Physics Colloquium

Michigan Technological University

Thursday, February 23, 2012
at 4:00 pm
Room 139 Fisher

Using Artificial Intelligence in Predicting First Interaction Length of An Extensive Air Shower

Tolga Yapici
Advisor: Brian Fick

Abstract: For particle accelerators to retrieve the hadronic interaction parameters (cross-section, inelasticity and multiplicity) at high energies (E>10^{18} eV) at the current technology level is impossible. The lack of experimental information about the hadronic interactions at these energies results in uncertainties in extensive air shower (EAS) simulations and the interpretation of observed EAS. The important information about the parameters can be probed using the Pierre Auger Observatory EAS data. In this presentation, it will be shown that a simple relation between EAS and hadronic interactions is hardly possible. An Artificial Neural Network model that predicts cross-sections for the hadronic interactions in EASs will also be discussed.

Elliptical Normal Modes and Stop Band Reconfiguration in Multimode Birefringent Onedimensional Magneto-photonic Crystals

Ashim Chakravarty
Advisor: Miguel Levy

Abstract: Photonic stop band reconfiguration in multimode elliptically birefringent Bragg filter waveguides can be obtained by changing the magnetic bias along the light propagation direction. Reversal of the longitudinal magnetization direction in the magneto-optic waveguides affects the character of the local orthogonal elliptically-polarized normal modes in the waveguide and therefore it impacts on the filter's stop band configuration. Helicity reversals yield new and different normal modes, with perpendicularly-oriented semi-major axes, corresponding to a north-south mirror reflection through the equatorial plane of the Poincaré sphere. Stop bands from 1D photonic crystals on multi mode supporting waveguide are due to the asymmetric contra-directional coupling between different order waveguide modes. Here, obliteration of the normal modes in the waveguide system upon magnetization reversal, allows for strongly reconfigured stop bands, through the hybridization of the elliptically-polarized states in such system.

Electronic and Transport Properties of Trilayers of Graphene and Boron Nitride

Xiaoliang Zhong
Advisor: Ravindra Pandey

Abstract: Structure, binding energy, electronic band structure, and electron transport properties of graphene/BN/graphene and BN/graphene/BN trilayers are studied with the use of van der Walls corrected density functional theory approach and non-equilibrium Green's Function method. Both trilayer systems show distinct stacking-dependent features in ground state electronic structure and response when perturbation of external electric field is applied. The graphene/BN/graphene system shows a negligible gap in the electronic band structure that increases, for the AAA and ABA stackings, in the presence of an external electric field applied perpendicular to the planes of the trilayers. The finite zero-field band gap in the case of BN/graphene/BN remains unchanged in the presence of external field. For both trilayer systems coupled with gold contacts, a metal-like conduction is predicted in the low-field regime, which changes to a p-type conduction with increase in the bias field.