

Giovanni Battista Pisani

CURRICULUM VITAE

11th February, 2015

■ Science High-School Diploma, 2000-2005

Institution: Liceo Scientifico Leonardo Da Vinci, Vallo della Lucania (SA), Italy;

Final Mark: 100 / 100.

■ Bachelor Degree in Physics, 2005-2008

Institution: Dipartimento di Fisica, Sapienza Università di Roma, Rome, Italy;

Thesis discussion date: 29th October 2008;

Final Mark: 110 / 110 cum laude;

Supervisor: Dr. Alessandro Melchiorri;

Thesis title: The primordial Nucleosynthesis;

Brief Thesis summary: In my thesis I discuss the standard model of primordial nucleosynthesis (SBBN) in light of the remarkable observational results in the current *Precision Cosmology Era*. I describe the initial conditions, the synthesis of the lightest nuclei, and their predicted abundance. I also briefly consider some non-standard models. I discuss the post-BBN evolution of the relic nuclei, focusing on the impact on observational problems and actual results. In the end I present the most recent observational results for the relic nuclei abundances and how they match with the standard and non-standard theoretical predictions.

■ Master Degree in Theoretical Physics, 2008-2010

Institution: Dipartimento di Fisica, Sapienza Università di Roma, Rome, Italy;

Thesis discussion date: 29th October 2010;

Final Mark: 110 / 110;

Supervisors:

- Dr. Alessandro Melchiorri (Sapienza Università di Roma, Rome, Italy);
- Dr. Roberto Trotta (Imperial College, London, UK);

Collaborators:

- Dr. Carlos Pérez de los Heros (IceCube collaboration, Uppsala University, Uppsala, Sweden);
- Dr. Roberto Ruiz de Austri (IFIC-UV/CSIC, Valencia, Spain);

Periods of Thesis work carried abroad:

- 1 month at the Institut Astrophysique de Paris (IAP), Paris, France;
- 2 months at the Imperial College of London, London, UK;

Thesis title: Indirect neutralino detection at the IceCube neutrino telescope;

Brief Thesis summary: Weakly interacting massive particles (WIMPs) are among the most promising candidates for dark matter. During the last decades a wide range of experiments have been developed with the goal of detecting such WIMPs directly or indirectly. Among the WIMPs, in my thesis I focus on the lightest neutralino predicted by the constrained minimal supersymmetric standard model (CMSSM), and on its search at the IceCube neutrino telescope. In fact, a promising indirect search line is to look for an excess of neutrinos produced by neutralino's annihilation in the center of the Sun.

In my thesis, using the SuperBayeS code, I prove that the most likely areas of phase space of the CMSSM are beyond reach of the 22-strings configuration of IceCube. Then, using the expected sensitivity of the final 86-strings configuration of IceCube, including its low energy extension DeepCore, I show that the IceCube constraints on the CMSSM improve, but the Sun neutralino detection chances remain significantly low.

■ Ph.D. in Physics and Relativistic Astrophysics, 2011-2014

Institution: Dipartimento di Fisica, Sapienza Università di Roma, Rome, Italy;

Ph.D. Program: International relativistic astrophysics (IRAP) Ph.D., Erasmus Mundus Joint Doctorate (EMJD) Program, supported by Grant Number 2011-1640 from the EACEA of the European Commission;

Thesis discussion date: 26th November 2014;

Supervisor: Prof. Remo Ruffini (Sapienza Università di Roma and ICRA, Rome, Italy; ICRANet, Pescara, Italy);

Thesis title: A novel paradigm for energetic gamma-ray bursts associated with supernovae: towards a new standard candle;

Summary of the Ph.D. Research project: Gamma-ray bursts (GRBs) are among the most extreme and puzzling astrophysical objects that we observe. The “fireshell” model, interpreting GRBs as the consequence of a stellar mass black hole (BH) birth, well reproduces the photometrical and spectral features observed in the bulk emission of GRBs. Recently, the induced gravitational collapse (IGC) mechanism, which includes the fireshell model, has been proposed to explain the spacial and temporal connection of some GRBs with supernovae (SNe) starting from an evolved binary system composed of a FeCO core and a neutron star (NS). The recent works on GRB 090618 and 101023, which were been found to show a multiepisodic nature, opened the way to the extension of the IGC application to GRBs with isotropic energy larger than 10^{52} erg.

