Department of Physics, IIT Kanpur
Ph.D. Open Seminar

Title: **Metamaterials for Infra-red Multi-spectral Absorbers**

Speaker: **Govind Dayal Singh (Y9109067)**

Date: 20th February 2014 (Thursday)

Time: 11.00 a.m. (Tea @ 10.45 a.m.)

Venue: FB 382 (Physics Conference room)

All are welcome.

(Dr. S. Anantha Ramakrishna)
Thesis Supervisor

Abstract: Electromagnetic absorbers have wide applicability and need to be impedance matched with free space to reduce the reflectance from their surface. Here we discuss the design and fabrication of metamaterials that show multi-band perfect absorbances at infra-red frequencies. The key a highly absorbing medium is to choose resonant structures that simultaneously have matched electrical and magnetic resonances. An array of metallic (conducting) particles separated from a conducting ground plane by a dielectric spacer layer constitutes the resonant structure. Proper choice of the particle size and layer thickness can result in perfect absorption that is reasonably independent of the excitation angle and polarization. Use of multi-layered stacks of particles that can also yield multi-band absorption. While most metamaterial designs utilize the fundamental mode in a sub-wavelength sized resonator, highly localized higher order modes can also be utilized for multi-band perfect absorption.

Multi-band metamaterial absorbers based on fundamental as well as higher order resonances for Infra-red frequencies have been designed, fabricated and characterized. The metamaterial absorbers have multiple absorption bands across the MWIR and LWIR bands with peak absorbances exceeding 90%. Metamaterial absorbers, with broadband absorption at the mid-infrared frequencies and high transmittance at visible frequencies, have been fabricated using a semiconductor Indium Tin Oxide (ITO) film as the ground plane.The metamaterials were fabricated by simple, cost-effective laser micromachining techniques, shadow mask deposition and oblique angle deposition technique. A strategy to tune or switch the metamaterial absorption by incorporated a phase change material such as VO_2 in the metamaterial has been implemented and results in a thermochromic metamaterial.
