Staff, Visiting Scientists and Graduate Students at the Pescara Center

December 2013

Contents

ICRANet Faculty Staff

Belinski Vladimir	ICRANet
Bianco Carlo Luciano	University of Rome "Sapienza" and ICRANet
Einasto Jaan	Tartu Observatory, Estonia
Izzo Luca	University of Rome "Sapienza"
Novello Mario	*Cesare Lattes-ICRANet Chair* 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
Benjamin Jegischewitsch Markarjan Chair
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
Mstislav Vsevolodich Keldysh-ICRANet Chair
Keldysh institute for Applied Mathematics Moscow, Russia

Damour Thibault
Joseph-Louis Lagrange- ICRANet Chair
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

Giavalisco Mauro
Department of Astronomy, University of Massachusetts, USA

Jantzen Robert
AbrahamTaub-ICRANet Chair
Villanova University USA

Jetzer Philippe
Institute of Theoretical Physics, University of Zurich, Switzerland

Khalatnikov Markovich Isaak
Lev Davidovich Landau–ICRANet Chair
Landau Institute for Theoretical Physics, Russia

Kerr Roy
Yevgeny Mikhajlovic Lifshitz-ICRANet Chair
University of Canterbury, New Zealand

Lee Hyung Won
Inje University, Korea

Madey John
William Fairbank-ICRANet Chair
University of Hawaii

Misner Charles
John Archibald Wheeler-ICRANet Chair
University of Maryland

Mo, Houjun   Department of Astronomy, University of Massachusetts, USA

Nicolai Hermann   Albert Einstein Institute – Potsdam, Germany

Pelster Axel   Institute for Advanced Study, Germany
Pian Elena   INAF and Osservatorio Astronomico di Trieste

Piran Tsvi   *Yuval Neeman-ICRAnet Chair*
                              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   *(Nobel Laureate)* 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
Kim Sang Pyo	Kunsan National University, Korea
Kim Sung-Won	Institute of Theoretical Physics for Asia-Pacific, Korea
Lee Chul Hoon	Hanyang University, Korea
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

Wiltshire David   University of Canterbury, New Zealand

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

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
Bisnovatyi-Kogan G.S.	Space Research Institute, Moscow
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 Cycle	*2002-05*
Peirani Sebastien	France

Second Cycle	*2003-06*
Bernardini Maria Grazia	Italy
Mattei Alvise	Italy
Mercuri Simone	Italy

Third Cycle	*2004-07*
Chiappinelli Anna	France
Cianfrani Francesco	Italy
Guida Roberto	Italy
Rotondo Michael	Italy
Yegoryan Gegham	Armenia

Fourth Cycle	*2005-08*
Battisti Marco Valerio	Italy
Dainotti Maria.Giovanna	Italy
Khachatryan Harutyun	Armenia
Lecian Orchidea Maria	Italy
Pizzi Marco	Italy
Pompi 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 Cycle	*2007-2010*
Ferroni Valerio	Italy
Izzo Luca	Italy
Kanaan Chadia	Lebanon
Pugliese Daniela	Italy
Sigismondi Costantino	Italy

Seventh Cycle	*2008-2011*
Belvedere Riccardo	Italy
Ceccobello Chiara	Italy
Ferrara Walter	Italy
Han Wen-Biao	China
Luongo Orlando	Italy
Pandolfi Stefania	Italy
Taj Safia	Pakistan

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 Cycle   *2011-2014*
Cáceres Uribe, Diego Leonardo   Colombia
Wang Yu   China

Eleventh Cycle   *2012-2015*
Barbarino Cristina   Italy
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
Wu Yuanbin   China

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

Fourth Cycle   *2013-2016*
Ahlén Olof   Sweden
Gómez Gabriel   Colombia
Kovacevic Milos   Serbia
Li Liang   China
Lisakov Sergey   Russia
Maiolino Tais   Brazil
Pessina Francesco   Italy
Sridhar Srivatsan   India
Yang Xiaofeng   China

Administrative and Secretarial Staff

ICRANet - Pescara

Adamo Cristina   Administrative Office

Del Beato Annapia   Documentation Office (until August 31st)

Di Berardino Federica   Head of the Secretarial Office

di Niccolo Cinzia   Secretariat (starting by August 1st)

Latorre Silvia   Administrative Office

Pirone Maria Elena   Secretariat (starting by October 1st)

Gabriele Brandolini   System Manager (starting by July 1st)

ICRANet – Nice

Barbaro Pina   (until August 31st)

ICRANet Br – Rio de Janeiro

Schaller Flavia

Belinski Vladimir

Position: ICRANet, Faculty Member

Period covered: December 2012-December 2013

I. Scientific Work

Exact solutions in General Relativity. It was found the new way of derivation of the Kerr and Kerr-Newman solution by adding to the Schwarzschild and Reissner-Nordstrom black holes a solitonic whirls. The main problem here were to integrate the Lax pair equations both for the Schwarzschild and Reissner-Nordstrom backgrounds in order to find the corresponding spectral matrices. These calculations were performed and with this approach we can have a new interpretation of the distribution of energy of the Kerr and Kerr-Newman black holes between their rotational and rest mass components. The first part of this work (Kerr) have been published [1], the second paper (Kerr-Newman) is in preparation.

Cosmology. 1) The work on the book "Cosmological Singularity" has been continued. The project is in progress under the official agreement with Cambridge University Press.

2) It was found the window in the space of the free parameters of the Israel-Stewart non-equilibrium thermodynamic for which the Friedmann initial cosmological singularity is stable. This means the existence of the general solution (i.e. without any fine tuning) of the relativistic theory of gravity posessing the Friedmann initial singularity [2].

Quantum Fields. It was found the way how to represent the homogeneous cosmological models as the non-constrained systems and it was constructed the corresponding Hamiltonian formulation of the such theory. In this framework it was performed the quantization of the Friedmann model and it was shown that the unavoidable boundary condition at the cosmological singularity is vanishing of the wave function (work in progress).

II. Publications

1. V. A. Belinski and H. W. Lee "Kerr rotation as solitonic whirl around the Schwarzschild black hole", Nuovo Cimento Vol. 36 C, N. 1 Suppl. 1, p.3 (2013).

2. V.A. Belinski "Stabilization of the Friedmann Big Bang by the shear stresses", Phys.Rev.D 88, 103521 (2013).

III. Teaching activity

V. Belinski "Relativistic dissipative thermodynamics and its application to cosmology", three lectures course for International Relativistic Astrophysics PhD Erasmus Mundus Program (Nice, 11-13 September, 2013).

Bianco Carlo Luciano

Position: ICRANet Faculty staff
        Member of ICRANet Scientific Committee
        Member of IRAP-PhD Faculty

Period covered: 2005 – present

I Scientific Work

Research on: Gamma-Ray Bursts, Relativistic astrophysics, Cosmology.

II Conferences and educational activities
II a Conferences and Other External Scientific Work

Gave the following invited lectures:

– C.L. Bianco, M.G. Bernardini, P. Chardonnet, F. Fraschetti, R. Ruffini, S.-S. Xue; Our model for Gamma-Ray Bursts; *1st Bego scientific rencontre*, Université de Nice Sophia-Antipolis, Nice, France, 14 February 2006.

– C.L. Bianco; Equations of motion and beaming in Gamma – Ray Bursts; *1st Cesare Lattes Meeting*, Mangaratiba (RJ), Brazil, 1 March 2007.

– C.L. Bianco, M.G. Bernardini, L. Caito, M.G. Dainotti, R. Guida, R. Ruffini; Theoretical interpretation of GRB060614; *2007 April Meeting of the American Physical Society*; Jacksonville, Florida (USA), 14 April 2007.

– C.L. Bianco; The fireshell model and the canonical GRB scenario; *Scuola Nazionale di Astrofisica (National School of Astrophysics)* (II course, IX cycle); Venice (Italy), 18 September 2007.

– C.L. Bianco, M.G. Bernardini, L. Caito, M.G. Dainotti, R. Guida, R. Ruffini, G. Vereshchagin, S.-S. Xue; Equations of motion of the fireshell; *3rd Stueckelberg Workshop*; Pescara (Italy), 10 July 2008.

– C.L. Bianco, M.G. Bernardini, L. Caito, G. De Barros, L. Izzo, F.A. Massucci, B. Patricelli, R. Ruffini, G. Vereshchagin, S.-S. Xue; The fireshell equations of motion and equitemporal surfaces; *6th Italian-Sino Workshop*; Pescara (Italy), 29 June 2009.

– C.L. Bianco, M.G. Bernardini, L. Caito, G. De Barros, L. Izzo, B. Patricelli, R. Ruffini; The canonical GRB scenario within the fireshell model: "long", "genuine short" and "disguised short" GRBs; *GRB 2010: Dall'eV al TeV tutti i colori dei GRB – Secondo congresso italiano sui GRB*; Cefalù (Italy), 15 June 2010.

– A.G. Aksenov, M.G. Bernardini, C.L. Bianco, L. Caito, C. Cherubini, G. De Barros, A. Geralico, L. Izzo, F.A. Massucci, B. Patricelli, M. Rotondo, J.A. Rueda Hernandez, R. Ruffini, G. Vereshchagin, S.-S. Xue; New developments of the Fireshell scenario; *The Shocking Universe Meeting*, San Servolo, Venice (Italy), September 2009.

- C.L. Bianco, M.G. Bernardini, L. Caito, G. De Barros, L. Izzo, B. Patricelli, R. Ruffini; The fireshell equations of motion and the P-GRB observational properties; *2nd Galileo – Xu GuangQi meeting*, Ventimiglia (Italy), July 2010.

- C.L. Bianco, M.G. Bernardini, L. Caito, G. De Barros, L. Izzo, B. Patricelli, R. Ruffini; The fireshell model for GRBs: toward a canonical GRB scenario; *3rd Galileo – Xu GuangQi meeting*, Beijing (China), October 2011.

II b Work With Students

- Students of the IRAP-PhD program at University "La Sapienza", Rome, Italy: Maria Grazia Bernardini, Letizia Caito, Maria Giovanna Dainotti, Gustavo De Barros, Maxime Enderli, Roberto Guida, Luca Izzo, Marco Muccino, Barbara Patricelli, Ana Virginia Penacchioni, Giovanni Battista Pisani, Luis Juracy Rangel Lemos, Yu Wang.

- Students of the First three years degree Thesis ("Tesi di Laurea triennale") in Physics at University "La Sapienza", Rome, Italy: Giulia De Rosi, Eliana La Francesca, Francesco Alessando Massucci, Federica Volpi.

- Students of the Final Degree Thesis ("Tesi di Laurea Vecchio Ordinamento") in Physics at University "La Sapienza", Rome, Italy: Letizia Caito, Walter Ferrara, Laura Rosano.

II c Diploma thesis supervision

- 2005. External supervisor of the First three years degree thesis ("Tesi di laurea triennale") in Physics by Francesco Alessandro Massucci at University "La Sapienza", Rome, Italy.

- 2006. External supervisor of the Degree thesis in Physics by Letizia Caito at University "La Sapienza", Rome, Italy.

- 2007. Thesis advisor of the IRAP-PhD Degree Thesis by Maria Grazia Bernardini at University "La Sapienza", Rome, Italy.

- 2008. External supervisor of the First three years degree thesis ("Tesi di laurea triennale") in Physics by Eliana La Francesca at University "La Sapienza", Rome, Italy.

- 2008. Thesis advisor of the IRAP-PhD Degree Thesis by Roberto Guida at University "La Sapienza", Rome, Italy.

- 2009. External supervisor of the Degree thesis in Physics by Laura Rosano at University "La Sapienza", Rome, Italy.

- 2010. Thesis advisor of the IRAP-PhD Degree Thesis by Letizia Caito at University "La Sapienza", Rome, Italy.

- 2010. External supervisor of the First three years degree thesis ("Tesi di laurea triennale") in Physics by Giulia De Rosi at University "La Sapienza", Rome, Italy.

II d Other Teaching Duties

− Assistant teacher in the course of "Laboratory of Electromagnetism and Circuits" by Prof. Giulio D'Agostini at Physics Department of the University "La Sapienza", Rome, Italy, academical year 2005/2006.

− Assistant teacher in the course of "Laboratory of Systems and Signals" by Prof. Mario Mattioli at Physics Department of the University "La Sapienza", Rome, Italy, academical years 2007/2008, 2008/2009, 2009/2010, 2010/2011, 2011/2012, 2012/2013.

− Assistant teacher in the course of "Laboratory of Systems and Signals" by Prof. Andrea Nigro at Physics Department of the University "La Sapienza", Rome, Italy, academical years 2013/2014.

II e. Work With Postdocs

III. Service activities

III a. Within ICRANet

− Administrator of the two servers used for numerical computations at ICRANet – Rome.

− Secretariat of the IRAP PhD.

− Member of the ICRANet Scientific Committee.

− Member of the IRAP PhD Faculty

III b. Outside ICRANet

− "Cultore della Materia" ("Expert of the subject") for the "FIS/01 – Experimental Physics", "FIS/02 – Theoretical Physics, Models and Mathematical Methods", "FIS/05 – Astronomy and Astrophysics" scientific sectors in the Mathematical, Physical and Natural Sciences Faculty of the University of Rome "La Sapienza".

IV. Other

PUBBLICAZIONI

– A.V. Penacchioni, R. Ruffini, L. Izzo, M. Muccino, C.L. Bianco, L. Caito, B. Patricelli, L. Amati; Evidence for a proto-black hole and a double astrophysical component in GRB 101023; *Astronomy & Astrophysics*, **538**, A58 (2012). <://adsabs.harvard.edu/abs/2012A%26A...538A..58P> <://dx.doi.org/10.1051/0004-6361/201118403>

– R. Negreiros, R. Ruffini, C. L. Bianco, J. A. Rueda; Cooling of young neutron stars in GRB associated to supernovae; *Astronomy & Astrophysics*, **540**, A12 (2012). <://adsabs.harvard.edu/abs/2012A%26A...540A..12N> <://dx.doi.org/10.1051/0004-6361/201117006>

– 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 genuinely long gamma-ray burst; *Astronomy & Astrophysics*, **543**, A10 (2012). <://adsabs.harvard.edu/abs/2012A%26A...543A..10I> <://dx.doi.org/10.1051/0004-6361/201117436>

– B. Patricelli, M.G. Bernardini, C.L. Bianco, L. Caito, G. De Barros, L. Izzo, R. Ruffini, G.V. Vereshchagin; Analysis of GRB 080319B and GRB 050904 within the Fireshell Model: Evidence for a Broader Spectral Energy Distribution; *The Astrophysical Journal*, **756**, 16 (2012). <://adsabs.harvard.edu/abs/2012ApJ...756...16P> <://dx.doi.org/10.1088/0004-637X/756/1/16>

– M. Muccino, R. Ruffini, C.L. Bianco, L. Izzo, A.V. Penacchioni; GRB 090227B: The missing link between the genuine short and long GRBs; *The Astrophysical Journal*, **763**, 125 (2013). <://adsabs.harvard.edu/abs/2013ApJ...763..125M> <://dx.doi.org/10.1088/0004-637X/763/2/125>

– A.V. Penacchioni, R. Ruffini, C.L. Bianco, L. Izzo, M. Muccino, G.B. Pisani, J.A. Rueda; GRB 110709B in the induced gravitational collapse paradigm; *Astronomy & Astrophysics*, **551**, A133 (2013). <://adsabs.harvard.edu/abs/2013A%26A...551A.133P> <://dx.doi.org/10.1051/0004-6361/201220679>

– G.B. Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A.V. Penacchioni, J.A. Rueda, Y. Wang; Novel distance indicator for gamma-ray bursts associated with supernovae; *Astronomy & Astrophysics*, **552**, L5 (2013). <://adsabs.harvard.edu/abs/2013A%26A...552L...5P> <://dx.doi.org/10.1051/0004-6361/201220829>

– C.L. Bianco, M. G. Bernardini, L. Caito, G. De Barros, L. Izzo, M. Muccino, B. Patricelli, A.V. Penacchioni, G.B. Pisani, R. Ruffini; The canonical GRB scenario; *Il Nuovo Cimento C*, **36 s01**, 21 (2013). <://dx.doi.org/10.1393/ncc/i2013-11482-9>

– A.V. Penacchioni, R. Ruffini, L. Izzo, M. Muccino, C.L. Bianco, L. Caito, B. Patricelli; Evidences for a double component in the emission of GRB 101023; *Il Nuovo Cimento C*, **36 s01**, 117 (2013). <://dx.doi.org/10.1393/ncc/i2013-11492-7>

– M. Muccino, R. Ruffini, C.L. Bianco, L. Izzo, A.V. Penacchioni, G.B. Pisani; GRB 090510: A Disguised Short Gamma-Ray Burst with the Highest Lorentz Factor and Circumburst Medium; *The Astrophysical Journal*, **772**, 62 (2013). <://adsabs.harvard.edu/abs/2013ApJ...772...62M> <://dx.doi.org/10.1088/0004-637X/772/1/62>

Position: Professor of Faculty

Period covered: 01.01.2012 - 31.12.2012

I Scientific Work

I participated in the analyze of the morphology of rich clusters in superclusters of galaxies, initiated by Maret Einasto. I continued the work on book " Dark Matter Story – a personal view", a personal recollection of the story of the discovery of dark matter and the large scale structure of the Universe, as seen from our viewpoint. The manuscript is presented to WSP Co, the editing of the text is finished.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

September 19, Talk in the seminar of Byurakan Astrophysical Observatory "Dark matter story";

October 22, Talk in opening ceremony of the restored main building of Tartu Observatory "Changing the world view on the Universe";

December 17, Invited talk in the 26th Texas Astrophysical Symposium in Brazil "Dark matter".

III. Service activities

III a. Within ICRANet

Main activity was writing of the text of the book on Dark Matter. Discussion of current problems during my stay in Pescara, including chapters of the text of the book.

III b. Outside ICRANet

Regular activity in Tartu Observatory (seminars, discussion of current research) and in Estonia Academy of Sciences (electing new members and foreign members to the Academy, participation in meetings of the Division of Astronomy and Physics and General Assembly of the Academy).

2013 List of Publication

Einasto, J. 2012a, Large Scale Structure of the Universe - a Powerful Probe for Fundamental Physics, International Journal of Modern Physics Conference Series, 12, 100

Einasto, J. 2012b, Two Hundred Years of Galactic Studies in Tartu Observatory, in Twelfth Marcel Grossmann Meeting on General Relativity, 453

Einasto, M., Liivamaegi, L. J., Tempel, E., Saar, E., Vennik, J., Nurmi, P., Gramann, M.,

Einasto, J., Tago, E., Heinaemaeki, P., Ahvensalmi, A., & Martinez, V. J. 2012a, Rich clusters from SDSS DR8 (Einasto+, 2012), VizieR Online Data Catalog, 354, 29036

Einasto,M., Liivam¨agi, L. J., Tempel, E., Saar, E., Vennik, J., Nurmi, P., Gramann,M., Einasto, J., Tago, E., Hein¨am¨aki, P., Ahvensalmi, A., & Mart´ınez, V. J. 2012b, Multimodality of rich clusters from the SDSS DR8 within the supercluster-void network, A&A, 542, A36

Einasto, M., Vennik, J., Nurmi, P., Tempel, E., Ahvensalmi, A., Tago, E., Liivamaegi, L. J., Saar, E., Heinaemaeki, P., Einasto, J., & Martinez, V. J. 2012c, Galaxy clusters from SDSS DR8 (Einasto+, 2012), VizieR Online Data Catalog, 354, 9123

Einasto,M., Vennik, J., Nurmi, P., Tempel, E., Ahvensalmi, A., Tago, E., Liivam¨agi, L. J., Saar, E., Hein¨am¨aki, P., Einasto, J., &Mart´ınez, V. J. 2012d,Multimodality in galaxy clusters from SDSS DR8: substructure and velocity distribution, A&A, 540, A123

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. Boshkayev, 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
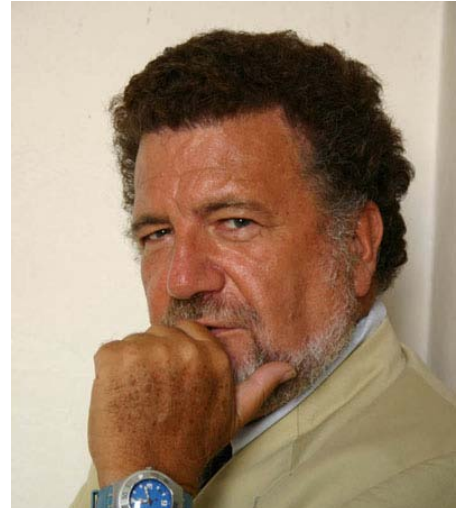
Curriculum Vitae:

- 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-

    o Alfred P. Sloan Foundation fellow, 1974-76.

    o 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,

2. (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,

3. (with H.Gursky) "Neutron Stars, Black Holes and Binaries Sources", D. Reidel, Dordrecht, 1975,

4. (with R. Giacconi et al.) "Physics and Astrophysics of Neutron Stars Black Holes", North Holland Pub. Co. Amsterdam 1978

5. (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

2012-2013 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, A58

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, A12

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

Astronomy and Astrophysics, 2012, v. 543, A10

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

The Astrophysical Journal, 2012, v. 756, 16

Electron and Positron pair production in gravitational collapse

W. B. Han, R. Ruffini, S. S. Xue

Physical Review D, 2012, v. 86, 084004

Gravitational field of compact objects in general relativity

Boshkayev K., Quevedo H., and Ruffini

Reference Physical Review D, 2012, v. 86, p. 064043

On the Induced Gravitational Collapse of a Neutron Star to a Black Hole by a Type Ib/c Supernova

Rueda, Jorge A.; Ruffini, Remo

The Astrophysical Journal Letters, 2012, v. 758, L7

SGRs and AXPs as Rotation-Powered Massive White Dwarfs

Malheiro, Manuel; Rueda, Jorge A.; Ruffini, Remo

Astronomical Society of Japan, 2012, v. 64, 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

Nuclear Physics A, 2012, v. 883, 1

Space-Time Evolution of Electric Fields in Cores of Compact Stars

W. B. Han, R. Ruffini, S. S. Xue

International Journal of Modern Physics, 2012, v. 12, 193

GRB 090618: a candidate for a neutron star gravitational collapse onto a black hole induced by a type Ib/c supernova

Izzo, L.; Rueda, J. A.; Ruffini, R.

Astronomy & Astrophysics, 2012, 548, L5

Fermi and electromagnetic mass

Jantzen, Robert T.; Ruffini, Remo

General Relativity and Gravitation, 2012, 44, 2063-2076

Grb 090227b: The Missing Link Between The Genuine Short And Long Grbs

M. Muccino, R.Ruffini, C.L. Bianco, L. Izzo, A.V. Penacchioni

The Astrophysiocal Journal, 2013, 763, 125.