My work during three years of Ph.D. has been, and currently is, focused on the application and development of the IGC and the fireshell model to GRB sources. My work comprehends reduction and analysis of data coming from various detectors, such as BAT, XRT and UVOT onboard Swift satellite; GBM and LAT onboard Fermi satellite; and others several space- and ground-based telescopes. My work also encompasses simulations of GRBs light curves and spectra within the fireshell model, search for correlations among different GRB observables and, in general, for analogies and differences among the multiwavelength components of GRBs.

Together with my collaborators, I have fitted various GRB sources within the fireshell model, such as: GRB 110709B and 970828, multiepisodic GRBs analogous to GRB 090618 and 101023; and GRB 090510, a long GRB which appears short due to the peculiar surrounding conditions. The main result on my thesis work is the discovery of a striking common behaviour in the late X-ray luminosity light curve within a “golden sample” of nearby, energetic, multiepisodic GRBs associated with SNe: GRB 060729, 061007, 080319B, 090618, 091127, and 111228. This result contributed to the development of the new concept of binary-driven hypernova (BdHN), which includes the IGC and the fireshell models, whose aim is the exhaustive explanation of the GRB-SN connection. This scaling law has rapidly become a necessary criterium for the BdHN identification, allowing us to predict the SN emergence in the optical band ~ 13 days after the GRB 130427A explosion. We have used this scaling law as a distance indicator too, inferring the distances of GRBs fitting the BdHN paradigm as GRB 101023 and 110709B, and successfully predicting the redshift of GRB 140512 before its measurement. Finally, we have recently identified the farthest ($z = 8.2$) GRB 090423 as a BdHN thanks to the overlapping of its X-ray luminosity with the BdHNe ones at late times. This result opens the way for the late X-ray luminosity of BdHNe to be actually used in future as a standar candle to test the Λ CDM model.

■ Scientific papers published on refereed Journals

- 1) 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;
- 2) Penacchioni, A.V.; Ruffini, R.; Bianco, C. L.; Izzo, L.; Muccino, M.; **Pisani, G. B.**; Rueda, J. A., “GRB 110709B in the induced gravitational collapse paradigm”, 2013, A&A, 551, A133;

- 3) **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;
- 4) Ruffini, R.; Muccino, M.; Bianco, C. L.; Enderli, M.; Izzo, L.; Kovacevic, M.; Penacchioni, A. V.; **Pisani, G. B.**; Rueda, J. A.; Wang, Y., ``On binary-driven hypernovae and their nested late X-ray emission'', 2014, A&A , 565, L10;
- 5) Ruffini, R.; Izzo, L.; Muccino, M.; **Pisani, G. B.**; Rueda, J. A.; Wang, Y.; Barbarino, C.; Bianco, C. L.; Enderli, M.; Kovacevic, M., ``Induced gravitational collapse at extreme cosmological distances: the case of GRB 090423'', 2014, A&A, 569, A39;
- 6) Kovacevic, M.; Izzo, L.; Wang, Y.; Muccino, M.; Della Valle, M.; Amati, L.; Barbarino, C.; Enderli, M.; **Pisani, G. B.**; Li, L., ``A search for Fermi bursts associated to supernovae and their frequency of occurrence'', 2014, A&A, 569, A180;
- 7) Ruffini, R.; Wang, Y.; Kovacevic, M.; Bianco, C. L.; Enderli, M.; Muccino, M.; Penacchioni, A. V.; **Pisani, G. B.**; Rueda, J. A., ``GRB 130427A and SN 2013cq: A Multi-wavelength Analysis of an Induced Gravitational Collapse Event'', 2015, ApJ, 798, 10;
- 8) Ruffini, R.; Izzo, L.; Muccino, M.; Rueda, J. A.; Barbarino, C.; Bianco, C. L.; Dereli, H.; Enderli, M.; Penacchioni, A. V.; **Pisani, G. B.**; Wang, Y., ``Induced Gravitational Collapse in the BATSE era: the case of GRB 970828'', in press, Astronomy Reports.

