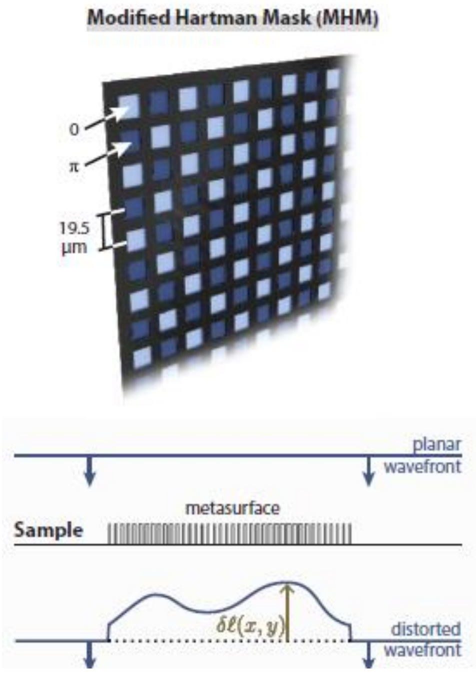
Master internship position

Title: Characterization of optical properties of metasurfaces using interferometry-based method

Metasurface is an emerging optical technology which enables ultrathin and flat functional optical surfaces. These devices address the characteristics of a light beam by relying on the scattering properties of subwavelength arrangement of nanoscale building blocks.[1] To date, various sort of metallic and/or dielectric metasurfaces have been realized to behave as flat metalenses, beam deflectors, holograms or polarizing interfaces. Usually, the design of a metasurface with a specific functionality is only based on predictions obtained from numerical simulations. If several approaches have been introduced to realize the metasurface designs, only limited experimental systems have been proposed to validate the functionalities of fabricated devices. Most of them rely on indirect characterization such as the measurement of focal distance and point spread function of metalenses. To further improving the device performances, new and dedicated experimental solutions are required to assess the quality of fabricated devices and eventually enable parallel wafer-level testing for device reliability.



In this context, the objective of this master internship is to exploit a yet less-known but very powerful quantitative phase microscopy technique to fully characterize any type of metasurafces. This technique based on quadriwave lateral shearing interferometry (QLSI) was initially dedicated for biological application,[2] more recently we extended its use for nanophotonic applications.[3,4] The candidate, in collaboration with PhD students and postdocs of the group will manage different tasks including i) modellisation and design of metasurfaces based on numerical tools, ii) fabrication of the metasurfaces using the different facilities available at CRHEA and iii) characterization of the fabricated devices using QLSI technique.

This internship can potentially be followed by a PhD position in collaboration with Phasics company which is at the origin of the development of QLSI technique (Thèse Cifre).

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References:

[1] Genevet, P.; Capasso, F.; Aieta, F.; Khorasaninejad, M.; Devlin, R. Recent advances in planar optics: from plasmonic to dielectric metasurfaces. Optica 2017, 4, 139–152.

[2] Bon, P.; Maucort, G.; Wattellier, B.; Monneret, S. Quadriwave lateral shearing interferometry for quantitative phase microscopy of living cells. Opt. Express 2009, 17, 13080−94.

[3] Khadir, S.; Bon, P.; Vignaud, D.; Galopin, E.; McEvoy, N.; McCloskey, D.; Monneret, S.; Baffou, G. Optical Imaging and Characterization of Graphene and Other 2D Materials Using Quantitative Phase Microscopy. ACS Photonics 2017, 4, 31303139.

[4] S. Khadir, D. Adrén, P. Chaumet, S. Monneret, N. Bonod, M. Käll, A. Sentenac, and G. Baffou, "Full optical characterization of single nanoparticles using quantitative phase imaging," Optica 2020, 3, 7.