

Title: Optical Metasurfaces: From Fundamental Principles to Practical Applications

Optical metasurfaces are planar optical devices composed of subwavelength meta-atoms arranged to precisely control the amplitude, phase, polarization, and propagation of light. This lecture will provide an overview of the fundamental principles governing MS operation and their ability to engineer optical wavefronts with exceptional flexibility. The main design approaches, including resonant, geometric-phase (Pancharatnam–Berry phase), and effective-index metasurfaces, will be presented alongside practical examples based on numerical electromagnetic simulations. The lecture will also cover key fabrication methods and optical characterization techniques used to evaluate device performance and fabrication fidelity. Finally, representative applications of passive and active metasurfaces will be discussed, highlighting the strong potential of metasurfaces for future integrated photonic technologies.



Samira Khadir is an Associate Professor at Université Côte d'Azur and a researcher at the Centre de Recherche sur l'Hétéro-Épitaxie et ses Applications (CRHEA) since 2019 where she is leading the Metasurface team since 2023. She obtained her PhD in Physics in 2016, working on plasmonic effects in organic light-emitting diodes, before joining Institut Fresnel as a postdoctoral researcher, where she developed advanced approaches for the optical characterization of nanomaterials using quantitative phase microscopy. Her recent research work focuses on the design, optimization, fabrication, and experimental characterization of optical metasurfaces for different applications. She has authored more than 25 peer-reviewed publications.