

GIUSEPPE DELLA VALLE

SHORT CV

Giuseppe Della Valle (GDV) has been Full Professor with the Physics Department of the Politecnico di Milano since 2024, and since 2006 he has been Associate Researcher with the Institute of Photonics and Nanotechnologies of the CNR (Milano Unit).

Since 2005, he has been teaching *Physics* for the BSc program with the Industrial and Information Engineering School of the Politecnico di Milano, and since 2013 he has been teaching *Metaphotonics* (formerly *Nanooptics*) for the MSc program in Engineering Physics and *Plasmonics* for the PhD program in Physics, at the Politecnico di Milano.

His scientific activity is in the field of Photonics, and has involved both theoretical and experimental works, from the basic study of the interaction processes between electromagnetic radiation and matter, to the demonstration of new devices with advanced optical functionalities for the fourth industrial revolution (*Industry 4.0*).

In particular, the research of GDV has been focused on the following topics: (i) development of optical amplifiers and compact lasers for metropolitan and local optical networks (*smart factories*); (ii) study of periodic optical structures, complex and plasmonic media, for the development of chemical and biological nanosensors based on resonant effects (*lab-on-chip*); (iii) demonstration of waveguide integrated optical circuits for quantum simulations and *quantum computing*; (iv) study of quantum phenomena of interacting/correlated particles in mesoscopic systems; (v) study of nonlinear electromagnetic phenomena at the nanoscale for the spectroscopy of nanostructured materials; (vi) development of reconfigurable optical metasurfaces (*smart materials*).

These studies were conducted in the context of various scientific collaborations and national and international research contracts and projects, including the recent European project H2020-FET-Open METAFAST (<https://www.metafast-h2020.eu>), of which GDV is the scientific coordinator.

GDV has co-authored more than 250 publications in scientific journals, books, international and national conference proceedings (of which more than 200 are indexed in SCOPUS, and more than 150 are journal articles).

In 2018 he received the *MIT-Italy Seed Funds Award* from MIT in Boston (USA), and since 2021 he has been included in the "World's top 2% scientist" list drawn up by Stanford University (USA).

CONTACTS AND CAREER DEVELOPMENT

Name & Surname : Giuseppe Della Valle

Date of Birth : 1974, April 27

Address : Department of Physics, Politecnico di Milano, Piazza Leonardo da Vinci, 32, 20133 Milano, IT. Email: giuseppe.dellavalle@polimi.it; Phone: 02 2399 6021

Sep 2024 - today : *Full Professor* of Experimental Physics of Matter and Applications (PHYS-03/A) at the Politecnico di Milano

Aug 2014 - Aug 2024: *Associate Professor* of Experimental Physics of Matter (FIS/01) at the Politecnico di Milano

Aug 2008 - Jul 2014 : *Assistant Professor* of Experimental Physics of Matter (FIS/01) at the Politecnico di Milano

Oct 2007 - Jul 2008 : *Visiting Scientist* with the Department of Physics and Nanotechnology of the Aalborg University (Denmark), within the *Plasmonics* group of Prof. S. I. Bozhevolnyi

2006 - Ott 2007 : *Researcher* of Experimental Physics of Matter (FIS/01) at the Politecnico di Milano

2003 – 2006 : *PhD in Physics* at Politecnico di Milano.

PhD Thesis title: “*Photonic devices at 1.5 micron manufactured by ion exchange and femtosecond laser writing*”, PhD Advisor: Prof. Paolo Laporta

RESEARCH ACTIVITY

The research activity of G. Della Valle (GDV) has been devoted to both experimental and theoretical research in Photonics and Quantum Physics, with particular interest to the generation and coherent control of light waves or matter waves in micro- and nano-structures.

Since 2001 he has contributed to the development of microfabrication technologies based on femtosecond laser pulses and to the proposal and experimental demonstration of photonic chips for quantum simulations. More recently, his research has focused on Nanoscale Electromagnetism, with particular interest to the study of carrier photogeneration processes in nanostructured metals and semiconductors and related nonlinear optical phenomena in nanoantennas and optical metasurfaces.

