REMAP & e-APP Roadshow
Book of Abstracts

19th September 2025

Onsite (Aula Magna, Università di Genova, via Balbi 5, Genova)
& online (Microsoft Teams) **event**

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

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PV at the Crossroads. The needs of Scaling Solar for System Integration and Hydrogen

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Abstract

Photovoltaics is shifting from an emerging technology to a dominant one in global energy markets. However, as installations grow, new questions arise: how do we ensure PV's continued value as grid saturation increases? And how can it power the next wave of decarbonization, including clean hydrogen production? This short talk will provide a global snapshot of PV deployment trends, focusing on technology shifts, regional leadership, and integration challenges. Once the scene is set, we will then focus on growing intersection between PV and green hydrogen—where expectations are high, but technical and economic alignment remains challenging. By highlighting key bottlenecks such as load matching, infrastructure readiness, and industrial uptake, the talk will frame a realistic view of what's needed for PV-H_2 systems to scale. The aim is to open the session by connecting current PV trajectories to near-term priorities for innovation, market design, and cross-sector collaboration.

Author's Bio

Verónica Bermúdez is an energy technologist and strategic advisor with over two decades of international experience at the intersection of clean energy research, industrial innovation, and technology deployment. She currently leads Berbetin, an innovation consulting firm focused on scaling deep-tech energy solutions, and serves as Director of the Energy Department at AlWajba Establishment in Doha, Qatar. Previously, she was Director of the Energy Center at the Qatar Environment and Energy Research Institute under Qatar Foundation, where she established pilot lines and testbeds for next-generation PV and storage technologies under extreme environmental conditions.

Her expertise spans thin-film photovoltaics, tandem solar cells, batteries, hydrogen, and system integration — with a strong emphasis on manufacturability, techno-economic viability, and strategic alignment with market and policy frameworks. She has held senior roles at EDF R&D and Solar Frontier and advises on EU and global innovation programs and industrial scale-up strategies.

Verónica is deeply engaged in bridging the gap between scientific excellence and real-world deployment. Her work focuses on aligning research agendas with industrial bottlenecks, regulatory constraints, and bankability filters—enabling clean technologies to move from lab breakthroughs to market impact.

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From PV research to industrial innovation: the platform SOLCIS in Orsay devoted to CIGS thin film technologies

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Abstract

Research on CIGS technologies is a long term research line started at the beginning of the 80's at CNRS-ChimieParistech (1984-2002) within the European "Eurocis" programs. The group has pioneered various aspects of the CIGS technologies, electrodeposition and photoelectrochemistry of CIGS, buffer layers by CBD and then by ALD. This was continued and amplified by the creation of the joint research lab with EDF "IRDEP" in Chatou from 2003 and the IPVF in Palaiseau since 2018, for flexible and innovative CIGS cells. IPVF is now a major player in France working with thin film technologies (perovskite, CIGS, tandems silicon-Perovskite…). In 2021 CNRS-IPVF and the University Paris Saclay created a dedicated platform for the valorisation of research, hosting a newly created startup SOYPV (Soleil sur Yvette Photovoltaïque). SOYPV aims to develop and commercialize CIGS modules on flexible light weight substrates. A joint project supported by the ADEME France-2030 program aims to explore flexible CIGS-Perovskite tandems.

Author's Bio

Emeritus Research Director at CNRS-IPVF and Entrepreneur

Daniel Lincot is an ESPCI engineer. He began his research into photovoltaics in 1978 and joined the CNRS in 1980 at Chimie Paristech-PSL, devoting his PhD in science to the photoelectrochemistry of semiconductors before turning his attention to the study of electrochemical processes for the development of thin films and interfaces for photovoltaics. In 2002, he co-founded IRDEP in Chatou with EDF, the CNRS, and ChimieParistech, with the aim of developing CIGS solar cells prepared by electrolysis for industrial use. This led to the creation of NEXCIS by EDF in 2009. Daniel Lincot went on to create IPVF, where he served as scientific director from its creation in 2013 until 2019. In 2021, after retiring, he co-founded the startup SOYPV as President, which aims to manufacture tandem thin-film cells in France using electrochemistry. He was professor at the Collège de France in 2021-2022 on the Liliane Bettencourt Chair of Industrial Innovation. He joined the Academy of Technologies in 2023. In 2024, he received the Vittorio de Nora Grand Prize from the Electrochemical Society and the Edmond Becquerel European Prize for photovoltaics. He authored 321 publications with a h-index of 59.

