

# Dr. Marco Baldi

## Curriculum Vitae et Studiorum

September 10, 2015

### — PRESENT STATUS —

At present I live in Bologna where I moved in November 2012 after a long period of study and work in Germany, during which I obtained a **PhD in Astrophysics from the Ludwig-Maximilians University** in March 2009, under the supervision of Prof. Simon D. M. White. After that, I have been working as a **Post-Doc at the Heidelberg University and at the Ludwig-Maximilians University in Munich**. In 2012 I obtained a **Marie Curie Intra-European Fellowship** to be spent at the Department of Physics and Astronomy of the Alma Mater University in Bologna, where I am presently a post-doctoral fellow. My research interests are mainly related to the **investigation of alternative cosmological model, as e.g. Dark Energy, Modified Gravity, non-standard Dark Matter candidates, massive neutrinos, and deviations from standard models of primordial inflation**, in particular in relation to **their impact on structure formation**. More specifically, my present work consists on **designing and using suitable N-body algorithms** to investigate the effects of various non-standard cosmological model on linear and non-linear structure formation processes. I also work on investigating the **possible observational degeneracies** of these models with other cosmologically relevant phenomena (such as baryonic physics or galaxy populations bias), or with each other. I have been recently **awarded an individual 3-years research grant of 530 k Euro from the Italian Ministry of Research and Education** (the SIR project, see [www.sir.miur.it](http://www.sir.miur.it)) for a proposal called SIMCODE specifically devoted to **investigate these degeneracies using cosmological N-body simulations**. I am a **member of the Euclid collaboration** in the *Theory, Cosmological Simulations*, and *CMB cross-correlation* Science Working Groups and in the *Galaxy Clustering Validation* Work Package of the Science Ground Segment. Within the *Cosmological Simulations* Working Group I hold the role of **Coordinator for the development of numerical tools for non-standard cosmological models**.

### — EDUCATION AND RESEARCH ACTIVITIES —

NOVEMBER 2014 - PRESENT

**Post-Doc researcher** at the Department of Physics and Astronomy of the Alma Mater University of Bologna.

NOVEMBER 2012 - OCTOBER 2014

**Marie-Curie Fellow** at the Department of Physics and Astronomy of the Alma Mater University of Bologna.

DECEMBER 2009 - OCTOBER 2012

**Post-Doc researcher** at the Excellence Cluster Universe in Garching, working with Prof. J. Weller on simulations of generalized **Dark Energy and Modified Gravity models and Large-Scale Structures**.

APRIL 2009 - OCTOBER 2009

**Transregio Post-Doc Fellow** at the Institute for Theoretical Physics in Heidelberg, working with Prof. C. Wetterich on interacting dark energy models.

20 MARCH 2009

**Ph.D. Rer. Nat.** with the grade **MAGNA CUM LAUDE** at the Ludwig-Maximilians University in Munich, with the research thesis **“Interactions between Dark Energy and Dark Matter”**, held under the supervision of Prof. Dr. Simon D. M. White.

SEPTEMBER 2005 - MARCH 2009

**PhD Student** at the Max-Planck-Institut für Astrophysik within the framework of the International Max Planck Research School on Astrophysics (IMPRS). **Member of the Transregio collaboration** of the German Physical Society (DPG) about the investigation of The Dark Universe.

JANUARY 2005 - AUGUST 2005

Collaboration with the Institute for Space Astrophysics and Cosmic Physics (IASF) in Bologna, working with Dr. Fabio Finelli and Prof. Sabino Matarrese on inflationary models.

17 DECEMBER 2004

**Laurea in Physics** with the maximum mark of **110/110 CUM LAUDE** at the Bologna University, with the research thesis “**Evolution of perturbations in cosmological models with dynamic dark energy**”, held under the supervision of Prof. Sabino Matarrese, Prof. Lauro Moscardini and Dr. Fabio Finelli.

