Integrated Optical Phased Arrays: LiDAR, Augmented Reality, and Beyond

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Abstract

Integrated optical phased arrays, fabricated in advanced silicon-photonics platforms, enable manipulation and dynamic control of free-space light in a compact-form-factor, low-cost, and non-mechanical way. As such, integrated optical phased arrays have emerged as a promising technology for many wide-reaching applications, including light detection and ranging (LiDAR) for autonomous vehicles, 3D holography for visible-light displays, free-space optical communications, and trapped-ion quantum computing.

This talk will present recent advances in integrated optical phased array architectures, results, and applications. First, beam-steering optical phased arrays monolithically integrated with on-chip rare-earth-doped lasers and heterogeneously integrated with CMOS drive electronics will be shown and single-chip coherent integrated LiDAR results will be presented; these demonstrations are important steps towards practical commercialization of low-cost and high-performance integrated LiDAR systems for autonomous vehicles. Next, passive integrated optical phased arrays that focus radiated light to tightly-confined spots in the near field and that generate quasi-Bessel beams will be discussed; these near-field modalities have the potential to advance a number of application areas, such as optical trapping for biological characterization, laser-based 3D printing, increased-depth-of-field microscopy, and adaptive free-space optical communications. Finally, integrated-phased-array-based visible-light holographic projectors will be proposed as a scalable solution towards the next generation of augmented-reality head-mounted displays; passive near-eye projectors that generate holographic images, integrated visible-light liquid-crystal-based modulators, and liquid-crystal-based visible-light integrated phased arrays will be presented.

Biography

Jelena Notaros is currently a Ph.D. student and researcher in the Photonic Microsystems Group at the Massachusetts Institute of Technology. She received her B.S. degree from the University of Colorado Boulder in 2015 and M.S. degree from the Massachusetts Institute of Technology in 2017. Her research interests are in integrated silicon photonics devices, systems, and applications.

Jelena's work has been published in top-tier Nature, OSA, and IEEE journals and conference proceedings. She is a Top-Three DARPA Riser, a DARPA D60 Plenary Speaker, an MIT Presidential Fellow, a National Science Foundation Graduate Research Fellow, and an EECS Rising Star. She was the recipient of the 2019 OSA CLEO Chair's Pick Award, 2014 IEEE Region 5 Student Paper Competition Award, 2019 MIT MARC Best Overall Paper Award, 2019 MIT MARC Best Pitch Award, 2018 and 2014 OSA Incubic Milton Chang Student Travel Grant, 2014 Sigma Xi Undergraduate Research Award, 2015 CU Boulder Chancellor’s Recognition Award, 2015 CU Boulder College of Engineering Outstanding Graduate for Academic Achievement Award, and 2015 CU Boulder Electrical Engineering Distinguished Senior Award.