Physics Colloquium
Graduate Posters
Michigan Technological University
Thursday, April 19, 2012
1:00 – 3:00 pm
Aftermath Atrium in Fisher Hall

Relativistic Configuration Interaction Lifetimes and Transition Probabilities for W II

Marwa H. Abdalamoneam
Advisor: Prof. Donald Beck

Abstract: Lifetimes of the lowest 13, 30, 38, 40, 35 and 20 levels of 2J= 1, 3, 5, 7, 9, and 11, respectively, odd parity have been computed. Comparisons with measured values indicate improved agreement as compared with the semi-empirical values. With the inclusion of FOTOS selected 5p ---> 5d excitations, agreement between velocity and length gauges is good. Small shifts are introduced for some nearby levels to represent the missing correlation effects, and it is shown that the sum of 1/tau and Lande g-values are nearly conserved as calculation proceeds for such levels.

Junction Dependent Conductance Study in a Ruthenium Based Molecular Wire

Kamal B Dhungana
Advisor: Dr. Ranjit Pati

Abstract: We have used _rst principles orbital dependent density functional theory together with single particle Green's function approach to study current-voltage characteristics in a Ru-terpyridine complex; molecule is connected to the gold electrodes through the thiolate(-S) anchoring group. A series of junction geometries are considered. Our results show that the current-voltage features obtained with ONTOP junction geometry agree reasonably well with the I □ V features reported from the experiment. We have analysed the bias dependent transmission to explain the unique I□V feature obtained with various junction geometries.

Fast Imaging of Freezing Drops: Further Studies of Contact Nucleation

Colin Gurganus
Advisor: Dr. Raymond Shaw

Abstract: Contact nucleation remains enigmatic and while much effort is made to empirically quantify the nucleation rates of various atmospherically relevant aerosols, the fundamental physical basis for this process remains unresolved. Our experimental approach utilizes simplified geometries to disentangle several competing hypotheses. To that end, the focus of our initial study was droplets in a spherical cap geometry resting on homogeneous and atomically smooth silicon substrates [1]. Observations of the nucleation sites in these slowly cooled systems revealed no preference for nucleation at the Triple line, a surprising null result. This result runs contrary to earlier observations of Suzuki et al. [2] who observed a strong preference for nucleation at the Triple line. To help resolve these contrary observations, we have redesigned our experiment to include horizontal imaging and rapid cooling rates. Initial results will be presented with an overview of the new apparatus.

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Exploring cloud microstructure with the Holodec II
Matthew Beals
Advisor: Dr. Raymond Shaw

Abstract: The HOLODEC II (Holographic Detector for Clouds version 2) instrument was flown during the IDEAS-4 campaign recording holograms of cloud air. Each digital hologram encodes the image and three dimensional position of all cloud particles contained within the 15 cm^3 sample volume at the time of exposure. Through digital reconstruction techniques, particle size and position data are extracted from the hologram, and size distributions are calculated. The retrieved size distributions represent particles sampled from discrete, spatially localized volumes of cloud air. The droplets are therefore microphysically connected in terms of vapor diffusion, heat transfer, and collisions. The 3D position of the cloud droplets also allow spatial statistics to be calculated, giving new insight into the cloud's microscale structure. These size distributions are compared with data recorded by other optical cloud probes that flew aboard the NCAR C-130 during the IDEAS-4 project and spatial distributions are explored.

Individual Particle Analysis of Carbonaceous Aerosols Emitted from the Las Conchas Wildfire, Los Alamos, NM
Swarup China
Advisor: Dr. Claudio Mazzoleni

Abstract: Carbonaceous aerosol emitted from biomass burning influence the radiative and cloud properties. In this study we investigated smoke particles emitted from the Las Conchas wildfire in northern New Mexico started on June 26, 2011. Los Alamos National Laboratory attained unique measurements of the smoke by sampling the ambient air. The aerosol samples were collected on nucleopore filters. Individual aerosol particles were investigated using scanning electron microscopy and energy dispersive X-ray spectroscopy to distinguish different carbonaceous particles and their shape, size, elemental composition and mixing state. A thermo-denuder was used to remove volatile compounds at temperatures up to 200°C, leaving behind the black carbon and others that did not volatize completely. Preliminary results will be presented.

Optical Fiber based Squeezed Light Generation via Four-Wave Mixing Process
Yong Meng Sua
Advisor: Dr. Kim Fook Lee

Abstract: The phenomenon of four-wave mixing(FWM) via non linear effect arising from third-order optical nonlinearity in optical fibers provides a natural way to generate squeezed light in a single spatial mode. A dispersion shifted fiber (DSF) based squeezed light generation at 1550nm utilizing the FWM process is experimentally explored employing intense, ultrashort light pulses in a single pass method in DSF. In addition to the fundamental interest of nonclassical light, squeezed light generation is of interest for quantum-information processing, quantum communication, below standard quantum limit measure, and quantum states engineering.