

# ELOISA BENTIVEGNA

Ricercatore a tempo determinato  
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## EDUCATION

**2003-2008, Pennsylvania State University (U.S.A.):** Ph.D. in Physics, Minor in High Performance Computing (thesis: *Ringing in unison: Exploring black hole coalescence with quasinormal modes*, advisor: D.M. Shoemaker).

**1996-2002, Università di Catania (Italy):** M.Sc. in Physics, Theory Sector, 110/110 cum laude (thesis: *Robertson-Walker cosmologies and recent data from type-Ia supernovae*, advisors: A.M. Anile, A. Bonanno).

## LANGUAGES

Native Italian, fluent English, intermediate German.

## EXPERIENCE

**Ricercatore a tempo determinato, Università di Catania (Catania, Italy) 2014-present**

I am currently funded by a Rita Levi Montalcini grant to establish a research group in the field of gravitational physics, with a particular emphasis on numerical relativity and cosmology.

**Founder and Director, Wissenswerkstatt Berlin (Berlin, Germany) 2013-present**

I participated in a program, run by the Universität Potsdam, to train researchers in technology transfer and entrepreneurship. As a result, I founded an outreach program to create an interface between professional researchers in the Berlin area and the public.

**Marie Curie Fellow, Max Planck Institute for Gravitational Physics (Potsdam, Germany) 2010-2013**

I was funded by a Marie Curie Reintegration Grant supporting project COSMOTOOLKIT, which I have designed and developed. The project aimed at extending the Einstein Toolkit, a community infrastructure used for simulations in relativistic astrophysics, to also simulate cosmological scenarios such as inflation and the growth of cosmic structure. COSMOTOOLKIT presently includes prototypes for the 3D evolution of perfect, pressureless fluids and scalar fields, along with a pipeline for the generation of initial data.

**Lecturer, International Max Planck Research School in Gravitational Wave Astronomy 2012**

I have designed and carried out part of the Numerical Relativity course during the first IMPRS Lecture Week 2012.

**Postdoctoral researcher, Center for Computation and Technology, Louisiana State University (Baton Rouge, LA, U.S.A.) 2008-2010**

I worked, co-supervising a graduate student, as the developer team for project Alpaca (Application-Level Performance and Correctness Analysis, an NSF-funded grant), which proposed to build tools for agile debugging and optimization of large-scale scientific codes. I concentrated, in particular, on 3D visualization, an area which I felt was underdeveloped since my graduate-school days. I also carried on pursuing my relativity interests with the study of energy and angular momentum estimates in compact-object spacetimes.

**Research Assistant, Pennsylvania State University (State College, PA, U.S.A.) 2004-2008**

My main focus during this period were black-hole physics and cosmology, mostly from a numerical-relativity perspective. In particular, I worked on a scattering-like method to extract information from a coalescing black-hole binary, with the aim of predicting how much detail of the strong-gravity regime one can read in the gravitational waveforms that leave the system. Concurrently, I collaborated with the Loop Quantum Gravity group to carry out one of the theory's first applications to cosmology: the early evolution of a homogeneous and isotropic universe with a cosmological constant. Starting from my first summer at Penn State, I collaborated with a number of groups in the Physics, Civil Engineering and Computer Science and Engineering departments, as well as the Institute for Gravitation and Geometry and the Center for Gravitational Wave Physics. Whilst my main focus was to advance my skills in gravitational physics, I was also attracted towards the great variety of opportunities and expertise that surrounded me. I ended

up enrolling in the High-Performance-Computing minor and had the chance to explore topics in 3D visualization, non-linear optimization and pervasive computing.

**Teaching Assistant, Pennsylvania State University (State College, PA, U.S.A.)**

**2003-2005**

For four semesters at the beginning of my graduate studies, I worked half-time leading the recitation sections for introductory physics classes aimed at non-majors (mostly life-science and pre-medical students). I designed parts of the course, held weekly recitations reviewing the course material with example problems, graded the homework and proctored the exams.