SEPTEMBER 1998 - DECEMBER 2004

**Undergraduate studies in Physics** at the Bologna University, with the General Theoretical Physics curriculum.

### — FELLOWSHIPS AND GRANTS —

**2015** - Awarded a **SIR individual research grant** (success rate  $\sim 2.7\%$ ) from the Italian Ministry of Research and Education (MIUR). The grant amounts to **EUR 530,552.00** for a period of 36 months.

**2012** - Principal Investigator of the **European Tier-0 PRACE project SIBEL1**: 8.4 million CPU hours on the Tier-0 machine MareNostrum3 at the Barcelona Supercomputing Center.

**2012** - Awarded a **Marie Curie Intra European Fellowship** in the context of the seventh framework program of the European Commission. The grant amounts to **EUR 185,763.60** for a period of 24 months.

**2011** - Awarded the **HPC-Europa2 Visiting Grant nr. 985**: 6 weeks of visiting time at European institutes and 80 thousand CPU hours on high-performance computing systems.

**2011** - Awarded the **HPC-Europa2 Visiting Grant nr. 589**: 8 weeks of visiting time in European institutes and 150 thousand CPU hours on high-performance computing systems.

**2006** - Awarded the **IMPRS PhD Fellowship** (3 years of PhD fellowship) from the International Max Planck Research School on Astrophysics in Garching (Germany).

**2005** - Awarded an **Early Stage Researcher Fellowship** (8 months of PhD fellowship) under the Marie Curie Actions of the European 6th Framework Programme.

### — INVITED TALKS —

- 3 July 2015 - International Conference “*Cosmological Simulations: from galaxies to large scales*”, Sexten Center for Astrophysics, Sesto Pusteria (Italy)
- 23 April 2015 - Invited Seminar, Institute for Theoretical Physics, Heidelberg University (Germany)
- 19 February 2015 - Invited Institute Seminar, Physics Department, Ferrara University (Italy)
- 15 December 2014 - International Conference “*The Quest for Dark Energy II*”, Ringberg (Germany)
- 3 July 2014 - International Workshop “*Non-Linear Structure in the Modified Universe*”, Lorentz Center, Leiden (The Netherlands) - **Invited Discussion Leader**
- 29 November 2013 - International GRAVASCO Conference “*Origin of cosmic structures*”, Paris (France)
- 9 May 2013 - *57th Congress of the Italian Astronomical Society*, Bologna (Italy)
- 14 March 2013 - International conference “*Cosmological tests of gravity*”, Oxford (UK)

- 25 June 2012 - International conference “*The quest for Dark Energy*”, Ringberg (Germany) - **Invited Review Talk**
- 4 October 2011 - International conference “*The Dark Universe*”, Heidelberg (Germany)
- 16 May 2011 - Invited Institute Seminar, Astronomical Observatory, Trieste University (Italy)
- 28 April 2011 - Invited Institute Seminar, Astronomy Department, Bologna University (Italy)
- 12 October 2010 - Invited Institute Seminar, Institute for Theoretical Astrophysics, Oslo University (Norway)
- 16 June 2010 - Invited Institute Seminar, S.I.S.S.A., Trieste (Italy)
- 21 October 2009 - Invited Institute Seminar, ICG, Portsmouth University (UK)
- 13 October 2009 - Excellence Cluster Science Week, Munich (Germany)
- 8 July 2009 - Invited Institute Seminar, CAUP, Porto University (Portugal);
- 18 June 2009 - Invited Institute Seminar, Astronomy Department, Bologna University (Italy);
- 27 November 2008 - Invited Institute Seminar, ICE, Barcelona University (Spain).