More precisely, the research activity of GDV has been focused on the following topics:

- 1) Development of active photonic devices and innovative laser cavities (in continuous wave and mode-locking regimes) based on waveguide structures, operating in the near infrared. Thanks to their compactness, these devices are of interest for optical telecommunications networks at metropolitan or local (building) level and for the development of the *smart factories*.
- 2) Study of innovative photonic materials, including fiber Bragg gratings, waveguide gratings, photonic lattices, gradient index media, complexified optical media (with parity time symmetry, gain/loss), nanoguides and plasmonic nanoresonators. Such configurations are currently of great interest for the development of chemical and biological *nanosensors* based on nanoscale resonant effects.
- 3) Design and experimental demonstration of classical simulators of coherent quantum phenomena in integrated optical circuits, including analogs of single-particle driven quantum tunneling (Bloch oscillations, CDT, CTAP), of interacting-particles phenomena (Fermi-Hubbard and Holstein-Hubbard models), and non-Hermitian quantum mechanics. Such studies are of general interest for the development of new protocols for *quantum computing* using photonic chips.
- 4) Study of quantum phenomena in mesoscopic systems, including the proposal of novel effects of transport and localization within single-particle quantum physics, dynamical effects of few interacting particles, and correlation effects induced by particle statistics.
- 5) Study of photogenerated hot carriers in metallic (gold, copper) and semiconductor (silicon, gallium arsenide, copper selenide, titanium nitride) nanostructures and of the related optical nonlinearities, for the spectroscopy of nanomaterials.
- 6) Development of intelligent optical metasurfaces based on plasmonic or all-dielectric materials, with advanced and/or reconfigurable functionalities, such as color routing, all-optical amplitude modulation, ultrafast control of polarization and orbital angular modulation of light.

SELECTED FUNDED RESEARCH PROJECTS

- October 2020 – present: *Principal Investigator* of the European Project H2020-FET-Open titled “METAFAST” (METasurfaces for ultraFAast light Structuring), contract no. 899673-FETOPEN-H2020. Total Budget: 2.5 M€.
- September 2023 – present: *Principal Investigator* of the Italian Project PRIN 2022 titled “HOTMETA” (HOT-carrier METasurfaces for Advanced photonics), contract no. 2022LENW33. Total Budget: 280 k€.
- January 2012 – July 2015: *Principal Investigator* of the Regional Research Project RST-Materiali Avanzati-Fondazione Cariplo titled "New Frontiers in Plasmonic Nanosensing", contract no. 2011-0338. Total Budget: 420 k€.
- Febbraio 2017 – Gennaio 2020: *Co-investigator* of the Italian Project PRIN 2015 titled “HotPlasMOS2” (Hot-electrons in self-organised plasmonic metasurfaces coupled to semiconducting MoS₂ nanosheets: Photon harvesting in 2D materials), contract no. 2015WTW7J3. Total Budget: 395 k€.
- 2009 – 2012: *Co-investigator* of the Italian Project MIUR PRIN 2008 titled “Quantum-Optical Analogies in Photonic Waveguide Structures”, contract no. PRIN-2008-YCAAK. Total Budget: 67 k€
- 2006 – 2009: *Team member* of the European Project FP7 titled “HYBISCUS” (Hybrid integrated biophotonic sensors created by ultrafast laser systems), contract no. IST-2005-034562. Total Budget: 3.2 M€.
- 2006 – 2008: *Team member* of the European Project Network titled “e-Photon/ONE+ - Optical Networks: Towards Bandwidth Manageability and Cost Efficiency”, contract no. FP6-027497. Total Budget: 3.75 M€.

AWARDS AND OTHER QUALIFICATIONS

- 2007: Recipient of the “QEOD Thesis Prize” of the European Physical Society. Motivations: *"for his photonic devices at 1.5 μm manufactured by ion exchange and femtosecond laser writing"*
- 2017: Habilitation (Abilitazione Scientifica Nazionale) as Full Professor (Professore di I Fascia) in Experimental Physics of Matter (Fisica Sperimentale della Materia - 02/B1) with unanimous positive evaluation from all the five Referees.
- 2018: “MIT-Italy Seed Funds Award” of the Massachusetts Institute of Technology (MIT) in Boston (USA).
- 2018: “FFABR - Finanziamento delle Attività Base di Ricerca” of the Italian MIUR (Score: 100/100).
- 2020: Habilitation (Abilitazione Scientifica Nazionale) as Full Professor (Professore di I Fascia) in Electromagnetics (Campi Elettromagnetici - 09/F1) with unanimous positive evaluation from all the five Referees.
- 2021: “Among World's top 2% scientists” according to Stanford's University 2021 survey. <https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3>

