

CV Prof. Stefano Frabboni

2019: Full Professor, SSD PHYS-03/A - Fisica sperimentale della materia e applicazioni, GSD 02/PHYS-03 - FISICA SPERIMENTALE DELLA MATERIA E APPLICAZIONI, University of Modena e Reggio Emilia.

2024-now: Deputy Director – Department of Physics, Computer Science and Mathematics, University of Modena and Reggio Emilia.

2022-now: Coordinator of the Bachelor's Degree in Physics-Unimore

2003-now: Member of the board of the Doctoral Course in Physics and, subsequently, in Physics and Nanosciences.

2019-2021: Coordinator of the PhD Course in Physics and Nanosciences XXXV cycle of the University of Modena and Reggio Emilia from 11/13/2019 to 12/20/2021.

2005-2019: Associate Professor, FIS/01 EXPERIMENTAL PHYSICS, University of Modena and Reggio Emilia.

2015-2018: Deputy Director – Department of Physics, Computer Science and Mathematics, University of Modena and Reggio Emilia.

2007-2008: Coordinator of the Doctoral Course in Physics, University of Modena and Reggio Emilia.

1990-2005: Researcher, Fis01, University of Modena and Reggio Emilia.

Research activities.

1. Bibliometric data, scientific topics of interest and recent publications

Author of over 160 papers (170 listed by ISI-WEB) in international journals and 4 book chapters. h-index: Scopus 34; WOS 32; Google Scholar 42.

The main scientific topics of interest are in the fields of Transmission Electron Microscopy, Nanotechnologies and Materials Physics.

In the field of electron microscopy, he is active in the development of experimental methodologies such as:

- Generation and use of structured electronic beams
- Converging beam electronic diffraction for strain measurement in semiconductor materials and devices
- Electronic interferometry and basic physics experiments
- Electronic holography of electromagnetic fields

In the field of Nanosciences, he is active in the development of methods such as:

- Focused electron beam assisted deposition processes (FEBIP) of nanowires and multilayers
- Creation of electro-optical systems and nano-devices using Focused Ion Beam (FIB).

In the field of materials physics, he has mainly worked on structural analyses of materials for electronics, thermoelectricity, and coatings.

10 Most Relevant papers (2021-2026):

1. Amir H Tavabi, Paolo Rosi, Giovanni Bertoni, Enzo Rotunno, Luca Belsito, Alberto Roncaglia, Stefano Frabboni, Gian Carlo Gazzadi, Ebrahim Karimi, Peter Tiemeijer, Rafal E Dunin-Borkowski, Vincenzo Grillo;

Demonstration of angular-momentum-resolved electron energy-loss spectroscopy

Nature Communication **16** 6601 (2025)

2. Giovanni Bolelli, Maria Francesca Bonilauri, Paolo Sassatelli, Francesco Bruno, Riccardo Franci, Giovanni Pulci, Francesco Marra, Laura Paglia, Gian Carlo Gazzadi, Stefano Frabboni, Luca Lusvarghi;

Synthesis of Al_xCoCrFeNi HEA thin films by high power impulse magnetron sputtering: Effect of substrate bias voltage

Surface and Coatings Technology **496**, 131644 (2025).

3. P Rosi, L Viani, E Rotunno, S Frabboni, AH Tavabi, RE Dunin-Borkowski, A Roncaglia, V Grillo

Increasing the resolution of transmission electron microscopy by computational ghost imaging

Physical Review Letters **133** 123801 (2024)

4. A. H. Tavabi, P. Rosi, E. Rotunno, A. Roncaglia, L. Belsito, S. Frabboni, G. Pozzi, G. C. Gazzadi,

P-H. Lu, R. Nijland, M. Ghosh, P. Tiemeijer, E. Karimi, R. E. Dunin-Borkowski, V. Grillo

Experimental Demonstration of an Electrostatic Orbital Angular Momentum Sorter for Electron Beams, **Physical Review Letters** **126**, 094802 (2021). doi.org/10.1103/PhysRevLett.126.094802