GRB 110709B in the induced gravitational collapse paradigm

A.V. Penacchioni, R. Ruffini, C.L. Bianco, L. Izzo, M. Muccino, G.B. Pisani, J.A. Rueda

Astronomy & Astrophysics, 2013, 551, A133

Novel distance indicator for gamma-ray bursts associated with supernovae

G.B. Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A.V. Penacchioni, J.A. Rueda, Y. Wang

Astronomy & Astrophysics, 2013, 552, L5

The canonical GRB scenario

C.L. Bianco, M. G. Bernardini, L. Caito, G. De Barros, L. Izzo, M. Muccino, B. Patricelli, A.V. Penacchioni, G.B. Pisani, R. Ruffini

Il Nuovo Cimento C, 2013, 36 s01, 21

Evidences for a double component in the emission of GRB 101023

A.V. Penacchioni, R. Ruffini, L. Izzo, M. Muccino, C.L. Bianco, L. Caito, B. Patricelli

Il Nuovo Cimento C, 2013, 36 s01, 117

GRB 090510: A Disguised Short Gamma-Ray Burst with the Highest Lorentz Factor and Circumburst Medium

M. Muccino, R. Ruffini, C.L. Bianco, L. Izzo, A.V. Penacchioni, G.B. Pisani

The Astrophysical Journal, 2013, 772, 62

Gravitational and electric energies in the collapse of a spherical thin-shell capacitor

Ruffini, Remo; Xue, She-Sheng

Physics Letters A, 2013, 377, 2450-2456.

Comptonization of photons near the photosphere of relativistic outflows

Aksenov, A. G.; Ruffini, R.; Vereshchagin, G. V.

Monthly Notices of the Royal Astronomical Society: Letters, 2013, 436, L54-L5

Einstein-Euler-Heisenberg theory and charged black holes

Ruffini, Remo; Wu, Yuan-Bin; Xue, She-Sheng

Physical Review D, 2013, 88, 085004

Black Holes, Supernovae and Gamma Ray Bursts

Ruffini, Remo

International Journal of Modern Physics D, 2013, 22, 1360009

Black Holes in Gamma Ray Bursts and Galactic Nuclei

Ruffini, Remo; Argüelles, C. R.; Fraga, B. M. O.; Geralico, A.; Quevedo, H.; Rueda, J. A.; Siutsou, I.

International Journal of Modern Physics D, 2013, 22, 1360008

On the Einstein-Maxwell Equations of Equilibrium for White Dwarfs and Neutron Stars

Rueda, Jorge A.; Ruffini, Remo

International Journal of Modern Physics D, 2013, 22, 1360007

A White Dwarf Merger as Progenitor of the Anomalous X-Ray Pulsar 4U 0142+61?

Rueda, J.A.; Boshkayev, K.; Izzo, L.; Ruffini, R.; Lorén-Aguilar, P.; Külebi, B.; Aznar-Siguán, G.; García-Berro, E.

Astrophysical Journal Letters, 2013, 772, L24.

Charged boson stars

Pugliese, Daniela; Quevedo, Hernando; Rueda H., Jorge A.; Ruffini, Remo

Physical Review D, 2013, 88, 024053

Equatorial circular orbits of neutral test particles in the Kerr-Newman spacetime

Pugliese, Daniela; Quevedo, Hernando; Ruffini, Remo

Physical Review D, 2013, 88, 024042

A Theory of Photospheric Emission from Relativistic Outflows

Ruffini, R.; Siutsou, I. A.; Vereshchagin, G. V.

Astrophysical Journal, 2013, 772, 11.

SGR 0418+5729, Swift J1822.3-1606, and 1E 2259+586 as massive, fast-rotating, highly magnetized white dwarfs

Boshkayev, K.; Izzo, L.; Rueda Hernandez, J. A.; Ruffini, R.

Astronomy & Astrophysics, 2013, 555, A151

Phase space evolution of pairs created in strong electric fields

Benedetti, A.; Ruffini, R.; Vereshchagin, G. V.

Physics Letters A, 2013, 377, 206-215.

On General Relativistic Uniformly Rotating White Dwarfs

Boshkayev, Kuantay; Rueda, Jorge A.; Ruffini, Remo; Siutsou, Ivan

Astrophysical Journal, 2013, 762, 117

Vereshchagin Gregory

Position: researcher

Period covered: January –November 2013

<u>I. Scientific Work</u>

The work focused on the following aspects:

- On the filling factor of the circumburst medium and GRB emission (with D. Begue and R. Ruffini)

We study the physical properties of filamentary structure of overdensities in circumburst medium near the GRB sources and identify main characteristics of this structure: density, physical dimension, opacity. We obtain observational constraints on these quantities, and present consistent treatment of the interaction of relativistic shell originating from the GRB source and this filamentary structure. We also discuss high energy emission originating from this interaction.

- 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.

- 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.

- 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.

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

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.

- 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. Our numerical results are in quantitative agreement with theoretical results of Ruffini, Siutsou, Vereshchagin (2011).

- 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.

- Spreading of ultrarelativistically expanding shell (with R. Ruffini and I.A. Siutsou)

We consider spreading of relativistic shell in GRBs and examine two mechanisms of the spreading: hydrodynamical and thermal. We consider their influence on the duration of signal from GRB plasma at transparency. It is found that thermal spreading is negligible for typical GRB parameters. Instead, hydrodynamical spreading leads to signal duration up to several seconds.

- Kinetic approach to transparency of relativistic outflow (with A. Benedetti)

We solve coupled relativistic Boltzmann equations for electrons and photons for spherically a symmetric relativistic outflow. We adopt the model of steady relativistic wind with finite duration. The momentum space is assumed to have cylindrical symmetry. Collision integrals are computed from matrix element of

Compton scattering. While photon spectrum shows characteristic broadening of the photospheric emission, the electron spectrum remains essentially unchanged.

II. Conferences and educational activities

II a. Conferences and Other External Scientific Works

II b. Work With Students

II c. Diploma thesis supervision

- Ivan Siutsou (IRAP PhD student, Belarus): defended his thesis in September 2013
- Alberto Benedetti (Erasmus Mundus IRAP PhD student, Italy): defended his thesis in November 2013
- Damien Begue (Erasmus Mundus IRAP PhD student, France)

II d. Other Teaching Duties

- "Relativistic kinetic theory and its applications in astrophysics and cosmology", 4 lectures. IRAP Ph.D. Erasmus Mundus September school, Nice, 2 – 20 September, 2013
- "Relativistic Boltzmann equation", 2 lectures at IRAP Ph.D. Erasmus Mundus September school, Nice, 16 – 31 May, 2013

III. Service activities

III a. Within ICRANet

- Member of the IRAP PhD Faculty
- Coordinating cooperation with the Belarusian State University
- Coordinating cooperation with the National Academy of Sciences of Belarus
- Member of the organizing committee of international meetings
- Editing volumes of the proceedings of international meetings

Mission to Minsk, Belarus, August 2013

- Visiting National Academy of Sciences of Belarus and signing the cooperation agreement.
- Visiting Belarusian State University and renewing the cooperation agreement.

III b. Outside ICRANet

2013 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.

- D. Begue, I. A. Siutsou, G. V. Vereshchagin, "Monte Carlo simulations of the photospheric emission in GRBs", The Astrophysical Journal, Vol. 767, Issue 2 (2013) article id. 139.

- A. Benedetti, R. Ruffini and G.V. Vereshchagin, "Phase space evolution of pairs created in strong electric fields", Physics Letters A, Vol. 377 (2013) 206–215.

- R. Ruffini and G.V. Vereshchagin, "Electron-positron plasma in GRBs and in cosmology", Il Nuovo Cimento C, Vol. 36, Issue 1, (2013) pp.255-266.

- A. Benedetti, R. Ruffini and G.V. Vereshchagin, "On the kinetic treatment of pair production in strong electric fields", Il Nuovo Cimento C, Vol. 36, Issue 1, (2013) pp.15-19.

- R. Ruffni, I. A. Siutsou and G. V. Vereshchagin, "Theory of photospheric emission from relativistic outflows", the Astrophysical Journal, Vol. 772, Issue 1 (2013) article id. 11.

- A.G. Aksenov, R. Ruffini and G.V. Vereshchagin, Radiative transfer near the photosphere of ultrarelativistic outflows, MNRAS Letters, Vol. 436, Issue 1 (2013) pp. L54-L58.

- D. Begue and R. Ruffini and G.V. Vereshchagin, On the filling factor of the circumburst medium and GRB emission, in preparation (2013).

Xue She-Sheng

Position: Staff
Period covered: 2011 – 2013

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. Phys. Rev. D84（2011）084007.

On the relativistic and electro-dynamical stability of massive nuclear density cores, V. S. Popov, M. Rotondo, R. Ruffini and S.-S. Xue, Int. Journal of Modern Physics D 20 (2011) 1995.

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.

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

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

Vacuum pair-production in a classical electric field and an electromagnetic wave, H. Kleinert and S.-S. Xue, Annals of Physics Vol. 333 (2013) 104.

Why is the top-quark much heavier than other fermions? S.-S. Xue, Phys. Lett. B 721 (2013) 347.

Higgs Boson and Top-Quark Masses and Parity-Symmetry Restoration S.-S. Xue, Phys. Lett. B 727 (2013) 308.

Neutron star equilibrium configurations within a fully relativistic theory with strong, weak, electromagnetic, and gravitational interactions, J. Rueda, R. Ruffini, Yuanbin Wu and S.-S. Xue, submitted to Phys. Rev. C (2013) .

Fractional QED from the Euler-Heisenberg-Lagrangian for strong electromagnetical fields, Hagen Kleinert, Eckhard Strobel and She-Sheng Xue, Phys. Rev. D88, 025049 (2013).

Gravitational and electric energies in collapse of spherically thin capacitor, Remo Ruffini, and She-Sheng Xue , Physics Letters A377 (2013) 2450.

Einstein-Euler-Heisenberg theory and charged black holes, R. Ruffini, Y.-B. Wu and S.-S. Xue, Physics Review D88, 085004 (2013)

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 2011)
The 13th Marcel Grossmann Meeting Stockholm, 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
The Scientific meeting of ICRANet, June, 2013, Pescara, Italy.
The meeting for 9th Italian-Korean meeting, July 12-18, 2013, Seoul, South Korea..

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

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, Han Wenbiao 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.

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

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
- Chair of the International Advisory Council of the Institute of Sciences of the Cosmos
        at the University of Barcelona
- 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

Organization of International Conference:
HEPRO IV (High Energy Phenomena in Relativistic Outflows**),** Heidelberg, Germany, July 23-26, 203

Publications**:** more than 400 papers in peer review journals – more than 20,700 citations, h-index: 79

Papers published in 2013

1. *Gamma-Ray Emission of Supernova Remnants and the Origin of Galactic Cosmic Rays,* F.A. Aharonian, in Planets, Stars and Stellar Systems Vol. 5, editors: T. Oswalt, G. Gilmore, Springer Science+Business Media Dordrecht, 2013, p. 79

2. *TeV Astronomy*, F. Rieger, E. de Ona Wilhelmi, F.A. Aharonian, in "Frontiers of Physics" on "High Energy Astrophysics" (eds. B. Zhang & P. Meszaros), 06/2013

3. *Evidence for a second component in the high-energy core emission from Centaurus A?* ApJ Letters, N. Sahakian, R. Yang, F.A. Aharonian, F. Rieger, vol 770, L6 (2013)

4. *Unraveling the high-energy emission components of gamma-ray binaries,* V. Zabalza, V. Bosch-Ramon, F.A. Aharonian, D. Khangulyan, A&A, vol. 551, id.A17 (2013)

5. *Gamma rays from supernova remnants,* F.A.Aharonian, Astroparticle Physics, vol. 43, p. 71 (2013)

6. *TeV gamma rays from blazars beyond z=1?* F.A. Aharonian, W. Essey, A. Kusenko, A. Peocekin, Phys. Rev D, vol. 87, id. 063002 (2013)

7. *Analytic Solution for Self-regulated Collective Escape of Cosmic Rays from their Acceleration Sites*, M. A. Malkov, P. H. Diamond, R.Z. Sagdeev, F.A. Aharonian, ApJ, vol. 768, id. 73 (2013)

8. *On the Jitter Radiation*, S.R. Kelner, F.A. Aharonian, D.V. Khangulyan, ApJ, vol. 774, id. 61 (2013)

9. *Star-Jet Interactions and Gamma-Ray Outbursts from 3C454.3,* D.Khangulyan, D. V.; M. Barkov, V. Bosch-Ramon, F. Aharonian, A. Dorodnitsyn, ApJ, vol. 774, id. 113 (2013)

Books:

Felix Aharonian, Lars Bergstrom, Charles Dermer: *Astrophysics at Very High Energies*, Springer-Verlag Berlin Heidelberg, 2013

, S. R.; , F. A.; , D.: *On the Jitter Radiation*

Amati Lorenzo

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

Period covered:

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 (2012-2013)

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 $E_{p,i}$ – E_{iso} 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). I also involved Luca Izzo and Ana Penacchioni in the studies aimed at investigating the possible GRB science with the LOFT (ESA/M3 candidate) mission, as coordinator of the corresponding international

Working Group. I am presently collaborating with the GRB group led by Prof. Ruffini on the brightest "nearby" gamma-ray burst, GRB 130427A.

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; Guidorzi et al. MNRAS, 2012; Dichiara et al., MNRAS, 2013), investigation of the cosmological use of GRBs (e.g., Amati, IJMPS, 2012; Amati & Della Valle, Astronomical Review, 2013), 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 am 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 (2012-2013)

Conferences and Other External Scientific Work

May 2013: Second Bego Scientific Rencontre Meeting, Nice, France (2 oral presentations)

April 2013: Huntsville Gamma Ray Burst Symposium - GRB 2013Nashville TN, USA (short oral / poster presentation and member of the Scientific Organizing Committee)

January 2013: Scientific perspectives in the MeV domain, Paris, France (oral presentation)

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), collaborations and discussion with G. Pisani, M. Muccino, L. Izzo.

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

III Service activities (2012-2013)

Within ICRANet

- Adjunct Professor of the ICRANet Faculty

- 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"

- Member of the International Organizing Committee of the The 2013 yearly ICRANet Scientific Meeting on Relativistic Astrophysics

- Seminars on GRB physics and cosmology at University of Rome "La Sapienza"

- Lectures at the IRAP – PHD School in Nice (France)

- Lecturer and Thesis Advisor for the IRAP-PHD Erasmus Mundus programme

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), "International Journal of Advanced Astronomy" (Science Publishing Corporation)

- 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

- Member of Committees for selection of post-doc fellowships (e.g., INAF) and staff researchers (e.g., University of Nice)

- Member of the Scientific Organizing Committee of the Huntsville Gamma Ray Burst Symposium - GRB 2013Nashville TN, USA (April 2013)

2012-2013 list of Publications

Refereed

S. Dichiara, C. Guidorzi, L. Amati, F. Frontera, 2013, " Average power density spectrum of long GRBs detected with BeppoSAX/GRBM and with Fermi/GBM " , Monthly Notices of the Royal Astronomical Society, 431, 3608

L. Amati, M. Della Valle, 2013, " Cosmology with Gamma-Ray Bursts: status and perspectives " , Astronomical Review, 8, 90

R. Farinelli, L. Amati, F. Frontera, R. Landi, E. Palazzi, N. Shaposhnikov, L. Titarchuk, N. Masetti, C. Lombardi, M. Orlandini, 2013, " 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, 428, 3295

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

L. Amati, E. Del Monte, V. D'Elia, B. Gendre, R. Salvaterra, G. Stratta, 2013, "The LOFT contribution to GRB science", Nuclear Physics B - Proc. Suppl., in press

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: 1.7.2012 – 31.7.2013

Recent period in which ICRA was visited:

Attended Marcel Grossman meeting in Stockholm (July, 2012)

as an ICRANET member.

<u>I Scientific Work</u>

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 is doing pioneering work on detecting x-rays and gamma rays from celestial objects using miniaturized instruments on board low cost balloons. He has written a book and edited several volumes.

<u>II Conferences and educational activities</u>

Doctorate Students Supervision

He has produced 23 Ph. D. scholars and another 10 students are registered for PhD. Four students are submitting their thesis soon. One student from Nigeria is 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) Quasi-periodic 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 (h) Effects of space weather on Earth's ionosphere and satellites.

<u>III Service activities</u>

Talks/papers

<u>2013 List of Publication</u>

Papers in Journals:

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

- Nandi, A., Debnath, D., Mandal, S. and Chakrabarti, S. K., Accretion flow dynamics during the evolution of timing and spectral properties of GX 339-4 during its 2010-11 outburst, Astronomy & Astrophysics, 2012, 542, 56

- Palit, S., Basak, T., Mondal, S. K., Pal, S. and Chakrabarti, S. K., Modeling of the Very Low Frequency (VLF) radio wave signal profile due to solar flares using the GEANT4 Monte Carlo simulation coupled with ionospheric chemistry, Atmos. Chem. Phys. Disc, 13, 6007, 2013

- Majumdar, L., Das, A., Chakrabarti, S. K. and Chakrabarti, S., Hydro-chemical study of the evolution of interstellar pre-biotic molecules during the collapse of molecular clouds, Res. Astron. Astrophys., 12, 1613, 2012

- Pal, S., Maji, S. K. and Chakrabarti, S. K., First ever VLF monitoring of the lunar occultation of a solar flare during the 2010 annular solar eclipse and its effects on the D-region electron density profile, Planetary and Space Science, 73, 310, 2012

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

- Mondal, S.K., Chakrabarti, S. K. and Sasmal, S., Detection of ionospheric perturbation due to a soft gamma ray repeater SGR J1550-5418 by very low frequency radio waves, Astrophysics and Space Science, 341, 259, 2012

- Chakrabarti, S. K., Pal, S., Sasmal, S., Mondal, S. K., Ray, S.,Basak, T., Maji, S. K., Khadka, B., Bhowmick, D. and Chowdhury, A. K., VLF campaign during the total eclipse of July 22nd, 2009: Observational results and interpretations, Jour. Atmos. Sol. Terres. Phys., 86, 65. 2012

- Pal, S., Chakrabarti, S. K., Mondal, S. K., Modeling of sub-ionospheric VLF signal perturbations associated with total solar eclipse, 2009 in Indian subcontinent, Advances. Space Res., 50, 196, 2012

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

- Das, A., Majumdar, L., Chakrabarti, S. K. and Chakrabarti, S., 2013, Chemical evolution during the process of proto-star formation by considering a two dimensional hydrodynamic model, NewA, 23, 118

- Mondal, S. and Chakrabarti, S. K., Spectral properties of two-component advective flows with standing shocks in the presence of Comptonization, MNRAS, 431, 2716

– Majumdar, L., Das, A., Chakrabarti, S. K. & Chakrabarti, 2013, Study of the chemical evolution and spectral signatures of some interstellar precursor molecules of adenine, glycine & alanine, NewA, 20, 15

– Giri, K.; Chakrabarti, S. K., 2013, Hydrodynamic simulation of two-component advective flows around black holes, MNRAS, 430, 2836

OTHER PUBLICATIONS

– Majumdar, L., Das, A., Chakrabarti, S. K., Chakrabarti, S., Chemical evolution and spectroscopy of some complex molecules which could be treated as the precursor of some bio-molecules in the interstellar medium, Proc. IAU Sym. 292, 250 2013

– Sasmal, S. and Chakrabarti, S.K., Case Studies of Seismic Events and Comparison with VLF Signal and Satellite Data, in 39th COSPAR Scien. Assem., 39, 1690, 2012

– Sasmal, S. Chakrabarti, S.K., Mondal, S.K. and Ray, S., Study the Broadband Very Low Frequency Data Received from Different Places and Observe the Possible Ionospheric Events, , in 39th COSPAR Scien. Assem., 39, 1689, 2012

– Sasmal, S. and Chakrabarti, S.K., Chakrabarti, S. and Ray, S., Study the Seismo-Ionospheric Correlations in the Indian Sub-Continent using Very Low Frequency (VLF) Signal Characteristics, in 39th COSPAR Scien. Assem., 39, 1688, 2012

– Saha, R., Chakrabarti, S.K. Das, A., Majumdar, L. and Chakrabarti, S., Effect of photo-dissociation on the composition of the grain mantle, in 39th COSPAR Scien. Assem., 39, 1647, 2012

– Ruffini, R. et al., Canonical GRBs: the long, the disguised short and the short, and their cosmic distances, in 39th COSPAR Scien. Assem., 39, 1628, 2012

– Ray, S. and Chakrabarti, S.K., Unusual Shifts in Terminator Times of the VLF Signals before the Pakistan Earthquake (M=7.4), Occurred on 19th Jan., 2011., in 39th COSPAR Scien. Assem., 39, 1595, 2012

– Ray, S., Chakrabarti, S.K., Sasmal, S. and Mondal, S.K., Unusual Fluctuations of the Nighttime VLF Signal Amplitude before Seismic Events, in 39th COSPAR Scien. Assem., 39, 1594, 2012

– Pal, S., Chakrabarti, S.K. and Mondal, S.K., Modeling of sub-ionospheric VLF signal perturbations associated with Total Solar Eclipse, 2009 in Indian subcontinent, in 39th COSPAR Scien. Assem., 39, 1431, 2012

– Nwankwo, V.U.J., Chakrabarti, S.K. and Sasmal, S., Daily Variation of Very Low Frequency (VLF) Signal Amplitude and Phase from North-West Cape (19.8kHz) to Kolkata, in 39th COSPAR Scien. Assem., 39, 1385, 2012

– Nwankwo, V.U.J. and Chakrabarti, S.K., Computation and Prediction of plasma drag on Orbiting Satellites due to Space Environmental Perturbation by Coronal Mass Ejections (CMEs), in 39th COSPAR Scien. Assem., 39, 1384, 2012

– Nandi, A. and Chakrabarti, S.K., Ejection mechanism for the disappearance of inner accretion disk of Black Holes: A theoretical study with observational signatures, in 39th COSPAR Scien. Assem., 39, 1336, 2012

– Mondal, S.K. , Chakrabarti, S.K. and Sasmal, S., Very Low Frequency Detection of the Soft Gamma ray Repeater SGR J1550-5418, in 39th COSPAR Scien. Assem., 39, 1269, 2012

– Mondal, S. and {Chakrabarti, S.K. and Das, R., A New Photometric Survey Design for Detection of Transiting Extrasolar Planets, in 39th COSPAR Scien. Assem., 39, 1268, 2012

– Majumdar, L., Chakrabarti, S.K., Das, A. and Chakrabarti, S. A quantum chemical approach to set a guideline for the observation of different pre-biotic molecules in the interstellar space, in 39th COSPAR Scien. Assem., 39, 1154, 2012

– Majumdar, L., Chakrabarti, S.K., Das, A., Chakrabarti, S. Formation of some of the bases of DNA in the interstellar space during the molecular cloud collapse, in 39th COSPAR Scien. Assem., 39, 1153, 2012

– Majumdar, L., Chakrabarti, S.K., Das, A. and Chakrabarti, S., Spectral signature and chemical evolution of some complex molecules which could be treated as the precursor of some bio-molecules in the ISM, in 39th COSPAR Scien. Assem., 39, 1152, 2012

– Lynn, K., Singh, R. , Chakrabarti, S.K. , Veenadhari, B. , More, C. and Brundell, J., Non-reciprocity observed by the VLF reception of NWC (19.8 kHz) over trans-equatorial east-west paths to India with reception over a non-equatorial west-east path of similar length to Dunedin, New Zealand, in 39th COSPAR Scien. Assem., 39, 1128, 2012

– Giri, K. and Chakrabarti, S.K.,Numerical simulations of a Two Component Advective flow for the study of the spectral and timing properties of BHs and NSs, in 39th COSPAR Scien. Assem., 39, 622, 2012

