

Curriculum Vitae

MARIA ALLEGRINI

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Education University of Reading (UK), Ph.D. Physics, July 1973
University of Pisa (IT), Laurea Physics, March 1969

Positions Full Professor, Matter Physics, University of Pisa, November 2000 onwards
Full Professor, Quantum Optics, University of Messina, Nov. 1994-Oct. 2000
Associate Professor, Experimental Physics, University of Pisa, Nov. 1988-Oct. 1994
Researcher/Senior Researcher of the Consiglio Nazionale delle Ricerche (CNR),
Istituto di Fisica Atomica e Molecolare, Pisa, Jan. 1972-Oct.1988

Fellowships / Awards

- 2012 Fellow of the American Physical Society – [Citation: For contributions to laser interactions with atoms and small molecules: energy pooling collisions, high resolution spectroscopy, laser cooling of diatomic molecules, and contributions to international physics through collaborations and professional service]
- 2009 Fellow of the European Academy of Sciences
- 2004 Professor “Honoris causa”, St. Petersburg University, Russia
- 2001 Fellow of the Institute of Physics
- 2000 Professor Qualification in France
- 1987 NATO Senior Fellow
- 1977 NATO Junior Fellow
- 1976 Canada Council Fellow
- 1971 Italian Physical Society "Young Physicist" Prize

Visiting Research Fellow / Visiting Professor

- USA: Brookhaven National Laboratory, University of Missouri-St. Louis, Lehigh University, JILA-Joint Institute for Laboratory Astrophysics Boulder, NIST-National Institute of Standards and Technology Gaithersburg
- Canada: Herzberg Institute of Astrophysics Ottawa
- France: Ecole Normale Supérieure Paris, Laboratoire Aimé Cotton Orsay
- Germany: Max Planck Institut für Quantenoptik Garching, Ulm University, Ludwig-Maximilian University München
- Denmark: Niels Bohr Institute Copenhagen

Enabling activities

Evaluation experience:

- Nominated in May 2011 by the French Ministry of Research and Higher Education in the Council of the French Evaluation Agency of Research and Higher Education (AERES). The AERES was replaced in November 2014 by the High Council for the Evaluation of Research and Higher Education (HCERES) while the AERES Council remained in charge.
- Expert evaluator for the European Commission, in various panels of FP5, FP6 and FP7, including the ERC, (step down in the period of secondment as national expert).
- Panel member of the International Science Foundation (Soros Foundation).
- Expert evaluator for several funding agencies in Europe, Middle East and USA.
- Member (2007-2008) of the “junior” selection panel of the Institut Universitaire de France (IUF).
- General chair (2009) of the “senior” selection IUF panel and chair (2010) of “sciences” sub-panel.
- Chairperson and/or member of several Italian committees for personnel recruitment at all levels, in universities and research institutions (CNR, INFN, INFN).
- Referee for several scientific international journals.
- External examiner of Ph.D. defence committees in various countries.

Organization, management:

- Ab imis set up of a research laboratory on scanning probe microscopy, Messina University
- Head of the “NanoLab” at the Physics Department, Pisa University.
- Scientific responsibility and management of national and European research projects, including bilateral exchange programs with Austria, Brazil, France, Japan, Russia, South Korea, USA.
- Chairperson and/or member of Scientific and/or Organizing Committee of International Conferences and Schools.
- Member of the Advisory Editorial Board of Optics Communications (1994-98) and of the International Journal of Nanomaterials and Technology (present).
- 1996-2001 Elected in the board of the European Group of Atomic Spectroscopy.
- 1997-2004 Elected in the board of Atomic, Molecular and Laser Physics Division, Italian Institute for the Physics of the Matter (INFN).
- 2000-2004 Nominated in the INFN Committee for Educational and Public Awareness.
- 2001-2004 Nominated Coordinator of the INFN Committee for International Relations.
- 2001-2006 Elected in the Executive Committee of the European Physical Society and nominated Treasurer for the years 2004-2006.
- 2001-2005 Nominated in the Conseil Scientifique, Département des Sciences Physiques et Mathématiques, CNRS, France.
- 2006-2009 Elected in the Executive Committee of the Division of the Atomic, Molecular and Optical Physics, American Physical Society
- 2006-2010 Elected in the Board of Directors of the Consorzio Interuniversitario per le Scienze Fisiche della Materia (CNISM, Italy).
- 2008-2012 Coordinator of Physics Courses at the Faculty of Engineering, Pisa University.
- 2009-2012 Elected in the Executive Committee of the Division of the Laser Science, American Physical Society.
- 2009-2012 Nominated in the International Affairs Committee of the American Physical Society.

Teaching activities

Introductory physics courses: Mechanics, thermodynamics, electro-magnetism
Advanced courses : Quantum Optics, Optoelectronics, Optics and nano-optics
Advisor of Master and Ph.D. students (Physics and various thematic Engineering) in Pisa and Messina; co-advisor for PhD students in “co-tutela” with the Université Paris Sud-11, Orsay.

Research activity

Atomic, Molecular, Laser Physics and Optics: A large part of my research activity has been devoted to experiments in this area. These investigations have ranged from analysis of energy partitioning at the microscopic level (binary collisions) to the study of macroscopic phenomena such as avalanche ionization. Also included in this area has been my work on the intrinsic properties of atoms and small molecules, principally investigated by high resolution laser spectroscopy. This study has comprised fundamental properties of matter as manifested in the precise measurement of the Rydberg constant. More recently, at the Laboratoire Aimé Cotton, Orsay, I have participated to experiments dealing with the control of the internal degrees of freedom (vibration and rotation) of ultracold molecules prepared by photoassociation of two laser cooled atoms. Currently, I am involved in the development of a multiple gyrolasers system (INFN project GINGER) to measure underground the consequences of the rotation of the Earth relative to the absolute space of Newton, (frame dragging and gravito-magnetism effects of general relativity).

