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Supervisor Expression of Interest MSCA - Marie Skłodowska Curie Action - (PF) Postdoctoral Fellowship 2024

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Link “Pagina docente”: <https://www.fisi.polimi.it/en/staff/show/paolo-biagioni-17089>

Department Name: Department of Physics

Research topic: Nanophotonics and sensing

MSCA-PF Research Area Panels:

PHY_Physics

Brief description of the Department and Research Group (including URL if applicable):

The host research group at the Department of Physics is currently composed of one Full Professor, two Associate Professors, one Research Assistant, and four PhD students. The activity of the group is devoted to nanophotonics and plasmonics, both at the single antenna level and exploiting novel metasurface designs, with specific applications in the field of nonlinear optical conversion at the nanoscale and surface-enhanced sensing. We are equipped with two state-of-the-art laboratories featuring confocal microscopes, visible, near-infrared, and mid-infrared spectrometers, pulsed and CW laser sources with parametric amplifiers/oscillators, together with the dedicated instrumentation to perform polarization-modulation techniques both in the visible and in the mid infrared.



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TITLE of the project: Superchiral fields for surface-enhanced chiral sensing

Brief project description:

The goal of the project will be to leverage novel electromagnetic concepts for the optimization of the optical chirality, potentially exploiting the whole palette of available nanophotonic designs (plasmonic antennas and metasurfaces, dielectric antennas and metasurfaces, one-dimensional and two-dimensional photonic crystals). The activity will profit from previous research done in the host group regarding superchiral surface waves in photonic crystal multilayers for enhanced chiral spectroscopies at visible frequencies [1-4] and the design of metasurfaces for enhanced vibrational circular dichroism in the mid infrared [5,6]. We envisage a strong synergy between the design, simulation, and characterization activities, which will all be coordinated by the candidate, while we will resort to well-established collaborations for the growth and fabrication of the sensing platforms.

References:

- [1] G. Pellegrini, M. Finazzi, M. Celebrano, L. Duò, and P. Biagioni, “Chiral surface waves for enhanced circular dichroism”, *Phys. Rev. B* **95**, 241402(R) (2017).
- [2] G. Pellegrini, M. Finazzi, M. Celebrano, L. Duò, and P. Biagioni, “Surface-enhanced chiroptical spectroscopy with superchiral surface waves”, *Chirality* **30**, 883 (2018).
- [3] G. Pellegrini, M. Finazzi, M. Celebrano, L. Duò, M. A. Iati, O. M. Maragò, and P. Biagioni, “Superchiral surface waves for all-optical enantiomer separation”, *J. Phys. Chem. C* **123**, 28336 (2019).
- [4] E. Mogni, G. Pellegrini, J. Gil-Rostra, F. Yubero, G. Simone, S. Fossati, J. Dostálek, R. Martínez Vázquez, R. Osellame, M. Celebrano, M. Finazzi, P. Biagioni, “One-dimensional photonic crystal for surface mode polarization control”, *Adv. Opt. Mater.* **10**, 2200759 (2022).
- [5] F. Mattioli, G. Mazzeo, G. Longhi, S. Abbate, G. Pellegrini, M. Celebrano, M. Finazzi, L. Duò, C. Zanchi, M. Tommasini, M. Pea, S. Cibella, F. Sciortino, L. Baldassarre, A. Nucara, M. Ortolani, and P. Biagioni, “Plasmonic superchiral lattice resonances in the mid-infrared”, *ACS Photonics* **7**, 2676 (2020).
- [6] F. Rusconi, P. Felhen, F. Gonzalez-Posada, L. Cerutti, G. Pellegrini, M. Celebrano, M. Finazzi, P. Biagioni, T. Taliercio, “Mid-infrared dielectric antennas on epsilon-near-zero substrates” (manuscript in preparation)