Overview of current Research activities for AVANCIS' R&D Roadmap

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Abstract

In this presentation, we would like to give a general overview of current activities and R&D roadmaps in AVANCIS. AVANCIS is a world leader for CIGS thin film technologies with single junction efficiency of 20.3%. Currently in AVANCIS, we are focusing mainly on the following research areas:

1. CIGS for Tandem applications: CIGS has the advantage of varying the absorber bandgap to form low bandgap bottom CIGS and high bandgap top CIGS in tandem applications.
2. CIGS cost reduction: In parallel, we are focusing on CIGS cost reduction where we are introducing a novel approach to form CIGS absorbers using Flash Annealing technology.
3. Perovskite: As an alternative to CIGS, thin-film layer structure including a metal-halide perovskite can be used as a top PV cell in a tandem PV module with efficiencies above 16% for 10x10cm^2 mini-modules achieved.
4. Semi-transparent PV modules: We are focusing on performing intensive research on semi-transparent PV modules with various degrees of transparency.
5. Photoelectrochemical applications: Part of AVANCIS R&D research for emerging technologies is currently focusing on using CIGS in different photoelectrochemical applications including hydrogen production, carbon capture, green ammonia extraction & seawater desalination and treatment.

Author's Bio

Hossam Elanzeery received his B.Sc. degree in Electrical & Electronics Engineering from University of Technology Petronas, Malaysia in 2010 and his M.Sc. degree in Microelectronics system design from Nile University, Egypt in 2014 with his Master's thesis, conducted at IMEC in Belgium, which helped set a world efficiency record in Kesterite solar cells. He earned his PhD in Physics from University of Luxembourg in 2019. His PhD doctoral thesis tackled performance challenges in CIGS, proposed treatments to enhance efficiency and achieved a world efficiency record for low bandgap CIGS.

Hossam joined AVANCIS R&D Center, Munich in 2019 as development engineer and was promoted in 2021 to Manager New Processes. In AVANCIS, he is leading the absorber formation and characterization group. Within AVANCIS, he is leading projects related to CIGS technology achieving world record efficiencies. He is also leading emerging technologies such as flexible, solar-to-hydrogen and others. He has been working in thin-film solar cells since 2013 with more than 50 publications and conference contributions in addition to 1 book on thin-film solar cells and more than 5 patents on novel materials and processes.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

NiO for hybrid photovoltaics: the journey of an electrodic material from p-type dye-sensitized solar cells to inverted perovskite solar cells

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Abstract

Hybrid photovoltaics (HPV) is a type of technology the development of which is based on the recent considerable progress in the materials science of practically all types of species: inorganic, nanostructured, organic and even living species like microorganisms, which, if opportunely combined, are capable to convert the luminous energy into electricity with additional efficiency. In the HPV ambit, dye-sensitized (DSC) and perovksite (PSC) solar cells are the two most advanced types of devices and both technologies can make use of p-type nickel oxide (NiO). Within p-/tandem-type DSCs, nanostructured NiO acts as the photocathode, with surface area larger than 40 m^2 g^{-1}. Within inverted PSCs, thin film NiO acts as the hole-transporting layer (HTL), with thickness of less than 100 nm. Here, the attention is first focused on the development of tandem DSCs for the purpose of building-integrated photovoltaics (BIPV) taking advantage of the progresses in NiO based photocathodic materials and in the synthesis of designed dye-sensitizers. In the second part of the contribution, the performances of PSCs with transparent NiO as HTL will be analyzed considering the perovskite $CH_3NH_3PbI_3$ as photoactive material.

