

Photonics Seminar



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Applied Physics and Electrical Engineering
California Institute of Technology

From Metasurfaces to Volumetric meta-optics for novel device functionalities

Tuesday, November 16, 2021

EEB 132

1:30 PM – 2:30 PM

Zoom Link:

<https://usc.zoom.us/j/91808071892?pwd=VUwyK3NSNW5rSzVLQzFKSGdPc05yUT09>

Abstract: Three-dimensional elements, with refractive index distribution structured at subwavelength scale, provide an expansive optical design space that can be harnessed for demonstrating multifunctional free-space optical devices. I discuss 3D dielectric elements, designed to be placed on top of the pixels of image sensors, that sort and focus light based on its color and polarization with efficiency significantly surpassing 2D absorptive and diffractive filters. The devices are designed via iterative gradient-based optimization to account for multiple target functions while ensuring compatibility with existing nanofabrication processes, and they are experimentally validated using a scaled device that operates at microwave frequencies. This approach combines arbitrary functions into a single compact element, even where there is no known equivalent in bulk optics, enabling novel integrated photonic applications. We further discuss capabilities enabled by volumetric meta-optical devices for compact on-chip polarimetry and discuss implementations using multi-layer nanofabrication.

Biography: Dr. Andrei Faraon is a Professor of Applied Physics and Electrical Engineering at California Institute of Technology. After earning a B.S. degree in physics with honors in 2004 at California Institute of Technology, he received his M.S. in Electrical Engineering and PhD in Applied Physics both from Stanford University in 2009. From 2009 to 2012 he was a postdoctoral fellow at Hewlett Packard Laboratories. During his PhD he was involved in seminal quantum optics experiments using single semiconductor quantum dots coupled to photonic crystal resonators. At HP, he pioneered quantum nano-photonic devices in single crystal diamond coupled to color centers. Dr. Faraon left HP in 2012 for a faculty position at Caltech where he works on nano-photonic technologies for both classical and quantum applications including: optically addressable quantum bits, optical quantum memories, microwave to optical quantum transduction, metasurfaces and metamaterials for multi-functional imaging applications. Dr. Faraon is the recipient of the 2018 Adolph Lomb Medal of the Optical Society of America (OSA) that recognizes a noteworthy contribution to optics made by a researcher who is still early in his or her career and was elected as OSA Fellow in 2020. He was also awarded the 2015 National Science Foundation CAREER award, the 2015 Air Force Office of Scientific Research young investigator award and the 2016 Office of Naval Research Young Investigator Award.

Hosts: Faculty-Wade Hsu, Mercedeh Khajavikhan, Michelle Povinelli, Constantine Sideris, and Wei Wu
Students-Max Lien and Raymond Yu
MHI: <http://mhi.usc.edu>