Notre Dame Science
Department of Physics

EXTREME MANIPULATION OF LIGHT WITH PLASMONICS AND METAMATERIALS

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Thursday, February 3, 2011
4:00 p.m. NSH 184

Metallic nanostructures have provided us with a unique opportunity to manipulate light in an unconventional manner. They have enabled both new fundamental physics and fascinating practical applications. Collectively, subwavelength metallic structures serve as building blocks for optical metamaterials with properties that were not observed or even speculated about in the past. Individually, metallic structures can be crafted into plasmonic nanodevices that enable routing, concentration, and active control of light beyond the conventional diffraction limit. This is a very exciting frontier in optics and materials science, with the promising goal of yielding better solar cells, faster computer chips, ultrasensitive biochemical detectors, and even invisible devices. In this talk I will present my recent work on both plasmonics and metamaterials. Topics to be discussed on metamaterials include experimental demonstrations of the first magnetic metamaterial across the entire visible spectrum, and the world's first negative-index material at optical frequencies. The unique flexibility in tailoring material prosperities rendered by metamaterial research allows us to control electromagnetic waves using a tool called transformation optics, with optical cloaking being a prominent example. As for individual plasmonic devices, I will discuss passive routing elements using three-dimensional metallic slot waveguides as well as active plasmonic electrooptic modulators. Finally I will show an extreme case of light creation and manipulation in plasmonics: electrically controlled nonlinear harmonic generation of light in a metallic nanocavity.

Condensed Matter Seminar

All interested persons are cordially invited to attend.