

Curriculum Vitae - **MANUEL MARIANI**

Name: Manuel Mariani

Date and place of birth: March 20th 1979, Pavia

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Working positions

- **July 2016 - present:** Researcher (FIS/01), Physics Department, University of Pavia
- **December 2011 - July 2016:** Researcher (FIS/07), Physics Department, University of Bologna.
- **November 2007 - December 2011:** four one-year post-doc positions, Physics Department, University of Pavia.

Education

- **2008:** PhD in Physics (Solid State Physics) - University of Pavia. Title: "Spin Dynamics in One-Dimensional and Quasi-One-Dimensional Molecular Magnets", supervisors: Prof. F. Borsa, Prof. A. Lascialfari.
- **2004:** Degree in Physics, University of Pavia (Full Marks). Title: "Study of the Phase Separation in Na_xCoO_2 through Nuclear Magnetic Resonance", tutor: Prof. P. Carretta

Main research interests

The research activity of M. M. has been mainly focused on Solid State Physics and Applied Physics research areas. In particular the activity in Solid State Physics regards the study, through NMR, μSR and SQUID magnetometry techniques, of molecular magnetism with specific attention to the static and dynamic magnetic properties of nanomagnetic systems such as homo- and hetero-metallic ferromagnetic and antiferromagnetic zero-th spin rings and one-dimensional and quasi one-dimensional spin chains. The main topics studied are: (a) the first experimental verification of theoretical predictions in quasi-1D molecular nanomagnets like the Glauber Kinetic Ising Model and the "Villain's conjecture"; (b) the study of the changes of the magnetic properties in 1D and quasi-1D molecular systems depending on the radical centre inserted in chains composed by the same building blocks characterized by the repeated pattern "magnetic ion-radical centre"; (c) the properties of 0D single molecules magnets (SMMs) such as the blocking of the macroscopic magnetization due to the resonant phonon trapping mechanism, the change of the spin dynamics with topological variation in the clusters due to the substitution of one of the magnetic ions of the magnetic core, the multiple-times character of the magnetization relaxation dynamics even at very low temperature due to the topology of the competing interactions in frustrated systems; (d) the investigation of the spin dynamics of the entangled magnetic molecular rings, where two neighbour molecules are connected by a magnetic link, in order to create exchange and super-exchange interactions, of great interest for their promising

technological applications in quantum-information field; (e) the discovery of the single molecule magnets behavior in $3d-4f$ dimers, not only limited to transition-metal complexes; (f) the study of the spin dynamics of Lanthanides-based Single Ion Magnets (SIM). Other systems investigated in the framework of the Condensed Matter Physics have also been the core-shell and dimer magnetoplasmonic systems consisting of coated maghemite and gold-maghemite superparamagnetic hybrid nanostructures with the identification of three distinct system dynamics depending on the temperature range and the strongly correlated electron systems close to a quantum critical point, with properties similar to those of the cuprates, precursors of the high- T_c superconductors.

The main topics related to Applied Physics are: (a) the relaxometric (NMRD profiles) and hypertermic characterization of paramagnetic and superparamagnetic nanoparticles as MRI contrast agents and/or for magnetic fluid hyperthermia treatment; (b) the study, through Time-Domaine $1H$ NMR measurements, of topics related to porous materials and biological systems for Environmental and Health Physics and of interest for Cultural Heritage such as scleractinian corals (markers of the climat changes), endodontic cements, biosensors at high sensitivity based on magnetic field detection, the human organism with relaxometric detection of cobalt content related to the problem of arthroprosthetic cobaltism in implanted patients and the diagnosis of osteoporosis through NMR with portable instrumentation, stone and rocks of interest for Cultural Heritage for the determination of their degree of deterioration and for testing the goodness of protective and consolidant chemical products.

Experimental techniques

Nuclear Magnetic Resonance (NMR)
Fast-Field Cycling (FFC) NMR relaxometry
Magnetic Resonance Imaging (MRI)
Muon Spin Resonance (μ SR)
SQUID magnetometry
Calorimetry

Institutional activity

2015 – 2016: Member of the Board of Didactics – Physics Department, University of Bologna

2017 – 2019: Member of the Joint Commettee of Didactics – Physics Department, University of Pavia

2018 – present: Manager of the MRI Laboratory - Physics Department, University of Pavia

Teaching activity

- 2010/2011: Assistant to the Courses of Physics for Pharmacy and CTF, University of Milan
- 2011/2012 - 2012/2013: “Physical elements of tomographic reconstruction methods” for the School of Specialization in Health Physics, University of Bologna
- 2012/2013 - 2014/2015: “Health Physics” for Physiotherapy, University of Bologna

- 2013/2014 - 2014/2015: “Physical Methods of Examining Cultural Property” for “Science for the Conservation-Restoration of Cultural Heritage” (SCoRe), University of Bologna
- 2014/2015: “Applied Physics” for Dentistry, University of Bologna
- 2016/2017 – 2017/2018: “Applied Physics” for Health Technical Professions, University of Pavia
- 2016/2017 - present: “Introduction to Solid State Physics” for Physics, University of Pavia
- 2017/2018 - present: “Instrumentation for Health Physics” for Physics, University of Pavia

Tutoring activity

- **Bachelor Degree Students:**

Tutor

- G. Pica (a. y. 2015/2016): “Magneto Fluid Hypertermia: a novel pre-clinical antitumoral treatment in the field of nanoscience”, Department of Physics, University of Pavia.

