

Colloquium Notice

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Nanophotonic Engineering: Extreme Control of Light using Nonlinearities and Metamaterials

Nanophotonic devices can enable unprecedented control over the flow of light, and they hold a great potential for both fundamental studies and next-generation quantum and classical computers, low-power optoelectronics, and free-space applications. In this talk, I will provide an overview of our recent efforts to engineer free-space and integrated photonic systems to enable advanced manipulation of classical and quantum light. In particular, I will describe several approaches to achieve functionalities such as light isolation and trapping, highly dispersive reflectors for augmented reality displays, and analog computation.

I will first focus on our recent works on **nonlinearity-based nonreciprocity**, a route for magnet-free nonreciprocity that is particularly appealing due to its bias-free operation and ease of fabrication. I will describe the fundamental physics underlying these phenomena, its drawbacks and opportunities for wave engineering, and then discuss our experimental results in silicon photonics and radiofrequency circuits. I will further discuss how these remarkably simple devices can be used for functionalities which go beyond isolations, such as **optically-controlled transmission switches** and homodyne detectors with **strongly enhanced phase sensitivity**.

In the second part of my talk, the focus will shift from integrated systems to **free-space metasurfaces** - planarized, patterned devices with thickness smaller than or comparable to the operational wavelength. I will discuss how local and nonlocal all-dielectric metasurfaces can be used to achieve different functionalities in the visible and near-infrared, such as focusing, tailored angle- and frequency-dependent **mirrors for AR/VR applications**, and **analog computation**.

Monday

May 9, 2022

Starts at **12:15 pm**

If not mentioned otherwise, all [online Zoom.us events are accessible via this link](#)
or use **meeting ID 829 2687 2594** and **passcode 866995**.