– Garain, S.K., Chakrabarti, S.K. and Ghosh, H., Effects of Compton Cooling on the Hydrodynamic and Spectral Properties of a Two Component Accretion Flow around a Black Hole, in 39th COSPAR Scien. Assem., 39, 589, 2012

– Debnath, D. and Nandi, A. and Chakrabarti, S.K., A comparative study of the timing and the spectral properties during two similar outbursts of 2010 2011 of H 1743-322, in 39th COSPAR Scien. Assem., 39, 431, 2012

– Das, A. and Chakrabarti, S.K., Chemical Composition of Interstellar Dust: A Monte Carlo Study, in 39th COSPAR Scien. Assem., 39, 399, 2012

- Das, A. and Chakrabarti, S.K., A Monte Carlo Study to Explore the Composition of the Grain Mantle, in 39th COSPAR Scien. Assem., 39, 398, 2012

- Chakrabarti, S.K., Towards the most complete solution of black hole accretion and outflows for the spectral and the timing studies, in 39th COSPAR Scien. Assem., 39, 292, 2012

- Chakrabarti, S.K. , Mondal, S.K. , Palit, S., Sarkar, R. and Bhowmick}, D., Balloon Programme of Indian Centre for Space Physics, Kolkata, in 39th COSPAR Scien. Assem., 39, 290, 2012

- Basak, T. and Chakrabarti, S.K., On the nature of time-delay in lower ionospheric response time during solar flares, in 39th COSPAR Scien. Assem., 39, 107, 2012

- Ghosh, H., Garain, S.K., Giri, K., Chakrabarti, S.K., Monte-Carlo Simulations of Comptonization Process in a Two Component Accretion Flow around a Black Hole in Presence of an Outflow, In Proceedings of Twelfth Marcel Grossmann Meeting on General Relativity, 985, 2012

Talks

Synthesis of prebiotic molecules and origin ogf life: Invited talk at 39th COSPAR Assembly, Mysore (July, 2012)

Very Low Frequency Radio wave monitoring programme of ICSP, Kolkata: Invited talk at 39th COSPAR Assembly, Mysore (July, 2012)

Towards the most complete Solution of black hole accretion and outflows for the spectral and timing studies: Invited talk at 39th COSPAR Assembly, Mysore (July, 2012)

Balloon Programme of ICSP, Invited talk at 39th COSPAR Assembly, Mysore (July, 2012)

Canonical GRBs: the long, the disguised short and the short, and their cosmic distances: Contributed talk at 39th COSPAR Assembly, Mysore (July, 2012)

State-of-the-Art Accretion flow Solution around a black hole: An end in sight? Invited talk at the 13th Marcel Grossman meeting, at Stockholm University (July, 2012)

My Experiment with Astrophysics: Bose Colloquium (August, 2012)

Chemical Evolution of the Universe and the Origin of Life: Public lectures at IIT-Guwahati and "Astrofest" at Cotton College University; (March, 2013)

Interpretation of spectral and temporal behaviour of black hole candidates from transonic flow solution of accretion flows, Plenary talk at "Recent Trends of Compact Objects" conference at IIT/Guwahati (March, 2013)

Mysterious Universe: Invited speaker at 150th anniversary of ACC institution, Malda (December, 2012)

Mysterious Black Holes: Plenary speaker at the 100th Indian Science Congress meeting (January, 2013)

Mysterious Universe from large scale to small scale: A popular invited talk atthe 100th Science Congress meeting (January, 2013)

Chemical Universe of the Universe and the origin of Life: Invited Colloquium at Presidency University (April, 2013)

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

Conferences and educational activities
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 m_1 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 $m_2 \gg m_1$. More precisely, we construct the function $h_{uu}(x) \equiv h_{\mu\nu} u^\mu u^\nu$ (related to Detweiler's gauge-invariant 'redshift' variable), where $h_{\mu\nu}$ is the regularized metric perturbation in the Lorenz gauge, u^μ is the four-velocity of m_1, and $x \equiv [Gc-3(m_1+m_2)\Omega]^{2/3}$ is an invariant coordinate constructed from the orbital frequency Ω. In particular, we explore the behavior of h_{uu} just outside the 'light ring' at $x=1/3$, where the circular orbit becomes null. Using the recently discovered link between h_{uu} and the piece $a(u)$, linear in the symmetric mass ratio nu, of the main radial potential $A(u,\nu)$ of the Effective One Body (EOB) formalism, we compute $a(u)$ over the entire domain $0<u<1/3$ (extending previous results for $u \leq 1/5$). 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 $O(\nu)$ piece $\bar{d}(u)$ of a second EOB radial potential $\bar{D}(u,\nu)$. Combining these results with our present global analytic representation of $a(u)$, we numerically compute $\bar{d}(u)$ on the interval $0<u \leq 1/6$.

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.
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 $\varrho=16$. This measurability result seems to hold for all the nuclear equations of state leading to a maximum mass larger than $1.97 M\odot$. 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.
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.
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 $\alpha 2=85/14\simeq 6.07143$ (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: Professor University of Ferrara
Period covered: Jan- December 2013

I Scientific Work

Experimental and observational X-/gamma-ray astronomy, in particular:

a. Gamma-ray lens development with long focal length (LAUE project);

b. Studies of new gamma-ray burst 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. *ASI conference on ESA Large missions*
b. *Celebration workshop of the "Group2003 for scientific research" with the President of Italian Republic*
c. *Organization of the 8th National Conference on Compact Objects in Ferrara, 17-19 Sept 2013*
d. *Conference on Science & Industry, held in Milan in November 2013*
e. *6th International Workshop on Astronomical X–Ray Optics, Prague Dec 9-12, 2013*

II b. Work With Students

yes, with

a) *2 PhD students (Vincenzo Liccardo, Vineeth Valsan), EMJD-IRAP-PhD program*

b) *2 PhD students (Disha Sawant and Tais Maiolino), EMJD-IRAP-PhD program*

c) *1 PhD student (Simone Dichiara), Doctorate in Physics, University of Ferrara*

II d Other Teaching Duties

One course at UNIFE, on "Measures and Observations of Celestial X- and gamma-rays" to Master Students in Physics.

II e. Work With Postdocs

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

III. Service activities

III a. Within ICRANet

Lectures to PhD students

IV. Other

2013 List of Publications

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 Sociery, Volume 428, Issue 4, p.3295-3305 (2013).

Seifina, Elena; Titarchuk, Lev; Frontera, Filippo, Stability of the Photon Indices in Z-source GX 340+0 for Spectral States, The Astrophysical Journal, Volume 766, Issue 1, article id. 63, 22 pp. (2013).

Titarchuk, Lev; Seifina, Elena; Frontera, Filippo, Spectral State Evolution of 4U 1820–30: The Stability of the Spectral Index of the Comptonization Tail, The Astrophysical Journal, Volume 767, Issue 2, article id. 160, 23 pp. (2013).

Filippo Frontera, Laue Lenses for Gamma-Ray Astronomy, Rendiconti Fisica Accademia Lincei (2013) 24 (Suppl 1):S115–S122

Amati, L.; Atteia, J.-L.; Balazs, L.; Basa, S.; Becker Tjus, J.; Bersier, D. F.; Boer, M.; Campana, S.; Ciardi, B.; Covino, S.; F. Frontera and 33 coauthors, Light from the Cosmic Frontier: Gamma-Ray Bursts, eprint arXiv:1306.5259, June 2013.

Dichiara, S.; Guidorzi, C.; Amati, L.; Frontera, F. , Average power density spectrum of long GRBs detected with BeppoSAX/GRBM and with Fermi/GBM, Monthly Notices of the Royal Astronomical Society, Volume 431, Issue 4, p.3608-3617 (2013)

Pal'shin, V. D.; Hurley, K.; Svinkin, D. S.; Aptekar, R. L.; Golenetskii, S. V.; Frederiks, D. D.; Mazets, E. P.; Oleynik, P. P.; Ulanov, M. V.; Cline, T.; Frontera, F., and 63 coauthors, Interplanetary Network Localizations of Konus Short Gamma-Ray Bursts, The Astrophysical Journal Supplement, Volume 207, Issue 2, article id. 38, 14 pp. (2013).

Frontera, Filippo, Prospects for Gamma-Ray Focusing Telescopes Beyond 70/100 keV, International Journal of Modern Physics D, Volume 22, Issue 11, id. 1360004 (2013)

Frontera, F.; Virgilli, E.; Valsan, V.; Liccardo, V.; Carassiti, V.; Caroli, E.; Cassese, F.; Ferrari, C.; Guidi, V.; Mottini, S.; and 17 coauthors , Scientific prospects in soft gamma-ray astronomy enabled by the LAUE project, Proceedings of the SPIE, Volume 8861, id. 886106 17 pp. (2013).

Valsan, V.; Frontera, F.; Virgilli, E.; Liccardo, V.; Caroli, E.; Stephen, J. B., Results of the simulations of the petal/lens as part of the LAUE project, Proceedings of the SPIE, Volume 8861, id. 886109 12 pp. (2013).

Liccardo, V.; Virgilli, E.; Frontera, F.; Valsan, V.; Guidi, V.; Buffagni, E. , Bent crystal selection and assembling for the LAUE project, Proceedings of the SPIE, Volume 8861, id. 88610A 9 pp. (2013).

Dichiara, S.; Guidorzi, C.; Frontera, F.; Amati, L., A Search for Pulsations in Short Gamma-Ray Bursts to Constrain their Progenitors, The Astrophysical Journal, Volume 777, Issue 2, article id. 132, 6 pp. (2013).

Frontera, Filippo; Amati, Lorenzo; Farinelli, Ruben; Dichiara, Simone; Guidorzi, Cristiano; Landi, Raffaella; Titarchuk, Lev, Comptonization signatures in the prompt emission of Gamma Ray Bursts, The Astrophysical Journal in press (2013), eprint arXiv:1311.1998, Nov. 2013.

Jantzen Robert

Position: Professor
Period covered: Summer 2012 through Summer 2013

I Scientific Work

Continuing collaboration with Donato Bini and Andrea Geralico on mathematical properties of stationary spacetimes and the relativistic Poynting-Robertson effect and with Remo Ruffini on Fermi.

II Conferences and educational activities

II a Conferences and Other External Scientific Work
Continuing MG13 organizational and editorial duties

II b Work With Students Collaborated with Maria Haney PhD work.

II c Diploma thesis supervision

II d Other Teaching Duties Gave 2 lectures to PhD students in June, 2013

II e. Work With Postdocs

Collaborated with Andrea Geralico.

III. Service activities

III a. Within ICRANet

III b. Outside ICRANet

IV. Other

Summer 2012 through 2013 List of Publication

. 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).

. Geodesics on the Torus and other Surfaces of Revolution Clarified Using Undergraduate Physics Tricks with Bonus: Nonrelativistic and Relativistic Kepler Problems
R.T. Jantzen
arxiv: math-differential geometry: http://arxiv.org/abs/1212.6206, 52 pp. (2012).

Khalatnikov Isaak M.

Position: Adjunct Professor at ICRANet; Academician of Russian Academy of Sciences; Honorary Director of L.D. Landau Institute for Theoretical Physics of Russian Academy of Sciences.

Period covered: 2013

I Scientific Work

The quasi-isotropic expansion for a simple two-fluid cosmological model, including radiation and stringy gas is constructed. The first non-trivial order expressions for the metric coefficients, energy densities and velocities are explicitly written down. Their small and large time asymptotics are studied. It is found that the large time asymptotic for the anisotropic component of the metric coefficients grows faster than that of the isotropic (trace-proportional) component.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

XXV IUPAP Conference on Computational Physics, August 20–24, 2013, Moscow, Russia. Plenary talk: "Numerical Methods For Partial Differential Equations and Early Days of Computational Physics". The abstract is available at the Conference website ://ccp2013.ac.ru .

III. Service activities

III a. Within ICRANet

Chaotic behavior of general cosmological solutions near singularities (visiting ICRA in April 2013).

III b. Outside ICRANet

Instability of the surface of superfluid liquid due to heat flow in the bulk of the liquid (Institute of Solid State Physics of Russian Academy of Sciences; Russian Foundation for Basic Research grant No.14-02-01065)
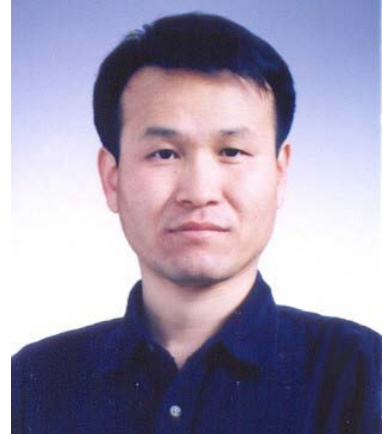
2013 List of Publication

I.M. Khalatnikov, A.Yu. Kamenshchik, A.A. Starobinsky, "Quasi-isotropic expansion for a two-fluid cosmological model containing radiation and stringy gas". The paper will be available in arXiv.org in December.

Lee Hyung Won

Position: Professor, Inje University

Period covered: 8 July 2012 – 22 July 2012

<u>I Scientific Work</u>

1. Dark energy

2. Exact solution of Einstein equations

3. Numerical Relativity

4. Neutrino Physics

<u>II Conferences and educational activities</u>

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.

<u>2012 List of Publication</u>

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).

Nicolai Hermann

Position: Director of MPI for Gravitational Physics, Golm, Germany

Period covered: since 1997

I Scientific Work

Relativistic Quantum Field Theory, General Relativity,

Unification of fundamental Interactions

II Conferences and educational activities

Work With Students

s. publication [2] and

On fundamental domains and volumes of hyperbolic Coxeter-Weyl groups

Philipp Fleig, Michael Köhn, Hermann Nicolai

Letters in Math. Physics 100 (2012) 261

AEI-2011-012

e-Print: :1103.3175 [math.RT]

III. Service activities

Honorary Professor, Humboldt University Berlin, since 22.04.1999

Honorary Professor, Hannover University, since 01.06.2005

Member of the Governing Board of the School of Theoretical Physics, Dublin Institute for Advanced Studies, Dublin, Ireland, since 01.07.2005

Editor-in-Chief of the journal "General Relativity and Gravitation", 01.01.2006 – 31.12.2011

Member (representative of the Max Planck Society) of the Conseil d' Administration of the Institute des Hautes Etudes Scientifiques (I.H.E.S.), Bures-sur-Yvette, France

Member of the International Advisory Board of the International Solvay Institutes for Physics and Chemistry, Brussels, Belgium

Member of the External Advisors Committee of the Theory Unit at CERN, Switzerland, since 01.09.2011

IV. Other

Einstein Medal 2010, awarded by the Albert Einstein Society Bern, Switzerland

Gay-Lussac-Humboldt Award 2012, German-French Science Award

2013 List of Publication

[1] (B-L) symmetry vs. neutrino seesaw

   Latosinski (U.),   A. Meissner (U. & , Max Planck Inst.),   Nicolai (, Max Planck Inst.). 2013.

   Published in Eur.Phys.J. C73 (2013) 2336

[2]   DeWitt Equation in Quantum Field Theory

   Dutta,   A. Meissner,   Nicolai. Mar 14, 2013. 26 pp.

   AEI-2013-159

   e-Print: :1303.3497 [hep-th]

[3]   the non-linear flux ansatz for maximal supergravity

   Godazgar,   Godazgar,   Nicolai. Mar 5, 2013. 23 pp.

   DOI: .1103/PhysRevD.87.085038

   e-Print: :1303.1013 [hep-th]

[4]   of gauged SO(8) supergravity and supergravity in eleven dimensions

   de Wit,   Nicolai. Feb 25, 2013. 29 pp.

   NIKHEF-2013-003, ITP-UU-13-03, AEI-2013-048

   e-Print: :1302.6219 [hep-th] |

[5]   Gravity: the view from particle physics

   Nicolai. Jan 2013.

   Conference: -06-25.1

   e-Print: :1301.5481 [gr-qc]

Punsly Brian

Position: Research Scientist

Period covered: 6/2012-6/2013:

<u>I Scientific Work</u>

Black Holes and Quasars

1. Introduction

This report describes the research performed by Brian Punsly and collaborators in cooperation with ICRANet in 2012-2013. There were two lines of research. The first was directed at finding environmental factors that are related to the switch-on of the general relativistic engine responsible for a few percent of quasars driving powerful relativistic jets. This is important since this will related directly to constraints on the initial state and boundary conditions on numerical models of black hole driven jets.. The second area of research is based on using the jet in the Galactic black hole, GRS 1915+105, as a test case for black hole driven jets.

2. AGN Environments and the Launching of Jets

In 2012, the research was concentrated on the nature of the broad emission line gas in AGN that launch relativistic jets. I am also leading collaborations to perform high frequency (high resolution), time resolved VLBA observations of broad absorption line quasars. Broad absorption line quasars have weak or no central engine for powerful radio jets with the jets rarely strong enough to make it out of the host galaxy. As principal investigator, in collaboration with Paola Marziani and Giovanna Stirpe at Istituto Nazionale di Astrofisica and Shaohua Zhang, we were granted telescope time on the VLT of the European Southern Observatory to study the Hβ line widths of quasars with broad high ionization absorption line flows for the first time. This is a follow-up to previous work with Shaohua Zhang on quasars with low ionization broad absorption lines that indicated narrow Hβ line widths consistent with polar outflows (Punsly and Zhang 2010)..

2a. Asymmetric Line profiles in Blazars

The Astrophysical Journal Letter, describes the paradoxical occurrence of redward asymmetric broad emission lines in blazars which have relativistic jets point nearly pole-on towards earth. Hence these are the most blueshifted objects in the known Universe. They also have the most redshifted known wings in their broad emission lines. This odd occurrence of redshifted structures within a highly blushifted system provides valuable clues to the origin of relativistic jets in some quasars.

Abstract: Multi-Epoch Observations of the Redwing Excess in the Spectrum of 3C279:

It has been previously determined that there is a highly significant correlation between the spectral index from 10 GHz to 1350 Å and the amount of excess luminosity in the red wing of quasar CIV λ1549 broad emission lines (BELs). Ostensibly, the prominence of the red excess is associated with the radio jet emission mechanism and is most pronounced for lines of sight close to the jet axis. Studying the scant significant differences in the UV spectra of radio loud and radio quiet quasars might provide vital clues to the origin of the unknown process that creates powerful relativistic jets that appear in only a few percent of quasars. In this study, the phenomenon is explored with multi-epoch observations of the MgII λ2798 broad line in 3C 279 which has one of the largest known redwing excesses in a quasar spectrum. The amount of excess that is detected appears to be independent of all directly observed optical continuum, radio or submm properties (fluxes or polarizations). The only trend that occurs in this sparse data is: the stronger the BEL, the larger the fraction of flux that resides in the redwing. It is concluded that more monitoring is needed and spectropolarimetry with a large telescope is essential during low states to understand more.

2b. VLBA Observations of Sub-Parsec Structure in Mrk 231: Interaction between a Relativistic Jet and a BAL Wind

I am leading an effort to study Mrk 231 at the highest resolution. It is the nearest broad absorption line quasar and we have proven that it conforms with the idea of a polar broad absorption line outflow (instead of the popular notion of an equatorial outflow) that was developed in Punsly (1999a,b). This research and proposal is being done in collaboration with Cormac Reynolds (Curtin University of Technology, Department of Imaging and Applied Physics), Christopher P. O'Dea (Department of Physics, Rochester Institute of Technology) and Joan Wrobel (NRAO, Socorro).

2b.1. Large VLBA Proposal Approved

We have been approved annually for the past few years for a very aggressive observation this object.

Abstract

We propose VLBA monitoring at 8.4, 15, 22 and 43 GHz of a high frequency flare in the nearby quasar MRK231. The "target of opportunity" observation (ToO) would be triggered by a flare detected by VLA monitoring at 22 and 43 GHz (see related proposal). The primary goals would be to detect a superluminal motion, estimate the internal energy of the flare from the spectrum and component sizes, and monitor the temporal evolution in order to understand the energy injection mechanism (rise) and the cooling mechanism (decay).

Background

From previous VLBA studies of MRK231 in Reynolds et al (2009) and other RQ (radio quiet) quasar studies, we have seen that RQ AGN can have relativistic outflows with significant kinetic luminosities (but maybe for short periods of time). So this raises the question what is it that makes some sources RQ and others radio loud (RL)? At a redshift of 0.042, MRK231 is one of the nearest radio quiet quasars to earth. The radio core is perhaps the brightest of any radio quiet quasar at high frequency (22 and 43 GHz). The combination of

significant 43 GHz flux density and its proximity to earth makes MRK231 the optimal radio quiet quasar for study with VLBA. No other radio quiet quasar central engine can be explored with such high resolution, so it is ideal for studying the high kinetic luminosity relativistic ejecta in radio quiet quasars. 43 GHz VLBA observations can fully resolve nuclear structure to within 3.5×10^{17} cm. We propose to use sensitive high resolution observations to study the temporal evolution of the size and spectrum of a strong flare in MRK231 in order to shed light on why such strong flares cool off and never link to large scale powerful radio lobes.

2b2. VLBA Observations of Parsec Scale Structure of the "Radio Loud" BALQSO FIRST J1556+3517

I am also leading an effort to study FIRST J1556+3517at the high resolution. It is one of the nearest broad absorption line quasar and we have proven (Ghosh and Punsly 2007) that it conforms with the idea of a polar broad absorption line outflow (instead of the popular notion of an equatorial outflow) that was developed in Punsly (1999a,b). The first epoch observations are complete the second epoch observations are stil in the proposal review cycle..This proposal was done in collaboration with Cormac Reynolds (Curtin University of Technology, Department of Imaging and Applied Physics), and Christopher P. O'Dea (Department of Physics, Rochester Institute of Technology).

ABSTRACT FROM ACCEPTED PROPOSAL: We propose VLBA observations at 1.8, 5, 8.4 and 15 GHz of the Broad Absorption Line Quasar FIRST J1556+3517 ("the first radio loud BALQSO"). The primary goal would be to resolve the flat spectrum radio core for the first time. Determination of the radio jet direction, in consort with the knowledge that the jet is relativistic and viewed in a pole-on orientation and the known PA of the optical continuum polarization tightly restrict the quasar geometry. This will allow us to directly constrain the relative orientations of the "dusty torus" (scattering surface), accretion disk and the broad absorption line outflow. We also propose multiple frequency observations to look for free-free absorption that might arise from the local environment of the accretion disk or the BAL wind gas itself. If the jet is resolved by the VLBA, this observation would be the first data point in a search for component motion. If the jet is not resolved, the incredibly compact nature of the relativistic outflow indicates a severe kinematical environment.

3. GRS 1915+105 as a Laboratory for Studying Black Hole Driven Jets

I am currently embarked on a research program to study the Galactic black hole jet in GRS 1915+105. There is much confusion in this field because it is led by scientist not familiar with the history of astrophysical jets or the theory of black holes. There are two large projects that were developed to understand the relationship of the energy output to the state of the accretion flow when the jets are launched. The first paper was published early this year, Punsly and Rodriguez (2013),

with collaborator Jerome Rodriguez of Laboratoire AIM, CEA/DSM-CNRS-Universit\'{e} Paris Diderot, IRFU SAp, F-91191 Gif-sur-Yvette, France.

