

Rafael Omar FERRAGUT

Place of birth: Buenos Aires (Argentina)

Nationality: Argentinian and Italian

Address: Politecnico di Milano, Como Campus

via Anzani 42, Como, 22100, Italy

Telephone: +39 031 332 7338

E-mail: rafael.ferragut@polimi.it

<http://www.como.polimi.it/ferragut>

<https://www.fisi.polimi.it/en/people/ferragut>

Researcher unique identifier(s): ORCID ID: [0000-0002-6079-1831](https://orcid.org/0000-0002-6079-1831)



PROFESSIONAL INTERESTS

Antimatter Physics with particular attention in its fundamental understanding and its application in Materials Science.

Rafael Ferragut is an Associate Professor in Experimental Physics at Politecnico di Milano and is an internationally recognized expert in Positron Annihilation Spectroscopy (PAS) to study defects such as vacancy, voids, porosities, free volumes and their chemical environment with the aim to develop advanced materials applied in several areas such as new energy: solar cells and ion batteries. A short list of recent relevant results using PAS include:

- (i) Investigating hybrid solar cells, in particular for the first time in this field using PAS was obtained the infiltration profile of a conductive polymer (P3HT) into mesoporous titania film and the influence of the interfacial modification (4-mercaptopyridine) [1].
- (ii) Determining the concentration profile of defects in thin films (such as the new generation of semiconductors, perovskites, oxides and polymer brushes) by means of a monoenergetic positron beam (e.g. [2]).
- (iii) Development and tailoring of hydrophobic mesoporous materials for positronium formation at cryogenic temperatures to be used in antimatter experiments (e.g. [3]).
- (iv) Development of a quantitative methodology to obtain the chemical environment around defects and to follow in-situ the kinetic mechanisms of hardening in the main aluminium alloys (i.e. Al-Cu-Mg and Al-Zn-Mg) with the discovery and explanation of the rapid hardening mechanism and secondary precipitation (e.g. [4]).

In 2019 was published the first demonstration of antimatter interferometry [5] measured by the QUPLAS collaboration in the Positron Laboratory at the L-NESS centre in Como led by Rafael Ferragut (R.F.). This result is one of the [Top-10 2019 Breakthroughs in Physics](#) of the year according to a team of Physics World editors. R.F. collaborates with antimatter experiments that takes place at L-NESS and CERN since 2008, where he participated to the observation of several phenomena such as the antimatter deflectometry [6]. At present, R.F. collaborates with the ASACUSA (Atomic Spectroscopy And Collisions Using Slow Antiprotons) collaboration at CERN and QUPLAS (QUantum interferometry and gravity with Positrons and LASers) at L-NESS.

Publications cited in the text:

- 1) E.V. Canesi, M. Binda, A. Abate, S. Guarnera, L. Moretti, V. D'Innocenzo, R. Sai Santosh Kumar, C. Bertarelli, A. Abrusci, H. Snaith, A. Calloni, A. Brambilla, F. Ciccacci, S. Aghion, F. Moia, [R. Ferragut](#), C. Melis, G. Mallocci, A. Mattoni, G. Lanzani, A. Petrozza. The effect of selective interactions at the interface of polymer-oxide hybrid solar cells, *Energy & Environ. Sci.* **5**, 9068 (2012) (I.F.: 33.25)
- 2) X. Yu, J. Smith, N. Zhou, L. Zeng, P. Guo, Y. Xia, A. Alvarez, S. Aghion, H. Lin, J. Yu, R.P.H. Chang, M.J. Bedzyk, [R. Ferragut](#), T.J. Marks, A. Facchetti, Spray-combustion synthesis: Efficient solution route to high-performance oxide transistors, *PNAS* **112** (2015) 3217 (I.F.: 9.504)
- 3) G. Consolati, [R. Ferragut](#), A. Galarneau, F. Di Renzo, F. Quasso. Mesoporous materials for antihydrogen production, *Chemical Society Reviews* **42** (2013) 3821 (I.F.: 40.443)
- 4) R.K.W. Marceau, G. Sha, [R. Ferragut](#), A. Dupasquier, S.P. Ringer: Solute clustering in Al-Cu-Mg alloys during the early stages of elevated temperature ageing, *Acta Mater.* **58** (2010) 4923 (I.F.: 7.293)
- 5) S. Sala, A. Ariga, A. Ereditato, [R. Ferragut](#), M. Giammarchi, M. Leone, C. Pistillo, P. Scampoli. First demonstration of antimatter wave interferometry, *Science Adv.* **5** (2019) eaav7610 (I.F.: 12.804)
- 6) S. Aghion, O. Ahlén, C. Amsler, A. Ariga, T. Ariga, A. S. Belov, K. Berggren, G. Bonomi, P. Bräunig, J. Bremer, R. S. Brusa, L. Cabaret, C. Canali, R. Caravita, F. Castelli, G. Cerchiari, S. Cialdi, D. Comparat, G. Consolati, H. Derking, S. Di Domizio, L. Di Noto, M. Doser, A. Dudarev, A. Ereditato, [R. Ferragut](#) et al. A moiré deflectometer for antimatter, *Nature Comm.* **5** (2014) 4538 (I.F.: 11.88)

