

International Doctoral Program in Science Position

Phase-change materials-based nano-antennas and meta-surfaces

Background and motivation

Recent advances of optoelectronic materials and devices expanded the frequency range of light sources and sensitivity of detectors enabling a variety of innovations that have helped to transform our lives and society. The quest to improve the device performances encouraged the miniaturization of traditional optical components. However, the hardcore underlying technology has not changed despite limitations in terms of integration and flexibility. On the material side, metals and, more recently, dielectric materials played the prominent role, despite the limited functionalities inherent to these materials. On the optical design side, most schemes rely on diffractive optical elements.

In order to expand the field beyond current technology the project will explore the route of phase-change materials as potential candidates to augment devices functionalities. The strategy relies on synthesizing phase-change materials, for instance V2O3 thin films, and exploring their structural and optical properties upon tunability of external parameters. Understanding of the underlying physics will then be exploited to investigate, first, single nano-resonators, and then expanding to metasurfaces – i.e. planar arrays of nanoscale (sub-wavelength) optical resonators. Different control protocols, based on the combination of electric fields, optical pulses and applied pressure, will be developed to engineer metamaterials whose properties can be switched on demand on ultrafast timescales. The project will involve both experimental and theoretical aspects spanning from ultrafast optics to structural characterization and Finite Element simulations.

Profile

- Master's degree or similar qualification in Physics, Materials Science, Engineering or adjacent fields.
- A solid background in physics, optics or materials science is required.
- Experience in optics, FEM simulations or thin films/nanodevice characterization (electrical, structural) will be considered an advantage. Programming skills, for example in MATLAB and/or COMSOL, are also welcome.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, ability to work in a team, and eagerness for international mobility is required.

Opportunities

- Participating to an international collaboration between Università Cattolica and Università degli Studi di Brescia (Italy), KU Leuven (Belgium) and Université Lyon 1 (France).
- Double degree opportunity.
- This position is supported by a fellowship of 15.343 (gross income) per year. The monthly allowance is increased by 50% when students are abroad.

Supervisors

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