**Department of Physics**
**MCMICKEN COLLEGE OF ARTS AND SCIENCES**

**SUMMER RESEARCH OPPORTUNITIES**
**FOR UNDERGRADUATE WOMEN**

**APLICATION DEADLINE: March 1, 2006**

**The Department of Physics is pleased to offer the following research project for the summer of 2006. 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.**

**PROBING THE NANOWORLD: CHARGE AND SPIN TRANSPORT IN SEMICONDUCTOR NANODEVICES**

**Professor Philippe Debray**
**Department of Physics**
**410 Geo/Physics**
**Cincinnati, OH 45221-0011**
**Tel. (513)556-0501**
**Fax. (513)556-3425**
**Email: philippe.debray@uc.edu**

**As the size of a device or sample shrinks progressively down to a length scale of the order of tens of nanometer, it becomes invisible to the naked eye and to even the most powerful optical microscope, and to "see" it one has to use a scanning electron microscope (SEM). The properties of these small "wonders" or nanodevices are governed by quantum mechanics, leading to fascinating new physical phenomena. In our group we are making such nanodevices from semiconductor thin films using high-resolution electron lithography and studying their electron transport properties at temperatures down to 25 mK and in high applied magnetic fields. As we all know, the electron carries a charge and also spins around itself or has a spin angular momentum. We are studying how the charge and the spin of the electron move in nanodevices. Can we have "pure" spin transport without net charge movement? Our aim is to study fundamental physical phenomena and explore their potential applications in the real world – nanoelectronics and spintronics!**

**The undergraduate student will work with graduate students and participate in the processing and electrical characterization of the nanodevices. She will learn the fundamentals of nanophysics and will have the option of learning the preliminaries of sample processing, the basics of cryogenics, and the use of electronic instruments to measure transport properties. After a discussion with the student, a research project will be defined to suit her background and preference.**