

**Department of Physics
COLLEGE OF Arts and Sciences**

**SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN**

APPLICATION DEADLINE: March 1, 2013

The Department of Physics is pleased to offer the following research project for the summer of 2013. 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.

ORBITS AROUND COMPACT ASTROPHYSICAL OBJECTS AND BLACK HOLES

**Professor F. Paul Esposito
Department of Physics
440 Geo/Physics
Cincinnati, OH 45221 ML #11
Tel: (513) 556-0636
Email: paul.esposito@uc.edu**

Project Description

**ORBITS AROUND COMPACT
ASTROPHYSICAL OBJECTS AND BLACK
HOLES**

This is a proposal for a summer project in Astrophysics and General Relativity. The physics of compact astrophysical objects including White Dwarf stars, Neutron Stars, and Black Holes has been a very active area of research in physics for the last forty years. The properties of matter in these extreme situations necessarily involves the gravitational field and this means that General Relativity must be used to describe them. Although the internal features of such configurations of matter has become of key importance in theoretical physics, the current set of satellite observatories make it likely that in the very near future observations will be able to distinguish between these compact objects. In order to do this, astrophysicist must know how matter in the vicinity of such an object behaves. In effect, when we look at an object, we see effects of matter in its neighborhood.

The proposed work is for an orbit calculation of matter exterior to a compact object as described by General Relativity. The student will learn the rudiments of the physics of compact objects and then begin to approach the computation of the orbits around them, using a computational package in "Mathematica". The real challenge will be to learn a sufficient amount of General Relativity to understand what it is that is being calculated. While the student will not be expected to master all of the mathematics involved, a certain amount of mathematical sophistication will be a great help. The project will have a goal of presenting a profile of orbits around compact objects that will be checked against observations.