■ Scientific papers submitted to refereed Journals or in preparation

- 1) Muccino, M.; Ruffini, R.; Kovacevic, M.; Izzo, Oliveira, F. G.; Rueda, J. A.; L.; Bianco, C. L.; Enderli, M.; Penacchioni, A. V.; **Pisani, G. B.**; Wang, Y.; Zaninoni, E., ``GRB 140619B: a short GRB from a binary neutron stars merger leading to the black hole formation'', submitted to ApJ;
- 2) **Pisani, G. B.**; Ruffini, R.; Bianco, C. L.; Enderli, M.; Kovacevic, M.; Muccino, M.; Penacchioni, A. V.; Rueda, J. A.; Wang, Y.; Zaninoni, E.; Izzo, L.; ``The GeV and X-ray emissions of GRB 090510 compared and contrasted with the one of GRB 130427A'', in preparation;

■ Proceedings of science

- 1) **Pisani, G. B.**; Ruffini, R.; Bianco, C. L.; Enderli, M.; Izzo, L.; Kovacevic, M.; Muccino, M.; Penacchioni, A. V.; Rueda, J. A.; Wang, Y., ``The IGC GRB-SN family: the cases of GRB 130427A and GRB 060614'', 2013, POS 27th Texas Symposium;
- 2) **Pisani, G. B.**, Izzo, L.; Ruffini, R.; Bianco, C. L.; Muccino, M.; Penacchioni, A. V.; Rueda, J. A.; Wang, Y., ``On a novel distance indicator for Gamma-Ray Bursts associated with Supernovae'', 2013, POS Huntsville GRB Symposium;

- 3) **Pisani, G. B.**; Izzo, L.; Ruffini, R.; Bianco, C. L.; Muccino, M.; Penacchioni, A. V.; Rueda, J. A.; Wang, Y., "On a novel distance indicator for Gamma-Ray Bursts associated with Supernovae", 2013, POS MG13;
- 4) Bianco, C. L.; Bernardini, M. G.; Caito, L.; De Barros, G.; Izzo, L.; Muccino, M.; Patricelli, B.; Penacchioni, A. V.; **Pisani, G. B.**; Ruffini, R., "Needs for a new GRB classification following the fireshell model: "genuine short", "disguised short" and "long" GRBs", 2012, POS GRB 2012 Conference;
- 5) Penacchioni, A. V.; **Pisani, G. B.**; Ruffini, R.; Bianco, C. L.; Izzo, L.; Muccino, M., "The proto-black hole concept in GRB 101023 and its possible extension to GRB 110709B", 2012, POS GRB 2012 Conference.

■ GRB Coordinates Network, Circular Service

- 1) Ruffini, R.; Bianco, C. L.; Enderli, M.; Kovacevic, M.; Muccino, M.; Penacchioni, A. V.; **Pisani, G. B.**; Rueda, J. A.; Wang, Y., "GRB 140206A: theoretical prediction of redshift and of supernova occurrence", 2014, GCN 15794, 1;
- 2) Ruffini, R.; Bianco, C. L.; Enderli, M.; Kovacevic, M.; Muccino, M.; Penacchioni, A. V.; **Pisani, G. B.**; Rueda, J. A.; Wang, Y., "GRB 140108A: theoretical prediction of redshift and of supernova occurrence", 2014, GCN 15707, 1;
- 3) Ruffini, R.; Bianco, C. L.; Enderli, M.; Kovacevic, M.; Muccino, M.; Penacchioni, A. V.; **Pisani, G. B.**; Rueda, J. A.; Wang, Y., "GRB 131202A: theoretical estimation of the redshift.", 2013, GCN 15576, 1;
- 4) Ruffini, R.; Bianco, C. L.; Enderli, M.; Kovacevic, M.; Muccino, M.; Penacchioni, A. V.; **Pisani, G. B.**; Rueda, J. A.; Wang, Y., "GRB 060614: theoretical derivation of the redshift and need for deeper search of the host galaxy", 2013, GCN 15560, 1;
- 5) 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 130925A: possible signatures of binary nature in the afterglow - request for observations", 2013, GCN 15322, 1;
- 6) Ruffini, R.; Bianco, C. L.; Enderli, M.; Muccino, M.; Penacchioni, A. V.; **Pisani, G. B.**; Rueda, J. A.; Sahakyan, N.; Wang, Y., "GRB 130603B: analogy with GRB 090510A and possible connection with a supernova", 2013, GCN 14913, 1;
- 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 130609B: theoretical redshift estimation", 2013, GCN 14888, 1;
- 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 130427A: predictions about the occurrence of a supernova", 2013, GCN 14526, 1;
- 9) Ruffini, R.; Izzo, L.; **Pisani, G. B.**; Bianco, C. L., "GRB 121217A theoretical estimate of redshift and of supernova occurrence", 2012, GCN 14095, 1.

