Post-doc position

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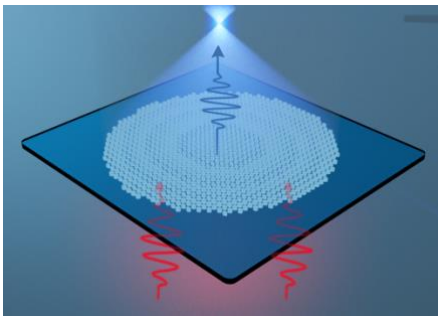
Nonlinear optical metasurfaces with real-time wavefront control

Metasurfaces are arrays of optical nanoantennas with sub-wavelength size. Before their appearance, the engineering of free-space propagation had always respected the paradigm of light being molded via phase accumulation over paths of several wavelengths. Recently, flat optics has revolutionized this framework, with the concrete perspective of replacing bulky and difficult-to-align assemblies of optical components with nanostructured thin films.

Metasurfaces also showed their potential in the nonlinear regime, mostly via the bulk nonlinearity of high-refractive-index semiconductors. In this context, we have achieved near-infrared second harmonic generation in both monolithic and hybrid AlGaAs-on-insulator platforms, with preliminary demonstrations of small nonlinear meta-gratings and meta-lenses for the second-harmonic field.

We currently aim at ultrafast dynamically controlled semiconductor-on-insulator ultrathin components for efficient nonlinear wavefront engineering, by exploiting metasurfaces that operate like phased-array antennas rather than photonic crystals. Their key asset is their capability to implement time-controlled wavefront shaping at the harmonic frequency, based on a lookup-table approach, with the approximate yet reasonable assumption of locality.



Meta-lens recently demonstrated by our group, where pairs of "red" pump photons at 1.55 µm generate and focus "blue" photons at 775 nm.
[Gigli et al., Optica 8, 269 (2021)]

Within this framework, we search for a skilled and motivated post-doctoral fellow to explore new horizons of this forefront research domain. He/She will design, fabricate and optically characterize new nonlinear metasurfaces operating from the visible to the mid-infrared range. His/Her activity will mainly take place in Paris in the framework of the METAFAST EU Project, in close collaboration with CEA-Grenoble, Politecnico di Milano, and University of Brescia.

The combination of advanced design, fabrication and nanophotonic measurements will soon spur the transition of the young field of nonlinear meta-optics from fundamental research into a whole set of applied technologies. The natural positioning of this project, on both the production of fundamental knowledge and nanophotonic engineering, perfectly illustrates the fertility of this research domain, which is about to lead to a true paradigm shift in modern optics.

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Skills: Experimental nanophotonics
Duration: 18 months (renewable), funded by METAFAST EU Project (H2020 #899673)
Start: Fall 2023
Net salary: 2250 € per month