Author's Bio

Danilo Dini is a researcher whose work focuses on the preparation, characterization, and design of functional materials for advanced optoelectronic and electrochemical devices, including electrochromic windows, sensors, displays, high-power sources, light-emitting devices, and nonlinear optical systems. He contributed to the optimization of electrochromic efficiency in tungsten trioxide through electrolyte engineering and developed innovative methods such as laser beam deflection for in-situ studies of electrochromic materials. His PhD research centered on the electrochemical synthesis of conjugated polymers for applications in smart windows, supercapacitors, sensors, artificial muscles, and photovoltaics, with particular attention to structure–property relationships. He has also investigated silicon anodic treatments, electrochemiluminescence in conjugated systems, and nonlinear optical properties of phthalocyanines. His postdoctoral and subsequent work extended to dye-sensitized semiconductors and photoelectrochemical devices, with current projects focusing on electrochemical and photochemical characterization of materials for dye-sensitized solar cells and related technologies.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

Eclipta: Next-Generation Semitransparent Solar Cells

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Abstract

Eclipta presents a breakthrough in semitransparent photovoltaics with its novel bottom-up fabricated CIGS-based solar cells, designed for seamless integration into building façades and various windows. Leveraging a scalable and sustainable deposition, our technology targets an optimal balance between transparency (≥70% AVT, comparable to car windows) and power conversion efficiency (8% PCE) via a unique microstriped design. Unlike conventional top-down methods, our approach eliminates subtractive lithography and high-temperature vacuum processing, enabling cost-effective, sustainable production.

Currently at TRL 3, Eclipta is optimizing fabrication through strategic collaborations with Carbon Ukraine (advanced material synthesis), RISE Technology (scalable area-selective deposition processes), and Avancis (CIGS expertise), ensuring rapid development and industrial scalability. Key advantages include superior Light Utilization Efficiency (LUE), neutral aesthetics, long-term durability (targeting 50+ years), and thermal insulation benefits.

By combining high performance, visual appeal, and scalable manufacturing, Eclipta shall address critical gaps in the Building-Integrated Photovoltaics (BIPV) market. Our solution promises to transform urban energy harvesting with solar windows that are both functional and architecturally versatile.

Author's Bio

Dr. Irina Gushchina is a pioneering researcher and entrepreneur in photovoltaics, holding three PhDs in Materials Science, Chemistry, and Nanotechnology from the University of Notre Dame (USA) and IIT/Università Cattolica (Italy). With over 10 years of expertise in solar cell fabrication, performance optimization, and advanced characterization, she bridges fundamental research and industrial applications. Her work spans high-efficiency thin-film technologies, including CIGS and perovskites, with a focus on semitransparent designs for building-integrated PV.

Currently, Dr. Gushchina is a Postdoctoral Researcher at the University of Genova, optimizing buffer layers for next-gen transparent solar cells. Simultaneously, she founded Eclipta, an innovative startup developing seamless CIGS-based solar windows. Her entrepreneurial vision combines scalable fabrication with architectural aesthetics, targeting urban energy solutions.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

Turning electricity into chemical bonds: industrially relevant electrocatalysis from lab-scale to electrolyzer stacks

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Abstract

As the world grapples with the urgent need to transition from fossil-based energy and feedstock to more sustainable alternatives, electrochemistry is a key enabler of this transformation. While electrochemical energy storage (e.g., batteries) is well known, the electrochemical synthesis of high-value molecules via electrolysis is now gaining increasing attention. By leveraging electricity and abundant feedstock such as water and small waste molecules (e.g., carbon dioxide, nitrate ions), electrolysis offers a green and scalable alternative for hard-to-abate sectors of the chemical industry—enabling for example the sustainable production of hydrogen, carbon monoxide, ammonia, and beyond.