TEACHING EXPERIENCE

- Lecturer teaching *General Physics* (“Experimental Physics A+B”, “Experimental Physics A+C”, “Physics”) at the Politecnico di Milano (semi-annual course in the 1st year of the BSc degree in Electronic Engineering, Computer Science, Automation Engineering): from the academic year 2005-2006 on.
- Lecturer teaching *Metaphotonics* (formerly *Micro- and Nano-Optics*) at the Politecnico di Milano (semi-annual course in the 1st year of the MSc degree in Engineering Physics): from the academic year 2013-2014 on.
- Lecturer teaching *Plasmonics* at the Politecnico di Milano (course in the 1st year of the PhD in Physics at the Department of Physics of the Politecnico di Milano): academic years 2012-2013, 2016-2017, 2020-2021, 2024-25.

- Since 2003 GDV has held numerous seminars, classroom exercises and educational workshops for the following courses at the Polytechnic of Milan: Experimental Physics I, Experimental Physics II, Principles and applications of Lasers, Complements of Optics and Lasers, Optical Technologies.
- Since 2005, GDV has been Supervisor ("Relatore"), Co-supervisor ("Correlatore") or Tutor of 7 PhD Theses in Physics at Politecnico di Milano, 13 MSc Theses in Engineering at Politecnico di Milano, 11 BSc Theses in Engineering at Politecnico di Milano.

REVIEWING AND ORGANIZATION ACTIVITIES

- 2006 - present: *Referee* for several international peer-referred journals including Nature Photonics, Nature Communications, Optica, Laser & Photonics Reviews, Nano Letter, Advanced Optical Materials, Optics Letters, Photonics Technology Letters.
- 2011 - present: Member of the MIUR Scientific Review Board ("Albo dei revisori") of the Italian Ministry for Education, University and Research (MIUR) for the evaluation of national research projects (including FIRB grants and SIR grants).
- 2013: Member of the Organization Committee of "PLASMONICA2013", the first national workshop on Plasmonics, Milano (IT), July 1-3, 2013.
- 2014 - present: Member of the Teaching Commission ("Commissione Didattica") of the Dipartimento di Fisica of the Politecnico di Milano (Italy).
- 2015: Member of the Scientific Advisory Committee of "E-MRS 2015 Spring Meeting" for the symposium entitled *Nanoparticles in dielectric matrix for electronics and optics: from the fabrication to the devices*, Lille (FRANCE), May 11-15, 2015.
- 2015 - present: Member of the Advisory Board for the PhD School in Physics ("Collegio di Dottorato di Ricerca in Fisica") of the Politecnico di Milano (Italy).
- 2018 - present: Member of the ERC Scientific Review Board ("Albo dei revisori") of the European Commission, for the evaluation of ERC grants (starting grants and advanced grants).
- 2019 - present: Secretary of the Advisory Board for the Degree ("Consiglio di Corso di Studi") in Engineering Physics ("Ingegneria Fisica") of the Politecnico di Milano (Italy).
- 2023: Special session organizer (SP23 - *Metasurfaces for Nonlinear and Ultrafast Nanophotonics*) at the "META2023" International Conference, Paris (FR), July 18-21, 2023.

METRICS AND HIGHLIGHTS

154 articles published in international peer-referred (ISI-WOS and/or SCOPUS) journals (among which *1 Nature Photonics*, *1 Advanced Photonics*, *3 ACS Nano*, *2 Nature Communications*, *1 Applied Physics Reviews*, *1 Small*, *1 Small Science*, *1 PNAS*, *3 original research papers in Laser & Photonics Reviews*, *5 Nano Letters*, *6 Advanced Optical Materials*, *4 Physical Review Letters*, *2 Nanophotonics*, *10 ACS Photonics*, *15 Physical Review B*, *11 Optics Letters*).

6 invited contributions in books with international editors, among which 2 contributions in Springer Book Editions and 3 in Elsevier Book Editions.

>40 invited communications in international conferences and workshops.

H-index: 44 (SCOPUS); 50 (Google Scholar).

Total number of citations: 5800 (SCOPUS); 8800 (Google Scholar).

Milano, November 20th, 2024