Condensed Matter Physics: My research interests in this field began during my Ph.D. work, “Polaron Anomalies in the Magnetic Behaviour of the III-V Semiconductors“, at the University of Reading (UK), and have been resumed in recent years with pulsed laser ablation and deposition, light emitting materials and devices, photoluminescence, carbon nanotubes, ferroelectric materials and phenomena, micro-cavities and nanostructures, scanning probe microscopy (AFM, SNOM with particular contrast mechanisms), nanolithography through laser cooled atom beams, near-field optical nanowriting, photonics, nano-optics and nano-plasmonics.

The interplay between these different areas of specialization is of great benefit for my research and my enabling activities as well as for mentoring of young students and researchers.

Publications

Over 330 articles in peer-reviewed journals (h-index 31, ISI WoS), over 300 contributions (including invited talks) to international conferences, 3 textbooks, 2 patents.

As invited seminar speaker, I have presented the results of my research in prestigious institutions in various countries.

Research Highlights

- First observation of an evanescent wave in the optical region of the spectrum. This work, which was the subject of my Laurea dissertation in Pisa, provided a measurement of a length differential of 10^{-3}\AA . This work was seminal to the establishment of near-field optical technology.
- Discovery of energy pooling collisions, in which two energy-rich atoms conspire to form products that are otherwise energetically forbidden. This work provided the basis for understanding several previously unexplained avalanche phenomena.
- Discovery of Na negative ion formation in collisions involving Rydberg atoms. This work provided stimulation for theoretical work on atomic negative ion excited states.
- A measurement of the Rydberg constant that was not limited by the apparatus, but rather, by the extant wavelength standard. This work provided motivation for others to improve the wavelength standard in the visible.

- Development of a near-field optical microscope implemented to perform acquisition of spectra with spatial resolution in the nanometer scale. This work relies heavily on my experience with precision atomic spectroscopy as well as evanescent wave detection.
- Near-field optical nanowriting on azo-plymethacrylate spin-coated films with unprecedented resolution and speed. This work shows the capability of nano light to store data in polymers.
- Demonstration of a fs-nanometric source of second harmonic (SH) light, by illumination of a metal tip conventionally used for atomic force microscopy. Applications of this nanosource are for extreme time and space resolution.
- Re-radiation enhancement has been observed and explained in polarized Surface Enhanced Resonant Raman Scattering of randomly oriented molecules on self-organized gold nanowires.
- Laser cooling of the internal degrees of freedom (vibration and rotation) of diatomic molecules. This important result has received the attention of the media and press also outside the scientific community.
- Disorder induced photoluminescence from dark excitonic states has been detected and explained in individual Single-Walled Carbon Nanotubes.
- Nanometer scale detection by near-field optical microscopy of the internal structure of polymeric fibers. This work opens the way to tailor the molecular morphology, the multifunctional electronic and optical properties of last generation fibers.
- Measuring general relativity effects in a terrestrial lab by multi ring-laser gyroscopes. This will be the first experiment testing relativistic gravito-magnetic effects on Earth complementing observations made in space experiments.
- Chirality is a central motif in biological systems. The specific chiral arrangement of the porphyrins within the structure packing has been detected for the first time by near-field microscopy with polarization control (PM-SNOM).
- Near field optical microscopy of tetraphenylethylene (TPE)/polymer films evidences how the fluorescence behavior is correlated to the different matrix morphology. These results could be used for developing a new tool for polymer traceability. One figures of the article was selected for the front cover of the journal issue.

Five selected recent publications

- I. Manai, R. Horchani, H. Lignier, P. Pillet, D. Comparat, A. Fioretti, M. Allegrini - Rovibrational cooling of molecules by optical pumping – *Phys. Rev. Lett.* **109**, 183001 (2012). Paper selected for the Viewpoint: Nicholas Bigelow, *Deep Molecular Cooling*, *Physics* **5**, 121 (2012)
 - M. Allegrini, J. Belfi, N. Beverini, F. Bosi, B. Bouhadeh, G. Carelli, G. Cella, M. Cerdonio, A.D. Di Virgilio, A. Gebauer, E. Maccioni, A. Ortolan, A. Porzio, M.L. Ruggiero, U.K. Schreiber, S. Solimeno, F. Stefani, A. Tartaglia, J-P. Zendri, J-P. Wells - A laser gyroscope system to detect the gravito-magnetic effect on Earth - *Journal of Physics* **375**, 062005 (2012)
 - A. Camposeo, I. Greenfeld, F. Tantussi, S. Pagliara, F. Fuso, M. Allegrini, E. Zussman, D. Pisignano - Local mechanical properties of electrospun fibers correlate to their internal nanostructure – *Nano Lett.* **13**, 5056-5062 (2013)
 - G. Iasilli, A. Battisti, F. Tantussi, F. Fuso, M. Allegrini, G. Ruggeri, A. Pucci – Aggregation-Induced Emission of Tetraphenylethylene in Styrene-Based Polymers - *Macromol. Chem. Phys.* **215**, 499-506 (2014) and Front Cover of *Macromol. Chem. Phys.* **215**, Issue 6, page 481 (2014)
 - F. Tantussi, F. Fuso, M. Allegrini, N. Micali, I.G. Occhiuto, L. Monsù Scolaro, S. Patanè - Circular and Linear Dichroism in Porphyrin J-Aggregates as Probed by Polarization Modulated Scanning Near-Field Optical Microscopy - *Nanoscale* **6**, 10874-10878 (2014)
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