In this talk, I will present the cutting-edge research conducted at the Italian Institute of Technology (IIT), where we bridge fundamental science and real-world applications. Our work spans from the rational design of novel electrocatalysts to the engineering of electrochemical devices. We explore both well-established processes, such as water splitting (i.e., the combination of Hydrogen Evolution Reaction, HER, and the Oxygen Evolution Reaction, OER), and emerging electrochemical pathways, including glycerol electrooxidation, CO_2 electroreduction, nitrate electroreduction, and electrochemical C–N bond formation. Beyond the lab-scale, we are committed to translating our research into impactful industrial technology. I will showcase how our startup, Antares Electrolysis, is transforming laboratory-scale innovations (TRL 1–4) into 100 kW AEM-based electrolyzer stacks, paving the way for the next generation of sustainable chemical manufacturing.

Author's Bio

Michele Ferri received his PhD in Industrial Chemistry from the Università degli Studi di Milano (UniMi) in 2021, with a multidisciplinary thesis encompassing inorganic materials synthesis and characterization (Gervasini's group, UniMi), applied electrochemistry (Trasatti's group, UniMi), and electrocatalysis (Atanassov's group, University of California, Irvine – UCI). Since July 2021, he has been a postdoctoral researcher at the Italian Institute of Technology (IIT) in Liberato Manna's group, where he coordinates the research activities of the electrocatalysis sub-group. In October 2024, he co-founded Antares Electrolysis S.r.l., an IIT-affiliated startup of which he is currently the Chief Scientific Officer (CSO). His main research interests include electrochemical water splitting and the electrochemical conversion of carbon- and nitrogen-based molecules under industrially relevant conditions.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

Programmable Pattern Transfer with Ferrofluid

Marco Piccinni[1,2], Diego Colombara[1,2,3,4], and Gary Friedman[5]

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Abstract

Fabrication of printed circuits today requires transfer of circuit patterns typically via photolithography. This process relies on photosensitive materials which need development and later stripping. In addition to costs associated with photosensitive materials, developers and strippers, the environmental impact of these processes is significant, requiring disposal and waste treatment as well as use of significant amount of water needed to perform several wash steps. 3D printed circuit manufacturing is being developed at least in part to reduce these costs and environmental impacts. However, 3D printing of conducting traces in printed circuits employs conducting inks which results in metallic trace conductivity 2-4 times lower than electroplated trace conductivity. As a result, it is difficult to achieve competitive circuit densities with 3D printed inks.

This presentation will discuss ideas on addressing the challenges of printed circuit fabrication using recordable patterns of magnetized material capable of creating programmable masking patterns of ferrofluid. The ferrofluid masking patterns can then be transferred into conducting traces via etching and/or electroplating, avoiding the need for photoresist development and stripping and, at the same time, permitting high conducting trace conductivity.

Last Author's Bio

Gary Friedman is a professor in the Department of Electrical and Computer Engineering at Drexel University, which he joined in 2001. In 2004, he also became affiliated with the Department of Surgery at the Drexel College of Medicine. From 1990 to 2001, he was on the faculty at the University of Illinois at Chicago. His research focuses on applying electrical and magnetic phenomena to medicine and biology. Recent projects include developing miniature coils for cellular NMR imaging, magnetic manipulation and separation in lab-on-a-chip devices, and magnetically targeted drug delivery for cardiovascular and orthopaedic applications. He has also initiated studies on medical applications of non-thermal plasma. In nanotechnology, Dr. Friedman investigates self-assembly of magnetic nanoparticles and their use in biochemical sensor fabrication. He is developing compact NMR sensors and systems. His MEMS work includes microfluidic systems for liquid micro-drop delivery and their integration in adaptive optical devices. He is also involved in modelling hysteresis in complex systems, such as magnetic particle assemblies and nano-structured materials. Currently, he co-leads the bilateral project e-APP between Università di Genova and Drexel University, focusing on the design and implementation of ferrofluid lithography systems based on permanent magnet arrays.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

Responsive Ferrofluids for Patterning and Actuation

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Abstract

The formulation of highly responsive ferrofluids represents the key step for several applications including reconfigurable masking materials. The capability to tune nanoparticles morphology (i.e., size and shape) [1], surface chemistry [2], and carrier fluid properties [3] ensure stability and responsiveness, under localized magnetic fields. A simplified model mimicking the behaviour of a ferrofluid under a magnetic field generated by a PAD (Patterned Active Device) composed of distant columns of NdFeB particles embedded in PDMS polymer, will be presented and discussed. Finally, a perspective on using ferrofluid-based systems in soft robotics, where remote magnetic control enables actuation and reconfiguration, will be briefly discussed.

