingdom)
Dates	07/2005
Title of qualification awarded	Degree in Foreign Languages and Literature (courses on Tourist Management) with final mark: 110 cum laude.
Principal subjects / occupational skills covered	Courses on: English and French language English and French literature American Literature Italian Literature Touristic Management Economics Marketing Didactics Linguistics Final Thesis on American Literature, title: "Charles W. Chesnutt: <i>The</i> <i>Marrow of Tradition</i> "
Name and type of organisation providing education and training	Università degli Studi "G. D'annunzio"
Address	V.le Pindaro, 65124 Pescara (Italy)
Dates Title of qualification awarded Principal subjects / occupational skills covered	Summer 1998 and 2000 Summer School Camps in UK Courses on English language
Name and type of organisation providing education and training	Westminster College - Oxford (United Kingdom) and Roehampton College - Putney, London (United Kingdom)

Dates 06/2000
Title of qualification awarded	High School Degree at Liceo Socio-Psico-Pedagogico with final mark: 100/100.
Principal subjects / occupational skills covered	Psychology Sociology Pedagogy Linguistics
Name and type of organisation providing education and training	Istituto "B. Spaventa"
Address	Città S. Angelo (Italy)
Personal skills and competences	
Mother tongue	Italian
Other language(s)	English, French
Social skills and competences	reliable, well-organized, punctual and accurate, able to work in stressful situations, adaptable to work in new situations, able to work in team, helpful
Computer skills and competences	ECDL (European Computer Driving Licence) Microsoft Office (Word, Excel, Powerpoint, Access, Publisher, Outlook)

Driving licence(s) B

Di Berardino Federica

NAME PHONE FAX E-MAIL NATIONALITY DATE AND PLACE OF BIRTH	FEDERICA DI BERARDINO0039-085-230542000039-085-4219252federica.diberardino@icranet.orgItalian31-03-1980 PESCARA
wORK EXPERIENCE November 2005-November 2007 May-October 2005 September-June 2005 April 2005 December 2004 October-December 2004 January-December 2004 May 2004	 Head of Secretariat at ICRANet Pescara: coordination of secretariat work, logistic organization for meetings and workshops, translations. Travel Agent at "Beg Viaggi" Pescara; Italian language training courses for foreign students; Congress Hostess for IN FIERA S.r.l., at "ECOTUR 2005"-Montesilvano; Congress Hostess (Marcinelle 2005) for Manoppello Municipality (PE); Customer service assistant for Terravision S.r.l. at <i>Aeroporto d'Abruzzo</i>, Pescara; English courses for elementary and high school Italian students; Translations from/to English; Work for Ajilon Agency, Pescara, for distribution of books in the local schools; Interviews for Customer Satisfaction, for "NETWORK Research Institute S.r.l." at Iper - Città Sant'Angelo; Researcher for "Informazione e servizi senza barriere"(Agency: NETWORK S.r.l.). Exhibition Hostess for IN FIERA S.r.l., at "ECOTUR –<i>Turismo in fiera</i>"
2001-2003	 Hostess and sales promoter for the agency "Image Service", Città Sant'Angelo (PE);
1998-2000 EDUCATION	 Birthday party organizer for kids; Educator and entertainment organizer in summer camps of E.N.I. in Cesenatico; additional training courses (<i>Cooperativa Sociale</i> D.O.C. S.c.r.l., Turin).
June 2004	 Foreign Language and Literature College degree, 110/110 <i>cum laudem</i>, at University G. D'annunzio (Pescara). Final thesis on Spanish and Economic -Tourism Geography: "Probleming tendence e prospettive

	dello sviluppo socio-economico in Spagna. Casi di studio" (Supervisor: Prof. G. Massimi);
January 2004	 Researches in Spain for graduation thesis and improvement of Spanish knowledge.
September-December 2002	 "Nazareth College", Rochester, N.Y. (U.S.A.) Four months classes and final exams on English, Marketing and Spanish.
1998	 High School degree at Foreign Languages High School "G. Marconi", Pescara.
October 1996	 English classes at "Irondequoit High-School" in Rochester (N.Y.)
1992, 1994, 1995	 Multiple visits to England to attend English colleges for training courses;
	 Visits to the USA (N.Y. e Massachusetts) to improve oral skills for American-English.
SOCIAL-CULTURAL EXPERIENCES	January-March 2005: Trip to Vanuatu (Melanesian archipelago, old "New Hebrides ") for humanitarian aid experience. Voluntary work in a few islands of the archipelago and elementary learning of local language, the Bislama.
Personal skills	Main studies and job experiences focused on foreign cultures and languages. University degree on Spanish and English. Daily practice with both languages through conversation and readings. The work experience in touristic exhibition and in the "in store promotion" field, in addition to the experience as entertainment organizer, helped to develop interpersonal abilities.
MOTHER-TONGUE	ITALIAN
OTHER LANGUAGES	ENGLISH, SPANISH, FRENCH
RELATIONAL ABILITIES	Team work experience, mainly in multi-cultural contexts. The two main training experiences in the US high school and later in college supported the personal and professional growth, helped to acquire an open- minded attitude towards other cultures, which are essential for cooperation and mutual respect.
	relevant in acquiring professional skills in the relationship with customers: importance of communication, which is the ability to listen to and to be listened.
	Development of a positive attitude towards any kind of problematic situation; problem-solving skills and working method based on the achievement of goals.
ORGANIZING COMPETENCES	Organizing ability mainly acquired trough team work in summer camps for kids and teen-agers, where showing a coordinating attitude in the group.
	In the same work field has been developed the spirit of adaptability, in addition to the creativity (namely invention of new games and artistic creation for entertainment).
	Open and charismatic personality, flexible, active, dynamic, loving challenges.