5. AH Tavabi, P Rosi, A Roncaglia, E Rotunno, M Beleggia, PH Lu, L Belsito, G Pozzi, S Frabboni, P Tiemeijer, RE Borkowski, V Grillo.; Generation of electron vortex beams with over 1000 orbital angular momentum quanta using a tunable electrostatic spiral phase plate; **Applied Physics Letters**, **121**(7), 073506 (2022). Selected in APL Scilight <https://doi.org/10.1063/10.0013819>

6. Fabrizio Porrati, Felix Jungwirth, Sven Barth, Gian Carlo Gazzadi, Stefano Frabboni, Oleksandr V Dobrovolskiy, Michael Huth; Highly-Packed Proximity-Coupled DC-Josephson Junction Arrays by a Direct-Write Approach; **Advanced Functional Materials** **32** (36) 2203889 (2022).
7. Akhil Kallepalli, Lorenzo Viani, Daan Stellinga, Enzo Rotunno, Richard Bowman, Graham M Gibson, Ming-Jie Sun, Paolo Rosi, Stefano Frabboni, Roberto Balboni, Andrea Migliori, Vincenzo Grillo, Miles J Padgett; Challenging point scanning across electron microscopy and optical imaging using computational imaging, **Intelligent Computing**, DOI: 10.34133/icomputing.0001 (2022).
8. Fabrizio Porrati, Sven Barth, Gian Carlo Gazzadi, Stefano Frabboni, Oleksii M Volkov, Denys Makarov, Michael Huth; Site-Selective Chemical Vapor Deposition on Direct-Write 3D Nanoarchitectures, **ACS nano** **5**, 4704-4715 (2023).
9. Enzo Rotunno, Simone Gargiulo, Giovanni M Vanacore, Chen Mechel, Amir H Tavabi, Rafal E Dunin-Borkowski, Fabrizio Carbone, Ivan Madan, Stefano Frabboni, Tugrul Guner, Ebrahim Karimi, Ido Kaminer, Vincenzo Grillo; One-Dimensional "Ghost Imaging" in Electron Microscopy of Inelastically Scattered Electrons, **ACS Photonics** **10**, 6, 1708–1715 2023.
10. Paolo Rosi, Alexander Clausen, Dieter Weber, Amir H Tavabi, Stefano Frabboni, Peter Tiemeijer, Rafal E Dunin-Borkowski, Enzo Rotunno, Vincenzo Grillo; Automatic alignment of an orbital angular momentum sorter in a transmission electron microscope using a convolutional neural network; **Microscopy and Microanalysis** **29**, 408-417 (2023)

2. Coordination activity

2.a Research group

2002-now Coordinator of the "TEM and Nanofabrication" research group of UNIMORE, which works in close synergy with the Electron Microscopy group of the S3 center of the Nanoscience Institute of the CNR (former S3-INFM center) coordinated by Dr. Vincenzo Grillo, <http://tem-s3.nano.cnr.it/>.

Set up of the starting laboratory, selecting the instrumentation and taking care of the start-up of the Focused Ion Beam facility as Head of the Research Activity: "Buried and nanostructured surfaces and interfaces: ion beam fabrication and HRTEM" of the INFM-S3 Research Center in Modena. (INFM-Research Centers competitive tender (2001-2002) PI Prof. Elisa Molinari).

He was responsible of the development project of the CIGS Unimore for the purchase of a new TEM/STEM Thermo Fischer Talos F200S G2+ EELS + electronic holography, installed at the end of February 2019.

This instrument replaces the TEM Jeol 2010+ GIF (until 2018 (of which he oversaw the configuration and started the scientific use in the field of matter physics and materials science since the year 2000)).

In 1990 he set up the first electron microscopy laboratory at the Department of Physics of the University of Modena and Reggio Emilia (Philips EM400 microscope, 120kV, Gatan Duo Mill thinning system and equipment for the mechanical preparation of samples).

Currently the UNIMORE-CNR group consists of 2 Unimore POs, a CNR research manager, a first CNR researcher, a first CNR technologist, a CNR researcher, a UNIMORE graduate technician, a CNR research fellow.

