INTERMEDIATE LABORATORY - PHYX 3870-3880

List of Experiments

Spring 2013

MECHANICS

M2. ***Coupled Pendulum***

Investigation of two pendulums coupled by a spring between them. Lab emphasizes comparison of measured results of the periods and damping to values derived from a theoretical model using differential equations. Completion of Analytical Mechanics is recommended. Computerized data collection with voltage probes and motion sensors and data reduction are used.

ELECTRICITY & MAGNETISM

E2. ***Thompson's e/m Experiment***

Measures the ratio of the charge to mass of an electron (e/m) by investigating the trajectory of electrons in electric and magnetic fields. The British physicist J. J. Thompson received a Nobel prize for the experiment. Good preparation for *Electron Diffraction from a Crystal Lattice* and subsequent Advanced Laboratory experiments. Emphasis is on determining the interdependence of experimental parameters (e.g., accelerating voltage, magnetic field, radius, charge) through the Lorentz Force Law. A good beginning lab.

ATOMIC PHYSICS

A1. ***Franck-Hertz Experiment***

Classic experiment which demonstrates the quantized nature of atomic electron orbitals. Good practice in use of electronics test equipment. Emphasizes experimental design and data analysis methods. Extensive computerized data collection.

A4. ***Atomic and Solar Spectra***

Investigates the atomic spectra of elements using a computer automated diffraction spectrometer and interferometry. Study the solar spectrum as a blackbody with absorption lines.

OPTICS

O4. ***Holography***

Explores the basics of holographic photography. Students record holographic images on film using a darkroom. Provides good experience with lasers, optics elements, interferometry, and an optics bench. Emphasizes experimental techniques in optics. Procedure is involved and time-consuming, but the end product is exciting. An interesting extension allows a hologram to be fully generated by computational methods, providing exceptional insight into the physics behind holography.

O6. ***Michelson and Fabry-Perot Interferometry***

Introduction to interferometric techniques. A number of experiments are possible including investigation of the index of refraction of a gas as a function of pressure, resolution of atomic spectral doublets, and hyperfine splitting Provides good experience with optics elements and light sources.

SOLID STATE PHYSICS

S2. ***Electron Diffraction from a Crystal Lattice***

Investigates the diffraction of electrons from a thin polycrystalline carbon film. Analysis of diffraction pattern allows determination of the crystal structure and lattice spacings of graphite. A suggested prerequisite for the *X Ray Diffraction* Advanced Laboratory experiment. Emphasizes diffraction physics principles and determination of the experimental parameters related to Bragg's Law.

S3. ***High Temperature Superconductivity***

Develops temperature measurement techniques using thermocouples and cryogenic techniques for handling liquid nitrogen. Explores the qualitative aspects of the Meigner Effect and magnetic levitation. Measures the resistance as a function of temperature to determine the critical temperature, critical magnetic field, and critical current. Measures the persistent current in a superconductor. Emphasis on the physical principles of superconductors.