Co-Tutor

- F. Nanetti (a. y. 2012/2013): “Assembling and characterization of the performance of a new NMR relaxometer with a 8cm radiofrequency coil”, Department of Physics and Astronomy, University of Bologna.
- N. Curti (a. y. 2013/2014): “Integration between NMR and microscopic measurements for the quantitative description of external stress effects on cells cultures”, Department of Physics and Astronomy, University of Bologna.
- M. C. Bossuto (a. y. 2015/2016): “Nuclear Magnetic Resonance applied to Cultural Heritage”, Department of Physics, University of Milan.

- **Master Degree Students**

Co-Tutor

- A. Capozzi (a. y. 2010/2011): “Spin dynamics in nanostructured magnetoplasmonic heterodimers: basic aspects and possible applications”, University of Pavia.
- M. Pedacchia (a. y. 2013/2014): “NMR relaxometry for the study of cobalt ions in Arthroprosthetic Cobaltism”, Department of Physics and Astronomy, University of Bologna.
- V. Cataldo (a. y. 2016/2017): “Formulation study of emulsions for the simulation of a steatotic liver: technological and physical methods”, Department of Pharmaceutical Sciences, University of Pavia
- F. A. Rusnati (a. y. 2018/2019): “Magnetic Properties and Spin Dynamics of a Terbium – Semiquinone Single-Ion Magnet”, Department of Physics, University of Milan

- **Ph-D students:**

- Tutor**

- Past*

- M. Avolio - Ph. D in Applied Physics, XXXII ciclo. Thesis: "Effects of magnetic nanoparticles correlation times and aspect ratio hyperthermic and relaxometric properties". Physics Department, University of Pavia

- Present*

- F. Brero - Ph. D in Applied Physics, XXXIII ciclo. Physics Department, University of Pavia
 - D. Cicolari - Ph. D in Applied Physics, XXXIV ciclo. Physics Department, University of Pavia
 - L. Rinaldi - Ph. D in Applied Physics, XXXIV ciclo. Physics Department, University of Pavia

- **Scientific supervision of external PhD students and post-doc during their stage at University of Pavia**

- P. Khuntia (Indian Institute of Technology Bombay, Mumbai, India) (2008-2009)

- H. Amiri Doumari (University of Milan, Italy) (2008-2010)

- K. Thangavel (University of Milan, Italy) (2008-2010)

- K. P. V. Sabareesh (University of Milan, Italy) (2010)

- Publications and Communications**

- 34 papers in peer-reviewed national and international journals. *h*-index: 13 (ISI-WoS, 09/07/2020)

- 60 Scientific Communications in National and International Conferences as co-author:

- 7 Oral Communications as main author; 20 Poster communications as main author.

- Research Grants**

- **Local Unit Coordinator (INFN-PV Unit):** HADROCOMBI project (2017); HADROMAG project (2018 - 2019); PROTHYP project (2020)

- **Partner Investigator:** FIRB 2001 (2003 - 2005): "Nano-organization of inorganic/organic hybrid molecules with magnetic and optic properties"; PRIN 2005 (2006-2008): "New contrast agents for Magnetic Resonance Imaging (MRI) and tissutal targeting: cerebral damages in animal models"; PRISMA-INSTM PROJECT (2006-2008): "Functional magnetic nanoparticles as contrast agents for Magnetic Resonance Imaging"; Seventh Framework Programme: Theme NMP-2007, Large Scale Integrating Collaborative Project (2008 - 2012): "Integration of novel NANOparticle based technology for THERapeutics and diagnosis of different types of cancer (NANOTHER)"; Seventh Framework Programme (2011 - 2015) european project: "Corals and global warming: the Mediterranean versus the Red

Sea" (CORALWARM); CARIPO FOUNDATION PROJECT (2010 - 2013): "Chemical synthesis and characterization of magneto-plasmonic nano-heterostructures"; FIRB 2010 (2012 - 2016): "Integrated network for Nanomedicine" (RINAME); AIRC PROJECT (2012 - 2015): "Magnetosomes as nanotechnology platform for thermotherapy of tumour"; FIRB 2012 (2013 - 2017): "New challenges for molecular: from spin dynamics to quantum information processing"; European COST action TD1402 (2014 - 2018): "Multifunctional Nanoparticles for Magnetic Hyperthermia and Indirect Radiation Therapy" (RADIOMAG)

- **Participant:** NETWORK OF EXCELLENCE "MAGMANET" (2005 - 2009): "Molecular Approach to Nanomagnets and Multifunctional Materials"; PRIN 2006 (2007 – 2009): "Spin dynamics and quantum effects in nanoscopic magnetic systems: new physical properties and potential applications"; CARIPO FOUNDATION PROJECT (2007 - 2010): "Design of new magnetic biosensors for their application in health and environmental sciences"; PRIN 2009 (2010 - 2012): "Topological effects and entanglement in molecular spin chains and clusters"; FARB 2012 – UNIVERSITY OF BOLOGNA PROJECT (2013 - 2015): "Numerical methods of regularization for data inversion in Applied Physics"; FONDAZIONE DEL MONTE OF BOLOGNA AND RAVENNA PROJECT (2014 - 2015): "Novel technique for the diagnosis of the osteoporosis through Nuclear Magnetic Resonance with a low-field portable-instrument"; European COST action CA15128 (2016 - 2020): "Molecular Spintronics" (MOLSPIN); European COST action CA15209 (2016 - 2020): "European Network on NMR relaxometry" (EURELAX)

Pavia, July 23rd 2020