— CONTRIBUTED TALKS AND CONFERENCES —

- 1 October 2014 - International Workshop “*Dark Energy Interactions*”, NORDITA (Norway)
- 9-11 April 2014 - International Workshop “*Modified Gravity Simulations*”, Garching (Germany) **(Talk)** – 8-13 September 2013 - International Conference “*Exascale Computing in Astrophysics*”, Ascona (Switzerland) **(Talk)**
- 17 January 2013 - *Physics and Astronomy Department*, University of Bologna (Italy), **(Talk)**
- 16-22 September 2012, International Conference “*Particles and the Universe*”, Corfu (Greece), **(Talk)**
- 13-17 June 2011 International Conference “*Advances in Computational Astrophysics*”, Cefalù (Italy), **(Talk)**
- 18 January 2011 - *Cahill Center for Astrophysics*, CALTECH, Pasadena (USA), **(Talk)**
- 10-14 January 2011- International Conference “*Essential Cosmology for the Next Generation*”, Puerto Vallarta (Mexico), **(Talk)**
- 4-8 October 2010 - International Conference “*Cosmology meets Particle Physics*”, Bad Honnef (Germany), **(Talk)**
- 28 June-1 July 2010 - International Conference “*Modified Gravity approaches to the Dark Sector*”, Strasbourg (France), **(Talk)**
- 29-31 March 2010 - “*5th IberiCos Cosmology Conference*”, CAUP, Porto (Portugal), **(Talk)**
- 7-11 September 2009 - International Conference “*Cosmo 09*”, CERN, Geneva (Switzerland), **(Talk)**
- 2-4 March 2009 - International Conference “*Dark Energy*”, Galileo Galilei Institute, Florence (Italy), **(Talk)**
- 7-11 October 2008 - *Third Biannual Leopoldina Conference on Dark Energy*, Munich (Germany), **(Talk)**
- 8-12 September 2008 - International Conference “*Cosmology Across Cultures*”, Granada (Spain)
- 23-25 June 2008 - International Conference “*Symmetries and Phases in the Universe*”, Kloster Irsee (Germany), **(Poster)**
- 30 September - 3 October 2007 - Second Transregio Meeting “*The Dark Universe*”, Bad Honnef (Germany), **(Poster)**
- 7-8 November 2006 - First Transregio Meeting “*The Dark Universe*”, Heidelberg (Germany), **(Poster)**
- 7-11 November 2005 - International Conference “*Einstein’s Legacy*”, Munich (Germany)
- 30 June - 2 July 2005 - 9th Paris Cosmology Colloquium “*Daniel Chalonge*”, Paris (France)

— SCHOOLS AND WORKSHOPS —

- *First* (2-7 December 2007), *Second* (7-12 December 2008), *Third* (6-11 December 2009), *Fourth* (5-10 December 2010), and *Fifth* (4-9 December 2011) *Transregio Winter School on Cosmology* (Organizing Committee), Passo del Tonale (Italy)
- DPG Physics School 2006 - “*Dark Matter and Dark Energy*”, Bad Honnef (Germany), 16-21 July 2006
- Workshop “*Dark matter and alternative gravities*”, Edinburgh (United Kingdom), 20-22 April 2006
- National PhD School in Astrophysics “*Cosmological parameters and extrasolar planets*”, Asiago (Italy), 5-11 September 2004

— PUBLIC OUTREACH TALKS —

- 10 October 2013 - Public Conference “*The scales of the Universe*”, Chieti (Italy)
- 27 September 2013 - Speaker of the international public event “*Origins 2013*” within the “Speed-Dating” initiative held in Bologna (Italy)
- 1 December 2010 - Speaker of the international public initiative “*Dark Matter Awareness Week*” at the Excellence Cluster Universe building in Garching (Germany)

— INTERNATIONAL COLLABORATIONS —

- **Task Coordinator** of the Euclid Simulations WG for the implementation of non-standard cosmologies.
- **Coordinator** of the Euclid Joint Theory+Simulations WP for the for the definition and selection of non-standard cosmologies.
- Member of the *Theory, Simulations* and *CMB cross-correlation* WGs of the **Euclid collaboration**
- Member of the **Transregio Collaboration** (<http://darkuniverse.uni-hd.de/view/Main/WebHome>) on the “Dark Universe” from 2006 to 2012