	Professionalism based on accuracy, punctuality and strong attitude to work towards goals.
TECHNICAL SKILLS	Computer competences: Windows; Software: Word, Excel, Power Point. Daily use of personal computer at work: 80% of the work is based on the use of PC. 2004: Certificate for Informatics Course on "Basic Office" (Word, Excel
	Internet e E-mailing) organized by: "E-Work", Pescara in cooperation with "Ok Work", Milano.
ARTISTIC SKILLS	Photography: First-level class and Advanced class Diplomas. Dance: Jazz Dance, Flamenco, Traditional Dances, Artistic Gym. Piano and guitar classes. Great passion for music (jazz, acoustic, ethnic, rock and classic), theatre and readings. Free time: travels, photography and museums.
DRIVING LICENCE	Driving license cat. B

Latorre Silvia

Latorre Silvia	
PERSONAL INFORMATION Place and date of birth Nationality E- mail Phone Fax WORK EXPERIENCES	Chieti, 23/09/1982 Italian silvia.latorre@icranet.org 085 - 23054223 085 - 4219252
• Data	12/02/2008 procent
Name of employer	ICRANet
• Firm or Sector	International Center for Relativistic Astrophysics Network
• Kind of Employment	Administrative employee
• Main Tasks	Managing the relationship with suppliers, controlling invoices, calculating reimbursement and rewards for our scientific visitors, preparing orders for the bank, executing and verifying on-line payments, meeting our bank referents for particular payment operations, cash holding, using ICRANet cost-accounting system.
• Date	01/12/2006 - 20/01/2008
 Name of employer 	DelVerde Industrie Alimentari S.p.A.
• Firm or Sector	Pasta Factory
 Kind of Employment 	Trainee
• Main Tasks	Study and analysis of annual financial statements of ten competitor pasta factories for the financial years from 2002 to 2006, as well as reclassification of balance sheets and profit and loss accounts and calculation of the main income and financial indexes. Analysis of export strategies of DelVerde and other Italian pasta factories.
EDUCATION	
• Date	11/2005 – 12/2007
InstitutionMain Subjects	Università degli Studi "G. D'Annunzio" Pescara Marketing, commercial law, innovation management and economics, business
	statistics, quality technique and theory
 Achieved Qualification 	Degree in Economics and Administration of the enterprises. Final thesis in analysis of balance sheet: <i>"La leva finanziaria e la leva operative nel settore pastario"</i> (supervisor Prof. Michele A. Rea)
• Mark	110/110 cum laude
• Date	09/2001 - 11/2005
Institution	Università degli Studi "G. D'Annunzio" Pescara
• Main Subjects	Financial Mathematics, bank technique, business economics, accountancy, microeconomics, macroeconomics, private and public law, work law, analysis
	of balance sheet, business strategy and politics
Achieved Qualification	Business Economics Degree. Final thesis in business strategy and politics: " <i>Gli strumenti di analisi strategica: l'analisi SWOT</i> " (supervisor Prof. Michele A. Rea)
• Mark	100/110

• Date • Institution	09/1996 – 07/2001 Secondary School focusing on sciences- Liceo Ginnasio Statale "Publio Virgilio Marone" Vico del Gargano (FG)
• Main Subjects	Mathematics analysis, Italian language and literature, Latin language and literature, Chemistry, Physics
 Achieved Qualification Mark 	Scientific school-leaving certificate 100/100
FOREIGN LANGUAGES	Italian
Mother-tongue	
OTHER LANGUAGES	English (good) – French (elementary)
RELATIONAL ABILITIES	Good relational abilities thanks to the past work experience at DelVerde and to the present experience at ICRANet. Self-reliant.
	Good listener.
ORGANIZING COMPETENCES	Good organizing abilities acquired handling the big amount of data at DelVerde and working at ICRANet, where they are essential for managing the large number of guests, mainly during the meetings.
TECHNICAL SKILLS	Computers competences: Windows. Softwares: Word, Excel, Power Point. Very good use of Internet and e-mail accounts.
	Good use of cost-accounting system HELPAZI and bank system BNL Businessway.
	Elementary knowledge of HTML e CSS programs for websites. Knowledge of "TOP VALUE" program for financial diagnosis and corporate planning.
ARTISTIC SKILLS	Piano classes attended for 8 years. sol-fa Diploma.
DRIVING LICENCE	Driving licence cat. B
FURTHER INFORMATION	I like reading, writing, travelling, going to the cinema, listening music, playing the piano. I have a determined, dynamic and flexible personality. I like staying and working with people.