**Research Collaborator, Università di Catania (Catania, Italy)**

**2002**

After obtaining my M.Sc., I spent six months as a research collaborator at the University's Astrophysical Observatory, extending my thesis project on comparing a cosmological model based on Asymptotically-Safe Gravity against new datasets.

**AWARDS**

- Rita Levi Montalcini Grant (MIUR, 2014)
- degewo Gründerpreis nomination (degewo, 2013)
- Marie Curie International Reintegration Grant (Seventh Framework, 2009)
- First Prize (with CCT team) (Second IEEE International Scalable Computing Challenge, 2009)
- J.A. Wheeler Fellow (University of Texas at Austin, 2006)
- Duncan Fellow (Pennsylvania State University, 2004-2007)
- Braddock Fellow (Pennsylvania State University, 2003)

**SELECTED TALKS AND PRESENTATIONS**

1. *Quanti buchi neri può contenere l'universo? Cosmologie analitiche e numeriche per un reticolo di singolarità di Schwarzschild*, XXI Conferenza Società Italiana di Relatività Generale e Fisica della Gravitazione (Università del Piemonte Orientale, Alessandria, September 16th 2014)
2. *A matter-free lumpy universe: modelling cosmological inhomogeneities with black holes*, invited seminar, (Oskar Klein Center, March 12th 2013)
3. *Black-hole lattices*, Spanish Relativity Meeting (Guimarães, Portugal, September 3rd 2012)
4. *Black-hole lattices and inhomogeneous dust: modelling the three-dimensional universe with numerical relativity*, invited Theory Seminar (Institut für Physik, Mainz, January 24th 2012)
5. *Verifying numerical relativity codes: application-level correctness and runtime tools*, Workshop on Numerical Relativity and Gravitational Waves (Università di Parma, Italy, September 7th 2011)
6. *Modelling and observing strong-gravity systems*, 5th European School on Experimental Nuclear Astrophysics (Santa Tecla, Italy, September 25th 2009)
7. *Ensuring correctness at the application level: A software framework approach*, 2nd Workshop on Component-Based High Performance Computing (Portland, OR, U.S.A., November 15th 2009)
8. *Constant-expansion surfaces for finite-distance angular momentum estimates in numerical relativity*, 12th Marcel Grossman Meeting (Paris, France, July 16th 2009)
9. *Introduction to the Cactus framework*, Tutorial (with Erik Schnetter and Frank Löffler), International Conference on Computational Science (ICCS) (Baton Rouge, U.S.A., May 24th 2009)
10. *Quasi-local angular momentum estimates via constant-expansion surfaces*, 5th Gulf Coast Gravity Meeting (Louisiana State University, U.S.A., April 19th 2009)
11. *Probing the black-hole merger regime with scalar perturbations*, Meeting of the American Physical Society (St. Louis, MO, U.S.A., April 12th 2008)
12. *Scalar field dynamics on black hole spacetimes*, 10th East Coast Gravity Meeting (Cornell University, U.S.A., May 31st 2007)
13. *Simulating Black Hole Spacetimes: the New Singularity Avoidance Paradigm*, Astronomy Colloquium (Università di Catania, May 19th 2006)

**PUBLICATIONS**

1. E. Bentivegna, *Solving the Einstein constraints in periodic spaces with a multigrid approach*, Class. Quantum Grav. 31 035004 (2014)
2. E. Bentivegna, *Black-hole lattices*, Proceedings of the Spanish Relativity Meeting 2012, Springer (2013)
3. E. Bentivegna & M. Korzynski, *Evolution of a family of expanding cubic black-hole lattices in numerical relativity*, Class. Quantum Grav. 30 235008 (2013)
4. E. Bentivegna & M. Korzynski, *Evolution of a periodic eight-black-hole lattice in numerical relativity*, Class. Quantum Grav. 29 165007 (2012)
5. E. Bentivegna & E. Schnetter, *Constant-expansion surfaces for finite-distance extraction of observables in numerical relativity*, in the Proceedings of the Twelfth Marcel Grossman Meeting (World Scientific) (2012)
6. F. Löffler, J. Faber, E. Bentivegna, T. Bode, P. Diener, R. Haas, I. Hinder, B. Mundim, C. Ott, E. Schnetter, G. Allen, M. Campanelli & P. Laguna, *The Einstein Toolkit: A Community Computational Infrastructure for Relativistic Astrophysics*, Class. Quantum Grav. 29 115001 (2012)

