# Giovanni **Pellegrini**

*Dipartimento di Fisica, Università degli Studi di Pavia, Via Bassi 6, 27100, Pavia, Italy*

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## Previous positions

**Associate Professor** — *Pavia, Italy*

Physics Department - Università di Pavia — *Oct. 2023 - Present*

Electromagnetic modeling of photonic and plasmonic nanostructures. Neural networks for inverse problems and computational imaging.

**Assistant Professor** — *Pavia, Italy*

Physics Department - Università di Pavia — *Oct. 2020 - Oct. 2023*

Electromagnetic modeling of photonic and plasmonic nanostructures. Neural networks for inverse problems and computational imaging.

**Software Developer** — *Belluno, Italy*

Sinteco Robotics — *May. 2018 - Oct. 2020*

Development and deployment of custom automation solutions for automotive, healthcare, biomedical and aerospace industries, with particular focus on robotics and machine vision.

**PostDoctoral Fellow** — *Milano, Italy*

Physics Department - Politecnico di Milano — *Sep. 2015 - May. 2018*

Electrodynamics modeling of optical nanostructures, superchirality and mid-infrared plasmonics.

**PostDoctoral Fellow - Associate P.I.** — *Padova, Italy*

Physics Department - Università di Padova — *Sep. 2012 - Mar. 2015*

Associate P.I. for the FIRB NanoPlasMag Project: Functional NANOstructured MAGneto-PLASMonic Materials: From Nanoengineering to active Plasmonics. Modeling of magneto-plasmonic nanostructures.

**PostDoctoral Fellow** — *Padova, Italy*

Physics Department - Università di Padova — *Mar. 2008 - Sep. 2012*

Modeling of nanocluster based functional plasmonic materials.

## Teaching activities

**Materials and Platforms for AI** — *Milano, Italy*

Università di Pavia, Università di Milano Bicocca e Università Statale di Milano — *2023- Present*

In charge of the course *Materials and Platforms for AI* for the master degree in *Artificial Intelligence*.

**Physics** — *Pavia, Italy*

Università di Pavia — *2020 - Present*

In charge of the *Physics* course for the *Conservation and Restoration of Cultural Heritage* and *Geology* master degrees.

**Computational Nanophotonics** — *Pavia, Italy*

Università di Pavia — *2022-2023*

In charge of the *Computational Nanophotonics* lectures for the *Ph.D school of Physics*.

**Physics** — *Milano, Italy*

Politecnico di Milano — *2015-2018*

In charge of the teaching support activity for the *Physics* course for the *Engineering* master degrees.

**Laboratory of Experimental Physics** — *Padova, Italy*

Università di Padova — *2009-2015*

In charge of the teaching support activity for the *Laboratory of Experimental Physics* course for the *Engineering and Materials Science master degree* from 2009 to 2014, and in charge of course itself for the year 2015.

## Prizes & Awards

2007 — **Young Scientist Award**, EMRS 2007, for the presentation *Local-field enhancement and plasmon tuning in bimetallic nanoplanets.* — *Strasbourg, France*

2013 — **Best Poster Award**, Plasmonica 2013, for the poster *A global optimization approach for optical nanoantenna design.* — *Milano, Italy*

# Funding

**Spiral - Associate P.I.** *Pavia, Italy*

Università di Pavia *2023 - 2025*

Funding for ∼50k€ from the Italian MIUR through the PRIN 2022 project *Spiral* (2022WFM5MZ): Lossless surface waves for chiral spectroscopy.

**NanoPlasMag - Associate P.I.** *Padova, Italy*

Università di Padova *2012-2015*

Funding for ∼250k€ from the Italian MIUR through the FIRB project *NanoPlasMag* (RBFR10OAI0): Functional NANOstructured MAGneto-PLASMonic Materials: From Nanoengineering to active Plasmonics.

# Participation to national and international projects

**Spiral** *Pavia, Italy*

Università di Pavia *2022*

PRIN 2022 project *Spiral* (2022WFM5MZ): Lossless surface waves for chiral spectroscopy.

**Plasmon-enhanced vibrational circular dichroism** *Milano, Italy*

Politecnico di Milano *2015*

PRIN 2015 project (2015FSHNCB): Plasmon-enhanced vibrational circular dichroism.

**GEMINI** *Milano, Italy*

Politecnico di Milano *2013*

FP7 2013 project *GEMINI* (Id: 613055): GErmanium MId-infrared plasmoNIcs for sensing.

