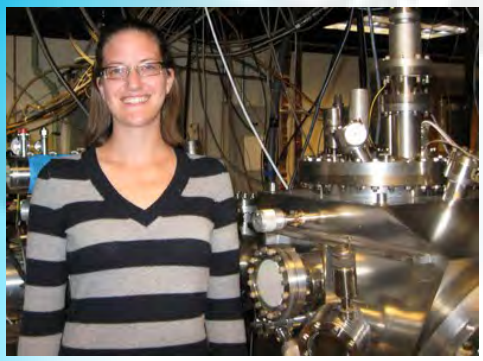
Physics Colloquium

Michigan Technological University

Tuesday, February 4, 2014
at 11:00 am
Room 139 Fisher Hall



Designer Plasmonic Materials for the Mid-infrared

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Abstract: The fields of plasmonics and metamaterials have seen significant growth in recent years, due to the interest in controlling light-matter interaction at the nanoscale as well as creating material systems with designer optical properties. Much of this work has been done in the visible spectral range with traditional metals such as gold and silver. However, the optical properties of these metals are difficult, if not impossible to control, and they suffer from significant interband absorption losses, especially near the material plasma frequency. When working in the infrared, these materials act as perfect electrical conductors, precluding their inclusion into many interesting plasmonic and metamaterial structures in this technologically-important wavelength range. In this talk, I will discuss my recent work using new materials, specifically heavily-doped InAs, for infrared plasmonic devices. I will explain the advantages of these new materials over traditional plasmonic materials in the infrared and demonstrate that they act as near-perfect Drude metals with tunable optical properties, allowing for investigation into fundamental aspects of light-matter interaction in subwavelength structures. I will then exhibit the utility of such materials in the fabrication of nanoantennas, which allow for confinement of the electric field in nano-scale volumes and thus enhanced interaction of long-wavelength infrared light with nano scale particles. These structures have been demonstrated to give improved sensing of analytes on the surface. Layered semiconductor samples show wavelength-specific near-perfect absorption due to the excitation of highly-confined negative-index surface plasmon polaritons in a plasmonic crystal structure, one of the first demonstrations of this phenomenon in the infrared. I will close by discussing the possibilities of using doped semiconductors as infrared metamaterials as well as topological insulators for use in the terahertz spectral range.

Bio: Dr. Law received her B. S. in Physics in 2006 from Iowa State University (Phi Beta Kappa, with Honors). She received her Ph. D. in Physics from the University of Illinois Urbana-Champaign in 2012. Dr. Law is currently a post-doc in the Electrical Engineering department at Illinois in the Wasserman group working on designer plasmonic materials for infrared photonic devices. Her research interests include new materials and layered structures for plasmonic and metamaterial devices (such as semiconductors and topological insulators) in both the mid- and far-infrared.

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