ABSTRACT from The Relationship Between X-ray Luminosity and Major Flare Launching in GRS~1915+105:

We perform the most detailed analysis to date of the X-ray state of the Galactic black hole candidate GRS~1915+105 just prior to (0 to 4 hours) and during the brief (1 to 7 hour) ejection of major (superluminal) radio flares. A very strong model independent correlation is found between the 1.2 keV - 12 keV X-ray flux 0 to 4 hours before flare ejections with the peak optically thin 2.3 GHz emission of the flares. This suggests a direct physical connection between the energy in the ejection and the luminosity of the accretion flow preceding the ejection. In order to quantify this concept, we develop techniques to estimate the intrinsic (unabsorbed) X-ray luminosity, $L_{intrinsic}$, from RXTE ASM data and to implement known methods to estimate the time averaged power required to launch the radio emitting plasmoids, Q (sometimes called jet power). We find that the distribution of intrinsic luminosity from 1.2 keV - 50 keV, $L_{intrinsic}$ (1.2 - 50), is systematically elevated just before ejections compared to arbitrary times when there are no major ejections. The estimated Q is strongly correlated with $L_{intrinsic}$ (1.2 - 50), 0 to 4 hours before the ejection, the increase in $L_{intrinsic}$ (1.2 - 50), in the hours preceding the ejection and the time averaged $L_{intrinsic}$ (1.2 - 50), during the flare rise. Furthermore, the total time averaged power during the ejection (Q + the time average of $L_{intrinsic}$ (1.2 - 50), during ejection) is strongly correlated with $L_{intrinsic}$ (1.2 - 50), just before launch with near equality if the distance to the source is ≈ 10 kpc.

The second paper accepted in ApJ this year looks at the results above in the context of quasars and 3-D numerical simulations of black holes.

ABSTRACT FROM: GRS 1915+105 as a Galactic Analog of a Fanaroff-Riley II Quasar

We study the long term time averaged kinetic luminosity, Q, of the major flares of the Galactic microquasar GRS 1915+105 and the relationship to the intrinsic X-ray (bolometric) luminosity, L_{bol}, and scale it to that of a complete sample of SDSS/FIRST FR II quasars. If the scale invariance hypothesis for black holes (BHs) holds then we show that the expected distribution in the Q - L_{bol} scatter plane of GRS 1915+105 is consistent with FR II quasars for distances D = 10.7 - 11 kpc. We compare the specific values of kinetic luminosity and L_{bol} during flares of GRS 1915+105 to that predicted by several 3-D MHD simulations of BH accretion flows with relativistic ejections. If FR II quasars are a scaled up version of GRS 1915+105, the data are consistent with numerical models when they contain an ergospheric disk jet and the BH spin is a/M= 0.99 or a/M=0.998 (we estimate a/M > 0.984). In the framework of scale invariance of BHs, our results may imply that FR II quasars also hold rapidly rotating BHs.

2013 List of Publication

Punsly, Brian; Multi-Epoch Observations of the Redwing Excess in the Spectrum of 3C279 2013 ApJ Letters 762 25

Punsly, B. and Rodriguez, J. The Relationship Between X-ray Luminosity and Major Flare Launching in GRS~1915+105 2013 ApJ 764 173

Punsly, B. and Rodriguez, J. GRS 1915+105 as a Galactic Analog of a Fanaroff-Riley II Quasar ApJ in Press

Quevedo, Hernando

Position: Full Profesor (Universidad Nacional Autónoma de México)

Adjunct Professor (ICRANet)

Period covered: December 2012 – May 2013

I. Scientific Work

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

Visit to ICRA-CBPF (Rio de Janeiro, Brazil, November 3, 2012 – May 2, 2013)

VI Workshop Anual do Instituto de Cosmologia Relatividade e Astrofísica ICRA-CBPF

"Geometrothermodynamics in Relativistic Cosmology" (Rio de Janeiro, Brazil December 5 – 7, 2012)

- Geometrothermodynamics: A brief introduction (Lecture – ICRA-CBPF)

- Thermodynamic evolution of matter and dark energy (Lecture – UERJ)

II b. Work With Students

ICRANet students:

II c. Diploma thesis supervision

ICRANet students:

- Alessandro Bravetti (PhD)

    Topic: Mathematical structure of geometrothermodynamics

UNAM students:

- 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

- Ana Lucía Baéz Camargo Aguilar (BSc)

  Topic: Topological defects in Geometrothermodynamics

II d. 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

- Dr. Orlando Luongo (UNAM)

  Topic: Applications of geometrothermodynamics in cosmology

- Dr. Daniela Pugliese (Queen Mary College)

  Topic: Motion of test particles in the Kerr-Newman spacetime

Publications December, 2012 – May, 2013

" and constraints on the equation of state of the Universe in various parametrizations"

(Aviles, Alejandro; Gruber, Christine; Luongo, Orlando; Quevedo, Hernando) Physical Review D 86, 123516 (2012)

"Conformastatic disk-haloes in Einstein-Maxwell gravity" (A. Gutierrez, G. Gonzalez, and H. Quevedo), Physical Review D 87 044010 (2013).

"The conformal metric structure of Geometrothermodynamics" (A. Bravetti, C.S. Lopez-Monsalvo, F. Nettel and H. Quevedo) Journal of Mathematical Physics 54 033513 (2013).

"Geometrothermodynamics of higher dimensional black holes" (A. Bravetti, D. Momeni, R. Myrzakulov, and H. Quevedo), General Relativity and Gravitation (2013) in press; arXiv: 1211.7134

"Cosmological implications of Geometrothermodynamics" (O. Luongo and H. Quevedo) in Proceedings of the XIII Marcel Grossmann Meeting on General Relativity and Gravitation (2013) in press; arXiv:1302.4866

"Constraints from Cosmography in various parametrizations"(A. Aviles, C. Gruber, O. Luongo, and H. Quevedo) in Proceedings of the XIII Marcel Grossmann Meeting on General Relativity and Gravitation (2013) in press; arXiv:1301.4044

"Geometric description of chemical reactions" (H. Quevedo and D. Tapias) submitted to Journal of Mathematical Chemistry (2013); arXiv: 1301.0262

"On the ensemble dependence in black hole geometrothermodynamics" (H. Quevedo, A. Sanchez and S. Taj), submitted to Physica A (2013); arXiv:1304.3954

"Classification of the charged test particle circular orbits in Reissner—Nordström spacetime" (D. Pugliese, H. Quevedo and R. Ruffini) submitted to Classical and Quantum Gravity (2013): arXiv:1304.2940

"Neutral test particle orbits in the Kerr—Newman spacetime" (D. Pugliese, H. Quevedo and R. Ruffini) submitted to Physical Review D (2013): arXiv:1303.6250

"Cosmographic study of the universe's specific heat: A landscape for Cosmology?" (O. Luongo and H. Quevedo) submitted to Astrophysics and Space Science (2013); arXiv:1211:0626

"Representation invariant Geometrothermodynamics: applications to ordinary thermodynamic systems" (H. Quevedo, F. Nettel, C.S. Lopez-Monsalvo and A. Bravetti) submitted to Journal of Geometry and Physics (2013); arXiv:1303.1428

"Power Series Solutions to Non-Linear Partial Differential Equations of Mathematical Physics" (E. López Sandoval, A. Mello, G. O. López Riquelme, J. J. Godina-Nava, H. Quevedo) submitted to Communications in Non-Linear Science and Numerical Simulation (2013)

"On charged boson stars¨ (D. Pugliese, H. Quevedo, J. Rueda and R. Ruffini) submitted to Physical Review D (2013)

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 Matter
b) Quantum Vacuum State in Strong Fields and Particle Production
c) 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
Lecture Series 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

Discussions With Faculty and Associates on
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: $200<T<2MeV$,*'' 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 ΛCDM 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 :://www.wfxt.eu).

II Conferences and educational activities

II a Conferences and Other External Scientific Work

- *"First results from CLASH: calibrating cluster masses"* - Invited Talk presented at "Clusters as Cosmological probes", Ringberg Castle (Germany), Nov 20, 201
- *"Present and Future Surveys of Galaxy Clusters"* - Invited Review presented at "X-ray Astronomy: Towards the Next 50 years", Milano (Italy), Oct 1-6, 2012
- *"High-z Lensed Galaxies from CLASH"* - Invited Talk 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"* - Invited Talk presented at "Annual Danish Astrophysics Meeting 2012", Island of Hven, May 30-31, 2012
- *"Testing the ΛCDM scenario with galaxy clusters across cosmic time"* JHU Colloquium 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 ΛCDM" 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)

<u>2012 List of Publication</u> (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 ∼ 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 ∼ 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 ∼ 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

Rosquist, Kjell

Position: professor

Period covered: 2012-2013

I Scientific Work

    (a) Relativistic cosmology

Ongoing project on discrete cosmology involving Erasmus Mundus Ph D student D. Gregoris at Stockholm University and collaborators at Queen Mary University of London.

    (b) Peculiar velocities in cosmology

Project with master student M. Ahrens at Stockholm University.

    (c) Friction forces in relativity

In this project, relativistic effects of friction are considered with applications to particle motion and cosmology. Collaborators include ICRANet associate D. Bini, Erasmus Mundus Ph D student D. Gregoris and master student M. Ahrens at Stockholm University.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

Chairman of the local organizing committee for the MG13 conference in Stockholm in July 2013.

Visits for research collaboration at the Albert Einstein Institute, Potsdam, and Queen Mary University of London.

II b Work With Students

Master thesis supervision of M. Ahrens and H. Engström

Member of master thesis committee.

II c Diploma thesis supervision

II d Other Teaching Duties

Ph D supervision of D. Gregoris, S. Iyyani, I. Galstyan

II e. Work With Postdocs

III. Service activities

III a. Within ICRANet

Selection meeting for the new students Erasmus Mundus students 2013

III b. Outside ICRANet

See II above.

2013 List of Publication

Effects of friction forces on the motion of objects in smoothly matched interior/exterior spacetimes, Bini et al.,

Class. Quantum Grav. **30** (2013) 025009

Time resolved observations of the jet photosphere, Iyyani et al., Mon.Not.R.Astron.Soc. (2013), (in press)

Titarchuk Lev

Position: Professor of University of Ferrara, Italy
Period covered: 1st of December 2012 to 1st of December 2013

I Scientific Work

X-ray radiation from Black Hole, Neutron star sources and Gamma-ray Bursters

II Conferences and educational activities

II a Conferences and Other External Scientific Work
Conference in Nice, France in May 2013 with the participation of IRAP students too.

II b Work With Students

As professor of University of Ferrara, Italy.

II c Diploma thesis supervision

Simone Giacche, student of University of Ferrara. I was his adviser on the master thesis where Simone studied X-ray emergent spectra of AGN. On the results of these studies Simone submitted a paper to Astronomy & Astrophysics. This his paper was accepted there (see below).

II d Other Teaching Duties

I gave lectures on the courses of Mathematical Physics and High Energy Astrophysics in University of Ferrara and for IRAP students.

II e. Work With Postdocs

Chiara Ceccobello, graduate student of University of Ferrara. She defended her Doctor thesis in March 2013.

Tais Michiele Maiolino, graduate student of IRAP, first year. I have started to formulate the topic of the thesis for her.

III. Service activities

III a. Within ICRANet

I gave talks for ICRANet and IRAP students, in May (Nice) and in October (Rome).

I have also been a member of PhD thesis defence by the IRAP student, Alberto Benedetti (in November, 2013)

III b. Outside ICRANet

IV. Other

2013 List of Publication

1. 2012, Seifina, Elena; Titarchuk, Lev; `` GX 3+1: The Stability of Spectral Index as a Function of Mass Accretion Rate'' ApJ, 747, 99

2. 2012, Titarchuk, Lev; Farinelli, Ruben; Frontera, Filippo; Amati, Lorenzo; ``An Upscattering Spectral Formation Model for the Prompt Emission of Gamma-Ray Bursts'', ApJ, 752, 116

3. 2013, Seifina, Elena; Titarchuk, Lev; Frontera, Filippo; ``Stability of the Photon Indices in Z-source GX 340+0 for Spectral States'', ApJ, 766, 63

4. 2013, Titarchuk, Lev; Seifina, Elena; Frontera, Filippo; `` Spectral State Evolution of 4U 1820-30'', ApJ, 767, 160

5. 2013, Giacche`, S.; Gilli, R.; Titarchuk, L., ``Analysis of X-ray spectral variability and black hole mass determination of the NLS1 galaxy Mrk 766'', accepted for the publication in Astronomy & Astrophysics. .1376G

6. 2013, Frontera, Filippo; Amati, Lorenzo; Farinelli, Ruben; Dichiara, Simone; Guidorzi, Cristiano; Landi, Raffaella; Titarchuk, Lev; ``Comptonization signatures in the prompt emission of Gamma Ray Bursts'', accepted for the publication in ApJ, .1998F

Aksenov Alexey

Position: Senior scientific staff member

Dep. of Comp. Methods, Information and Management

Institute for Computer-Aided Design, RAS,

Moscow

<u>Scientific Work</u>

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.

<u>II Conferences and educational activities</u>

2013: The 2013 yearly ICRANet Scientific Meeting on Relativistic Astrophysics http://www.icranet.org/index.php?option=com_content&task=view&id=720

<u>III Service activities</u>

2013 Visitor at Icranet 1.5 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

<u>2013 List of Publications</u>
Aksenov, A. G.; Chechetkin, V. M. Gravitational radiation during coalescence of neutron stars // Astron. Rep. 2013, Volume 57, Issue 7, pp.498-508

Aksenov, A. G.; Ruffini, R.; Vereshchagin, G. V. Comptonization of photons near the photosphere of relativistic outflows // Monthly Notices of the Royal Astronomical Society: Letters 2013; doi: 10.1093/mnrasl/slt112

Alekseev George A.

Position: Leading researcher,

Steklov Mathematical Institute
of the Russian Academy of Sciences
Moscow, Russia

Period covered: 1975 – present time

<u>I Scientific Work</u>

Development of the theory of integrable reductions of Einstein's field equations and its applications in General Relativity and other gravity, string gravity and supergravity models in four and higher dimensions. Construction of physically interesting solutions for stationary axisymmetric fields, interacting gravitational and electromagnetic waves or cosmological models and studies of their physical and geometrical properties.

This work includes, in particular, 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 the studies of equilibrium configurations of the fields of two massive charged rotating sources of the Kerr-Newman type.

<u>II Conferences and educational activities</u>
II a Conferences and Other External Scientific Work

❖ 2013 yearly ICRANet Scientific Meeting on Relativistic Astrophysics
on the Occasion of the 50th Anniversary of the Kerr solution of the Einstein's equations (June 3-17, 2013 – ICRANet – Rome and Pescara)

Talk-1: G.A.Alekseev, "Kerr and Kerr-Newman black holes in Mathematical General Relativity:
I.   *Black holes in the context of perturbation theory''* (1 hour)

Talk-2: G.A.Alekseev, "Kerr and Kerr-Newman black holes in Mathematical General Relativity:
II.   *Black holes in the context of solution generating methods''* (1 hour)

<u>Abstract</u> A large variety of discoveries in the modern gravitational theory where made due to a knowledge of exact black hole solutions -- Schwarzschild and Reissner-Nordstr\"om solutions at first and then, about 50 year later, of Kerr, Kerr-NUT and Kerr-Newman solutions. During the next 50 years which passed now from the R.Kerr's discovery of the rotating black hole solution different branches of ``mathematical theory'' of black holes had been developed:
a) various geometrical features of an isolated black hole space-times (existence and structure of horizons, ergospheres and singularities, the complete analytical extensions and structure of geodesics) as well as the dynamics of particles and fields on these backgrounds had been studied;
b) developed perturbation theory allowed to study (in the linear approximation, at least) the backward influence of particle and field dynamics on the black hole background, to prove the uniqueness of Kerr and

Kerr-Newman solutions, to formulate the laws of black hole thermodynamics, to analyse numerous aspects of radiation and propagation of fields in these space-times;

c) application of powerful ideas of the modern theory of integrable nonlinear systems to Einstein and Einstein - Maxwell equations gave rise to discoveries of various solution generating methods which allow to construct the exact solutions for Schwarzschild, Reissner-Nordstrom, Kerr and Kerr-Newman black holes interacting with various external fields and to analyze (though for very idealized models, but in exact, non-perturbative form) the character of this interactions in the arbitrary strong field regimes.

In the present communication, we concentrate on the last two of the above points and describe the soliton nature of Kerr and Kerr-Newman black holes discovered in the framework of inverse scattering approach to vacuum and electrovacuum fields (Belinski and Zakharov - 1978 and GA-1980 respectively). As a new example, an exact electrovacuum solution which describes a charged black hole immersed into the external asymptotically homogeneous electric field -- the Bertotti-Robinson universe which possess a non-trivial space-time topology ($AdS_2\times S_2$) will be presented and the most interesting properties of this solution will be described.

- ❖ 20th International Conference on General Relativity and Gravitation (GR20) (June 7 – 13 July 2013, Uniwersytet Warszawski)

  A1: Exact solutions and their interpretation

G.A.Alekseev, "Dynamics of Black Holes in AdS2 x S2 space-times   (Bertotti-Robinson Universes)''
              (15 min)

Abstract   Using the monodromy transform approach and corresponding linear singular integral equation form of the symmetry reduced Einstein - Maxwell equations, we construct in a very simple form the exact solutions of these equations which describe
 (a) Schwarzschild black hole at static position in Bertotti-Robinson magnetic universe;
 (b) Schwarzschild black hole in arbitrary \geodesic" motion along the magnetic field in the
     Bertotti-Robinson pure magnetic universe;
 (c) Reissner-Nordstrom black hole accelerated by the electric field of the Bertotti-Robinson pure
     electric universe.
In each of these cases, we have in an explicit form a picture of a nonlinear interaction of gravitational and electromagnetic fields of a black hole with those of the Bertotti-Robinson universe which are (in the absence of a black hole) static and spatially homogeneous. In all cases, the character of motion (and in particular, the acceleration) of a black hole is determined by the condition of absence of conical singularities on both parts of the axis of symmetry outside the horizon. This condition imposed on the parameters of the solution relates the acceleration of a black hole with the values of its charge and of the external electric field (the analogue of the Lorenz force). Various physical and geometrical properties of these solutions are described.

       D2: Strings, branes and M-theory

 G.A.Alekseev, "Monodromy transform and integral equation method for solving symmetry reduced string
              gravity and supergravity equations'' (15 min)

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>= 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 arbitrary coordinate-independent holomorphic (d x d)-

and (d x n)- matrix functions $u_{\pm}(w)$ and $v_{\pm}(w)$ of the spectral parameter 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 rational and analytically matched ($u_+=u_-$ and $v_+=v_-$) 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>= 4 dimensions.

<u>Visits:</u>

1. IHES (Paris, France):   17.04.2013 – 28.04.2013

2. ICRA (Pescara, Italy):   6.06.2013-19.06.2013

3. GR20 (Uniwersytet Warszawski Warszawa, Poland) 7.07.2012 – 13.07.2013

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

<u>III. Service activities</u>

III a. Within ICRANet

III b. Outside ICRANet

<u>IV. Other</u>

<u>2013 List of Publications</u>

❖ G.A.Alekseev, ``Monodromy transform and the integral equation method for solving the string gravity and supergravity equations in four and higher dimensions'',
Phys. Rev. D 88, 021503(R) (2013) [6 pages]
(This recently published paper is a slightly modified version of the preprint reported in 2012 year: arXiv:1205.6238v1 [hep-th])

<u>Abstract</u> 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 $d=D-2$ commuting 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 \cal{arbitrary} coordinate-independent holomorphic $d\times d$- and $d\times n$- matrix functions $\{\mathbf{u}_\pm(w),\, \mathbf{v}_\pm(w)\}$ 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 \emph{rational} and \emph{analytically matched} (i.e. $\mathbf{u}_+(w)\equiv\mathbf{u}_-(w)$ and $\mathbf{v}_+(w)\equiv\mathbf{v}_-(w)$) 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.

❖ G.A.Alekseev, ``Influence of Electromagnetic Fields on the Evolution of Initially Homogeneous and Isotropic Universe'', Proceedings of the Steklov Institute of Mathematics, vol. 281, issue 2 of 4, pp. 129 -- 139, (2013). ISSN 0081-5438; arXiv:1302.3338 [astro-ph.CO]

Abstract Simple exact solutions presented here describe the universes which spatial geometries are homogeneous and isotropic near the initial singularity, but which evolution goes under the influence of primordial magnetic fields. In all these ``deformed'' Friedmann models (spatially flat, open or closed), the initial magnetic fields are concentrated near some axis of symmetry and their lines are the circles -- the lines of azimuthal coordinate φ. Caused by the expansion of the universe, the time-dependence of a magnetic field induces (in accordance with the Faraday law) the emergence of source-free electric fields. In comparison with the standard Friedmann models, the cosmological expansion goes with acceleration in spatial directions across the magnetic field, and with deceleration along the magnetic lines, so that in flat and open models, in fluid comoving coordinates, the lengths of φ-circles of large enough radius or for late enough times decrease and vanish for $t\to\infty$. This means that in flat and open models, we have a partial dynamical closure of space-time at large distances from the axis, i.e. from the regions where the electromagnetic fields in our solutions are concentrated. To get simple exact solutions of the Einstein-Maxwell and perfect fluid equations, we assume for the perfect fluid (which supports the isotropic and homogeneous ``background'' Friedmann geome\-tries) rather exotic, stiff matter equation of state $\varepsilon=p$. However, it seems reasonable to expect that similar effects might take place in the mutual dynamics of geometry and strong electro\-magnetic fields in the universes with more realistic matter equations of state.

Bini Donato

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

<u>I Scientific Work</u>
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 MAPLE™ tensor calculus package.

<u>II Conferences and educational activities</u>
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 several 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.," year 2011.
Dr. M. Haney, IRAP Ph.D, University of Rome "Sapienza," year 2013

Teaching experiences
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."

<u>III Service activities</u>
Scientific collaboration with:
Prof. R. Ruffini (University of Rome, Italy and ICRANet);
Prof. R.T. Jantzen (Villanova Univesity, USA and ICRANet);

Outside ICRANet

Scientific collaboration with:
Dr. G. Esposito (INFN, Naples, Italy)
Prof. F. de Felice (University of Padova, Italy);
Dr. A. Ortolan (INFN Legnaro, Padova, Italy);
Prof. O. Semerak (University of Prague, Czech Republic);
Prof. T. Damour (IHES, Paris, France).

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*

2013 List of publications

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., vol. 30, 025009, 2013.

2) 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, vol. 30, 045009, 2013

3) Bini D., Geralico A.
Dynamics of quadrupolar bodies in a Schwarzschild spacetime
Phys. Rev. D, vol. 87, 024028, 2013.

4) Bini D., Geralico A., Gregoris D., Succi S.
Friction forces in cosmological models
EPJC, vol. 73, 2334, 2013

5) Bini D., Fortini P., Geralico A., Haney M. and Ortolan A.
Light scattering by radiation fields: the optical medium analogy
EPL, vol 102, 20006 , 2013

6) Bini D., Esposito G., Kiefer C., Kramer M. and Pessina F.,
On the Modification of the Cosmic Microwave Background Anisotropy Spectrum from
Canonical Quantum Gravity
Phys. Rev. D, vol. 87, 104008, 2013

7) 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).
Nuovo Cimento C, Vol. 36, Issue S01, 2013

8) Bini D., Geralico A.
 On the occurrence of Closed Timelike Curves and the observer's point of view

Proceedings of the meeting " The Time-Machine Factory", October 14-19, 2012, Torino (Italy)
[Invited speaker].
EPJ Web of Conferences {\bf 58}, 01002, (2013)
DOI: 10.1051/epjconf/20135801002
Published by EDP Sciences, 2013.