**NanoPlasMag** *Padova, Italy*

Università di Padova *2012*

FIRB 2012 project *NanoPlasMag* (RBFR10OAI0): Functional NANOstructured MAGneto-PLASMonic Materials: From Nanoengineering to active Plasmonics.

**BONSAI** *Padova, Italy*

Università di Padova *2006*

FP6 2006 project *BONSAI* (Id: 37639): Bio-imaging with smart functional nanoparticles.

# Education

**Università di Padova** *Padova, Italy*

Ph.D. in Materials Science and Engineering *29 March 2008*

Master's Degree in Physics (Condensed Matter, 110/110) *23 March 2004*

# Software portfolio (On GitHub)

### Photonics

- **1DPyHC:** A python code to calculate the optical properties of 1D Photonic Crystals.
- **py_matrix:** A python implementation of the transfer matrix method for multilayer structures with arbitrary dielectric tensors.
- **chipy:** A python transfer matrix code for chiral multilayers.

### Nano-optics

- **py_gmm:** A Generalized Multiparticle Mie code, especially suited for plasmonics.
- **EMUstack (contributor and maintainer):** an open source simulation package for calculating light propagation through multilayered stacks of dispersive, lossy, nanostructured, optical media.

### Deep Learning

- **enet_tensorflow:** a tensorflow 2.0 implementation of Enet for real time semantic segmentation.
- **transfer_net:** a lightweight PyTorch implementation of Gatys neural style transfer, capable of space resolved transfer of multiple styles.
- **partialAutoencoders:** deep convolutional autoencoders for image retrieval from partial autocorrelations.

# Publications

Maximum Chirality Empowered by a Bound State in a Continuum in a Plasmonic Metasurface

Hanan Ali, Simone Zanotti, Giovanni Pellegrini, Emilija Petronijevic, Lucio Claudio Andreani

*ACS Applied Optical Materials* (2024). American Chemical Society, 2024

Temporal and spectral signatures of the interaction between ultrashort laser pulses and Bloch surface waves

Isaac Doughan, Atsu L Asilevi, Atri Halder, Tian-Long Guo, Erika Mogni, Michele Celebrano, Marco Finazzi, Giovanni Pellegrini, Paolo Biagioni, Emiliano Descrovi

*APL Photonics* 9.4 (2024). AIP Publishing, 2024

Towards the epitaxial growth of Au thin films on MgO substrates for plasmonic applications

Marco Finazzi, Matteo Savoini, Paolo Biagioni, Giuseppe Della Valle, Giovanni Pellegrini, Matteo Cantoni, Christian Rinaldi, Daniela Petti, Riccardo Bertaco, Lamberto Duo

*Journal of the European Optical Society-Rapid Publications* (2024). 2024

Glass supported SERS chips for emerging pollutant analyses

B Albini, M Parmigiani, G Pellegrini, A Taglietti, P Galinetto

*Journal of Materials Science: Materials in Electronics* 34.22 (2023) p. 1619. Springer US New York, 2023

Circular dichroism in a plasmonic array of elliptical nanoholes with square lattice

H. Ali, E. Petronijevic, G. Pellegrini, C. Sibilia, L. C. Andreani

*Optics Express* 31.9 (2023) pp. 14196–14211. Optica Publishing Group, 2023

One-Dimensional Photonic Crystal for Surface Mode Polarization Control

E. Mogni, G. Pellegrini, J. Gil-Rostra, F. Yubero, G. Simone, S. Fossati, J. Dostálek, R. Martínez Vázquez, R. Osellame, M. Celebrano

*Advanced Optical Materials* 10.21 (2022) p. 2200759. 2022

Surface-Enhanced Raman Spectroscopy Chips Based on Silver Coated Gold Nanostars

M. Parmigiani, B. Albini, G. Pellegrini, M. Genovesi, L. De Vita, P. Pallavicini, G. Dacarro, P. Galinetto, A. Taglietti

*Nanomaterials* 12.20 (2022) p. 3609. MDPI, 2022

Field-resolved detection of the temporal response of a single plasmonic antenna in the mid-infrared

M. P. Fischer, N. Maccaferri, K. Gallacher, J. Frigerio, G. Pellegrini, D. J. Paul, G. Isella, A. Leitenstorfer, P. Biagioni, D. Brida