— ADVISORY BOARD, CONFERENCE ORGANIZATION, AND OTHER DUTIES —

- **Referee of the international journals:** Monthly Notices of the Royal Astronomical Society (MNRAS), Monthly Notices of the Royal Astronomical Society Letters (MNRAS-L), Physical Review D (PRD), The Astrophysical Journal (ApJ), Journal of Cosmology and Astroparticle Physics (JCAP), Physics Letters B (PLB).
- **Member of the Scientific Organizing Committee** of the international workshop “The quest of Dark Energy II: theory and simulations confront observations”, Ringberg Castle (Germany), 14-19 December 2014
- **Invited external member of two Ph.D. defence committees** of the *Physics and Astronomy Department, Aarhus University, Denmark (September 2014)*.
- **Member of the reviewing panels** of: *French National Research Agency (Call 2012)*; *Polish National Science Center (Call 2013)*; *PRACE Time Assignment Committee (8th Call)*; *NASA Post-Doctoral Fellowships (Call 2014)*.
- **Member of the Scientific Organizing Committee** of the international workshop “The quest of Dark Energy: when theory meets simulations”, Ringberg Castle (Germany), 24-29 June 2012
- **Member of the Local Organizing Committee** of all the five editions of the Transregio Winter School on Cosmology, from 2007 to 2011.

— TEACHING EXPERIENCE —

- 2015: **Invited Lecturer** for the Ph.D. school “*Astrophysical Probes of fundamental Physics*” at the University of Ferrara, Department of Physics and Earth Science (see <http://fst.unife.it/eventi/phd-school-astrophysics-1>);
- 2014: **Teaching Assistant** for the undergraduate courses of “Informatics” and “Scientific Computing for Astronomy”, University of Bologna;
- 2014: **Supervision of the Master Thesis in Physics** of Enrico Garaldi on “Zoomed simulations of halo segregation in cosmological models with two species of coupled dark matter”;
- 2013 - 2014: **Supervision of the Master Thesis in Astrophysics and Cosmology** of Giorgia Pollina on “Statistical and structural properties of voids in cosmological simulations of interacting Dark Energy”;
- 2012 - 2013: **Supervision of the Diploma Thesis in Physics** of Santiago Casas on “Large scale structure formation and the nonlinear power spectrum in cosmological simulations of coupled Dark Energy”;
- 2011 - 2012: **Supervision of the Diploma Thesis in Physics** of Ludwig Schrobenhauser on “Analysis of simulated data for interacting Dark Energy models”;
- 2011: **Assistant of Prof. Jochen Weller** for the Summer Semester Astrophysics Students Seminars at the Ludwig-Maximilians-University, Munich (Germany);
- 13 October 2010: **Lecture on “N-body techniques for interacting scalar field cosmologies”** held at the Institute for Theoretical Astrophysics, University of Oslo (Norway)

— SPOKEN LANGUAGES —

**Italian** (Native Speaker), **English** (Excellent), **Spanish** (Good), **French** (Basic), **German** (Basic)

— COMPUTER SKILLS —

- Good knowledge of the main operating systems: **Unix, Mac, Windows**.
- Programming languages: **Fortran, C, IDL**. Editing tools: **L<sup>A</sup>T<sub>E</sub>X**.
- Special purpose numerical codes: good knowledge of the use of the cosmological simulation codes **GADGET-2** and **GADGET-3**.
- Long experience in the use of large parallel supercomputing systems, including: “OPA”, “VIP”, and “Hydra” clusters (RZG, Germany); “SP6” and “Fermi” clusters (CINECA, Italy); Linux Cluster (LRZ, Germany); “SCIAMA” Computing Center (ICG, UK); “MareNostrum3” cluster (BSC, Spain).