9) Bini D., de Felice F., Geralico A.
On the spacetime acting as an optical medium: the observer-dependent approach
to appear on IJGMMP, 2013.

10) Bini D., Geralico A., Gregoris D, Succi S.
Dark energy from cosmological fluids obeying a Shan-Chen nonideal equation of state
Phys. Rev. D., vol. 88, 063007, 2013

11) Bini D. Geralico A., Haney M.
Refraction index analysis of light propagation in a colliding gravitational wave spacetime
to appear on Gen. Rel. Grav., 2013.

12) Bini D., Damour T.
Analytic determination of the two-body gravitational interaction potential at the 4th
post-Newtonian approximation
Phys. Rev. D. Rapid Communications, vol. 87, 121501, 2013.
[arXiv:1305.4884]

Filippi Simonetta

Position: **Associate Professor** (permanent) in Theoretical Physics (FIS/02).

Integrated Center for Research and ICRA

Vice-Dean, Faculty of Engineering,

University "Campus Bio-Medico",

Via A. del Portillo 21, I-00128 Rome, Italy,

Tel. +39-06-225419611

Email: .filippi@unicampus.it

Professional Experiences

[2003-today] Associate Professor in Theoretical Physics, University Campus Bio-Medico of Rome.

[2010] Visiting Professor, Biosciences Department, Cornell University, USA

[1999-2003] Researcher in Physics University Campus Bio-Medico of Rome, Italy.

[1996-99] Expert on Theoretical Physics Department of Physics, University of Rome "La Sapienza,".

[1993-99] Assistant Professor of Physics University Campus Biomedico of Rome, Italy.

[1993-96] Project Leader ASI grant.

[1993-96] Research Leader ICRA Project on "Structure and Morphology of galaxies," (CEE grant).

[1990-93] Research Assistant Department of Physics, University "La Sapienza," Rome.

[1990] Visiting Researcher Harvard-Smithsonian Center for Astrophysics (Harvard University-Boston),University of Chicago

[1987-90] Researcher ICRA: International Center for Relativistic Astrophysics, Rome.

[1985-86] High-school professor, Liceo Classico, Naples.

[1984-86] Research Fellow Astronomical Observatory of Capodimonte (Naples).

[1983-84] Assistant Professor of Physics Department of Mathematics, Catholic University, Brescia, Italy.

ICRANet activities 2012/2013

Prof. Filippi is working with the IRAP PhD student Federico Cipolletta on numerical methods for obtaining rotating and self-gravitating classical fluids equilibrium configurations.

Other ICRANet activities

Prof. Filippi has a longstanding collaboration with other ICRANet scientists. In particular in collaboration with Prof. Remo Ruffini she has written plenty articles on various aspects of Gravitational Physics. With Dr Christian Cherubini, Dr Andrea Geralico and Dr Donato Bini she is involved in research activities in the fields of Stellar and Galactic Structures, Effective Geometries and Complex Systems in Nature.

Service activities

-Participation to the Faculty of the INTERNATIONAL RELATIVISTIC ASTROPHYSICS PH.D.

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

Participation to Conferences

-XXIII Dynamics Days Europe, Madrid, (SPAIN) 2013

-V International Symposium on Modeling of Physiological Flows, Chia (ITALY)   2013

-VIII European Solid Mechanics Conference, EUROMECH, Paris (FRANCE) 2012.

-VPH Institute Conference, London (UK). 2012

-XIII Marcel Grossmann Meeting, Stockholm (SWEDEN) 2011

-IV International Symposium on Modeling of Physiological Flows, Chia (ITALY) 2010

-Cardiac MEF and Arrhythmias Conference, Oxford (UK) 2010.

- Joint SIAM/RSME-SCM-SEMA Meeting Emerging Topics in Dynamical Systems and Partial Differential Equations DSPDEs'10 May 31st, – June 4th, 2010, Barcelona, Spain 2010

- 12th Marcel Grossman Meeting, Paris 2009.

- Cardiac MEF and Arrhythmias Conference, Oxford, UK 2007.

- 10th Italian-Korean Symposium on Relativistic Astrophysics in Pescara, Italy, 2007.

- Cardiac Dynamics Kavli Institute for Theoretical Physics, University of Santa Barbara,   California, 2006.

- Bego scientific Rencontres, Nice, France 2006.

- COMSOL Users Conference, Milan, Italy 2006.

-COMSOL Italian Multiphysics Meeting, Milan Italy, 2005.

- Russian-Italian Lifshitz-Zeldovich Meeting on Relativistic Astrophysics, Pescara, Italy,   2005.

- Vip guest at Stanford University for the Gravity Probe B launch mission.2004.

- YALE Cosmology Workshop on "The shapes of galaxies and their halos", communication: "A General Theory of self-gravitating Systems: Shapes of Astronomical Objects", 2001.

- Member of Scientific Organizing Committee "Fermi and Astrophysics", 2001.

-"Ninth Marcel Grossmann Meeting" University of Rome "La Sapienza", communications: "Equilibrium Solutions for Self-Gravitating Polytropic Systems"

- "Functional Method to solving the Euler Equation for Self-Gravitating Systems", 2000.

- International Meeting on Normal galaxies at high and low red-shift. Structure, Dynamics and Evolutions, Accademia Nazionale dei Lincei (Rome, Italy) , communication: "Inhomogeneous self-gravitating, rotating toroidal sequences," 1997.

-"Eighth Marcel Grossmann Meeting" (Hebrew University, Jerusalem, Israel), communications: "Landau damping of fermions perturbations in an expanding universe," "Toroidal solutions to the problem of inhomogeneous rotating gravitational systems," 1997.

-"Italian - Korean meeting on relativistic astrophysics," (Italy), invited talk: "The n-th order Virial Theory," 1995.

-"Seventh Marcel Grossmann Meeting," Stanford University (USA), communication: "The Landau damping in semi-degenerate gravitating systems," 1994.

-International Meeting on Structures in Early-Type Galaxies, Accademia Nazionale dei Lincei (Rome, Italy), communication: "Landau damping in galactic systems," 1992.

-International Meeting on Dynamics of Elliptical Galaxies, Accademia Nazionale dei Lincei (Rome, Italy) , communication: "Relations between observed quantities and parameters of galactic models," 1991.

-"Sixth Marcel Grossmann Meeting," (Kyoto, Japan) communication on "Dynamical Equilibrium and Stability of Rotating Masses," 1991.

-International Meeting on Dynamics of Galaxies, Accademia Nazionale dei Lincei (Rome, Italy) , communication: "Nonlinear Velocities in Ellipsoidal Figures of equilibrium," 1990.

-International Meeting on Dynamics of Galaxies, Accademia Nazionale dei Lincei (Rome, Italy) , communication: "Observable properties of generalized Riemann ellipsoids and their application to elliptical galaxies", 1989.

-"Italian - Soviet Symposium on Cosmology and Relativistic Astrophysics" (Estonia), invited talk: "Generalized Riemann ellipsoids," 1989.

-"Italian - Korean meeting on relativistic astrophysics", (Rome, Italy), invited talk: "Non-linear Dedekind-Riemann sequences," 1989.

-International Meeting on Internal Dynamics of Galaxies, Accademia Nazionale dei Lincei (Rome,Italy), invited talk: "New class of rotating, anisotropic and inhomogeneous models of elliptical galaxies based on the tensor virial theorem," 1988.

-"Fifth Marcel Grossmann Meeting," Perth (Australia), communication on "Equilibrium of triaxial selfgravitating ellipsoid with rotation and anisotropic pressure," 1988

-Equatorial School of Relativistic Astrophysics, CIF (Centro Internacional de Fisica), Bogotà (Colombia), communication on "Processes of clustering in Friedmann cosmology", 1984.

-Varenna Physics School on "Gamow Cosmology": communication on "The Capture of Particles in an Einstein- Straus Universe", 1982.

MEMBERSHIP

American Physical Society (APS).
Gruppo Nazionale per la Fisica Matematica (GNFM, INdAM)

Society for Industrial and Applied Mathematics (SIAM).

Societa' Italiana di Fisica (SIF).
Comitato Nazionale per l'Anno Internazionale della Fisica 2005.

Scientific Work

- Astrophysics of self-gravitating fluids.
- Cosmology.
- Numerical Relativity.
- Fluid dynamics
- Theoretical biophysics.

Educational activities

2012/13   Lecturer "Mechanics and Thermodynamics" (Engineering Faculty,

    University Campus Bio-Medico of Rome).

2012/13 Lecturer "Complex Systems Dynamics" (Engineering Faculty,

    University Campus Bio-Medico of Rome).

List of Publications 2013

1) Portuesi R, Cherubini C, Gizzi A, Buzzetti R, Pozzilli P, Filippi S (2013). A stochastic mathematical model to study the autoimmune progression towards type 1 diabetes. DIABETES/METABOLISM RESEARCH AND REVIEWS, vol. 29, p. 194-203, ISSN: 1520-7552, doi: DOI: 10.1002/dmrr.238

2) Cherubini C, Filippi S (2013). An Analog of Einstein's General Relativity Emerging from Classical Finite Elasticity Theory: Analytical and Computational Issues. COMMUNICATIONS IN COMPUTATIONAL PHYSICS, vol. 14, p. 801-818, ISSN: 1991-7120, doi: doi: 10.4208/cicp.200712.301112a

3) Cherubini C, Filippi S (2013). Classical field theory of the Von Mises equation for irrotational polytropic inviscid fluids. JOURNAL OF PHYSICS. A, MATHEMATICAL AND THEORETICAL, vol. 46, p. 115501-1-115501-13, ISSN: 1751-8113, doi: doi:10.1088/1751-8113/46/11/115501

4)   Fenton F H, Gizzi A, Cherubini C, Pomella N and Filippi S (2013). Role of temperature on nonlinear cardiac dynamics. PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS, vol. 87, p. 042717-1-042717-11, ISSN: 1539-3755, doi: 10.1103/PhysRevE.87.042717

5) A. Gizzi, E.M. Cherry, R.F. Gilmour Jr, Luther S. and Filippi S. (2013) Effects of pacing site and stimulation history on alternans dynamics and the development of complex spatiotemporal patterns in cardiac tissue. FRONT. PHYSIOL. 4, p.1-20, doi:10.3389/fphys.2013.00071.

6) R. Portuesi, P. Pozzilli, B. Boehm, R. Buzzetti, S. Filippi, (2013) Assessment of Type 1 Diabetes Risk Conferred by HLA-DRB1, INS-VNTR and PTPN22 Genes Using the Bayesian Network Approach, vol 8. p.1-7 doi:10.1371/journal.pone.0079506

Perez Bergliaffa Santiago Esteban

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

<u>I Scientific Work</u>

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

<u>II Conferences and educational activities</u>

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.

<u>III Service activities</u>

Outside ICRANet

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

<u>IV Other</u>

Reviewer of Classical and Quantum Gravity.

Reviewer of International Journal of Theoretical Physics.

Reviewer of Physical Review D.

Wiltshire David L.

Position: Professor, Department of Physics & Astronomy,
                 University of Canterbury, Christchurch, New
                 Zealand

Period covered: 29 July 2008 – 30 October 2008

2013 List of Publications

J.A.G. Duley, M.A. Nazer, and D.L. Wiltshire,

" Timescape cosmology with radiation fluid",

Class. Quantum Grav. 30 (2013) 175006 (18pp).

D.L. Wiltshire, P.R. Smale, T. Mattsson, and R. Watkins,

"Hubble flow variance and the cosmic rest frame",

Physical Review D 88 (2013) 083529 (37pp).

D.L. Wiltshire,

"Cosmic structure, averaging and dark energy",

in S. Perez Bergliaffa and M. Novello (eds), *Proceedings of the 15th Brazilian School on Cosmology and Gravitation,* (CUP, 2013)

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.

Cherubini Christian

Position**:** <u>University Researcher</u> (permanent) in Theoretical Physics (FIS/02).

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

    Engineering faculty,

    University "Campus Bio-Medico",

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

Period covered: November 1st 2007-today

I Scientific Work

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

II Conferences and educational activities

Courses

2012/13   Lecturer "Physics" (Alimentation and Human Nutrition Sciences, Medicine

    Faculty, University Campus Bio-Medico of Rome).

2012/13   Lecturer "Mathematical Physics Models for Engineering" (Engineering Faculty,

    University Campus Bio-Medico of Rome).

-At the moment Dr Cherubini is working with the IRAP PhD student Federico Cipolletta on numerical methods for obtaining rotating and self-gravitating classical fluids equilibrium configurations.

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.

Other

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.

<u>2013 List of Publications</u>

1) Portuesi R, Cherubini C, Gizzi A, Buzzetti R, Pozzilli P, Filippi S (2013). A stochastic mathematical model to study the autoimmune progression towards type 1 diabetes. DIABETES/METABOLISM RESEARCH AND REVIEWS, vol. 29, p. 194-203, ISSN: 1520-7552, doi: DOI: 10.1002/dmrr.238

2) Cherubini C, Filippi S (2013). An Analog of Einstein's General Relativity Emerging from Classical Finite Elasticity Theory: Analytical and Computational Issues. COMMUNICATIONS IN COMPUTATIONAL PHYSICS, vol. 14, p. 801-818, ISSN: 1991-7120, doi: doi: 10.4208/cicp.200712.301112a

3) Cherubini C, Filippi S (2013). Classical field theory of the Von Mises equation for irrotational polytropic inviscid fluids. JOURNAL OF PHYSICS. A, MATHEMATICAL AND THEORETICAL, vol. 46, p. 115501-1-115501-13, ISSN: 1751-8113, doi: doi:10.1088/1751-8113/46/11/115501

4) Fenton F H, Gizzi A, Cherubini C, Pomella N and Filippi S (2013). Role of temperature on nonlinear cardiac dynamics. PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS, vol. 87, p. 042717-1-042717-11, ISSN: 1539-3755, doi: 10.1103/PhysRevE.87.042717

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

II b Work With Students

Daniele Gregoris and Maria Haney (IRAP Ph. D. students)

2013   List of publications

1)   D. Bini, M. Crosta, F. de Felice, A. Geralico, A. Vecchiato,
The Erez-Rosen metric and the role of the quadrupole on light propagation,
Classical and Quantum Gravity, vol. 30, 045009, 2013

2)   Bini D., Geralico A.,
Dynamics of quadrupolar bodies in a Schwarzschild spacetime,
Phys. Rev. D, vol. 87, 024028, 2013.

3)   Bini D., Geralico A., Gregoris D., Succi S.,
Friction forces in cosmological models,
EPJC, vol. 73, 2334, 2013

4)   Bini D., Fortini P., Geralico A., Haney M. and Ortolan A.,
Light scattering by radiation fields: the optical medium analogy,
EPL, vol 102, 20006 , 2013

5)   Bini D., de Felice F., Geralico A.
Observer-dependent optical properties of stationary axisymmetric spacetimes,
IJGMMP, vol. 11, 1450024, 2014 (to appear).

6)   Bini D., Geralico A., Gregoris D, Succi S.,
Dark energy from cosmological fluids obeying a Shan-Chen nonideal equation of state,
Phys. Rev. D., vol. 88, 063007, 2013.

7)   Bini D., Geralico A., Haney M.,
Refraction index analysis of light propagation in a colliding gravitational wave spacetime,
Gen. Rel. Grav., 2014 (to appear).

8)   Bini D., Geralico A.,
Scattering of spinning bodies by a radiation field in Schwarzschild spacetime,
Il Nuovo Cimento C, vol. 36, 37, 2013.

9)   Bini D., Geralico A.,
On the occurrence of Closed Timelike Curves and the observer's point of view,
EPJ Web of Conferences, vol. 58, p. 01002, 2013.

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

<u>II Conferences and educational activities</u>
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.

<u>2011-2012 List of Publication</u>

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.

Bisnovatyi-Kogan G.S.

Position: Professor
Period covered: 2 – 21 June, 12-15 November 2013

I Scientific Work

II Conferences and educational activities

2013 yearly ICRANet Scientific Meeting on Relativistic Astrophysics
on the Occasion of the 50th Anniversary of the Kerr solution of the Einstein's equations

June 3-19, 2013 – ICRANet – Rome and Pescara

II a Conferences and Other External Scientific Work

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

III. Service activities

III a. Within ICRANet   Referee of dissertation:

Andrey Baranov (Annesy)

Alberto Bartolini (La Sapienza**)**

III b. Outside ICRANet

IV. Other

2013 List of Publication

1. O.Yu. Tsupko and G.S. Bisnovatyi-Kogan, «Gravitational lensing in plasma: Relativistic images at homogeneous plasma», Physical Review D 87, 124009, 2013

2. O.Yu. Tsupko and G.S. Bisnovatyi-Kogan, «Chromatic gravitational lensing», in Proceedings of the Xth International conference on Gravitation, Astrophysics and Cosmology (ICGAC10), Quy Nhon, December 17-22, 2011, edited by Roland Triay, Jean Trân Thanh Vân, Ludwik M.Celnikier, p.17, 2013

3. O.Yu. Tsupko and G.S. Bisnovatyi-Kogan, «Influence of plasma presence on relativistic images formed by Schwarzschild black hole lensing», Conference Abstracts, XI-th International Conference on Gravitation, Astrophysics and Cosmology of Asia-Pacific Countries (ICGAC-11), Al Farabi Kazakh National University in Almaty, Kazakhstan, October 1-5, 2013, p.31

4. G. S. Bisnovatyi-Kogan, S. G. Moiseenko, N. V. Ardeljan,
"Magnetorotational Explosions of Core-collapse Supernovae"
Numerical Modeling of Space Plasma Flows (ASTRONUM2012). Proceedings of a 7th International Conference held at Big Island, Hawaii, USA June 25-29, 2012. Edited by N.V. Pogorelov, E. Audit and G.P. Zank. San Francisco: Astronomical Society of the Pacific, p.47, 2013.

5. S.G. Moiseenko, G.S. Bisnovatyi-Kogan,
«Magnetorotational supernovae and magnetorotational instability»
Odessa Astronomical publications (accepted), 2013

6. F. Giovannelli, G.S. Bisnovatyi-Kogan, A.S. Klepnev
«Time delay between the optical and X-ray outbursts in the high mass X-ray transient
A0535+26/HDE245770», arXiv:1305.5149, 2013; Astron.Ap. (accepted)

7. M.V. Glushikhina, G.S. Bisnovatyi-Kogan,
«Calculation of thermal conductivity coefficients for magnetized neutron star»
arXiv:1304.4752 2013; Proc. MG13 (accepted)

8. Bisnovatyi-Kogan, G.S.; Merafina, M.
"Galactic cluster winds in presence of a dark energy"
Monthly Notices of the Royal Astronomical Society, Volume 434, Issue 4, p.3628 (2013)

9. Chernin, A.D.; Bisnovatyi-Kogan, G.S.; Teerikorpi, P.; Valtonen, M.J.; Byrd, G.G.; Merafina,M.
"Dark energy and the structure of the Coma cluster of galaxies"
Astronomy & Astrophysics, Volume 553, A101, (2013)

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

<u>2012 List of Publication</u>

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

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>

13th Marcel Grossmann Meeting – 1-7 july Stockhlom

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

<u>2013 List of Publication</u>

M. Novello and E. Bittencourt, Dragged Metrics, in General Relativity and Gravitation 45, p.1005 (2013);

Mohammadi Rohoollah

PhD. in High Energy Physics

Graduated from Department of Physics,

Isfahan University of Technology, Iran

Gender: Male ☐Nationality: Iranian ☐D.O.B: 06/05/1981

Position: 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.

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.

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.

<u>IV. Other</u>

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.

Piechocki Włodzimierz

Position: Professor

Period covered: 16-22/01/2012

I Scientific Work

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

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

2013 List of Publication

[1] E. Czuchry and W. Piechocki, 'Bianchi IX model: Reducing phase space',
Phys. Rev. D 87, 084021 (2013) [arXiv:1202.5448 [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.

Raffaelli Bernard

Position: Postdoctoral position

Period covered:

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

I. Scientific Work

Research interests:

Gravitation, Black Holes Physics, Quantum Field Theory, Quantum Gravity and Cosmology.

My recent works are focused on:

- Quantum Field Theory on curved spacetime and the role of the quantum vacuum in the accelerated expansion of the Universe, in the framework of Hadamard renormalization.

- Quantum understanding of matter, spacetime and gravitation, through 2-spinors formalism.

II. Conferences and educational activities

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
- Presentation given in the 3rd Workshop in Non-Perturbative Quantum Field Theory, in Sophia-Antipolis, France, May 2013

III. Service activities

III a. Within ICRANet

Presentations and stays at ICRA Roma and ICRA Pescara, collaborations.

III b. Outside ICRANet

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

    Mechanics, Special Relativity, Quantum Mechanics, Thermodynamics, Mathematical Tools for Physicists, Quantum Field Theory at undergraduate and graduate level.

    - Research: works on Gravitation, Quantum Field Theory on curved spacetime and Renormalization, Quantum Gravity and Cosmology.

IV. Other

Award:

- Japan Society for the Promotion of Science:

  2 years FY2013 JSPS postdoctoral fellowship for foreign researchers (Yukawa Institute for Theoretical Physics)

2012/2013 List of Publications

2013 : J.P. Provost, B. Raffaelli, « An unsual heuristic point of view concerning Newton gravitational constant, spacetime and quantum physics », submitted to Class. Quantum Grav.

January 2013: B. Raffaelli, « A scattering approach to some aspects of the Schwarzschild black hole », 10.007/JHEP01(2013)188.

August 2011 : Y. Decanini, A. Folacci, B. Raffaelli, « Resonance and absorption spectra of the Schwarzschild black hole for massive scalar perturbations: a complex angular momentum analysis », PhysRevD.84:084035, 2011

April 2011 : Y. Decanini, A. Folacci, B. Raffaelli, « Fine structure of high energy absorption cross sections for black holes », Class. Quantum Grav. 28:175021, 2011

May 2010 : Y. Decanini, A. Folacci, B. Raffaelli, « Unstable circular null geodesics of static spherically symmetric black holes, Regge poles and quasinormal frequencies », Phys.Rev.D81:104039, 2010.

Fall 2007 : JP. Provost, C. Bracco, B. Raffaelli, « Action, Mass and Non Inertia », p487-512, AFLB (Annals of the Louis de Broglie Foundation), Volume 32 n°4, 2007

June 2006 : B. Raffaelli, JP. Provost, C. Bracco, « Un problème d'oscillateurs : la formule de Planck », p735-739, B.U.P (« Bulletin de l'Union des Physiciens ») n°885, June 2006

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.

I.   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.

Van Putten Maurice

Position: Associate Professor of Astronomy

Period covered: 2013-present

<u>I Scientific Work.</u> Multimessenger gravitational-wave physics and astronomy focused on long duration bursts from black hole spindown in hyper-energetic core-collapse supernovae and gamma-ray bursts; priors to gravitational wave searches with KAGRA (Japan) and LIGO-Virgo (US-EU) from analysis of GRB light curves from BATSE, BeppoSax and Swift; Gravitational attraction from Gibbs' principle; Tidal streams from evaporation of globular clusters; Hyperbolic formulations of general relativity and relativistic magneto-hydrodynamics with applications to numerical simulations (first-ever on the morphological evolution of relativisitc hydro- and MHD jets in 1993 and 1996); Experimental fluid dynamics in modulated Rayleigh-Benard chambers (approved for use in commerce by CTEP/CDFA #5554-08, 6 US and EU patents).