*Optica* 8.6 (2021) pp. 898–903. Optica Publishing Group, 2021

Stable and scalable SERS tags conjugated with neutravidin for the detection of fibroblast activation protein (FAP) in primary fibroblasts

F. Talamona, M. Truffi, A. A. Caldarone, A. Ricciardi, F. Corsi, G. Pellegrini, C. Morasso, A. Taglietti

*Nanotechnology* 32.29 (2021) p. 295703. IOP Publishing, 2021

Plasmonic superchiral lattice resonances in the mid-infrared

F. Mattioli, G. Mazzeo, G. Longhi, S. Abbate, G. Pellegrini, E. Mogni, M. Celebrano, M. Finazzi, L. Duò, C. G. Zanchi

*Acs Photonics* 7.10 (2020) pp. 2676–2681. American Chemical Society, 2020

Evidence of cascaded third-harmonic generation in noncentrosymmetric gold nanoantennas

M. Celebrano, A. Locatelli, L. Ghirardini, G. Pellegrini, P. Biagioni, A. Zilli, X. Wu, S. Grossmann, L. Carletti, C. De Angelis

*Nano letters* 19.10 (2019) pp. 7013–7020. American Chemical Society, 2019

Chiral optical tweezers for optically active particles in the T-matrix formalism

F. Patti, R. Saija, P. Denti, G. Pellegrini, P. Biagioni, M. A. Iatì, O. M. Maragò

*Scientific reports* 9.1 (2019) p. 29. Nature Publishing Group UK London, 2019

Superchiral surface waves for all-optical enantiomer separation

G. Pellegrini, M. Finazzi, M. Celebrano, L. Duò, M. A. Iatì, O. M. Maragò, P. Biagioni

*The Journal of Physical Chemistry C* 123.46 (2019) pp. 28336–28342. American Chemical Society, 2019

Evaluation of molecular polarizability and of intensity carrying modes contributions in circular dichroism spectroscopies

C. Zanchi, G. Longhi, S. Abbate, G. Pellegrini, P. Biagioni, M. Tommasini

*Applied Sciences* 9.21 (2019) p. 4691. MDPI, 2019

Rare-earth fluorescence thermometry of laser-induced plasmon heating in silver nanoparticles arrays

T. Cesca, G. Perotto, G. Pellegrini, N. Michieli, B. Kalinic, G. Mattei

*Scientific reports* 8.1 (2018) p. 13811. Nature Publishing Group UK London, 2018

Plasmonic mid-infrared third harmonic generation in germanium nanoantennas

M. P. Fischer, A. Riede, K. Gallacher, J. Frigerio, G. Pellegrini, M. Ortolani, D. J. Paul, G. Isella, A. Leitenstorfer, P. Biagioni

*Light: Science & Applications* 7.1 (2018) p. 106. Nature Publishing Group UK London, 2018

Plasmon-enhanced second harmonic sensing

L. Ghirardini, A. L. Baudrion, M. Monticelli, D. Petti, P. Biagioni, L. Duò, G. Pellegrini, P. M. Adam, M. Finazzi, M. Celebrano

*The Journal of Physical Chemistry C* 122.21 (2018) pp. 11475–11481. American Chemical Society, 2018

Metal–dielectric hybrid nanoantennas for efficient frequency conversion at the anapole mode

V. F. Gili, L. Ghirardini, D. Rocco, G. Marino, I. Favero, I. Roland, G. Pellegrini, L. Duò, M. Finazzi, L. Carletti

*Beilstein Journal of Nanotechnology* 9.1 (2018) pp. 2306–2314. Beilstein-Institut, 2018

Benchmarking the use of heavily doped Ge for plasmonics and sensing in the mid-infrared

G. Pellegrini, L. Baldassare, V. Giliberti, J. Frigerio, K. Gallacher, D. J. Paul, G. Isella, M. Ortolani, P. Biagioni

*Acs Photonics* 5.9 (2018) pp. 3601–3607. American Chemical Society, 2018

Surface-enhanced chiroptical spectroscopy with superchiral surface waves

G. Pellegrini, M. Finazzi, M. Celebrano, L. Duò, P. Biagioni

*Chirality* 30.7 (2018) pp. 883–889. 2018

Plasmon-enhanced second harmonic generation: from individual antennas to extended arrays

M. Baselli, A. L. Baudrion, L. Ghirardini, G. Pellegrini, E. Sakat, L. Carletti, A. Locatelli, C. De Angelis, P. Biagioni, L. Duò

