SYLLABUS FOR GRADUATE LABORATORY – PHYS 472

Students will be assessed individually as to their prior experience and training in laboratory work. A course of laboratory work will be determined for each student. Students with normal backgrounds will have the following syllabus:

Weeks 1 - 4 -- Introduction to computer controlled data acquisition systems, application to digital voltmeters and lock-in amplifiers.

Weeks 5 - 8 – Two experiments selected from the following list:

Photon Attenuation - The attenuation of gamma rays as they pass through solids is measured as a function of the atomic mass of the solid and the initial energy of the gamma ray. This information is then used to determine the dominant scattering mechanism responsible for the attenuation.

Cavendish Balance - The value of the Gravitational constant G is measured with a Cavendish balance. Computer control of the apparatus and proper numerical analysis of the data allows G to be determined with an accuracy of a few per- cent.

Interferometry - A Michelson optical interferometer is used to measure the speed of light in air and helium relative to its speed in vacuum. Microwave Michelson and Fabry-Perot interferometers are then assembled and used to examine how the performance of these instruments is affected by their construction.

Franck-Hertz Experiment - The behavior of an electron beam accelerated through mercury vapor is used to prove that atomic energy levels are quantized. The experiment also provides some experience with small signals.

Weeks 9 - 13 --Two experiments selected from the following list:

Introduction to vacuum systems: measurement of pressure, pumping speed of mechanical and diffusion pumps, conductance of vacuum systems.

Introduction to scintillation counting: the use of a NaI scintillation counter and high purity germanium detector to determine the gamma rayy spectrum

of long- lived radioisotopes.

Determination of the memo life of the muon. Comic ray muons are stopped in a large block of scintillator and their subsequent decay is detected. This experiment introduces the student to some techniques of elementary particle physics - the use of fast coincidences and time-to-amplitude converters.

Observation of the Josephson effect: This experiment introduces students to the techniques of low temperature physics, using a helium refrigerator to achieve temperatures in the neighborhood of a few Kelvin.

The scattering of light from small spheres. Observing light scattered from a suspension of small particles and measuring the autocorrelation function of the scattered light intensity in the time domain allows a determination of the size and diffusion coefficient of these particles.

PHYS 472 -- Graduate Laboratory Physics

A series of projects designed to introduce the student to modern research techniques such as automated data acquisition. Students will be assessed as to their individual needs and a sequence of projects will be established for each individual. Topics may include low temperature phenomena, nuclear gamma rayy detection and measurement and optics.