<u>II Conferences and educational activities</u>

II a Conferences and Other External Scientific Work

2012: Invited talk at GRB4/MG13, Stockholm, Sweden

2013: May 23, Colloquium, Department of Astronomy, Yonsei University, Seoul Korea

2013: June 4, Talk at Starobinsky fest, June 3-5, IEU, Ewha Woman University, Seoul

II b Work With Students

Searches for progenitors to long GRBs in X-ray afterglow data

II c Other Teaching Duties

2012-present: Relativistic Astrophysics I/II, Mathematical Astronomy I/II, Introduction to Relativity and Gravitation.

<u>III. Service activities</u>

2009-present: Member of the USNWG/NIST on H2

<u>2013 List of Publication</u>

van Putten, M.H.P.M., 2013, Search for gravitational waves in supernovae and long GRBs, in Proc. Vulcano Workshop Frontier Objects in Astrop. Phys., May 28-June 2, Vulcano, Italy, Acta Polytecnica, to appear

Book: Lectures in Astrophysics, in preparation

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 Professor 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 physical 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 Professor 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 density is an alternative for a central massive Black Hole.
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 constraints, the baryonic and Dark Matter components

This work is under the general supervision of Professors Jorge. A Rueda (ICRANet) and Remo Ruffini.

The interplay between the baryonic (i.e. stars) and the dark matter components in galaxies is an open issue in astrophysics. A theoretical study in the context of the Jeans equations for multicomponent self-gravitating systems is considered. Special attention to isotropic and spherical distributions of matter is developed. The baryonic variables of the model are directly obtained from HST photometric and spectroscopic high angular resolution data, as analyzed in the literature. For the dark matter component I use the model of semi-degenerate fermions presented above. Analytic expressions for the dark matter density profiles are obtained

in Newtonian gravity, allowing to constraints the free parameter of the model (fermion mass and central degeneracy) just from the observables. By now, main attention on dwarf spheroidal galaxies is given.

Fermi liquids and fermionic superfluidity as an application to Dark Matter

This work is under the general supervision of Professors Nickolaos E. Mavromatos (King's College), Jorge A. Rueda (ICRANet)and 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, where the novel interactions within a Relativistic Mean Field Theory (RMFT)approach is developed. This theory is applied to big galactic cores , where new physics appears.

II Conferences and educational activities
II a Conferences and Other External Scientific Work

☐Astrophysics from the radio to the Submillimetre-Planck and other experimnts in temperature and polarization, Bologna-Italy. February (2012). Participant.

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

☐IRAP Ph.D Meeting (Murray Gell-Mann visit), Nice-France. June (2012). Participant.

☐XIII Marcel Grossmann Meeting, Stockholm-Sweden. 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, Nice-France. 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.

☐2nd Bego scientific reecontre. Nice-France. (2013). Participant/Speaker.

☐The 2013 yearly ICRANet scientific meeting on Relativisitc Astrophysics. Pescara-Italy.

☐First URCA Meeting on Relativisitc Astrophysics. Rio de Janeiro-Brazil. (2013). Speaker.

The 13th Italian-Korean Meeting on Relativisitc Astrophysics. Seoul-Korea. (2013). Speaker.

Talk: The dark matter distribution in galaxies: a novel approach.

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 Diploma thesis supervision

-

II d Other Teaching Duties

-

II e. 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.

III. Service activities

III a. Within ICRANet

-

III b. Outside ICRANet

-

IV. Other

-

List of Publications

Black Holes in Gamma Ray Bursts and galactic nuclei; R. Ruffini, C. R. Argüelles, B. Fraga, A. Geralico, H. Quevedo, J. A. Rueda, I. Siutsou. IJMP D, 22, 11.

On the distribution of dark matter in galaxies: quantum treatments; C. R. Argüelles, R. Ruffini, I. Siutsou, B. Fraga. Submitted to the Journal of the Korean Physical Society (JKPS).

The relativistic Feynman Metropolis Teller Theory at Zero and finite Temperatures; S. Martins de Carvalho, J. A. Rueda, M. Rotondo, C.R. Argüelles and R. Ruffini. IJMP D: conference series, 23, 244.

Self-Gravitating system of fermions as central objects and Dark Matter halos in Galaxies; B. Fraga, C. R. Argüelles, R. Ruffini. IJMP D: conference series, 23, 357.

On the core-halo constituents of a semi-degenerate gas of massive fermions; C. R. Argüelles, I. Siutsou, R.Ruffini, , J. A. Rueda, B. Fraga. Proceedings to the AAS. 2013pdmg.conf30204A.

Belvedere Riccardo

Position: Post-doc
Period covered: May 2013-December 2013
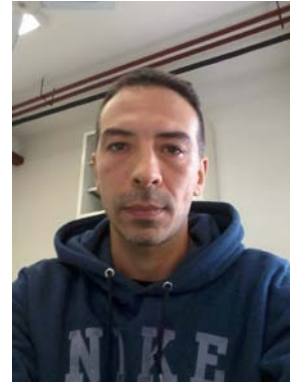
I Scientific Work

My work, done in collaboration with Prof. Ruffini and Dr. Rueda, is devoted to the analysis of the equations of state of Neutron Stars. We extended our previous work, in which we introduced for the static case a new kind of equilibrium configurations based on the solution of Einstein-Maxwell-Thomas-Fermi system of equations. The extension consisted in the introduction of the rotation, following the perturbative approach suggested by Hartle in 1967. Lately, we investigated the astrophysical effects of our new configurations, namely, the changes on respect the traditional approach on the moment of inertia, the Keplerian frequency and the magnetic field.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

III. Service activities

III a. Within ICRANet

III b. Outside ICRANet

IV. Other

2013 List of Publication

>>> R. Belvedere, Jorge A. Rueda and R. Ruffini, *"Neutron stars within a general relativistic theory including strong, weak and electromagnetic interactions"*. Nuovo Cimento C 36 Issue 1 Suppl. 1, (2013) 5-13.
>>> R. Belvedere, Jorge A. Rueda, and R. Ruffini, *"Neutron star cores in the general relativistic Thomas-Fermi treatment"*. Int. J. Mod. Phys. Conf. Ser. 23, (2013) 185-192.

>>> R. Belvedere, K. Boshkayev, Jorge A. Rueda, and R. Ruffini, *"Uniformly rotating neutron stars in the global and local charge neutrality case"*. In print: *Nucl. Phys. A (2013)*.

>>> R. Belvedere, Jorge A. Rueda, and R. Ruffini, *"On static and rotating globally and locally neutron stars"*. Submitted to *Journal of the Korean Physical Society*.

>>> R. Belvedere, Jorge A. Rueda, R. Ruffini, *"On the Keplerian frequency and moment of inertia of neutron stars"*, to be submitted to *A&A Letters*.

>>> R. Belvedere, Jorge A. Rueda, R. Ruffini, *"On the magnetic field of pulsars with realistic neutron star configurations"*, to be submitted to *ApJ Letters*.

Benetti Micol

Position: Ph.D. Student, IX IRAP
Period covered: from November 1st 2010 to 10 May 2013

<u>I Scientific Work</u>

In this third year of my Ph.D, I worked on constraint cosmological parameters starting from the minimal model ΛCDM with variation of 5 parameters ($\omega_b, \omega_c, \theta, \tau, A_s$), called Harrison-Zel'dovich (HZ) model, and increasing the number of parameters going to explore several interesting models.

The goal of that work is to examine whether existing cosmological datasets can provide evidence for the dynamics of the inflaton field during inflation or evidence for new "neutrino" physics. The departure from the HZ model could take the form of a scalar spectral index different than unity, a "running" (a scale-dependence) of the scalar spectral index, or evidence for tensor modes. The type of new "neutrino" physics we model would be a mass for neutrinos or additional relativistic degrees of freedom contributing to the expansion rate around the time of recombination.

In this work is used data from the Atacama Cosmology Telescope (ACT) and the South Pole Telescope (SPT), combined with the nine-year data release from the WMAP satellite, provide very precise measurements of the cosmic microwave background (CMB) angular anisotropies down to very small angular scales. Augmented with measurements from Baryonic Acoustic Oscillations surveys and determinations of the Hubble constant, the extended datasets including either ACT or SPT provide very different indications: while the extended-ACT dataset is perfectly consistent with the predictions of standard slow-roll inflation, the extended-SPT dataset prefers a non-power-law scalar spectral index with a very large variation with scale of the spectral index. Both extended-ACT and extended-SPT favor additional light degrees of freedom. Extended-ACT is consistent with zero neutrino masses, while extended-SPT favors nonzero neutrino masses at more than 95% confidence. The results are published in JCAP **10** (2013) 030.

Moreover, after the publication of new data from the Planck satellite, I work on new constraints of Inflation step-like model. 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 I can derive constraints on the position, magnitude and gradient of a possible step, updating my previous work [Benetti et al., Phys. Rev. D **84**, 063509 (2011)] and [Benetti et al., Phys. Rev. D **87**, 023519 (2013)].

In this work is used data from WMAP-9 low-l polarization data and the temperature data from the Planck experiment. We have considered two different methods. The first uses a numerical routine to accurately calculate the primordial density spectrum corresponding to a given inflaton potential. The second employs an approximate form of the power spectrum, reproducing the features caused by a step-like inflaton potential. For the latter analysis, we have also studied the impact of different prior ranges, corresponding to features in the low-l and mid-l ranges. The analysis done performing the exact integration of the mode equations shows a $\Delta\chi^2=9$ with respect to the featureless ΛCDM model, at the cost of three new parameters. The results are published in Phys. Rev. D **88**, 087302 (2013).

<u>II Conferences and educational activities</u>
II a Conferences and Other External Scientific Work

Presented poster in *New Horizons for Observational Cosmology* - Ph.D School, June 30 -July 6 2013, Varenna, Italy.

II b Work With Students

Work with Martina Gerbino, Ph.D. student of Sapienza Physics department, the results are published in JCAP **10** (2013) 030.

II c Diploma thesis supervision – None

II d Other Teaching Duties - None

II e. Work With Postdocs - None

III. Service activities

III a. Within ICRANet

Work with Massimiliano Lattanzi, the results are published in JCAP **10** (2013) 030.

III b. Outside ICRANet

Work with W. H. Kinney (University of Buffalo, Buffalo USA), E. W. Kolb(E. Fermi Institute, Chicago USA), A. Riotto (Centre for Astroparticle Physics, Switzerland), the results are published in JCAP **10** (2013) 030

IV. Other - None

2013 List of Publication

> *"Cosmological data and indications for new physics"* **M. Benetti**, M. Gerbino, W. H. Kinney, E. W. Kolb, M. Lattanzi, A. Melchiorri, L. Pagano, A. Riotto (JCAP – *Journal of Cosmology and Astroparticle Physics*, **10**, 030)

> *"Updating constraints by Planck data on inlationary features model"* **M. Benetti** (Phys. Rev. D **88**, 087302)

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.

Bravetti Alessandro

Position: IRAP Ph.D. Student

Period covered: November 1st, 2009 – to date

<u>I Scientific Work</u>

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

<u>II Conferences and educational activities</u>

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

<u>III. Service activities</u>

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.

<u>2012 List of Publication</u>

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

Soft gamma ray repeaters (SGRs) and anomalous X-ray pulsars (AXPs) are compact objects that can be explained as massive fast rotating white dwarfs. The stability properties of white dwarfs can account for the observed periods (2-12 secs) of these objects and their rotational energy loss can explain the high luminosities in x and gamma ray bands. I am focused on the magnetospheric emission of these objects, in order to explain the emission in X and gamma rays, taking into account the backflow of positrons coming from the magnetosphere and from the interaction between gamma-ray curvature photons and the intense magnetic fields ($B \sim 10^8 - 10^9$ G).

I also worked on the stability of magnetized white dwarfs, in particular, the microscopic instabilities coming from the Inverse-beta decay, the pycnonuclear reactions and general relativity.

II Conferences and educational activities
II a Conferences and Other External Scientific Work

Assistance to meetings organized by Icra such as:

1. *13th Marcel Grossman Meeting, July 1-7, 2012. Stockholm, Sweden.*

2. *IRAP PhD. Erasmus Mundus School. September 3 – 21, 2012. Nice, Frances.*

Participation with oral presentation in the following events:

- *"On the stability of highly magnetized white dwarfs". Diego Leonardo Cáceres Uribe, Jorge Armando Rueda Hernández and Remo Ruffini. 2nd Bego Rencontres, Universitre Nice Sophia Antipolis. 16-31 May 2013, Nice, France.*

- *"High Magnetic Fields in White Dwarfs". Diego Leonardo Cáceres Uribe, Jorge Armando Rueda Hernández and Remo Ruffini. The 13th Italian-Korean Symposium on Relativistic Astrophysics. 15-19 July 2013, Seoul-Korea, 2013.*

- *"Magnetospheric emission of soft gamma-ray repeaters (SGRs) and anomalous x-ray pulsars (AXPs) within the white dwarf model". The 27th Texas symposium on relativistic astrophysics. 8 – 13 December, 2013, Texas, United States of America.*

1. "Dynamical instability of white dwarfs and breaking of spherical symmetry under the presence of extreme magnetic fields". J. G. Coelho, R. M. Marinho Jr., M. Malheiro, R. Negreiros, D. L. Cáceres, J. A. Rueda and R. Ruffini [arXiv: 1306.4658v2].

2. "On the stability of ultra-magnetized white dwarfs". Diego L. Caceres, Jorge A. Rueda and Remo Ruffini. Submitted to Journal of the Korean Physical Society.

Cipolletta Federico

Position: IRAP PhD, XI Cycle
Period covered: 2012-2015

<u>I Scientific Work</u>

-Bachelor Degree in Mathematics, University of Camerino (MC), Italy, from a.y.2006/2007 to a.y. 2008/2009. Graduation thesis' title: "Rational Tangles and Continued Fractions".

-Master Degree in Mathematics, University of Camerino (MC), Italy, from a.y. 2009/2010 to a.y. 2010/2011. Graduation thesis' title: "Avoidance of singularities for charged collapsing relativistic solutions in spherical symmetry".

<u>II Conferences and educational activities</u>
II a Conferences and Other External Scientific Work

-Nice BEGO school, May 2013

-2013 ICRANet meeting on Relativistic Astrophysics on the Occasion of the 50th anniversary of the Kerr solution of the Einstein's equations in Pescara

-Nice BEGO school, September 2013

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

<u>III. Service activities</u>

III a. Within ICRANet

– **Research project:** numerical models to obtain equilibrium sequences of rotationg, self gravitating stars, in both classical and relativistic frame. During my first PhD year I got back the model by Eriguchi and Muller (Y. Eriguchi, E. Muller. *A general computational method for obtaining equilibria of self- gravitating and rotating gases*, Astron. Astrophys. 146, 260-268(1985)) and reproduced it using Maple software. After that I began to study relativistic models, in particular the one presented in the book "Relativistic Figures of Equilibrium" (R. Meinel, M. Ansorg, A. Kleinwachter, G. Neugebauer, D. Petroff, Cambridge University Press (2008)) and trying to use the code published with this book and which can be dawnloaded from the web, to obtain a sequence of equilibrium using a Neutron Star EOS.

    After this results I will move my research towards the process of Neutron Stars Cooling, always

approached from a numerical point of view.

III b. Outside ICRANet

<u>IV. Other</u>

<u>2013 List of Publication</u>

- Federico Cipolletta and Roberto Giambò 2012 *Class. Quantum Grav.* **29** 245008. doi:10.1088/0264-9381/29/24/245008 Received 3 August 2012, in final form 15 October 2012. Published 19 November 2012.

Haney Maria

Position: IRAP Ph.D. student

Period covered: 01/2013 – 10/2013

<u>I Scientific Work</u>

For my doctoral research I have mainly focussed on massive particles and fields in the background of exact gravitational wave spacetimes. With Donato Bini and his collaborators I have worked on projects related to this field of research, including:

- the propagation of electromagnetic waves in exact gravitational wave spacetimes,

- the response of an interferometric gravitational wave detector beyond the linear approximation of general relativity,

- the scattering of massive particles by electromagnetic and gravitational wave radiation fields in the framework of GR,

- the description of such radiation fields as an equivalent optically active medium with an analysis of the associated optical properties.

In our most recent work we have studied light propagation in colliding gravitational wave spacetimes, applying the optical medium analogy to these backgrounds. In view of the complexity of the non-linear interaction of the two waves, the optical medium analogy proves helpful in describing some interesting effects concerning the analysis of the refraction index and the propagation of light rays in the different spacetime regions.

I have sucessfully defended the thesis summarising my doctoral research on October 22nd, 2013.

<u>II Conferences and educational activities</u>
II a Conferences and Other External Scientific Work

talk @ the 2013 yearly ICRANet Scientific Meeting on Relativistic Astrophysics (June 3-21, Pescara, Italy)

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

<u>III. Service activities</u>

III a. Within ICRANet

III b. Outside ICRANet

IV. Other

2013 List of Publication

D. Bini, P. Fortini, A. Geralico, M. Haney and A. Ortolan, *Light scattering by radiation fields: the optical medium analogy*, EPL **102**, 20006, (2013)

D. Bini, A. Geralico and M. Haney, *Refraction index analysis of light propagation in a colliding gravitational wave spacetime*, accepted for publication by Gen. Rel. Grav., (2013)

D. Bini, A. Geralico, M. Haney and A. Ortolan, *Strong field effects induced by electromagnetic waves*, in preparation, (2013)

Lecian Orchidea Maria

Position: Post-doc (Post-doctoral Research Fellowship 'Classical and quantum Physics of the Early Universe' awarded by Sapienza University of Rome, Physics Department.)
Period covered: 2013

<u>I Scientific Work</u>

<u>General Relativity, Cosmological billiards:</u> Investigation of the features of the Early Universe within the framework of the BKL paradigm. The most general solution to the Einstein field equations in the asymptotic limit to the Cosmological Singularity have been analyzed both for the homogenous case and for the inhomogeneous one. The statistical properties of the maps, which are obtained by visualizing the solution to the Einstein equations in a suitable target space, have been analyzed as far as the definition of a suitable Poincaré surface of section is concerned. As a result, the values characterizing the statistical auxiliary variables of the BKL maps have been demosntrated to define the angular velocity at which the Poincaré surface is crossed within the target space.

<u>General Relativity, Early-Universe Dynamics:</u> The stochastization of the Early-Universe dynamics within the BKL paradigm has been investigated. The mathematical tools which define the dynamicsl properties of this model have been established: as a result, the evolution of the Early Universe has been described as the stochastization of the BKL dynamics, for which the observational evidence of anysotropic patterns in the Sky is clearly connected with the evlutionary description of strongrly anisotropic cosmologies, for which a quasi-isotropization mechanism has to be further hypothesized.

<u>Quantum Cosmology:</u> the quantum features of the Early Universe have been investigated within the BKL paradigm. At the quantum regime, for which quantum features of the space-time have to be taken into account, the role of the BKL statistics has been implemented. The appearance of scars (enhancements of the wave-function of the Universe) in correspondence of the lowest periodic orbits has been proven by means of analyzing the reduced phase space of the model for Cosmological Billiards.
The Selberg trace formula has been specified for the BKL statistics. The validity of this formula at the quantum regime, at the classical level and in the semiclassical limit allows one to define the properties of the observed large-scale structure of the universe through the stochastization of the BKL dynamics and the classicalization of the quantum phase.

<u>II Conferences and educational activities</u>
II a Conferences and Other External Scientific Work

Participation in the Workshop Geometry and Physics II, 28-29 November 2013, Institut Henry Poincaré, Paris, France.

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

Teaching assistant for the Dpertment of Mathematics for Engeenering (SBAI) at Sapienza University of Rome for the academic year 2013 (Post-doctoral Teaching Grant awarded by Sapienza University of Rome, SBAI Department).

II e. Work With Postdocs

III. Service activities

III a. Within ICRANet

Seminars
Sapienza University, Physics Department and ICRA, Rome (Italy), 3 May 2013, Statistical maps for cosmological billiards.
Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam-
Golm (Germany), 10 June 2013, Recent developments in cosmological billiards.

III b. Outside ICRANet

Seminar
 Turin University, Turin (Italy), 28 May 2013, Cosmological billiards in 4 = 3 + 1 dimensions: statistical maps and their quantum version.

IV. Other

Intensive Research Program at Max Planck Institute for Gravitational Physics, Albert Einstein Institute, Potsdam-Golm, Germany, 1 May 2013- 31 July 2013 (Max Planck Institute Grant for Foreign Postdocs).

2013 List of Publication

Orchidea Maria Lecian, Giovanni Montani, Nakia Carlevaro, Novel Analysis of Spinor Interactions and non-Riemannian Geometry, EPJ Plus 128, 19 (2013) [arXiv:1301.7708].
Orchidea Maria Lecian, Reflections on the hyperbolic plane,
International Journal of Modern Physics D Vol. 22, No. 14 (2013), 1350085 [arXiv:1303.6343].
 Orchidea Maria Lecian, Giovanni Montani, Riccardo Moriconi, Semiclassical and quantum behavior of the Mixmaster model in the polymer approach,

Physical Review D 88, 103511 (2013) [arXiv:1311.6004].

Orchidea Maria Lecian, BKL maps and Poincaré sections and quantum scars, Physical Review D 88, 104014 (2013) [arXiv:1304.4973].

Orchidea Maria Lecian, Stochastization of BKL dynamics and Anisotropic Sky Patterns, accepted for publication on Physical Review D, [arXiv:1310.7544].

Orchidea Maria Lecian, Periodic orbits in cosmological billiards: the Selberg trace formula for asymptotic Bianchi IX universes, evidence for scars in the wavefunction of the quantum universe and large-scale structure anisotropies of the present universe, submitted to Journal of High Energy Physics, [arXiv:1311.0488].

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.

– <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.

Muccino Marco

Position: PhD student
Period covered: 2010/2013

<u>I Scientific Work</u>

My research area includes:
- *data reduction of GRBs, from Swift-BAT and XRT, Fermi-GBM and*
  LAT and BATSE. I am familiar with XSPEC and RMFIT, and the
  Swift BAT and XRT pipelines to create the spectra and light curves
  and to analyze them;
- *search and analysis of short GRBs and short bursts with extended*
  emission, and their theoretical interpretation in terms of genuine short GRBs and disguised short
  GRBs in the contest of the Fireshell model;
- *analysis of the spectral features of GRBs and application of the "Induced gravitational collapse"*
  (IGC) model, proposed to explain the GRBs-supernovae (SNe) connection;
- *accretion process and analysis of the X-ray afterglow of GRBs in the IGC scenario;*
- *analysis of the high energy spectral component of GRBs;*
- *possible use of GRBs as distance indicators.*

<u>II Conferences and educational activities</u>
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)

11) IRAP Ph.D. Erasmus Mundus School, May 16th-31st, 2013 Nice (France).

12) IRAP Ph.D. Erasmus Mundus school, September 2nd - 20st, 2013 Nice (France).

