

Department of Physics

McMicken College of Arts and Sciences

**SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN**

APPLICATION DEADLINE: March 1, 2007

The Department of Physics is pleased to offer the following research project for the summer of 2007. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and if possible, develop a timetable for the twelve-week research period.

QUANTUM DYNAMICS OF SPIN-ENTANGLED ELECTRONIC STATES

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Project Description

The first area concentrates on the properties of electrons confined to small regions of space, and has the long-term goal to understand how individual electrons interact with their environment and eventually learn how to control and manipulate their quantum states. . Our focus is on the time-dependent behavior, which we study by applying microwave-frequency signals to a specially-designed device, a single-electron transistor, which acts as a nanoscale "trap" capable to isolate a few electrons from a macroscopic conducting object. Our immediate goal is to further the understanding of a spin-related phenomenon called the Kondo effect, which occurs when a localized electronic spin is allowed to interact with itinerant electrons.

An undergraduate student would have the opportunity to get exposure to fundamental concepts in nanoscale transport, such as Coulomb blockade, co-tunneling, resonant tunneling, Kondo correlations and spin –dependent transport, and be actively involved in measurements and data analysis. Several experimental projects are available depending on the student's preference: Constructing and testing electronic circuitry required to perform ultra-low noise transport measurements, developing novel microwave detection techniques, and radio-frequency filtering schemes and developing novel types of single-electron devices.