POSITION

- From 2014: Associate Professor (tenured position), Department of Physics, Politecnico di Milano. Position obtained by concourse.
- From 2011: Responsible of the Positron Laboratory VEPAS (Variable Energy Positron Annihilation Spectroscopy) at the research center L-NESS in Como, Politecnico di Milano.

EDUCATION

- 1999: Ph.D. in Physics, Thesis: Age-hardening study in Aluminum based alloys, Universidad Nacional del Centro de la Provincia de Buenos Aires (UNICEN), Tandil, Argentina.
- 1995: Licenciatura en Ciencias Físicas (equivalent to Master in Physics), Thesis: Microstructural analysis of age-hardening alloys based in Al-Zn-Mg, UNICEN, Tandil, Argentina.

PROFESSIONAL EXPERIENCE

- 2005-2014: Assistant Professor (tenured position, ricercatore a tempo indeterminato), Department of Physics, Politecnico di Milano. Position obtained by concourse.
- 2002-2004: Member as researcher of Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina (permanent position; leave-of-absence in this period).
- 2000-2004: Assistant Professor. Universidad Nacional del Centro de la Provincia de Buenos Aires (UNICEN). Argentina (tenured position; leave-of-absence in this period).
- 1996-2000: Assistant Professor. UNICEN. Argentina.
- 1990-1995: Undergraduate Teaching Assistant. UNICEN. Argentina.

POSTDOCTORAL FELLOW

- Visiting scientist. Post doctorate position with Alfredo Dupasquier at the Department of Physics, Politecnico di Milano, Italy.
- 2000-2002: Postdoctoral Fellow - International Centre for Theoretical Physics (ICTP) - Italy - <https://www.ictp.it/>
 - 2002-2003: Postdoctoral Fellow - Istituto Nazionale per la Fisica della Materia (INFM) - Italy - <http://materia.fisica.unimi.it/>
 - 2003-2004: Postdoctoral Fellow - Politecnico di Milano - Italy - <http://www.polimi.it/>

PHD FELLOW

- 1998-1999: Beca de perfeccionamiento - Comisión de Investigaciones Científicas de la Prov. de Bs. As. (CICPBA) - Tandil, Argentina - <http://www.cic.gba.gov.ar/>
- 1996-1997: Beca de iniciación - CICPBA - Tandil, Argentina - <http://www.cic.gba.gov.ar/>

STUDENT FELLOW

- 1994-1995: Beca de entrenamiento - CICPBA - Tandil, Argentina - <http://www.cic.gba.gov.ar/>

AWARDS and HONORS

- 2020- : Member of the scientific committee as coordinator of Exact and Natural Sciences of [RCAI](#) (Red de Científicos Argentinos en Italia).
- 2019: The experiment performed by the [QUPLAS collaboration at the VEPAS Positron Laboratory](#) at L-NESS in Como was chosen [Top-10 2019 Breakthroughs in Physics](#). Physics World - United State - <https://physicsworld.com/>
- 2004: Nano TAP award. Nano Travel and Access Program to Atom Probe measurements. Project: Nanostructural study of light alloys. The University of Queensland - Australia - <http://www.uq.edu.au/nanoworld/>

LANGUAGES

- Spanish (mother tongue)
- Italian
- English

REVIEWER OR REFEREE OF RELEVANT MAGAZINES

Nature Materials, Physical Review B, Acta Materialia, Philosophical Magazine, Journal of Applied Physics, and others.

