

Physics Colloquium

Michigan Technological University

Thursday, March 3, 2011, 4:00 pm

Room 139, Fisher Hall

Search for Exotic Elementary Particles Using the Pierre Auger Observatory

Niraj Dhital

Advisor: Dr. Brian Fick

Abstract: Collisions between ultrahigh-energy cosmic rays and atmospheric nuclei have the potential to produce new, exotic elementary particles. These particles may significantly influence the development of extensive air showers (particle cascades) which we observe with both the Fluorescence detector and Surface detector systems of the Auger Observatory. Using monte carlo simulations of particle interactions, extensive air shower development, and detector performance, I am investigating the sensitivity of the observatory for detecting a specific class of exotic particles. In this talk I will present some early results.

Modeling of Multi-Island Single-Electron Transistor (SET) Devices

Madhusudan Savaikar

Advisors: Drs. Paul Bergstrom and John Jaszczak

Abstract: Devices in which the storage and transport of individual electrons are systematically controlled could lead to a new generation of nanoscale devices. Researchers have taken keen interest in the fabrication and modeling of charging-effectbased Single Electron Devices (SEDs) ever since such charging effects were experimentally observed. Tunnel junctions provide pathways for charge transport between the metallic islands in such devices. Because of the strong sensitivity of the stochastic charge transport on the junction width, we propose that “the random positioning of the islands and the distribution in junction widths are responsible for the existence of a single dominant conducting path (DCP) in a multi-island multi dimensional device”. The semi-classical calculations clearly show the existence of a DCP implying that the device behaves effectively as a one dimensional (1D) device. The weakest junction in the DCP plays a dominant role in determining the DCP current. The individual junction characteristics exhibit a good agreement with the DCP current at the potentials dropped across the various junctions in the DCP.

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