Physics Colloquium

Michigan Technological University

Thursday, February 14, 2008

4:00 - 5:00 pm

Room 139, Fisher Hall

Slow light phenomena in Photonic Crystals

Zhuoyuan (Joy) Zu

(Advisor: Professor Miguel Levy)

Abstract: Photonic Crystals (PhCs) are artificial multi-dimensional periodic structures with periodically modulated refractive indices. PhCs control the flow of the light, possessing photonic band gaps, ranges of frequency in which light cannot propagate. Photons are confined due to the photonic band gap where photons are not allowed to exist, which means PhCs will block wavelengths that fall within the band gap. Magnetic Photonic Crystals (MPCs) are made from magnetic materials. They allow tuning of their optical properties under magnetic field action. Slow light phenomena include large enhancement of magnetic Faraday rotation. Such an enhancement can facilitate design of controllable optical delay lines, phase shifters, miniature and efficient optical amplifiers and lasers, etc. The speed of light propagation in photonic crystals is determined by the group velocity: $v=\partial\omega/\partial k$ and have large optical transmittance. In our slow light pattern designs, the key point is to design a stationary inflection point in the band structure of a photonic crystal in order to simultaneously satisfy $v=\partial\omega/\partial k=0$, which is known as inflection point. In the slow light case, the electromagnetic pulse propagates through PhCs at the speed $v \ll c$. In some cases, velocity can even become very small, like at the inflection point, which is the subject of our group interest. In this presentation, I will discuss the fabrication process of magnetic photonic crystals, the experimental data we have gotten so far and further research we plan to do.

Magnetic properties of the one dimensional Fe/Pt/Fe multilayered nanowires.

Puspamitra Panigrahi

(Advisor: Professor Ranjit Pati)

Abstract: In this project, we used first principles density functional theory to predict equilibrium structures, electronic and magnetic properties of one dimensional ferromagnetic Fe/Pt/Fe multilayered barcode nanowire. We found, in the ferromagnetic configuration, the magnetic moment per iron atom can be enhanced significantly by increasing the thickness of the platinum layer and reducing the thickness of the iron layer in the nanowire. Modulation of the ferromagnetism in these nanowires based upon the thickness of the ferromagnetic and non-ferromagnetic layer sequence in the nanowire opens up the scope for their potential application in nanometer scale magnetic barcodes.

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