PROJECT REVIEWER

Agencia Nacional de Promociones Científica y Tecnológica (Argentina), Research Fondation - Flanders -FWO (Belgium), MIUR, etc.

SUPERVISOR OF POST-DOCS

2006-2007: M. M. Iglesias, Funding Agency: Program IDEAS, Lombardy Region and European Commission, at Positron Laboratory (Como Campus).

2011-2012: F. Moia, Founding Agency: Lombardy Region 50% + 50% Politecnico di Milano, at Positron Laboratory (Como Campus).

2015-2018: S. Aghion, Funding Agency: Politecnico di Milano, at Positron Laboratory (Como Campus).

SUPERVISOR OF DOCTORAL THESIS

Physics Doctorate -PhD- (6)

- 2018-2021: Valerio Toso. "Study of the interferometric and gravitational behavior of antimatter". Department of Physics. Politecnico di Milano. Supervisor: Rafael Ferragut (in progress).
- 2014-2017: Craig W. Evans. "Mesoporous materials for positronium production in transmission geometry". Department of Physics. Politecnico di Milano. Supervisor: Rafael Ferragut.
- 2012-2014: Stefano Aghion. "Study of thin films and porous materials by means of Positron Annihilation Spectroscopy". Department of Physics. Politecnico di Milano. Supervisor: Rafael Ferragut.
- 2007-2009: Alberto Calloni. "Positron beam spectroscopy in thin layers and porous materials". Department of Physics. Politecnico di Milano. Supervisors: Alfredo Dupasquier and Rafael Ferragut.
- 2006-2008: Fabio Moia. "Vacancy-solute interaction in Mg-rare earth alloys". Department of Physics, Politecnico di Milano. Supervisors: Alfredo Dupasquier and Rafael Ferragut.
- 2004-2006: Marina Marta Iglesias. "The CDB method applied to the study of aluminium nanostructures and its alloys". Department of Physics. Politecnico di Milano. Supervisors: Alfredo Dupasquier and Rafael Ferragut.

Supervisor of Master Thesis in Physics (4)

- 2020: Giuseppe Vinelli. "Micro-channel plate detector as a positron beam diagnostic method". Department of Physics. Politecnico di Milano. Supervisor: Rafael Ferragut (in progress).
- 2015: Erasmo Dei Cas. "Studio di materiali mesoporosi per la produzione di positronio freddo". Department of Physics. Politecnico di Milano. Supervisors: Rafael Ferragut and Stefano Aghion.
- 2014: Luca Lucera. "Light emission from zinc oxide nanoforest plasma". Politecnico di Milano. Supervisors: Helena Silva and Rafael Ferragut.
- 2011: Stefano Aghion. "Studio di materiali mesoporosi per applicazioni avanzate mediante spettroscopia di annichilazione di positroni", Department of Physics. Politecnico di Milano. Supervisor: Rafael Ferragut.
- 2011: Gaia Tosi. "Produzione di positronio in materiali porosi per l'esperimento AEGIS sull'antimateria al Cern. Department of Physics". Università degli Studi di Milano. Supervisors: Rafael Ferragut and Fabrizio Castelli.

Supervisor of Master Thesis in Computing Engineering (1)

- 2006: Angeles Macuso. "Sistema de Procesamiento de Datos para Espectroscopía Temporal de Aniquilación de Positrones". Facultad de Ciencias Exactas, UNICEN, Tandil, Argentina. Supervisors: Rafael Ferragut and Hernán Cobo.

Supervisor of Bachelor Thesis in Physics Engineering (Supervisor/co-supervisor of at least 25 students)

Emanuele Spirito (Mar/2020), Federico Tassone (Jul/2019), Daniele Ronchetti (Sep/2018), Iorgo Giacomo Argyropoulos (Jul/2018), Alessio Magni (Sep/2015), Cecilia Landini (Sep/2015), Enrico Talamas (Sep/2015), Francesca Luoni (Sep/2015), Giovanni Casula (Sep/2013), Andrea Sattin (Sep/2013), Valerio Bitetta (Sep/2011), Lorenzo Baldrati (Sep/2011), William Capra (Sep/2011), Lara Sormani (Sep/2011), Eric Vezzoli (Sep/2010), Luca Lucera (Sep/2010), Tommaso Zandrini (Sep/2010), Valeria Rossi (Sep/2010), Marta Galbiati (Sep/2008), Andrea Bertelè (Sep/2008), Graciela Ferreira (Dec/2007), Filippo Cavalca (Jul/2007), Nur Fadel (Sep/2005), Sara Bortot (Sep/2005), Ana Huarte (Mar/2001).