*Plasmonics* 12 (2017) pp. 1595–1600. Springer US, 2017

Polarization properties of second-harmonic generation in AlGaAs optical nanoantennas

L. Ghirardini, L. Carletti, V. Gili, G. Pellegrini, L. Duò, M. Finazzi, D. Rocco, A. Locatelli, C. De Angelis, I. Favero

*Optics letters* 42.3 (2017) pp. 559–562. Optica Publishing Group, 2017

Functional magneto-plasmonic biosensors transducers: Modelling and nanoscale analysis

M. G. Manera, G. Pellegrini, P. Lupo, V. Bello, C. Julián Fernández, F. Casoli, S. Rella, C. Malitesta, F. Albertini, G. Mattei

*Sensors and Actuators B: Chemical* 239 (2017) pp. 100–112. Elsevier, 2017

Chiral surface waves for enhanced circular dichroism

G. Pellegrini, M. Finazzi, M. Celebrano, L. Duò, P. Biagioni

*Physical Review B* 95.24 (2017) p. 241402. American Physical Society, 2017

Near-field imaging of free carriers in ZnO nanowires with a scanning probe tip made of heavily doped germanium

E. Sakat, V. Giliberti, M. Bollani, A. Notargiacomo, M. Pea, M. Finazzi, G. Pellegrini, J. P. Hugonin, A. Weber-Bargioni, M. Melli

*Physical Review Applied* 8.5 (2017) p. 054042. American Physical Society, 2017

Tunability of the dielectric function of heavily doped germanium thin films for mid-infrared plasmonics

J. Frigerio, A. Ballabio, G. Isella, E. Sakat, G. Pellegrini, P. Biagioni, M. Bollani, E. Napolitani, C. Manganelli, M. Virgilio

*Physical Review B* 94.8 (2016) p. 085202. American Physical Society, 2016

Magnetoplasmonics

G. Pellegrini, V. Bonanni, G. Campo, F. Pineider, C. Sangregorio, C. Julián Fernández, F. Casoli, M. G. Manera, R. Rella, G. Mattei

*Encyclopedia of Nanotechnology*, 2016

Local field enhancement: comparing self-similar and dimer nanoantennas

G. Pellegrini, M. Celebrano, M. Finazzi, P. Biagioni

*The Journal of Physical Chemistry C* 120.45 (2016) pp. 26021–26024. American Chemical Society, 2016

High-performance magneto-optic surface plasmon resonance sensor design: an optimization approach

G. Pellegrini, G. Mattei

*Plasmonics* 9.6 (2014) pp. 1457–1462. Springer US, 2014

Asymmetric plasmonic nanoshells as subwavelength directional nanoantennas and color nanorouters: a multipole interference approach

G. Pellegrini, P. Mazzoldi, G. Mattei

*The Journal of Physical Chemistry C* 116.40 (2012) pp. 21536–21546. American Chemical Society, 2012

Nanoantenna arrays for large-area emission enhancement

G. Pellegrini, G. Mattei, P. Mazzoldi

*The Journal of Physical Chemistry C* 115.50 (2011) pp. 24662–24665. American Chemical Society, 2011

Hybrid organic–inorganic ZnS-loaded nanocomposite films for stable optical coatings

A. Antonello, G. Brusatin, M. Guglielmi, A. Martucci, V. Bello, G. Mattei, P. Mazzoldi, G. Pellegrini

*Thin Solid Films* 518.23 (2010) pp. 6781–6786. Elsevier, 2010

Nonlinear optical properties of Au–Ag nanoplanets made by ion beam processing of bimetallic nanoclusters in silica

T. Cesca, G. Pellegrini, V. Bello, C. Scian, P. Mazzoldi, P. Calvelli, G. Battaglin, G. Mattei

*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 268.19 (2010) pp. 3227–3230. Elsevier, 2010

Synthesis of ZnO nanostructures using different metal catalyst: morphology and photoluminescence characteristics

A. D. Chandra, K. Debdulal, S. Fouran, A. D. Kumar, G. Pellegrini, C. Ramesh, P. Mazzoldi

*Journal of Nanoscience and Nanotechnology* 10.4 (2010) pp. 2933–2937. American Scientific Publishers, 2010

Effect of the annealing atmosphere on the Au site in Er+ Au-implanted silica

C. Maurizio, G. Perotto, E. Trave, G. Pellegrini, G. Mattei, P. Mazzoldi

*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 268.19 (2010) pp. 3219–3222. Elsevier, 2010

