Physics Colloquium
Graduate Posters
Michigan Technological University
Thursday, April 21, 2011
1:00 – 3:00 pm
Aftermath Atrium in Fisher Hall

Intrinsic Quantum Correlations of Weak Coherent States for Quantum Communication
Yong Meng Sua
Advisor: Kim Fook Lee

Abstract: Intrinsic quantum correlations of weak coherent states are observed between two parties, which can be used as a supplement to the existence decoy-state BB84 and differential phase-shift quantum key distribution protocols. In a proof-of-principle experiment, we generate bi-partite correlations of weak coherent states using weak local oscillator fields in two spatially separated balanced homodyne detections. We employ non-linearity of post measurement method to obtain the bi-partite correlations from two single-field interferences at individual homodyne measurement. This scheme is then used to demonstrate bits correlations in a transmission fiber over a distance of 10 km. We believe that the scheme can add another physical layer of security to these protocols for quantum key distribution and implement linear optics quantum computing with weak coherent states.

Analysis of Diffuse Gamma-Ray Emission with MILAGRO
Jessica Galbraith-Frew
Advisor: Petra Huentemeyer

Abstract: Previous analysis of TeV diffuse gamma ray emission with the MILAGRO detector shows a large excess in the cygnus region of the galactic plane. Studies of the diffuse gamma ray sky can provide clues to the origins of high energy cosmic rays. In order to understand this gamma ray excess further studies have been done on the region. My poster will show the results of a new analysis technique which can estimate the spectrum of the diffuse emission from the region.

Functionalized Boron Nitride Nanotubes for Devices
Boyi Hao
Advisor: Yoke Khin Yap

Abstract: Boron Nitride Nanotubes (BNNTs) perform structural similarities to Carbon Nanotubes. Theoretically, the tunable band gaps (around 5eV) of BNNTs will lead to potential applications like field effect transistor (FET) and single electron transistor (SET). BNNTs are grown by thermal chemical vapor deposition technique. BNNTs are functionalized by Fe-Quantum Dots. We will present our preliminary results for both growth and current-voltage measurement on the functionalized BNNTs.

A Theoretical Approach for Constructing Optical
Phase-Space-Time-Frequency Tomography
Rachel Blaser and Paul Rojas
Advisor: Kim Fook Lee

Abstract: ography (OPSTFT) of an optical wave field. A novel four-window optical imaging system is used to measure the tomography. The four-window technique is based on two local oscillator (LO) fields balanced heterodyne detection. The OPST-FT can provide temporal and spatial properties of an optical field beyond the uncertainty principle since the OPSTFT is a Wigner distribution function of two independent Fourier Transform pairs, phase-space and time-frequency. This approach could be used for quantum image processing and biophotonics.

Numerical Computation of Optical Properties of Soot Particles
During the Boston College Experiment
Noopur Sharma
Advisor: Claudio Mazzoleni

Abstract: A black carbon instrument inter-comparison study was conducted in July 2008 at Boston College to measure the optical, physical and chemical properties of laboratory generated soot under controlled conditions. From the measured optical properties (scattering and absorption coefficients) we calculate the values of refractive index with the help of Mie theory for high equivalence ratio spherical soot particles.

Decorated Zinc Oxide Nanostructures for Energy Harvesting Applications
Abhishek Prasad
Advisor: Yoke Khin Yap

Abstract: Design of more energy efficient materials and better device architecture is being widely investigated. Here, we report on the application of (CdSe) ZnS Core Shell quantum dots decorated ZnO nanostructures in solar energy harvesting. A conventional thermal chemical vapor deposition (CVD) technique was used for the synthesis of ZnO nanostructures. (CdSe) ZnS Core Shell quantum dots were coated on as grown ZnO nanostructures by drop casting and annealing in air at 350 ^{o}C. Enhancement in the photocurrent response of (CdSe) ZnS Core Shell quantum dots decorated ZnO nanostructures is observed as compared to response from as grown ZnO nanostructures.