

Colloquium Notice

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Towards Metaphotonic Devices: Near-Field Nanoscopy and Novel Material Platforms for Metasurfaces

Optical metamaterials are three-dimensional structures with rationally designed building blocks that enable devices with distinct optical responses not attainable with naturally available materials. Comprising a class of metamaterials with a reduced dimensionality, optical metasurfaces allow the miniaturization of conventional refractive optics into planar structures, and a novel planar technology is expected to provide enhanced functionality for photonic devices being distinctly different from those observed in the three-dimensional case. In this talk, I will show that nanostructures made of high-index materials, such as silicon, transition metal dichalcogenides, or hexagonal boron nitride, support optically induced both electric and magnetic resonances in the visible and infrared spectral ranges. I will present the results on antireflective properties of metasurfaces based on high-index nanoparticle arrays and explain how zero backward scattering from the highly reflective substrate can be achieved [1]. Scattering-type scanning near-field optical microscope (s-SNOM) provides optical, chemical, and structural information of metasurfaces and enables their imaging with nanoscale resolution. I will show an approach to analyze layered of materials with different permittivities and demonstrate a technique to identify material type based on near fields at sample edges [2]. The recent discovery of high-index materials that offer low loss and tunability in their optical properties as well as complementary metal-oxide-semiconductor (CMOS) compatibility can enable a breakthrough in the field of nanophotonics, optical metamaterials, and their applications.

[1] V.E. Babicheva and A.B. Evlyukhin, "Resonant Lattice Kerker Effect in Metasurfaces with Electric and Magnetic Optical Responses," *Laser & Photonics Reviews* **11**, 1700132 (2017).

[2] Y. Abate, S. Gamage, L. Zhen, S.B. Cronin, H. Wang, V. Babicheva, M.H. Javani, M.I. Stockman, "Nanoscopy reveals surface-metallic black phosphorus," *Light: Science & Applications* **5**, e16162 (2016).

Monday

April 16, 2018

Starts at 12:15 PM

Coffee at 12:00 PM

Physics Conference Room, SB B326