Université Côte d'Azur (Nice)
Master 2 internship offer
Duration: 5/6 months
Starting date: February/March 2026
Location: CRHEA

Title: Experimental Characterization of Coupling Effects and Fabrication Errors in Metasurfaces

Metasurfaces are an emerging class of optical devices that enable the realization of ultra-thin, flat, and functional optical surfaces. By controlling the scattering properties of arrays of subwavelength structures [1], they can shape light in precise and complex ways. Various metallic and/or dielectric metasurfaces have been demonstrated, including flat lenses (metalenses), beam deflectors, holograms, and polarization control elements.

In most cases, metasurface designs rely solely on numerical simulations, which often assume idealized periodic structures. However, full-wave simulations of large-area metasurfaces are computationally expensive and typically limited to a single unit cell with periodic boundary conditions. This approach does not capture the coupling effectsbetween neighboring nanostructures of different shapes and sizes, which can significantly influence device performance. Additionally, fabrication imperfections introduced during nanofabrication may further degrade the optical response.

This internship aims to experimentally study both the inter-element coupling effects and nanofabrication-induced errors using a phase measurement technique called Quadriwave Lateral Shearing Interferometry (QLSI) [2]. The student will characterize different metasurface samples to evaluate how these factors affect their actual optical behavior. The work will be carried out primarily in the optical characterization lab of the Metasurface team at CRHEA (CNRS). The student will also be trained in nanofabrication techniques within the cleanroom facilities.

A CIFRE PhD opportunity in collaboration with Phasics (a company specializing in wavefront sensing and optical metrology) may follow this internship.

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References:

1. P. Genevet, F. Capasso, F. Aieta, M. Khorasaninejad, and R. Devlin, "Recent advances in planar optics: from plasmonic to dielectric metasurfaces," Optica 4, 139-152 (2017).
2. S. Khadir, D. Andrén, R. Verre, Q. Song, S. Monneret, P. Genevet, M. Käll, G. Baffou "Metasurface Optical Characterization Using Quadriwave Lateral Shearing Interferometry" ACS Photonics, 8, 603 (2020)