II b Work With Students
II c Diploma thesis supervision
II d Other Teaching Duties
II e. Work With Postdocs

III. Service activities

III a 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"*

2) *Lecture: IRAP Ph.D. Erasmus Mundus School, September 3rd - 21st, 2012 Nice (France) "GRB090227B: the missing link between genuine short and long GRBs"*

3) *Lecture: IRAP Ph.D. Erasmus Mundus School, May 16th-31st, 2013 Nice (France)   "GRB 090510: A Disguised Short Gamma-Ray Burst with the Highest Lorentz Factor and Circumburst Medium"*

4) *Lecture: IRAP Ph.D. Erasmus Mundus School, September 2nd - 20st, 2013 Nice (France) "Data analysis of GRBs in the Fermi era"*

III b. Outside ICRANet

IV. Other

2010-2013 List of Publication

1)"Evidence for a proto-black hole and a double astrophysical component in GRB 101023"; A&A,

538, A58 (2012). A.V. Penacchioni, R. Ruffini, L. Izzo, M. Muccino, C.L. Bianco, L. Caito, B. Patricelli, L. Amati.

2)*"GRB 090227B: the missing link between the genuine short and disguised short GRBs , ApJ, 763, 125 (2013); M. Muccino; R. Ruffini; C.L. Bianco; L. Izzo; A.V. Penacchioni.*

3)*"GRB 110709B in the induced gravitational collapse (IGC) paradigm", A&A, 551, A133 (2013); A.V. Penacchioni, R. Ruffini, C.L. Bianco, L. Izzo, M. Muccino, G.B. Pisani, J. A. Rueda.*

4)*"On a novel distance indicator for Gamma-Ray Bursts associated with Supernovae", A&A, 52L, 5 (2013); G.B.Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A.V. Penacchoni, J. A. Rueda, Y. Wang.*

5) *"GRB 090510: A Disguised Short Gamma-Ray Burst with the Highest Lorentz Factor and Circumburst Medium", ApJ, 772, 62 (2013); M. Muccino; R. Ruffini; C.L. Bianco; L. Izzo; A.V. Penacchioni; G.B. Pisani.*

6)*"Induced Gravitational Collapse in the BATSE era: the case of GRB 970828", submitted to A&A (arXiv1311.7432R), 2013; R. Ruffini; L. Izzo; M. Muccino; J.A. Rueda; C. Barbarino; C.L. Bianco; H. Dereli; M. Enderli; A.V. Penacchioni; G.B. Pisani; Y. Wang.*

Sigismondi Costantino

Position: Visiting Researcher
Period covered: 1 dec 2012-30 nov 2013

<u>I Scientific Work</u>

Solar Astrometry

<u>II Conferences and educational activities</u>
II a Conferences and Other External Scientific Work
Florianopolis 25-29 november 2013 XIV LARIM Latin America Regional IAU Meeting
Warszawa 14-20 oct, Communicating Astronomy with the Public, IAU Meeting
Rio de Janeiro 29-set – 3 ott 2013 VI IWARA Meeting
Pescara 27 sept, Notte dei Ricercatori
Rio de Janeiro 30 june-3 july- ICRC Meeting
Jerusalem 24 -29 June Scienza Sindone e Tilma di Guadalupe International Meeting
Roma 21 June, European Symposium of University Professors
Rio de Janeiro, 11 June, CBF Colloquium

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

Solar Astrometry Observatorio Nacional RJ joint with ICRANet Brazil

II e. Work With Postdocs

<u>III. Service activities</u>

III a. Within ICRANet

IRAP-PhD Course of Solar Astrometry

Colloquia at CBPF, Rio de Janeiro

III b. Outside ICRANet

Observatorio Nacional Rio de Janeiro Visiting Resarcher

<u>IV. Other</u>

2013 List of Publication

arxiv1311.3472 Solar astrometry with Rio Astrolabe and Heliometer

arxiv 1310.6557 The occultation of Arcturus in the Vatican

arxiv 1310.2763 Considerations on the light curve of Nova Delphini 2013

arxiv 1307.0548 The Heliometer of Rio de Janeiro in Operation - 2013 Calibration

arxiv 1306.3204 The Heliometer of Rio de Janeiro in Operation - 2010 to 2013

arxiv 1302.6910 Pawel Max Maksym (1983-2013) Polish Astronomer and Film-maker

arxiv 1301.0311 Venus transits: history and opportunities for planetary, solar and gravitational physics

arxiv 1301.0296 Transits of Venus and the Astronomical Unit: four centuries of increasing precision

Baranov Andrey

Position: Ph. D. student (Erasmus Mundus Program),

LAPTH, Universite de Savoie, Annecy-le-Vieux, France

Period covered: 09/2010-09/2013
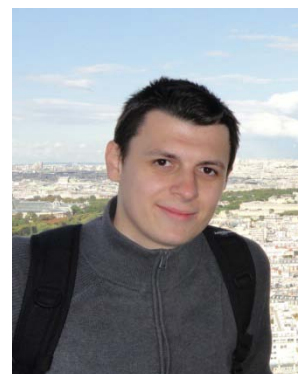
I Scientific Work

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

Benedetti Alberto

Position: Phd Student
Period covered: September 2010 – November 2013

<u>I Scientific Work</u>

We apply Relativistic Kinetic Theory to specific physical processes: electron-positron pairs production in strong electric fields and transparency of relativistic outflows.

In the case of pair production, we verify the results obtained in the literature only for very short time-scales. For larger times interactions are dominant and a kinetic treatment is necessary to describe the approach to thermalization. Concerning transparency of relativistic outflows, we describe the main interactions occurring when photons undergo the last scattering before reaching the observer. This study is tightly related to the problem of photospheric emission in Gamma-Ray Bursts.

Being out of equilibrium, both systems are studied making use of the relativistic Boltzmann equation for electron, positron and photon distribution functions. Collision integrals are calculated starting from exact QED matrix elements for 2-particle interactions. Since a system of partial integro-differential equations has to be solved, reasonable assumptions concerning physical and momentum space symmetries have to be made and computations are carried out numerically.

<u>2013 List of Publication</u>

Benedetti A., Han W.-B., Ruffini R., Vereshchagin G.V. On the frequency of oscillations in the pair plasma generated by a strong electric field. Phys. Lett. B 698, 75-79, 2011.

Benedetti A., Ruffini R., Vereshchagin G.V. On kinetic treatment of pair production in strong electric field. Nuovo Cimento C 1, 15-19, 2013.

Benedetti A., Ruffini R., Vereshchagin G.V. Phase space evolution of pairs created in strong electric fields. Phys. Lett. A 377, 206-215, 2013.

Machado de Oliveira Fraga, Bernardo

Position: PhD Student
Period covered: 2012-2013

I Scientific Work

I worked with Prof. Ruffini on a model of semidegenerate self-gravitating fermions in general relativity. Such systems present mass density solutions with a central degenerate core, a plateau and a tail where the density decreases with the square of the radius. The different solutions are governed by the free parameters of the model: the degeneracy and temperature parameters at the center, and the particle mass. We then analyze in detail the free parameter space for a fixed particle mass in the keV regime, by studying the one-parameter sequences of equilibrium configurations up to the point of relativistic collapse, which is represented by the maximum in a central density Vs. core mass diagram. We show that for fully degenerate cores, the known expression for the critical core mass inversely proportional to the particle mass squared is obtained, while instead for low degenerate cores, the critical core mass increases showing the temperature effects in a non linear way. The main result of this work is that when applying this theory to model the distribution of dark matter in galaxies from the very center up to the outer halos, we found that no collapsed object in the center can co-exist with a halo simultaneously.

II Conferences and educational activities
II a Conferences and Other External Scientific Work
Attendance to the 7th Yearly ICRANet scientific meeting, Pescara, Italy (06/2013).

Oral Presentations: Self-gravitating system of fermions as dark matter halos and central objects in

galaxies;

A multi-wavelength catalog of HSP blazars based on the WISE all-sky survey.

Attendance to the 1st URCA meeting, Rio de Janeiro, Brazil (06/2013).

Oral Presentations: Self-gravitating system of fermions as dark matter in galaxies;

A multi-wavelength catalog of HSP blazars based on the WISE all-sky survey.

Attendance to the 13th Italo-Korean Meeting, Seoul, South Korea (07/2013). Oral presentation: Self-

gravitating system of fermions as dark matter in galaxies.

I

III. Service activities

III a. Within ICRANet

III b. Outside ICRANet

<u>IV. Other</u>

<u>2013 List of Publication</u>

Black holes in Gamma-ray bursts and galactic nuclei - Remo Ruffini, C. R. Argüelles, B. M. O. Fraga,

A. Geralico, H. Quevedo, J. A. Rueda, I. Siutsou International Journal of Modern Physics D 22 11 (2013).

Self-gravitating system of semidegenerate fermions as central objects and dark matter halos in galaxies

- Bernardo M. O. Fraga, Carlos R. Argüelles, Remo Ruffini

International Journal of Modern Physics: Conference Series 23, pp. 357-362. Proceedings for the 3rd

Galileo-Xu Guanqxi meeting, China, 2011.

Critical Configurations for a system of semidegenerate fermions - Carlos R. Arguelles, Bernardo M.O. Fraga, Remo Ruffini.

To be submitted to JKPS

1WHSP: A catalog of over 700 TeV candidate blazars

 - B. Arsioli, B. Fraga, P. Giommi., P. Padovani and M. Marrese.

TO be submitted to A&A. Already submitted to the Fermi team

Gregoris Daniele

Current position: Erasmus mundus Ph.D. student (2011-2014) supported by the Erasmus Mundus Joint Doctorate Program by Grant Number 2011-1640 from the EACEA of the European Commission.

Host Institution: Stockholm University

Contacts: @libero.it, .Gregoris@fysik.su.se

Academic degrees:
Laurea triennale (2009), Università degli studi di Trieste, 110/110

Laurea magistrale (2011), Università "La Sapienza", Rome, 110 cum laude/110 under the supervision of Prof. Remo Ruffini and Dr. Donato Bini

Scientific work:

Under the supervision of prof. Kjell Rosquist and in collaboration with Dr. Timothy Clifton and Prof. Reza Tavakol, we are considering a Universe made by a regular lattice of an increasing number of Schwarzschild black holes (which should play the role of the observed astronomical structures like galaxies and clusters of galaxies) tiling a 3-sphere since this is a genuinely inhomogeneous model on small scale and instead a homogeneous one on large scale. This is a fully general relativistic exact non perturbative model in vacuum whose dynamics can be completely solved during all the evolution of the system along special lines admitting local rotational symmetry and on the face of the cell whose center is occupied by the black hole which admits invariance under reflection, since these models do not possess any global continuous symmetry. The kinematic quantities like the expansion rate, the shear tensor, the spatial gravito-electric and gravito-magnetic Weyl tensor have been evaluated on these lines and surfaces. In particular we can follow the time evolution of the length of these special lines and we can introduce a Hubble function and a deceleration parameter based on it, formally in the same way as in the Friedmann model. It turns out that different regions of the space-time admit completely different behaviors.

On the other hand, under the supervion of Drs. Donato Bini, Sauro Succi and Andrea Geralico, I considered a Friedmann model without cosmological constant whose matter content is given by the Shan-Chen non-ideal equation of state with asymptotic freedom with the purpose of giving a physical interpretation of the nature of dark energy. This is a modified equation of state introduced in the context of kinetic lattice theory which admits ideal gas behavior (pressure and density changes in linear proportion to each other) at both low and high density regimes (for this reason we speak of asymptotic freedom), with a liquid-gas coexistence loop in the between. This equation of state has also been compared to the bag model of hadronic matter. We showed that when we plug this equation of state in the Einstein equation we can evolve from an initially radiation dominated universe to a dark energy dominated one. This means that we have a phase transition in which the pressure changes sign at a certain instant in the past and remains negative for a long time interval including the present day. After adding a pressure-less matter content to our picture of the Universe, we proved that our model can fit the supernovae data where the Hubble function is plotted with respect to the redshift for an appropriate choice of the free parameters without any need of vacuum energy. We also showed that for this specific choice of the parameters inside the equation of state, our model is stable under perturbations and so it is self-consistent. In this way we can provide a microscopic interpretation of the dark energy.

A related topic that I faced during the current year is the study of the motion of test particles undergoing frictional effects in the Friedmann space time. We have proved first of all that the Poynting-Robertson formula is the correct general relativistic extension of the Stokes' law and then we applied it to the analysis of the peculiar velocity of a cosmological object.

2013 Oral presentations given in international meetings and schools:
"Friction forces in cosmological models", 2nd Bego Scientific Rencontre, May 2013
"Friction forces in cosmological models", Erasmus Mundus school, September 2013
"Dark energy from cosmological fluids obeying a Shan-Chen non-ideal equation of state ", NA12/QGSKY, SISSA (Trieste), 24-25 October

2013 Publications on journals with referees:

D. Bini, A. Geralico, D. Gregoris, S. Succi, "Friction forces in cosmological models", Eur. Phys. J. C (2013), 73:2334

D. Bini, A. Geralico, D. Gregoris, S. Succi, "Dark energy from cosmological fluids obeying a Shan-Chen nonideal equation of state ", Physical Review D 88, 063007 (2013)

T. Clifton, D. Gregoris, K. Rosquist, R. Tavakol, "Exact Evolution of Discrete Relativistic Cosmological Models "JCAP vol. 11, Article 010, ArXiv 1309.2876

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

2013, May – July: Research Stay at ICRANet Pescara, Italy

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, May – July: Research Stay at ICRANet Pescara, Italy.

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 for a summer internship (June – August 2011, June-August 2013).

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

<u>2013 List of Publications</u>

A. Aviles, C. Gruber, O. Luongo, H. Quevedo, "Constraints from Cosmography in various parametrizations", arXiv:[astro-ph.CO]1301.4044, proceedings to MGXIII.

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 -7th Jul, 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.

LUDWIG Benjamin Hendrik Martin

Position: Erasmus Mundus Joint Doctorate IRAP PhD Student
Period covered: 12/2012 – 11 2013

<u>I Scientific Work</u>

Gravitational Collapse of Charged Fluids in General Relativity

Pulsation Modes of Compressed Atoms in Thomas-Fermi Model

Historical Development of Neutron Star Critical Mass Computation

<u>II Conferences and educational activities</u>

II a Conferences and Other External Scientific Work

13th Italian-Korean meeting, Seoul, July 15 – 19 2013

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

<u>III. Service activities</u>

III a. Within ICRANet

III b. Outside ICRANet

<u>IV. Other</u>

<u>2013 List of Publication</u>

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)

Pisani Giovanni Battista

Position: Ph.D. Student, Erasmus Mundus program, 3rd year
Period covered: 1st September 2011 – Today

I Scientific Work

Gamma Ray Bursts (GRBs) are among the most puzzling astronomical objects since their first detection by the Vela satellites in the late 1960s. GRBs are flashes in gamma-rays observed in distant galaxies. They can last from milliseconds to several minutes with an isotropic energy released up to the order of one solar mass. This peculiarity makes them the most powerful events ever observed in the Universe. A variety of models have been developed to theoretically explain the observational properties of GRBs.

My PhD research project includes the reduction and analysis of GRBs data from different satellites, such as Batse, Swift or Fermi. I investigate GRBs observations within the fireshell model scenario, which predicts that GRBs originate from an optically thick e+e- plasma at thermal equilibrium created by vacuum polarization during the formation of a Black Hole.

My attention is now focused on GRBs associated with Supernovae (SN). Since the first discovery of this association (GRB 980425 - SN1998wt), various mechanisms have been proposed to explain it. Recently Prof. Ruffini and his collaborators have proposed the Induced Gravitational Collapse (IGC) occurring in a particular class of binary systems as progenitors for these GRB-SN sources. Together with them we are further developing the IGC scenario. One of the most exciting outcomes of this work is the possibility to consider this class of GRB-SN events as distance indicators. If confirmed, this result could provide new independent challenges on the current cosmological model.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

1) Attendance to the "Erasmus Mundus School", Nice, France, 5th - 17th September, 2011.

2) Attendance to the "IRAP PhD. "Erasmus Mundus Workshop", Les Houches, France, 2nd - 6th October, 2011.

3) Attendance to the "Third Galileo-Xu Guangqi" meeting, Beijing, China, 11th - 15th October, 2011.

4) Attendance to the "Fermi/Swift GRB 2012 Conference", Munich, Germany, 7th – 11th May, 2012.

 Posters presentation:

- Title: The proto-black hole concept in GRB 101023 and its possible extension to GRB 110709B.

Authors: A.V. Penacchioni, R. Ruffini, C.L. Bianco, L. Izzo, M. Muccino, G.B. Pisani.

- Title: "Needs for a new GRB classification following the fireshell model: "genuine short", "disguised short" and "long" GRBs"

Authors: C.L. Bianco, M.G. Bernardini, L. Caito, G. De Barros, L. Izzo, M. Muccino, B. Patricelli, A.V. Penacchioni, G. B. Pisani, R. Ruffini.

5) Attendance to the "13th Marcel Grossmann Meeting", Stockholm, Sweden, 1st - 7th July, 2012.

Oral presentation: A new possible interpretation for GRB 060614.

6) Attendance to the "Erasmus Mundus School", Nice, France, 3rd – 19th September, 2012.

7) Attendance to the III National Congress "Lampi su Napoli", Naples, Italy, 20th - 22nd September, 2012.

8) Attendance to the symposium "The Current Issues on Relativistic Astrophysics", 5th - 6th October, 2012, Seoul, South Korea.

 Oral presentation:

- Title: Evidence and consequences of universal behavior of late time X-ray emission of Gamma-Ray Bursts connected with Supernovae.

Authors: G. B. Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A. V. Penacchioni, J. A. Rueda, Y. Wang.

9) Attendance to the "7th Huntsville GRB Symposium", Nashville TN, USA, 14th – 18th April, 2013.

 Posters presentation:

- Title: On a novel distance indicator for gamma-ray bursts associated with supernovae.

Authors: G. B. Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A. V. Penacchioni, J. A. Rueda, Y. Wang.

10) Attendance to the "2nd Bego Rencontres", Nice, France, 16th – 31st May, 2013.

 Oral presentation:

- Title: A new subclass of energetic GRB-SN sources: The IGC GRB-SN family.

Authors: G. B. Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A. V. Penacchioni, J. A. Rueda, Y. Wang.

11) Attendance to the "2013 yearly ICRANet Scientific Meeting on Relativistic Astrophysics", Pescara, Italy, 3rd – 21th June, 2013.

12) Attendance to the "1ˢᵗ URCA Meeting on Relativistic Astrophysics", Rio de Janeiro, Brasil, 24ᵗʰ – 29ᵗʰ June, 2013.

Oral presentation:

- Title: A new subclass of energetic GRB-SN sources: The IGC GRB-SN family.

Authors: G. B. Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A. V. Penacchioni, J. A. Rueda, Y. Wang.

13) Attendance to the "13ᵗʰ Italian-Korean Symposium on Relativistic Astrophysics", Seoul, South Korea, 15ᵗʰ – 19ᵗʰ July, 2013.

Oral presentation:

- Title: A new subclass of energetic GRB-SN sources: The IGC GRB-SN family.

Authors: G. B. Pisani, L. Izzo, R. Ruffini, C.L. Bianco, M. Muccino, A. V. Penacchioni, J. A. Rueda, Y. Wang.

14) Attendance to the "Erasmus Mundus School", Nice, France, 16ᵗʰ – 19ᵗʰ September, 2013.

II b Work With Students

None

II c Diploma thesis supervision

None

II d Other Teaching Duties

None

II e. Work With Postdocs

None

III. Service activities

III a. Within ICRANet

None

III b. Outside ICRANet

None

IV. Other

None

2013 List of Publication

1) Pisani, G. B.; Izzo, L.; Ruffini, R.; Bianco, C. L.; Muccino, M.; Penacchioni, A. V.; Rueda, J. A.; Wang, Y., "Novel distance indicator for gamma-ray bursts associated with supernovae", 2013, A&A, **552**, L5, <http://adsabs.harvard.edu/abs/2013A%26A...552L...5P>

2) A.V. Penacchioni, R. Ruffini, C.L. Bianco, L. Izzo, M. Muccino, G.B. Pisani, J. A. Rueda, "GRB 110709B in the induced gravitational collapse paradigm", 2013, A&A, **551**, A133, <http://adsabs.harvard.edu/abs/2013A%26A...551A.133P>

3) Muccino, M.; Ruffini, R.; Bianco, C. L.; Izzo, L.; Penacchioni, A. V.; Pisani, G. B., "GRB 090510: a disguised short GRB with the highest Lorentz factor and circumburst medium", 2013, ApJ, **772**, 62 <http://adsabs.harvard.edu/abs/2013ApJ...772...62M>

4) Ruffini, R.; Izzo, L.; Muccino, M.; Rueda, J. A.; Bianco, C. L.; Dereli, H.; Penacchioni, A. V.; Pisani, G. B.; Wang, Y., "Induced Gravitational Collapse in the BATSE era: the case of GRB 970828", 2013, submitted to A&A

5) Izzo, L.; Pisani, G. B.; Muccino, M.; Rueda, J. A.; Wang, Y.; Bianco, C. L.; Penacchioni, A. V.; Ruffini, R., "A common behavior in the late X-ray afterglow of energetic GRB-SN systems", 2012, ARXIV, <http://adsabs.harvard.edu/abs/2012arXiv1210.8034I>

6) Izzo, L.; R. Ruffini, C.L. Bianco, H. Dereli, M. Muccino, A.V. Penacchioni, G.B. Pisani, J.A. Rueda, "On the thermal and double episode emissions in GRB 970828", 2012, ARXIV <http://adsabs.harvard.edu/abs/2012arXiv1205.6651I>

7) Ruffini, R.; Bianco, C. L.; Enderli, M.; Muccino, M.; Penacchioni, A. V.; Pisani, G. B.; Rueda, J. A.; Sahakyan, N.; Wang, Y.; Izzo, L., "GRB 130427A: predictions about the occurrence of a supernova", 2013, GRB Coordinates Network, Circular Service, 14526, <http://adsabs.harvard.edu/abs/2013GCN..14526...1R>

8) Ruffini, R.; Bianco, C. L.; Enderli, M.; Muccino, M.; Penacchioni, A. V.; Pisani, G. B.; Rueda, J. A.; Sahakyan, N.; Wang, Y.; Izzo, L., "GRB 130609B: theoretical redshift estimation", 2013, GRB Coordinates Network, Circular Service, 14888, <http://adsabs.harvard.edu/abs/2013GCN..14888...1R>

9) Ruffini, R.; Bianco, C. L.; Enderli, M.; Muccino, M.; Penacchioni, A. V.; Pisani, G. B.; Rueda, J. A.; Sahakyan, N.; Wang, Y.; Izzo, L., "GRB 130603B: analogy with GRB 090510A and possible connection with a supernova", 2013, GRB Coordinates Network, Circular Service, 14913, <http://adsabs.harvard.edu/abs/2013GCN..14913...1R>

10) Ruffini, R.; Izzo, L.; Pisani, G. B.; Bianco, C. L., "GRB 121217A theoretical estimate of redshift and of supernova occurrence", 2012, GRB Coordinates Network, Circular Service, 14095, <http://adsabs.harvard.edu/abs/2012GCN..14095...1R>

Strobel Eckhard

Position: PhD Student
Period covered: September 1, 2012- August 31, 2015

<u>I Scientific Work</u>

Critical and overcritical Electromagnetic Fields

<u>II Conferences and educational activities</u>
II a Conferences and Other External Scientific Work

May 2013 "Second Bego Scientific Rencontre Meeting", Nice, France

Jun 2013 "The 2013 yearly ICRANet Meeting on Relativistic Astrophysics", Pescara, Italy

Jun 2013 "The first URCA meeting on Relativistic Astrophysics", Rio de Janeiro, Brazil

Jul 2013 "LOOPS 13", Waterloo, Canada

Sep 2013 "IRAP Ph.D. Erasmus Mundus school", Nice, France

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

<u>III. Service activities</u>

III a. Within ICRANet

III b. Outside ICRANet

<u>IV. Other</u>

<u>2013 List of Publication</u>

Kleinert, Hagen, Eckhard Strobel, and She-Sheng Xue. "Fractional Effective Action at strong electromagnetic fields." *Phys. Rev. D* 88 (2013): 025049

Borja, Enrique F., Iñaki Garay, and Eckhard Strobel. "The Quantum Scalar Field in Spherically Symmetric Loop Quantum Gravity." *Progress in Mathematical Relativity, Gravitation and Cosmology*. Springer Berlin Heidelberg, 2014. 153-156.

