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Ming Hsieh Institute Seminar Series
Ming Hsieh Department of Electrical Engineering

Semiconductors & Microelectronics Technology

On-chip wavefront shaping and image classification on silicon photonics

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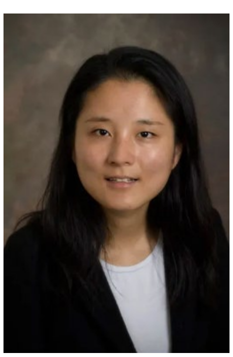
Date: Friday, Feb. 9th, 2024
Time: 2:00 – 3:30pm PT
Location: EEB 248

Abstract: The advancement of nanotechnologies enables powerful control of photons by subwavelength structures. In recent years, rapid advancement of metasurface and metamaterials reveal the potential of nanophotonics in the applications across disciplines, from image processing/conversion to controlled light-matter interactions. In this talk, I will progressively illustrate the powerful role of the meta-atoms, meta-surface, and meta-system in integrated photonic platform, which enabled the control of nonHermicity, perform mathematical conversion to machine learning, respectively. 0D: Embedding individual symmetric or asymmetric meta-atoms in silicon micro-resonators provide the full control of non-Hermicity, which has been proved to coherently suppress the nanofabrication resulted backscattering [1]. 1D: The integrated metasystem performs analogue optical computing tasks, from simple Fourier transformation to spatial differentiations (1D+) [2]. Also, we have shown that asymmetric subwavelength design engineers the wave momentum space for broadband and power independent back reflection suppression. 2D: With lithographically defined inter-layer alignment, we demonstrate diffractive deep optical network on silicon photonic platform, towards broadband spatial pattern classification and hyperspectral imaging [3]. In addition to materials offered by the foundry, I will try to extend the scope of 'heterogeneous integration' for layered phase change materials for integrated photonic memory devices [4], and potential integration scheme with silicon photonics.

References: [1] Chiral exceptional point and coherent suppression of backscattering in silicon microring with low loss Mie scatterer, eLight 3, 20 (2023); [2] On-chip wavefront shaping with dielectric metasurface, Nature Communications 10, 3547 (2019); [3] Integrated photonic metasystem for image classifications at telecommunication wavelength, Nature Communications 13, 2131 (2022); [4] Structural phase transitions in layered Indium Selenide for integrated photonic memory, Advanced Materials 2022, 2108261.



Biography: Tingyi Gu is an associate professor in the electrical engineering of University of Delaware. Her group works on foundry compatible silicon photonic meta-components for optical communication and sensing, with the focus on optoelectronic reconfigurability and high-speed operation. She served on 19 committees for optics and optoelectronics societies, including SPIE, CLEO, FiO and IPC. She received a B.S. from Shanghai Jiao Tong University, and M.S. and Ph.D. degrees from Columbia University, all in EE. She has held positions at Bell Labs, Princeton University and Hewlett Packard Labs.

Hosted by Prof. J. Joshua Yang, Prof. Han Wang, Prof. Chongwu Zhou, Prof. Stephen Cronin, and Prof. Wei Wu.
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