DRAFT FOR DISCUSSION (10/25/00)

Physics 511
Topics in Contemporary Physics (*Interferometry in Experimental Physics*)

The primary objectives of this course are to:

- Acquaint students with a broad view of current topics in experimental physics.
- Relate real-world quantum mechanics to formal quantum theory being studied in Physics 517-519.
- Examine issues related to key features that bring about successful measurement.
- Learn to critically assess experimental results.

The course is centered around the unifying theme of interferometry, which allows it to explore a very broad set of topics in physics and astrophysics. Topics that are currently covered include:

- Classical Interferometry (Lorentz Invariance and test of the Equivalence principle)
- Radio and Stellar Interferometry (Very long baseline interferometry and Hanbury-Brown-Twiss effect)
- Photon correlations, quantum optics (Photon Bunching and Anticorrelation effects)
- Interferometric Gravity Wave detectors (Ground based and Space based)
- Quantum Interferometry with Matter Waves (neutrons and atoms)
- Tests of the fundamental properties of physics (including: gravitational deflection of light, EPR, Kaon oscillations, Quantum Eraser, neutron EDM, Aharonov-Casher, Quantum non-demolition)
- Multiparticle Interferometry

The material is covered not through traditional lectures or texts, but through the examination of both classic and recently published papers in Interferometry. For each class, students are given a paper along with a list of questions, "Points to Ponder" which help focus their study of the paper. Class periods are spent discussing issues related to the papers. There are essentially no lectures by the instructor, instead one student is assigned for each class to present a brief overview of the paper. During the course of the discussions, students are randomly called on to answer various questions. Often additional handouts are distributed to help reinforce or clarify particular topics.
There are no traditional "problem sets" or exams, but there are regular, brief quizzes to "encourage" class preparation. The students are required to write a research paper that deals with an interferometry-related topic of their choice. They are also required to give an oral presentation which are strictly styled after American Physical Society Contributed Talk sessions. The work level is aimed at being similar to a second year graduate course. It is expected the course can be taught by experimentalists in the department.
The implementation of the course helps achieve the secondary objectives for the course:

- Prepare the students for their General Exams.
- Develop critical reasoning skills.
- Allow the students opportunities to give presentations and talks.