Sversut Arsioli Bruno

Position: PhD IRAP-ErasmusMundus
Period covered: 2012-2014

I Scientific Work

Preparation of the largest catalog of HSPs (high spectral peaked blazars) based on WISE all-sky survey data (in collaboration). We have applied a multi-frequency selection scheme taking into account special features from the spectral energy distribution (SED) of well know HSP blazars. The final catalog contains about 700 sources, all expected to be emitters of TeV photons, and many in the observational range of the present and upcoming generation of Cherenkov observatories.

Future Prospects: I – We plan to build a complete sample of Swift/SDSS faint blazars and non-thermal dominated AGN, based on Deep Field XRT images. II – Validate predictions from *Giommi P. and Padovani P.* concerning the existence of transition (or intermediate) sources, connecting the family of BL Lac objects with the FSRQ.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

-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

-Magic AGN WG Meeting, Frascati, 11 to 14 February 2013 ASI Science Data Center, ESRIN

- Erasmus Mundus School, Nice, France, 15th - 31st May, 2013. Presentation; Active Galactic Nucley; Selection scheme for building large samples of HSP blazars (Candidates for TeV detection).

-The 2013 yearly ICRANet Scientific Meeting on Relativistic Astrophysics; June 3-21st, Pescara, Italy & Rome, Italy). On the Occasion of the 50th Anniversary of the Kerr solution of the Einstein's equations, in presence of Roy Kerr.

-Erasmus Mundus School, Nice, France, 2nd - 21st September, 2013. Prepared Presentation; Active Galactic Nuclei; Building a large sample of HSP blazars, Statistical Properties, Fermi γ-ray counterparts, and Candidates for TeV detection.

II b Work With Students

II c Diploma thesis supervision

II d Other Teaching Duties

II e. Work With Postdocs

<u>III. Service activities</u>

III a. Within ICRANet

III b. Outside ICRANet

<u>IV. Other</u>

<u>2013 List of Publication</u>

Ready for Submission: : *1WHSP: an IR-based sample of over 700 TeV blazar candidates. Based on Wise all-sky survey and multi-frequency data*

Valsan Vineeth

Position: Erasmus Mundus PhD, University of Ferrara

Period covered: From September 2010

I Scientific Work

Extending the band of focusing X-ray telescopes beyond 100 keV: motivations and proposed solutions

Developing focusing telescopes for hard X-/soft gamma-rays (70-600 keV) based on Laue lenses, including the study of possible payload configurations for future broad band X-ray missions. The thesis will also deal on science objectives that can be solved with this new instrumentation.

II Conferences and educational activities

II a Conferences and Other External Scientific Work

Schools and Workshops:

1. Erasmus mundus School, Nice, France: 6-30 Setpember 2010.
2. Erasmus Mundus Workshop, Les Houches, France: 3rd- 8th April, 2011.
3. Erasmus Mundus School, Nice, France: 22 May - 11 June, 2011
4. Erasmus Mundus School, Nice, France: 5th - 16th September, 2011.
5. Erasmus Mundus School, Nice, France: 3rd – 21st September, 2012.

Conferences and Seminars:

1. Visit to the ICRANet center in Pescara: 1-13 October, 2010.
2. "IRAP Ph.D. Erasmus Mundus Workshop", March 21th-26th, 2011, Pescara (Italy);
3. 25th Symposium of Relativistic Astrophysics "Texas 2010", Heidelberg, Germany: December 6th-10th, 2010.
4. SPIE Optics and Photonics Conference, San Diego, California USA: 19 - 23 Aug, 2011
5. "Second Ferrara Workshop on X-Ray astrophysics up to 511keV", Ferrara, Italy: 14th-16th September, 2011.
6. "RJR-70" Meeting, University of La Sapienza, Rome, Italy: 5 - 7 June, 2012

7. SPIE Astronomical Instrumentation and Telescopes Conference, Amsterdam, Netherlands: 1 - 6 July, 2012

8. "Marcel Grossmann" meeting, Stockholm, Sweden: 1st - 7th July, 2012.

Publications:

1."The LAUE project for broadband gamma-ray focusing lenses", E. Virgilli, F. Frontera, V. Valsan, V. Liccardo. (Proc. SPIE 8147, 81471C (2011); doi:10.1117/12.895236);

2."Laue lenses for hard x-/soft gamma-rays: new prototype results", E. Virgilli, F. Frontera, V. Valsan, V. Liccardo. (Proc. SPIE 8147, 81471B (2011); doi:10.1117/12.895233);

3. "Gamma-ray Laue lenses under development for deep AGN observations", F. Frontera, G. Risaliti, E. Virgilli, V. Liccardo, V. Valsan. (Journal of Physics: Conference Series 355 (2012) 012005; doi:10.1088/1742- 6596/355/1/012005);

4. "Characterization of bent crystals for Laue lenses", V. Liccardo, F. Frontera, E. Virgilli, V. Valsan. Proc. SPIE 8443, (2012);

5."Development status of LAUE project", F. Frontera, V. Liccardo, E. Virgilli, V. Valsan, V. Carassiti, S. Chiozzi, F. Evangelisti,

S. Sqerzanti, M. Statera Proc. SPIE 8443, (2012);

6."Expected performance of a Laue lens based on bent crystals", V. Valsan, E. Virgilli, V. Liccardo, F. Frontera. Proc. SPIE 8443, (2012)

Presentations and Poster:

1. "Laue lenses for hard X–/soft gamma–rays: new prototype results", SPIE Optics and Photonics conference, San Diego, USA. August 2011.

2. "Test results of a new Laue lens prototype for soft gamma-rays", Second Ferrara workshop on X-ray Astrophysics upto 511 keV, Ferrara, Italy. September 2011.

3. "Expected performance of a Laue lens based on bent crystals", SPIE Astronomical telescopes and Instrumentation conference, Amsterdam. July 2012.

4. "Laue lenses for hard X–/soft gamma rays: From retrospective modeling to prospective performance.", Erasmus Mundus School, Nice, France, September 2012.

<u>Courses, activity and certificates:</u>

- "Techniques of analysing temporal datas", Prof. Mauro Orlandini

  (40 hours course)

- "Observation techniques of astrophysical X-rays and Gamma rays", Prof. Filippo Frontera

  (40 hours course)

- "Spectrum energy correlations in GRBs", Prof. Lorenzo Amati

  (40 hours course)

-- " Detectors for high energy astrophysics", Prof. Ezio Carol

   (40 hours course)

-- "Computational analysis of crystal diffraction",

  Manuel Sanchez Del Rio, Engineer, Instrumentation Services and Development Division European

  Synchroton Radiation Facility (ESRF), Grenoble.

- First certificate in Italian language.

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 → 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 → 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 responsibilities	Evaluation of markets perspective. 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
Main subjects	Expert according to the ISO regulations. Qualification for leading controls according to the UNI EN 9002 regulations.

Personal skills and competences	
Mother tongue	Italian
English	Indipendent User
French	Basic User
Social skills and competences	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
Organisational skills and competences	Innate sense of organisation both in the working place and in the management of personal and familiar life. I am considered as a reference point by the production operators.

Technical skills and competences	Mastery in quality control processes in small enterprises (I was responsible for the qualily evaluation)
Computer skills and competences	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
.Barbaro@unice.fr

Work experiences

02.11.2010	Introduction in the third functional F1 area: Administrative and Consular Officer
15.11.2006	Introduction in the C Functional Area, qualification: Administrative, Consular and Social Adjunct officer
16.05.2001	Introduction in the Functional B3 area, qualification: Administrative collaborator
01.02.1983	Introduction in the Foreign Ministry, qualification: B2 Administrative Assistant

Service in Italy

04.09.2007	Press and information service
01.02.2002	General Direction of the Staff
01.09.1995	General Direction Political Affairs
01.02.1983	General Direction Cultural Affairs

Service abroad

From 2008	Nice – Detached at the International Organization ICRANet
From 2002 to 2007	Nice – Italian General Consulate
From 1990 to 1995	Bruxelles – Permanent Italian Representative at the Athlantic Council

Missions abroad

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 Council

<u>Education and competences</u>

15.03.1985   Degree in Political Sciences – University of Rome "La Sapienza"

Languages:

French   Excellent

English   Good

Spanish   Elementary

<u>Computer Skills</u>

Word – Excel - Internet

Brandolini Gabriele

First name	Gabriele Attilio
Surname	Brandolini
E-mail address	gabriele.brandolini@icranet.org
Telephone	+39 085 23054203
Fax	+39 085 4219252
Nationality	Italian
Place and date of birth	Ortona (CH), 22 April 1986

Work experiences

Date	01 July 2013 - present
Name of employer	Soabit srl
	c/o ICRANet - International Center for Relativistic Astrophysics Network
Kind of Employment	System manager
Main activities and responsibilities	Network administrator – Web development

Date	2011 - 2011
Name of employer	Tipografia F.lli Brandolini snc
Kind of Employment	Graphic designer
Main activities and responsibilities	Network administrator Graphic design and layout texts

Date	2010-2010
Name of employer	Soabit srl
	c/o Univesità degli Studi "G. d'Annunzio" - Chieti
Kind of Employment	Help desk
Main activities and responsibilities	Web development: analysis and development of applications for managing stock of average complexity using PHP and MySQL technologies. Network administrator: support to the installation of network devices and updating of its firmware, to the segmentation of local area network (VLAN 802.1q) and support to troubleshooting activities. Network management: implementation of procedures for the historicizing of traffic flows (NetFlow / PMAcct) generated by the various firewalls on the various local networks.

Date	2009 - 2009
Name of employer	Tipografia F.lli Brandolini snc
Kind of Employment	Graphic designer
Main activities and responsibilities	Network administrator Graphic design and layout texts

Education

Date	September 2005 – 18 December 2012
Title of qualification awarded	Degree in Computer Science
Name and type of organisation providing education and training	University of L'Aquila – Final marks: 88/110 Thesis: "Analisi di prestazioni dell'instradamento in reti di sensori wireless"

Dates	September 2009 – July 2005
Title of qualification awarded	Secondary School Degree
Name and type of organisation providing education and training	Istituto Tecnico Industriale Statale "Luigi di Savoia" - Chieti

Personal skills and competences

Mother tongue	Italian
English	Basic User
Social skills and competences	Ability to work in a team matured in many situations where it was necessary collaboration between the figures, both in academia and in the business and sports. Good relational abilities thanks to the past work experience.
Organisational skills and competences	Sense of organization Good experience in project and team management
Computer skills and competences	Excellent knowledge of Operating Systems: Windows, Mac OS X and Linux. Excellent knowledge of Apple and Microsoft applications and Microsoft Office. Excellent knowledge, also, of various graphics and layout software. Excellent ability to use the Internet and manage applications that use them. Management of Local Area Networks LAN and WLAN and implementation of web applications. Excellent knowledge of HTML, PHP, CSS, Javascript, jQuery, MySQL. Good knowledge of C, C++, Java, VPN, Firewalling.

Other skills and competences	Considerable passion for the sport, followed and practiced.
Driving licence	Driving licence cat. A – B.

Del Beato Annapia

P.zza della Repubblica 10
I-65122 Pescara (Italy)

+39 085 23054206

+39 085 4219252

annapia.delbeato@icranet.org

<u>Work experiences</u>

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
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 qualification awarded	I° level Master "How to teach English"
Principal subjects / occupational skills covered	English and German linguistics psycholinguistic sociolinguistic didactics

computer skills
240 training hours as English teacher at Liceo Scientifico C. D'Ascanio Montesilvano.

Name and type of organisation providing education and training	Università degli Studi "G. D'Annunzio"
Address	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: *The Marrow of Tradition*"
Name and type of organisation providing education and training	Università degli Studi "G. D'annunzio"
Address	V.le Pindaro, 65124 Pescara (Italy)

Dates	Summer 1998 and 2000
Title of qualification awarded	Summer School Camps in UK
Principal subjects / occupational skills covered	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	FEDERICA DI BERARDINO
PHONE	0039-085-23054200
FAX	0039-085-4219252
E-MAIL	federica.diberardino@icranet.org
NATIONALITY	Italian
DATE AND PLACE OF BIRTH	31-03-1980 PESCARA

WORK EXPERIENCE

November 2005-up to now	▪ Head of Secretariat at ICRANet Pescara: coordination of secretariat work, logistic organization for meetings and workshops, translations.
May-October 2005	
September-June 2005	▪ Travel Agent at "Beg Viaggi" Pescara;
April 2005	▪ Italian language training courses for foreign students;
December 2004	▪ Congress Hostess for IN FIERA S.r.l., at "ECOTUR 2005"-Montesilvano;
October-December 2004	
January-December 2004	▪ Congress Hostess (Marcinelle 2005) for Manoppello Municipality (PE);
May 2004	▪ Customer service assistant for Terravision S.r.l. at *Aeroporto d'Abruzzo*, Pescara;
March 2004	▪ 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;
2001-2004	▪ Researcher for "Informazione e servizi senza barriere"(Agency: NETWORK S.r.l.).
	▪ Exhibition Hostess for IN FIERA S.r.l., at "ECOTUR –*Turismo in fiera*" 2001, 2002, 2003, 2004 (at *Palacongressi*, Montesilvano – PE);
2001-2003	▪ Hostess and sales promoter for the agency "Image Service", Città Sant'Angelo (PE);
1998-2000	▪ Birthday party organizer for kids;
	▪ Educator and entertainment organizer in summer camps of E.N.I. in Cesenatico; additional training courses (*Cooperativa Sociale* D.O.C. S.c.r.l., Turin).

EDUCATION

June 2004	▪ Foreign Language and Literature College degree, 110/110 *cum laudem*, at University G. D'annunzio (Pescara). Final thesis on Spanish and

	Economic -Tourism Geography: "Problemi, tendenze 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 language 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 courses 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-level learning of local idiom, the Bislama.
PERSONAL SKILLS	Main studies and job experiences focused on foreign cultures and languages. Graduation on Spanish and English. Daily practice with both languages through conversation and readings. The work experience in touristic exhibitions 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. The work as customer service assistant, hostess and sales promoter have been 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, showing a coordinating attitude in the group. In the same work field it 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.

<u>TECHNICAL SKILLS</u>	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.
<u>ARTISTIC SKILLS</u>	Photography: Diploma of Basic and advanced courses, Reportage and work flow.
	Dance: Jazz Dance, Flamenco, Swing, Afrodance, Latin and Brazilian Dances, Traditional Dances, Artistic Gym.
	Piano and guitar classes.
	Great passion for music (jazz, acoustic, ethnic, rock and classic), theatre and readings.
	Free time: travels and photography.
<u>DRIVING LICENCE</u>	Driving license cat. B

di Niccolo Cinzia

E mail address	cinzia.diniccolo@icranet.org
Telephone	+39 085 23054 219
Fax	+39 085 4219252
Nationality	Italian
Date and place of birth	Terlizzi, 23 May 1985

Work experiences

Date	01 August 2013 → present
Name of employer	ICRANet - International Center for Relativistic Astrophysics Network
Main activities and responsibilities	Secretariat Office

Date	12 June → 16 July 2013
Occupation or position held	ISTAO – Project Work
Main activities and responsibilities	Report And Presentation Of The Results Loccioni Group – Our Presence In The World: Germany, USA, China; Country Analysis: Turkey. Results, Report And Final Slide Presentation To Loccioni Managers
Name and address of employer	Loccioni Group, via Fiume 16, 60030 Angeli di Rosora, Ancona Phone +39.0731.8161 | Fax +39.0731.814.700

Date	From October 2012
Occupation or position held	Conference interpreting and translations.
Name and address of employer	OS-Card Srl – Bologna

Date	May 2012 → September 2012
Occupation or position held	Junior Export Manager
Main activities and responsibilities	Brazil country analysis. Brazilian Portuguese website translation. Company profile in Brazilian Portuguese language.
Name and address of employer	Marzoarreda – Novoli (LE)

Date	September 2011 → January 2013
Occupation or position held	Stageur
Main activities and responsibilities	Legal Office – Notary services Drafting of documents concerning: general/special power of attorney, will and testament of citizens living abroad, public acts, certificates of authentications, self-certifications and official certificates that can be replaced by self-certifications.
Name and address of employer	Italian General Consulate in Brazil – São Paulo Aveinda Paulista, 1963; CEP 01311-300 São Paulo (SP)

Date	October 2011 → January 2012
Occupation or position held	Italian teacher
Main activities and responsibilities	Italian teacher for native Brazilian students. Private lessons and classes. Conference interpreter for 30th São Paulo *Venice Architecture Biennial* 2012
Name and address of employer	Italian Institute of Culture in Brazil – São Paulo Avenida Higienópolis, 436; CEP 01238-000, São Paulo (SP)

Date	January → July 2011
Occupation or position held	Internship
Main activities	Editing, proofreading.
Name and address of employer	Edizioni dell'Urogallo – Literature from Portuguese-speaking countries

Education and training

Date	February → July 2013
Title of qualification awarded	Postgraduate master course in International Management
Name and type of organisation providing education and training	ISTAO – Istituto Adriano Olivetti di Studi per la gestione dell'economia e delle aziende The Masters Course in International Management prepares highly specialized students in the field of international business and trade. Organized in collaboration with ICE (Governamental Agency for the internationalization of Italian companies), Confindustria Marche (Italian Employers' federation) and the Government of the Marche Region, the Master represents one of the most important and valuable programs for new graduates approaching the business world focused on the themes of internationalization: macroeconomics and global markets, enterprise organization, emerging countries, strategies and decision-making skills, contracts, rules, techniques.

Date	May 2012
Title of qualification awarded	CEDILS Certificate Certified teacher for Italian as foreign language
Name and type of organisation providing education and training	Ca' Foscari – University of Venice

Date	November 2008 → 11 July 2011
Title of qualification awarded	Master degree in *Languages for international communication – Portugues EU/BR and Spanish*
Name and type of organisation providing education and training	Univerità degli Studi di Perugia Final marks: 110/110 cum laude Thesis: "Way to Europe. Portugal and the European integration process"

Date	November – December 2010
Title of qualification awarded	Brief Master on Europroject Management 2007-2013
Name and type of organisation providing education and training	Introduction to European Union: institutional, juridical and economic aspects. Training courses: full lifecycle of an EC funded project: proposal preparation and submission, evaluation, negotiation, technical and financial project management, reporting, technical reviews and post-project audits.
Date	November 2004 → 9 November 2008
Title of qualification awarded	Degree in *Linguistic and Cultural Mediation Sciences – Portugues EU/BR and Spanish*
Name and type of organisation providing education and training	Univerità degli Studi di Perugia Final marks: 110/110 cum laude Thesis: Modern poetry in Portugal.
Dates	1999 - 2004
Title of qualification awarded	Secondary School Degree
Name and type of organisation providing education and training	Liceo Linguistico Carlo Troya – Andria (BT)

Personal skills and competences

Mother tongue	Italian
Portuguese	Second language
Spanish	Very good
English	Good
French	Basic User

Social skills and competences	Good ability to adapt to multicultural environment, gained through my experience of studying and travelling abroad (Brazil and Europe); Very good aptitude in teamwork (working within collective projects in the postgraduate course and in academia); Ability to work under pressure.
Organisational skills and competences	Very good sense of organisation and time planning abilities; Self rigorousness and self discipline; Good analytical and problem-solving abilities gained during all study years and especially during internship at Italian General Consulate in Brazil (the Vice-Consul signed my letter of recommendation)
Computer skills and competences	Very good command of Microsoft Office (Word, Excel e PowerPoint); Very good knowledge of Internet and web search engines; Knowledge of graphic application.

Latorre Silvia

PERSONAL INFORMATION

Place and date of birth	Chieti, 23/09/1982
Nationality	Italian
E- mail	silvia.latorre@icranet.org
Phone	085 – 23054223
Fax	085 - 4219252

WORK EXPERIENCES

• Date	12/02/2008 – present
• 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
• Institution	Università degli Studi "G. D'Annunzio" Pescara
• Main Subjects	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: "*La leva finanziaria e la leva operative nel settore pastario*" (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: "*Gli strumenti di analisi strategica: l'analisi SWOT*" (supervisor Prof. Michele A. Rea)
• Mark	106/110
• Date	09/1996 – 07/2001

• Institution	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	Scientific school-leaving certificate
• Mark	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.

Pirone Maria Elena Angela

E-mail address: mariaelena.pirone@icranet.org
Telephone: +39 085 23054206
Fax: +39 085 4219252
Nationality: Italian
Date and place of birth: Rome, 23 April 1985

Work Experiences

October 2013 - up to now ICRANet Pescara – International Center for Astrophysics Network: Secretariat Office.

September – February 2012 Preparation Course and Registration to RUI -Registro Unico degli Intermediari- at Insurance Company Ina Assitalia S.P.A. in Pescara

May 2011 – June 2012 Internship at Banca Tercas S.p.A. in Teramo: Foreign Office and Compliance and Anti-laundering Office.

September 2007 – Genuary 2008 Internship at United States of America Consulate of Milan: Protocol/Ceremony Office.

2007 – 2010 Baby-sitting activities and private English lessons for children

Education

June 2010 – September 2010 Specialization Course in Business English at Frances King School of London

April 2010 Master Degree in International Management (Faculty of Linguistic Sciences and Foreign Litaratures) at Cattolica del Sacro Cuore University of Milan.
Main subjects: international economic subjects and foreign languages English and French.
Thesis in International Marketing: "Internationalization strategies of the Italian PMI (small and medium companies): a focus on the Chinese market".

June 2008 – September 2008   Brief Master in Creative Advertising, PR & Marketing Communication
at Michigan State University.

February 2008   Degree in Linguistic Sciences for Communication and Business (Faculty
of Linguistic Sciences and Foreign Literatures) at Cattolica del Sacro
Cuore University of Milan.
Main subjects: economic subjects and foreign languages, English and
French.

June 2004   High School Degree at Liceo Classico "G. D'Annunzio" of Pescara.

<u>Foreign Languages</u>

Italian: mother tongue
Inglese: f luent
French: good

<u>Technical Competences</u>

2006   ECDL (European Computer Driving Licence)
Microsoft Office (Word, Excel, Powerpoint, Access, Internet)

<u>Other activities and Hobbies</u>

2003   Diploma at Accademia di teatro "Circus" of Pescara (Artistic
Director Enzo Garinei).

Hobbies: reading, classical ballet and modern dance, keen about art, theatre and fashion.

<u>Driving Licence</u>   Driving licence cat. B