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Author's Bio

Sawssen Slimani (SS) took her Ph.D. in Sciences and Technologies of Chemistry and Materials in 2022 from the University of Genova (Italy). Currently, she is a Fixed-term researcher at the University of Genova (UniGe) department of chemistry and industrial chemistry (DCCI). Since 2018 she has been carrying out her research activity on magnetic hybrid nanoarchitectures for different applications (i.e., biomedical, energy, environmental) and fundamental studies. Her expertise spans the synthesis of magnetic nanoarchitectures using different synthetic approaches (i.e., coprecipitation, thermal decomposition and microemulsion) and their surfaces functionalization (i.e., mesoporous silica coating, molecular coating). The results of her research were published in 26 papers and 22 oral and 9 invited contributions to national and international conferences. SS actively contributes to European projects as a member of the Nanostructured Magnetic Materials Laboratory (NM2-Lab) and has been involved in organizing committees for several conferences and workshops.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

Advanced micro-structured magnetic fields

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Abstract

Within the project *REusable MAsk Patterning* (REMAP), INL is developing devices to achieve micro-structured magnetic field patterns. These patterning devices are based on current elements that generate controlled micro-structured magnetic fields to remotely drive magnetic nanoparticles of a magnetorheological electrolyte fluid to form different masking patterns.
These patterning devices are comprised of two arrays of micro-fabricated orthogonal metallic current lines of 50 µm width, 1 mm length, 0.5 µm or 5 µm thickness, 200 µm in-plane separation, vertically separated by a 500 nm insulator layer. This geometry was defined based on finite element analysis simulations, to optimize the magnetic field patterns, carried out by the REMAP partner NCSRD. For the 0.5 µm thick lines, sputtered AlSiCu was used. However, resistive Joule heating limits the usable current range and consequently the magnetic field strength. Thus, electro-plated Cu with up to 5 µm thickness was used to achieve higher magnetic fields, requiring a modification of the complete fabrication process. The performance of the patterning device was assessed by imaging the temperature of the device during operation and by measuring the magnetic field distribution above the device using magnetic tunneling junctions as sensitive magnetic field sensors. We are currently exploring additional applications for these devices, beyond the reusable mask patterning.

Last Author's Bio

Dr. Sascha Sadewasser is a Research Group Leader at the International Iberian Nanotechnology Laboratory (INL), Portugal. His group works on materials for sustainable energy, specifically for photovoltaics, batteries, and catalysis, covering advanced solar cell materials and devices implementing nano- and microstructures, thin-film solid-state batteries, and 2D chalcogenide materials. Notably, scanning probe microscopy methods are developed and applied for the characterization of the optoelectronic nanostructure of energy materials.

Sascha Sadewasser holds a Diploma (1995) in Physics from the RWTH Aachen, Germany and a PhD (1999) from the Washington University St. Louis, MO, USA. After post-docs in Berlin (Hahn-Meitner Institute) and Barcelona (Centro Nacional de Microelectrónica), he became group leader and later deputy department head at the Helmholtz-Zentrum Berlin, Germany. After his Habilitation in Experimental Physics from the Free University of Berlin, Germany (2011) he joined INL in 2011, where he is currently co-Chair of the Research Board and member of the Executive Board. Sascha has published more than 140 peer-reviewed papers (incl. Nature series, Advanced Materials series, and Phys. Rev. Lett.), with about 4100+ citations (h-index 37). He has published five book chapters and two books and has been granted three patents. He has participated in and coordinated several European and international projects and is a member of several scientific committees and evaluation boards.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