■ Ph.D. Schools and International Meetings attended

- 1) "Erasmus Mundus School", Nice, France, 5th - 17th September, 2011;
- 2) "IRAP Erasmus Mundus Workshop", Les Houches, France, 2nd - 6th October, 2011;
- 3) "Third Galileo-Xu Guangqi" meeting, Beijing, China, 11th- 15th October, 2011;
- 4) "Fermi/Swift GRB 2012 Conference", Munich, Germany, 7th – 11th May, 2012;
Poster 1: The proto-black hole concept in GRB 101023 and its possible extension to GRB 110709B
Poster 2: Needs for a new GRB classification following the fireshell model: "genuine short", "disguised short" and "long" GRBs
- 5) "Erasmus Mundus School", Nice, France, 4th – 8th June, 2012;
Lecture: A new interpretation for the disguised short GRB 060614
- 6) "13th Marcel Grossmann Meeting", Stockholm, Sweden, 1st - 7th July, 2012;
Talk: A new possible interpretation for GRB 060614
- 7) "Erasmus Mundus School", Nice, France, 3rd – 19th September, 2012;
Lecture: The class of "disguised" short GRBs within the fireshell model and the particular case of GRB 060614
- 8) III National Congress "Lampi su Napoli", Naples, Italy, 20th - 22nd September, 2012;
- 9) "The Current Issues on Relativistic Astrophysics", 5th - 6th October, 2012, Seoul, South Korea;
Talk: Evidence and consequences of universal behavior of late time X-ray emission of Gamma-Ray Bursts connected with Supernovae
- 10) "7th Huntsville GRB Symposium", Nashville TN, USA, 14th – 18th April, 2013;
Poster: Novel distance indicator for Gamma-Ray Bursts associated with Supernovae
- 11) "2nd Bego Rencontres", Nice, France, 16th – 31st May, 2013;
Talk: A new subclass of energetic GRB-SN sources: The IGC GRB-SN family
- 12) "2013 yearly ICRA Net Scientific Meeting on Relativistic Astrophysics", Pescara, Italy, 3rd – 21th June, 2013;
- 13) "1st URCA Meeting on Relativistic Astrophysics", Rio de Janeiro, Brasil, 24th – 29th June, 2013;
Talk: A new subclass of energetic GRB-SN sources: The IGC GRB-SN family
- 14) "13th Italian-Korean Symposium on Relativistic Astrophysics", Seoul, South Korea, 15th – 19th July, 2013;
Talk: A new subclass of energetic GRB-SN sources: The IGC GRB-SN family
- 15) "Erasmus Mundus School", Nice, France, 3rd – 20th September, 2013;
Lecture: A new subclass of energetic GRB-SN sources: The IGC GRB-SN family

- 16) 27th Texas Meeting on Relativistic Astrophysics”, Dallas TX, USA, 8th - 13th, December 2013;
Talk: The IGC GRB-SN family: the cases of GRB 130427A and GRB 060614
- 17) “Erasmus Mundus School”, Nice, France, 23rd - 27th February, 2014;
Lecture 1: GRBs-SNe within the Induced Gravitational Collapse model
Lecture 2: The role of the High Energy in short and long GRBs
- 18) “Erasmus Mundus School”, Les Houches, France, 11th - 16th May, 2014;
Lecture: GRBs-SNe within the Induced Gravitational Collapse model: towards a new standard candle
- 19) “1st Scientific ICRA Net Meeting in Armenia”, Yerevan, Armenia, 30th June - 4th July, 2014.
Talk: Energetic GRBs-SNe within the Induced Gravitational Collapse model: towards a new standard candle
- 20) “3rd Bego Rencontres”, Nice, France, 8th – 19th September, 2014;
Talk: Energetic GRBs-SNe within the Induced Gravitational Collapse
- 21) “Swift: 10 Years of Discovery”, Rome, Italy, 2nd – 5th November, 2014.
Poster: Binary-driven HyperNovae and their nested late X-ray emission

■ Awards

ADISU Fellowship for support Bsc studies, academic year 2006/07;
ADISU Fellowship for support Bsc studies, academic year 2007/08;
ADISU Grant for BSc Graduation, 2008;
ADISU Fellowship for support MSc studies, academic year 2008/09;
ADISU Fellowship for support MSc studies, academic year 2009/10;
AST Fellowship for at least 2 months of MSc Thesis work carried abroad, 2010;
ADISU Grant for MSc Graduation, 2010;
Erasmus Mundus IRAP PhD fellowship, 2011-2014.

■ Foreign languages

English:
Writing: very good;
Reading: very good;
Speaking: very good.

■ Computer skills

Operating System known: Microsoft Windows, Linux, Mac OS X.
Programming languages known: C, Fortran, MATLAB, LaTeX, Mathematica.