

**Physics Colloquium  
Graduate Posters  
Michigan Technological University  
Thursday, April 15, 2009  
1:00 – 3:00 pm  
Aftermath Atrium in Fisher Hall**

**Ultra High Energy Neutrino Signatures in the Pierre Auger Observatory  
Niraj Dhital**

**Advisor: Dr. Brian E. Fick**

**Abstract:** The Ultra High Energy neutrinos which are quasi-horizontal(down going) and those which are earth skimming (up going) produce the cosmic ray showers which are different from the showers generated by hadronic primary particle. In this work, I have tried to distinguish the showers induced by the Ultra High Energy Neutrinos from those which are induced by hadronic primary particles.

**An Instrument to Measure Ice Nucleation in the Contact Mode  
Kristopher Bunker**

**Advisor: Dr. Will Cantrell**

**Abstract:** We have developed an instrument capable of measuring ice nucleation catalyzed via aerosol particles in the contact mode. Preliminary results using Arizona Test Dust are presented, as well as the design and operation of the instrument.

**Investigating temperature effects in Single Electron Devices  
Douglas Banyai**

**Advisor: Dr. John Jaszczak**

**Abstract:** Single electron devices hold promise for future electronics applications due to their peculiar electronic properties. Unfortunately these devices need to be as small or smaller than our current technologies allow in order to avoid detrimental temperature effects at room temperature. Here we study the various ways temperature impacts the operation of single electron devices.

**Identification of Exotic Extensive Air Showers  
Tolga Yapici**

**Advisor: Dr. Brian Fick**

**Abstract:** It is expected that the large center-of-mass energies present in Ultra-high energy cosmic rays (UHECRs) collisions will occasionally be converted into rare, exotic elementary particles, which will manifest itself as a bumpiness in the secondary particles extensive air shower (EAS) development. Human-based searches for these rare events among the vast number of EAS recorded by the Pierre Auger Observatory, is impractical. Here, for automatic scanning, possible methods for identification are discussed.

**Heterogeneous Nucleation Studies with High Speed Imaging, or My Summer Playing with Labview  
Colin Gurganus**

**Advisor: Dr. Raymond Shaw**

**Abstract:** Ice formation in clouds, through heterogeneous nucleation, influences the formation of precipitation and the optical properties of the clouds --- and therefore the earth's climate. In this study we utilize high speed photography to record the progression of a freezing event in water droplet resting on an ice-nucleating substrate. From these images we are able to identify the preferred location of the initial heterogeneous freezing event, which provides a clue about the underlying physical mechanism.

**Magnetically Triggered Gyrotropic Band Gaps and Their Application to Waveguide Switch  
Ashim Chakravarty**

**Prof. Miguel Levy**

**Abstract:** Iron garnet photonic crystal-based optical switches are being developed in our laboratory. Material selection, fabrication process optimization, and loss minimizing device characterization aspects are being addressed for this purpose. The optical properties of  $\text{Bi}_{1.28}\text{Lu}_{1.69}\text{Gd}_{0.03}\text{Fe}_{3.65}\text{Ga}_{1.35}\text{O}_{12}$  film on EuGG (100) substrate are under investigation for enhancing Faraday rotation currently less pronounced in iron garnet film-based devices. Better adaptation of already known waveguide fabrication process for the present material will help to reduce low coupling constant related deficiencies seen in previous devices.