In-situ formation of re-usable masks for patterned electroplating

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Abstract

High value metallic structures with complex geometries are used in the micro-electronics industry and are formed by combining classical lithography and electroplating. Traditionally, lithographic masks are applied and removed externally to the plating bath and are single use. We propose a new paradigm, infinitely usable masks that comprise colloids that self -assemble on the surface of the substrate from the plating bath before deposition, and that they re-disperse after the deposition is finished. We demonstrate masked electroplating of Cu, In, Ga and Se on two different types of substrates to show the generality of the method. Factors affecting the size, complexity and quality of the masking will be discussed.

Last Author's Bio

Phillip Dale is a full Professor in the Department of Physics and Materials Science at the University of Luxembourg. The REMAP project brings his research career into a full circle, having started his Ph.D in colloidal stability before moving into thin film electrodeposition and semiconductor formation for solar cell applications. These solar cell applications include semi-transparent photovoltaics and micro-solar cells, which all need lithography. More recently, his interests have broadened into colored photovoltaics and their societal implications, as well as scientific communication to the public and the politicians on the topic of energy and sustainability. Listen here to find out more:

https://www.researchluxembourg.org/en/scilux-podcast-phillip-dale-on-solar-energy/.

Projects funded by the European Innovation Council under grant agreement no. 101046909 and by Italian Ministry of Foreign Affairs and International Cooperation under grant agreement no. PGR02078

FeGa thin film coupled to a network of photoresponsive liquid crystals: control of magnetic properties by light irradiation

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Abstract

Composite magnetic materials with multiple responses to environmental stimuli have significant potential for sensing and actuation applications. Here, we present the effect of light on a composite structure consisting of a 30 nm magnetostrictive FeGa layer combined with a soft photo-responsive liquid crystalline network (LCN) polymer containing an azobenzene dye. This hybrid system enables precise control of the film's magnetic properties through light irradiation without applying an external magnetic field. Under UV irradiation, the LCN polymer contracts along the x-axis and expands along the y-axis due to dye isomerization, inducing mechanical stress in the FeGa film. This stress drives the rearrangement of magnetic domains via uniaxial stress anisotropy, altering the film's magnetic behavior as a function of UV light intensity and duration. Conversely, green light restores the polymer's molecular order, gradually releasing the stress and recovering the pristine magnetic properties of the FeGa layer. Room-temperature hysteresis loops measured along the x- and y-directions confirm this reversible behavior. Key magnetic parameters, including normalized remanence, coercive field, and susceptibility, were evaluated as a function of light exposure. Magnetoresistance measurements further demonstrate a light-controlled magnetic memory effect, highlighting the potential of opto-mechanical coupling for multifunctional magneto-photonic devices.

Author's Bio

Paola Tiberto holds a Ph.D. in Experimental Physics from Politecnico di Torino (1993). She works at the National Institute for Metrological Research (INRIM) in the Advanced Materials Metrology and Life Science Division, which she led until 2024. INRIM focuses on metrology, materials research, and the development of innovative technologies and devices. Her scientific activity has been mainly dedicated to phase transformations in metastable ferromagnetic alloys, magnetotransport properties of thin films and multilayers, magnetization processes in materials produced through non-equilibrium techniques (nanogranular powders and thin films), magnetic thin-film patterning via nanolithographic methods, and the synthesis of magnetic nanoparticles by chemical routes. Dr. Tiberto is the author of more than 300 peer-reviewed publications in international journals in the field of magnetism. She has served as an Editor of Materials Chemistry and Physics (Elsevier) and has participated in the technical program committees of leading international conferences in magnetism and spintronics. She was President of the Italian Association for Magnetism (AIMagn) until December 2024, promoting scientific initiatives, national research networking, and the involvement of young researchers. She has also coordinated several national and European research projects (H2020 and Horizon Europe) on advanced magnetic materials at the nanoscale.

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