In February 2025, a new laboratory was established featuring a new monochromated 300keV TEM for high-resolution EELS spectroscopy (SPEQTEM).

The research group technically manages and financially supports the following instrumentation:

- Dual Beam FEI Strata 235M (Focused Ion Beam (FIB) and field emission Scanning Electron Microscope (SEM));
- Electron Beam Lithography (SEM+Raith system)

The following international collaborations are currently active:

- Department of Physics of the University of Ottawa (Canada)- Prof. E. Karimi
- Electron Microscopy Center "E. Ruska" of Juelich (Germany) - Prof. R.E. Dunin-Borkowski, Prof. Giulio Pozzi.
- FEI Electron Optics BV – Thermofisher (The Netherlands) F. De Jong and P. Tiemeijer, and the following national collaborations:
- CNR-IMM Bologna- Dr. R. Balboni, Dr. A. Parisini.

The research group regularly presents oral communications and posters at industry scientific conferences. Below is a list of the most significant in the last 15 years:

- M&M 2023 Microscopy and Microanalysis Minneapolis (2023)
- M&M2021, Microscopy and Microanalysis Virtual Meeting (2021)
- M&M 2020, Microscopy and Microanalysis Virtual Meeting (2020)
- IMC 19, World Congress of Electron Microscopy Sydney (2018)
- IMC 18, World Congress of Electron Microscopy Prague (2014)
- EMC 2016 16th European Congress of Microscopy Lille (Fr).

MCM2015 Multinational Congress on Microscopy Eger Hungary (2015)
Microscopy and Microanalysis 2015, Portland, OR (USA)
Microscopy and Microanalysis 2014, Hartford, CT (USA),
EMC 2012 15th European Microscopy Congress (EMC 2012-Manchester)
MCM2011, Multinational Congress on Microscopy, Urbino 2011
36th International Conference on Micro- and Nano-Engineering (MNE2010), Genoa 2010;

2.b Conferences

2018 Member of the Scientific Committee of the Materials.it 2018 conference (Bologna, 22-26)
2018 Co-Chair of the international conference FEBIP 2018 (Modena 10-13 July).
2018 Chair of the session “EMCD, Plasmons and Quantum Phenomena” International Conference on Electron Beam Shaping in Space And Time (Juelich (De) 27-30 May)
2012 Co-Chair of the symposium “Advances in Ion Microscopy” European Congress of Electron Microscopy (EMC 2012 – Manchester (GB)).
2012 Co-Chair of the International Workshop “Focused Ion beam Workshop” (Manchester 12 September)
2011 Chair of the session “Environmental microscopy, x-ray and ion microscopy” Multinational Congress on Microscopy – Urbino 4-9 September

2.c Board of research institutions/laboratories

2023-now: Member of the Scientific Council of the CNR Nanoscience Institute.
1999-now: Member of the Scientific Council of the Centro Interdipartimentale Grandi Strumenti (CIGS) University of Modena and Reggio Emilia
2003-2020: Scientific Council of the S3 Research Center in Modena (former INFM-CNR, since 2010 NANO-CNR)
2010-2015: Member of the Scientific Council of the CNR Nanoscience Institute
2009-2011 Deputy Director of Centro Interdipartimentale Grandi Strumenti (CIGS) University of Modena and Reggio Emilia of the University of Modena and Reggio Emilia

3. Recent projects

2023-2025 “AI-TEM” PRIN 200K€ 2023-2025-participant
2017-2021 FET OPEN Programme: QSORT (<http://www.qsort.eu>): Coordinator of scientific unit.
The project is coordinated by Dr. V. Grillo of CNR-S3, member of the research group coordinated by me.

4. Teaching Activities.

He has been carrying out teaching activities in university courses of General Physics and Physics Laboratory since the 1990-1991 Academic Year, with teaching assignments since the 1995-1996 Academic Year and Teaching Responsibility since the 2005-2006 Academic Year.

Tutor of numerous PhD theses, Bachelor's degree theses in Physics and Master's degree theses in Physics. He currently coordinates the three-year degree course in Physics.

Modena, september 17th, 2026

