

# CURRICULUM VITAE ET STUDIORUM

*Dr. GIOVANNI MONTANI*

## Personal Data

*Date and place of birth:* July 14<sup>th</sup> 1966, Latina (Italy)  
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## Present position

Since March 2006, he has a permanent position as Researcher at ENEA (*Italian National Agency for New Technologies, Energy and Sustainable Economic Development*), joining the “*Theoretical Group on Plasma Physics*” in the Research Center of Frascati (Rome, Italy) where he started investigating the problem of the Angular Momentum Transport in astrophysical and laboratory plasmas.

## Lines of research

Within the agreement between ENEA and “Sapienza” University of Rome, he conjugates the research on Plasma Physics with studies on the nature of the gravitational field in cosmology, focusing on the Big Bang morphology in Quantum Gravity. The scientific issues of the last years deals with timely topics in fundamental physics and in astrophysical plasma theory. Two specific and original directions emerge: the representation of the gravitational theory as kinematically isomorphic to an SU(2) gauge theory, and the analysis of the accretion process around a compact magnetized object in the frame of a local crystalline plasma structure.

Among ongoing international collaborations, he developed a joint research project on plasma astrophysics with Prof. Bruno Coppi (*Massachusetts Institute of Technology*, Boston (USA)) regarding the relation of accreting matter flows in thin disks with the typical instabilities arising in laboratory plasmas, like the so-called *ballooning modes*. The experience in primordial theoretical Cosmology - over about 20 years - is summarized in a book entitled “*Primordial Cosmology*” (*World Scientific*, March 2011, in press) describing the evolution of the early Universe from the Planck era to the formation of large-scale structures in the framework of the Einstein theory of gravity.

### Impact

Since 1997, his academic tasks included the direct supervision of **20** Bachelor Theses, **33** Master Degree Theses (Laurea) and **9** PhD graduate students.

Since 2003, he is member of the faculty of the IRAP *International PhD Graduate School* and of the ERASMUS program for the PhD in Relativistic Astrophysics.

Since 2000, he supervises a research group on Cosmology, Gravity and Multi-Dimensions (*CGM Group*) within the Physics Department of "Sapienza" University of Rome of about 10 young researchers per year. (See: <http://www.cgwcollaboration.it/webcgm/welcome.htm>).

Since 2008, he constituted the international collaboration CGW (Cosmology, Gravity and Wave-Phenomena) of experienced and young researchers addressing open problems in Cosmology, Astrophysics and Plasma Physics. (See: <http://www.cgwcollaboration.it>).

He presented the results of his activity in several international meetings and workshops. In 2009, he was invited to the "*XII Marcell Grossmann Meeting on General Relativity*" (Paris), to review the developments in chaotic cosmologies over the last ten years. In January 2010, he has been invited to give a lecture at the "*14 Gravitational Wave Data Analysis Workshop (GWD AW-14)*" (Rome), on the interaction of cosmological neutrinos with gravitational waves. In March 2010, he was invited to the workshop "*Cosmology, the Quantum Vacuum and Zeta Function*" (Barcelona), to give a talk on the cosmological implications of modified theories of gravity.

He is regularly involved as a referee for the journals: *General Relativity and Gravitation* (Springer); *Journal of Mathematical Physics* (AIP); *International Journal of Modern Physics A and D*, *Modern Physics Letters A* (World Scientific), *Il Nuovo Cimento B* (SIF, Società Italiana di Fisica) and *Europhysics Letters* (IOP).

He is the co-organizer of 7 international workshops and co-editor of 2 proceeding volumes.

### Publications

He is author or co-author of nearly **180** articles on peer-reviewed international journals and conference proceedings. He published 5 invited review articles, one monograph in a dedicated issue of *International Journal of Modern Physics A* and one book "*Primordial Cosmology*" edited by *World Scientific*.

## Experience

Since the Academic year 2007-2008, he is Lecturer for the MSc course "*Primordial Cosmology*" at the Physics Department of the "Sapienza" University of Rome, and since 2011 of the PhD course "*Plasma Configuration and Stella Accretion Disks*".

Since May 2005, he lectures for the IRAPhD (*International Relativistic Astrophysics PhD*, ICRA/Net) on relativistic cosmology and unification theories.

From June 2000 to November 2005, supported by a research fellowship from the Physics Department at "Sapienza" University of Rome and from ICRA, he worked on hot topics in theoretical physics. In the field of gravitation as a gauge theory he derived a consistent formulation for a gauge theory of the Lorentz Group and explored its phenomenological implications. Regarding the geometrical aspects of the electro-weak model he provided a phenomenology for the geometrization of the fermion-boson gauge coupling. In the framework of canonical quantum gravity, he formulated an evolutionary theory for the quantum dynamics of the gravitational field. Such results were also considered in view of their implications on the primordial Universe dynamics.

On November 15<sup>th</sup> 2000, the Faculty of "Sapienza" University of Rome nominated him "*expert in Theoretical Physics*" to lecture the course "*Theoretical Physics II*" (theories of gravity). From 2000 to 2005 he also lectured part of the course "*Gravitational Physics*" for an amount of 40 hours per year.

Since November 1999, he participates to the graduation boards as senior tutor within the Physics Department, "Sapienza" University of Rome, and as an internal member of examination boards.

On June 1998, he was granted a two-year post-doctoral fellowship from INFN (*National Institute for Nuclear Physics*, Italy) in Theoretical Physics. His investigations regarded dynamical aspects of the gravitational field in classical, semiclassical and quantum regimes, within the framework of theoretical cosmology and relativistic astrophysics, deriving the fully invariant measure for a generic cosmological solution in the reduced phase space.

From January 1997 to May 1998, supported by ICRA at the Physics Department, "Sapienza" University of Rome, he approached non-Riemannian geometries in order to geometrize spinorial fields, starting his activity as master thesis advisor.

On July 9<sup>th</sup> 1997, he obtained his PhD defending the Thesis "*Dynamical Aspects of the General Cosmological Solution*", supervised by Prof. V.A. Belinskii. In this study, the stochastic behaviour of an inhomogeneous cosmological model near the initial singularity was investigated providing a novel statistical characterization, generalized from Bianchi VIII and IX models. Furthermore, the multidimensional implementation was addressed outlining a spontaneous compactification scenario. These activities were developed also in collaboration with Prof. A.A. Kirillov (University of Nizhny Novgorod, Russia) and Prof. R.M. Zalaletdinov (University of Tashkent, Uzbekistan).

He graduated in Physics (MSc) on December 14<sup>th</sup> 1992, at "Sapienza" University of Rome, with full marks (110/110, Cum Laude), defending the thesis "*On the Asymptotic Singularity-Approaching Regime in the General Cosmological Solution of the Einstein Equations*", under the supervision Prof. V.A. Belinskii. Such line of research was continued during 1993 within the ICRA collaboration.