7. I. Hinder, B. Wardell & E. Bentivegna, *Falloff of the Weyl scalars in binary black hole spacetimes*, Phys.Rev.D84:024036 (2011)
8. O. Korobkin, G. Allen, S. Brandt, E. Bentivegna, P. Diener, J. Ge, F. Löffler, E. Schnetter, J. Tao, *Runtime analysis tools for parallel scientific applications*, in Proceedings of the 2011 TeraGrid Conference: Extreme Digital Discovery, ACM (New York), ISBN: 978-1-4503-0888-5 (2011)
9. A. Hutanu, E. Schnetter, W. Bengert, E. Bentivegna, A. Clary, P. Diener, J. Ge, R. Kooima, O. Korobkin, K. Liu, F. Löffler, R. Paruchuri, J. Tao, C. Toole, A. Yates & G. Allen, *Large scale problem solving using automatic code generation and distributed visualization*, Scalable Computing: Practice and Experience, Special Issue on Grid Applications and Middleware and Large Scale Computations in Grids (2010)
10. E. Bentivegna, *Modelling and observing strong-gravity systems*, AIP Conf. Proc. 1213:189 (2010)
11. E. Bentivegna, G. Allen, O. Korobkin & E. Schnetter, *Ensuring correctness at the application level: a software framework approach*, Proceedings of the 2009 Workshop on Component-Based High Performance Computing (2009)
12. M. Wenstrom, E. Bentivegna & A. Hurson, *Balancing transparency, efficiency and security in pervasive systems*, in Advances in Computers, vol. 73, ISBN-13: 978-0-12-374425-8, Elsevier (2008)
13. E. Bentivegna & T. Pawlowski, *Anti-deSitter universe dynamics in Loop Quantum Cosmology*, Phys.Rev.D77:124016 (2008)
14. E. Bentivegna, D. Shoemaker, I. Hinder & F. Herrmann, *Probing the Binary Black Hole Merger Regime with Scalar Perturbations*, Phys.Rev. D77:124016 (2008)
15. E. Bentivegna, P. Laguna & D. Shoemaker, *The effect of gauge conditions on waveforms from binary black hole coalescence*, AIP Conf.Proc. 873:94 (2006)
16. E. Bentivegna, A. Bonanno & M. Reuter, *Confronting the IR fixed point cosmology with high redshift supernova data*, JCAP 0401-001 (2004)

## OTHER ACTIVITIES

### Outreach

- Presentation: *Numerical relativity at the MPI-GP*, Jürgen Ehlers Spring School "Gravitational Physics" (2011)
- LSU-CCT machine room tours (2009)
- Pennsylvania State University Graduate School Exhibition (2008)

### Service

- Program Committee Member for the IEEE/ACM International Conference on Grid Computing
- Referee for Classical and Quantum Gravity
- APS Blue Apple Award Committee Member

### Memberships

- European Physical Society
- Marie Curie Fellow Association
- Einstein Toolkit Consortium
- American Physical Society (until 2012)
- Sigma Delta Epsilon - Graduate Women in Science (until 2008)
- American Association for the Advancement of Science (until 2004)
- Società Italiana di Fisica (until 2003)

### Visits

- Oskar Klein Center for Cosmoparticle Physics (Stockholm), March 11th-15th, 2013
- Perimeter Institute for Theoretical Physics (Waterloo), October 29th-November 2nd, 2012
- Erwin Schrödinger International Institute for Mathematical Physics (Vienna), July 11th-22nd, 2011
- Institute of Cosmology and Gravitation (Portsmouth), January 10th-14th and February 2nd-4th, 2011
- Max Planck Institute for Gravitational Physics (Potsdam-Golm), March 2nd-10th, 2009 and February 17th-23rd, 2010
- San Diego Supercomputer Center, July 16th-20th, 2007