



Congratulations to New ICFO PhD Graduate

Dr Adeel Afridi graduated with a thesis entitled 'Reconfigurable metasurfaces based on thermos-optical and optomechanical controls'

April 28, 2023

We congratulate Dr Adeel Afridi who defended his thesis today online.

Dr Afridi obtained his MSc in Electrical and Electronics Engineering from the Koc University of Istanbul. He joined the Plasmon Nano-Optics research group at ICFO led by Prof Dr Romain Quidant as a PhD student. Dr Afridi's thesis 'Reconfigurable metasurfaces based on thermos-optical and optomechanical controls' was supervised by Prof Dr Romain Quidant.

ABSTRACT:

Optical metasurfaces established themselves as potential platform for planar and integrated optics. Progress in the material sciences and fabrication process paves the way towards ultra-thin metasurface based devices, also known as meta-devices. Meta-devices include

holograms, flat lenses, wave-plates, polarizers and deflectors. Amongst these meta-devices, great effort focuses toward the development of high performance, aberrations-free, and multi-functional metalenses.

High refractive index and lossless dielectric materials have enabled metalenses with near-unity transmission and high numerical aperture. However, the static nature of metalenses limits their use for the applications where continuous and on demand tunability of lens operation is required such as imaging and adaptive vision.

In this thesis, I developed two different techniques to achieve reconfigurability in metasurfaces which I used to create reconfigurable metalens devices. devices based on two types of reconfigurability techniques. First technique achieves focal length tunability of a dielectric metalens by utilizing the electro-thermo-optical effect to change the refractive index of the surrounding media. The electro-thermo-optically controlled metalens exhibits linear and continuous focal length tunability, high efficiency and low power consumption with switching time of the order of 100 ms. The second varifocal metalens Device takes advantage of the optomechanical effect to introduce change in the geometry of the metalens itself. Carved onto a freestanding ultra-thin silicon membrane, the metalens exhibits continuous and linear focal length tunability with fast response time as short as a few μ s.

Thesis Committee:

Prof. Dr. Niek van Hulst, ICFO

Prof. Dr. Giulia Tagliabue, Ecole Polytechnique federale de Lausanne (EPFL)

Dr. Patrice Genevet, CRHEA -Centre de Recherche sur l'Hetero-Epitaxie et ses Applications



Thesis Committee



Dr. Adeel Afridi in online thesis defense