TEACHING EXPERIENCE

- From 2018: Semiconductor Physics (Master in Physics), in average students: 50, credits: 5, lesson: 28 h and exercises: 22 h. Politecnico di Milano. Leonardo-Milan.
- From 2018: Physics (Mechanics and Thermodynamics - Bachelor), in average 200 students, credits: 7, lesson: 42 h + 28 h. Politecnico di Milano, Milano-Bovisa.
- 2009-18: Physics (Mechanics, Thermodynamics, Electrostatics and Magnetostatics - Bachelor): in average 130 students, credits: 12, lesson: 72 h + exercises: 48 h. Politecnico di Milano. Como Campus.
- 2015-17: Semiconductor Physics (Master): students: 9, credits: 5, lesson: 28 h and exercises + laboratory: 22 h. Politecnico di Milano. Como Campus.
- 2009-17: Responsible of courses of Physics, School of Industrial and Information Engineering, Politecnico di Milano. Como Campus.
- 2007-08: Mechanics and Thermodynamics: in average 110 students, credits: 7.5, lesson: 45 h. Politecnico di Milano. Como Campus.
- 2005-08: Electrostatics and Magnetostatics: in average 120 students, credits: 5, lesson: 30 h + exercises: 18 h. Politecnico di Milano. Como Campus.
- 2003-05: Mechanics and Thermodynamics: in average 114 students, credits: 7.5, lesson: 45 h (contract professor). Politecnico di Milano. Como Campus.
- 2002-03: Teacher Assistant undergraduate courses. Exercises and Laboratories of the course Physics A+B. (Mechanics, Thermodynamics, Electrostatics and Magnetostatics). Politecnico di Milano. Leonardo-Milan.
- 2001-02: Teacher Assistant of undergraduate courses. Laboratories of the course Physics A+B. Politecnico di Milano. Como Campus.
- 1996-00: Teacher Assistant of undergraduate courses. Physics and Electronics (Electricity and Magnetisms/Mechanics and Thermodynamics/Digital Electronics) UNICEN. Tandil (Argentina).

- 1993-95: Assistant of undergraduate courses (as Student). Exercises and Laboratories of the course Electricity and Magnetisms, UNICEN. Tandil (Argentina).

OTHERS ACADEMIC RESPONSIBILITIES

- 2020: Invited as member of the Doctoral Thesis Examination Committee: Pierfrancesco Aversa. Title of the Thesis: Primary defects in halide perovskites: effect on stability and photovoltaic performances. September 30th 2020. Ecole Polytechnique - Palaiseau. France.
- 2018: Member of the Doctoral Thesis Examination Committee: Craig W. Evans, Luca Anzi and Andrea Ballabio Como. February 23rd 2018. Politecnico di Milano, Como Campus.
- 2017: Member of the Doctoral Thesis Examination Committee: Zeudi Mazzotta, Giacomo Guarnieri and Jacopo Trapani. January 19th 2017. Università degli Studi di Milano. Milan.
- 2016: Member of the Doctoral Thesis Examination Committee: Eneko Axpe. Spain, October 23rd 2015.
- 1999-2000: Departmental Counsellor, Department of Physics (researcher in formation). Facultad de Ciencias Exactas, UNICEN, Argentina.
- 1991-1995: Departmental Counsellor, Department of Physics (student). Facultad de Ciencias Exactas, UNICEN, Argentina.

ACTIVE SCIENTIFIC COLLABORATIONS

- ASACUSA (Atomic Spectroscopy and Collisions Using Slow Antiprotons) collaboration at CERN.
- Istituto Nazionale di Fisica Nucleare - INFN (Italy). Dr. Marco Giammarchi.
- Northwestern University (USA), Department of Chemistry and the Materials Research Center Prof. Antonio Facchetti and Prof. Tobin Marks.
- Jet Propulsion Laboratory - NASA (USA), Dr. M.P. Petkov and Dr. S.M. Jones.

