University of Texas at San Antonio

Department of Physics & Astronomy

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Time: 3:00 p.m.-4:00 p.m.

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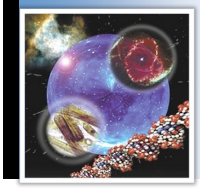
Broadband and 3D Plasmonics: Holes Redux

The interaction of light with surface plasmons—collective oscillations of free electrons—in noble metal nanostructures has resulted in exceptional displays of enhanced optical transmission, collimation of light through subwavelength apertures, and negative refraction at visible wavelengths. The structures that display these phenomena typically consist of ordered arrays of holes with sizes of the order 100 nm. Surface plasmon interactions extend over much longer distances, however, and hence the organization of plasmonic materials over multiple length scales could lead to new optical metamaterials with novel and unexpected properties.

This talk will discuss two plasmonic structures that take advantage of two or more length scales: (1) 3D nanohole arrays and (2) finite-areas of nanoholes (patches). First, we will describe how 3D nanoholes support localized surface plasmons (LSPs) that enhance the optical transmission more than an order of magnitude compared to surface plasmon polaritons (SPPs) on the same nanohole array. Different from SPP-enhanced transmission, LSP-enhanced optical transmission can occur at different wavelengths and with different dispersion properties depending on the shape of the 3D hole. Second, we will describe a new type of diffractive microlens based on finite-areas of 2D arrays of circular nanoholes. The plasmonic microlenses can focus single wavelengths of light across the entire visible spectrum and broadband white light with only minimal divergence. The focal length is determined primarily by the overall size of the patch and is tolerant to significant changes in patch substructure, including lattice geometry as well as local order of the circular nanoholes. The optical throughput, however, depends critically on patch substructure and is determined by the SPP wavelengths. Prospects for these new structures will be given.



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