

Physics Senior Research Oral Presentations

Michigan Technological University

Thursday, April 24, 2008

4:00pm

Room 139 of Fisher Hall

Determination of the 2006 Fireball Rate from Continuous CCD Fisheye Monitoring

Ashley Ames, Applied Physics Senior

Advisor: Dr. Robert Nemiroff

Abstract: Images from the MMT fisheye CCD all-sky camera in Arizona taken between May 2006 and April 2007 were visually inspected for bright fireballs. Two undergraduate observers (APA & CEB) independently scanned web-assessable archived digital movies composed of consecutive 10-second frames, recording sky coordinates at opposite ends of every observed meteor trail. Given daylight, moonlight, and inclement weather constraints, fireballs were recordable about 10 percent of the time. After critically contrasting the data sets, about 220 candidate fireballs remained, many of which were clearly associated with known meteor showers. Plots of the fireball rate over the observing period, including sporadic and known shower meteors, are presented.

Ozonolysis of Oleyl Alcohol Applied to Ice Nucleation in the Upper Troposphere

Stephanie Irish, Physics Senior

Advisor: Dr. Will Cantrell

Abstract: Products of biomass burning are often lofted into the upper troposphere through convection, possibly affecting the process of ice nucleation. One such compound, oleyl alcohol, is of interest because of its reactivity with ozone in the atmosphere. To study possible effects on the freezing temperature of water in the upper troposphere, experiments were run in which oleyl alcohol was placed on droplets of pure water and the nucleation temperature of the water and organic film was observed. Next, the drop was exposed to ozone and a new nucleation temperature was observed. In some experiments, the nucleation temperature increased after ozonolysis, while other drop showed no nucleation temperature change. The discrepancies in the outcomes of different drops under identical experimental conditions can possibly be explained through examination of the reaction products of oleyl alcohol and ozone.

Modeling Single Electron Transistors with the Kinetic Monte Carlo Algorithm

Douglas Banjai, Applied Physics Senior

Advisor: Dr. John Jaszczak

Abstract: As we strive to make electronic devices smaller and more energy efficient, the quantized nature of charge and nanoscale size effects require us to develop fundamentally different devices. Our work explores these quantization and size effects in the context of single electron quantum dot transistors. This is a device fabricated here at MTU that consists of tungsten quantum dots deposited over top of source, drain, and gate electrodes. The device is modeled using a semi-classical theory that includes quantum tunneling effects, and the electronic characteristics are calculated using the kinetic Monte Carlo algorithm.

An examination of anomalous extensive air shower (EAS) profiles

Michael Gussert, Physics Senior

Advisor: Brian Fick

Abstract: The energy lost by a cosmic ray shower as a function of depth in the atmosphere, known as the showers profile, is dependant on the type and energy of the primary particle. This profile follows a Gaussian like distribution with a single peak. Profiles with multiple peaks may be indicators of rare or exotic particles created within the shower as a result of the highly energetic conditions. The shower profiles generated by the Pierre Auger Observatory between 2004-07 were searched for such anomalous structures. Of the 43,000 cosmic ray events detected by the observatory, 2,224 met base quality conditions. Of these 2,224, only 3 events displayed the double peak structure and of these, only one has sufficient atmospheric data to potentially withstand scientific scrutiny.

Exploration on BNNT/CNT Heterojunctions

Ben Coupland, Physics Senior

Advisor: Dr. Yoke Khin Yap

Abstract: A heterojunction of boron nitride nanotubes and carbon nanotubes is predicted to have many interesting electronic, magnetic, photonic/optical and spintronic properties. Thus, fabrication of such a heterojunction is desirable. We attempt to fabricate a BNNT/CNT heterojunction using plasma advanced pulsed laser deposition. This takes advantage of the monopoly held by the Yap research group on physical deposition methods for BNNTs and CNTs.

Statistical Analysis of Nearest Neighbor Collision Models

for MMC Polymer Folding Simulations

Michael Aden, Physics Senior

Advisor: Dr. Alexei Podtelezhnikov

Abstract: An introduction to Metropolis Monte Carlo (MMC) simulations for heteropolymer folding and their applications, programming and design considerations for MMC simulations, and investigation of the contributions of nearest neighbor collisions to the time average and distribution of a polymer's end to end distance and radius of gyration.