FINANCED PROJECTS (some)

- ASACUSA project (INFN, Milano Unit, Responsible: Dr. Marco G. Giammarchi). 2020- . Local Responsible (Politecnico di Milano).
- AEgIS project (INFN, Milano Unit, Responsible: Dr. Marco G. Giammarchi). 2008-2019. Local Responsible (Politecnico di Milano).
- Polo Territoriale di Como. Politecnico di Milano. 2010-continue. Positron Group, L-NESS. Responsible.
- Electric Control of Magnetization in Spintronic Devices (ECoMag). *Cariplo Foundation*. 2011-2013. Positron Group. Task-leader.
- PRIN 2004, Coordinator: Alfredo Dupasquier. Period: 2004-2007. Participant.
- NANO TAP GRANT - TAP # 4023: Nanostructural study of light alloys. Sydney (Australia), 07/2004. Responsible.
- PICT 3-12739: Agencia Nacional de Investigaciones Cientificas y Tecnologicas (Argentina). Project: MICROESTRUCTURA Y DEFECTOS EN SEMICONDUCTORES. Period: 2002-2003. Responsible. Resigned due to his transfer in Italy.

PARTICIPATION IN RESEARCH INSTITUTIONS (Local and International)

- Team Leader (Politecnico di Milano) ASACUSA experiment at CERN from 02/2020.
- Member of the Executive Board: Interuniversity Centre L-NESS from 01/2010.
- Secretary of the Research Lines 4 and 5: Department of Physics. Politecnico di Milano. 09/2013-12/2019.
- Member of the Executive Committee: AEgIS experiment at CERN. 09/2013-12/2019.
- Team Leader (Politecnico di Milano) AEgIS experiment at CERN 06/2013- 12/2019.
- Departmental Counsellor, Department of Physics (as researcher in formation). Facultad de Ciencias Exactas, Universidad Nacional del Centro de la Provincia de Buenos Aires. 01/1999-12/2000.
- Departmental Counsellor, Department of Physics (as student). Facultad de Ciencias Exactas, Universidad Nacional del Centro de la Provincia de Buenos Aires. 01/1991-12/1995.

TECHNOLOGY TRANSFER

- Development of a system for telephone calls from tetraplegic people (Sep/2012). First prototype used by Prof. Alfredo Dupasquier. Feasibility study of a patent.
- SATA S.p.A (Argentina). Advisor for error calculation and propagation (Jan/2000). Department of Metrology and Quality Control: SATA Argentina S.A.

CONFERENCES AND SCHOOLS

He participated in many schools and conferences (more than 50) with oral contributions and invited talks.

List of the recent conferences in which RF has presented invited talks:

- Invited to The International Workshop on Positron Studies and Defects 2020 (PSD-20) Mumbai, India (programed to November 2nd-6th, 2020).
- “15th International Workshop on Slow Positron Beam Techniques & Applications (SLOPOS-15)” Prague, Czech Republic (September 2nd-6th, 2019).
- “18th International Conference on Positron Annihilation (ICPA-18)” Orlando, USA (August 19th-24th, 2018).

- The International Workshop on Positron Studies and Defects 2017 (PSD-17) Dresden (September 3rd-8th, 2017).
- International Forum on Advances in Radiation Physics, Buenos Aires (May 3rd-6th 2017).
- “11th International Workshop on Positron and Positronium Chemistry (PPC-11)” Cidade de Goa, Goa, India, (November 9th-14th, 2015).
- “Energy, Materials and Nanotechnology (EMN) Meeting 2014: Defects in Electronic and Photonic Materials”, Cancun, Mexico, (Programmed: 9-12 June, 2014).
- “13th International Workshop on Slow Positron Beam Techniques and Applications”, Munich (Sep 15th-20th 2013).
- “7th International conference on Positron Studies of Defects”, Delft, The Netherlands (Aug 28th-Sep 2nd, 2011).
- “Conference of Precision Physics of Simple Atomic Systems 2010 (PSAS 2010)”, Les Houches, France (May/Jun, 2010).

PUBLICATIONS

The contributions of RF are documented by about 150 publications (international journals and proceedings).

Current Hirsch index (h): 27 in Google Scholar.

Publications listed in: ->[Click here to see the publications list](#)<-

Other sources:

->[Click Google Scholar](#)<-

->[Click Scopus](#)<-

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