Nanopatterning of silica with mask-assisted ion implantation

G. Perotto, V. Bello, T. Cesca, G. Mattei, P. Mazzoldi, G. Pellegrini, C. Scian

*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 268.19 (2010) pp. 3211–3214. Elsevier, 2010

Synthesis and characterization of $SnO_2$ nanoparticles embedded in silica by ion implantation

M. A. Tagliente, V. Bello, G. Pellegrini, G. Mattei, P. Mazzoldi, M. Massaro, D. Carbone

*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 268.19 (2010) pp. 3063–3065. North-Holland, 2010

Laser beam irradiation of silver doped silicate glasses

E. Trave, F. Gonella, P. Calvelli, E. Cattaruzza, P. Canton, D. Cristofori, A. Quaranta, G. Pellegrini

*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 268.19 (2010) pp. 3177–3182. Elsevier, 2010

VLS-like growth and characterizations of dense ZnO nanorods grown by e-beam process

D. C. Agarwal, R. S. Chauhan, D. K. Avasthi, I. Sulania, D. Kabiraj, P. Thakur, K. H. Chae, A. Chawla, R. Chandra, S. B. Ogale

*Journal of Physics D: Applied Physics* 42.3 (2009) p. 035310. IOP Publishing, 2009

Light Extraction with Dielectric Nanoantenna Arrays

G. Pellegrini, G. Mattei, P. Mazzoldi

*ACS nano* 3.9 (2009) pp. 2715–2721. ACS Publications, 2009

Tunable, directional and wavelength selective plasmonic nanoantenna arrays

G. Pellegrini, G. Mattei, P. Mazzoldi

*Nanotechnology* 20 (2009) p. 065201. IOP Publishing, 2009

$SnO_2$ nanoparticles embedded in silica by ion implantation followed by thermal oxidation

M. A. Tagliente, V. Bello, G. Pellegrini, G. Mattei, P. Mazzoldi, M. Massaro

*Journal of Applied Physics* 106.10 (2009) p. 104304. American Institute of Physics, 2009

Surface plasmon resonance optical gas sensing of nanostructured ZnO films

C. Julián Fernández, M. G. Manera, G. Pellegrini, M. Bersani, G. Mattei, R. Rella, L. Vasanelli, P. Mazzoldi

*Sensors and Actuators B: Chemical* 130.1 (2008) pp. 531–537. Elsevier, 2008

Local-field enhancement in metallic nanoplanets

G. Pellegrini, G. Mattei, V. Bello, P. Mazzoldi

*Materials Science and Engineering: B* 149.3 (2008) pp. 247–250. Elsevier, 2008

Size-dependent oxidation in ZnO nanoparticles embedded in ion-implanted silica

M. A. Tagliente, M. Massaro, G. Mattei, P. Mazzoldi, V. Bello, G. Pellegrini

*Journal of Applied Physics* 104.9 (2008) pp. 093505–093505. AIP, 2008

Local-field enhancement and plasmon tuning in bimetallic nanoplanets

G. Pellegrini, V. Bello, G. Mattei, P. Mazzoldi

*Optics Express* 15.16 (2007) pp. 10097–10102. Optical Society of America, 2007

Interacting metal nanoparticles: Optical properties from nanoparticle dimers to core-satellite systems

G. Pellegrini, G. Mattei, V. Bello, P. Mazzoldi

*Materials Science and Engineering: C* 27.5-8 (2007) pp. 1347–1350. Elsevier, 2007

Gold nanoclusters–organometallic polymer nanocomposites: synthesis and characterization

F. Vitale, L. Mirenghi, E. Piscopiello, G. Pellegrini, E. Trave, G. Mattei, I. Fratoddi, M. V. Russo, L. Tapfer, P. Mazzoldi

*Materials Science and Engineering: C* 27.5-8 (2007) pp. 1300–1304. Elsevier, 2007

Modification of composition and structure of bimetallic nanocluster in silica by ion beam irradiation

G. Mattei, V. Bello, P. Mazzoldi, G. Pellegrini, C. Sada, C. Maurizio, G. Battaglin

*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 240.1 (2005) pp. 128–132. Elsevier, 2005

Finite depth square well model: Applicability and limitations

G. Pellegrini, G. Mattei, P. Mazzoldi

*Journal of applied physics* 97.7 (2005) p. 073706. American Institute of Physics, 2005

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