**List of Experiments in the Advanced Physics Laboratory Courses (4410/6510)**
**Cornell University Department of Physics**
**Spring 2009**

| INSTR. | | LABORATORY | CREDITS | LEVEL |
|---|---|---|---|---|
| **Acoustics and Aeronautics** | | | | |
| PM | AR-4 | Subsonic wind tunnel | 1.5 | S |
| **Circuits** | | | | |
| DR | C-1 | Transistor amplifiers | 2.0 | S |
| DR | C-7 | Non-linear Oscillator | 2.0 | A |
| DR | C-8 | Lumped transmission line; cut-off and dispersion | 1.5 | S |
| GH | C-9 | Radio frequency transmission line study | 2.0 | A |
| DR | C-10 | Microwaves: components, phenomena, optical characteristics | 2.0 | S |
| GH | C-11 | Transmission line studies with nanosecond pulse techniques | 1.5 | S |
| GH | C-12 | Microwave Resonant Circuits | 2.0 | |
| PM | C-13 | Quantitative Studies of Electronic Noise | 2.0 | |
| **Physical Electronics** | | | | |
| DH | E-4 | Stern-Gerlach experiment, space quantization | 1.5 | S |
| PM | E-5 | Critical potential in Hg and scattering in Argon | 1.5 | S |
| PM | E-10 | Photoelectric effect; h/e, Einstein relation | 1.5 | S |
| ~~——~~ | ~~E-12~~ | ~~Electron lens: magnetic and electrostatic types~~ | ~~1.5~~ | ~~S~~ |
| PM | E-15 | e/M: mass spectrograph with alkali metal ions | 2.0 | |
| **General** | | | | |
| DR | G-7 | Nuclear magnetic resonance | 2.0 | |
| DR | G-7a | Pulsed NMR; spin echo | 2.0 | |
| DR | G-7b | Pulsed NMR; advanced with computerized data acquisition system | 2.0 | |
| PM | G-8 | G: gravitational constant; the Cavendish balance | 1.5 | S |
| GH | G-10 | Brownian motion (static and kinetic), Avogadro's number | 1.5 | S |
| **Heat and Mechanics** | | | | |
| DH | H-4 | Specific heat discontinuities; order and phase transitions | 2.0 | A |
| PM | H-5 | Liquid and vapor densities in $CCl_4$; critical temperature | 1.5 | S |
| ~~——~~ | ~~M-3~~ | ~~Mechanical resonance: forced and free oscillations~~ | ~~1.5~~ | ~~S~~ |
| **Nuclear** | | | | |
| DR | N-0 | Gamma ray spectroscopy: pulse height analyzer | 1.5 | S |
| DR | N-1 | Gamma ray absorption | 1.5 | S |
| DR | N-2 | Alpha particle range in air and Helium | 1.5 | S |
| DH | N-4 | Rutherford scattering of alpha particles | 2.0 | S |
| DR | N-12 | Annihilation radiation: coincidence experiments | 2.0 | A |
| GH | N-15 | μ meson lifetime (2 set-ups) | 2.0 | |

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|---|---|---|---|---|
| DH | N-16 | Mossbauer effect (2 set-ups) | 2.0 | |
| DR | N-17 | μ meson lifetime with PC (3 set-ups) | 2.0 | |

**Optics**

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|---|---|---|---|---|
| GH | O-2 | Michelson interferometer (3 set-ups) | 1.5 | S |
| GH | O-3 | Diffraction: Fraunhofer, Fresnel, Fourier image formation | 2.0 | S |
| DH | O-4 | Optical constants of metal: mirror evaporation, Babinet compensator | 2.0A | |
| GH | O-11 | Polarization phenomena: electro- and magneto-optics | 2.0 | S |
| PM | O-14 | Speed of light; rotating mirror and double pulse technique (Kerr cell) | 2.0A | |

**Spectroscopy**

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|---|---|---|---|---|
| PM | S-2 | Fine structure in H and D Balmer alpha: Fabry-Perot interferometer | 2.0 | S |
| DH | S-4 | Alkali metals spectra and absorption spectrum in Na | 2.0 | A |
| DH | S-6 | Zeeman effect in Hg; e/m | 2.0 | A |
| PM | S-7 | Raman scattering ($Ar^+$ ion laser) | 2.0 | A |
| GH | S-8 | Vibrational structure in molecular spectrum $N_2$ | 2.0 | |
| PM | S-9 | Rotational structure in molecular band: CO | 2.0 | |
| GH | S-10 | Optical pumping in Rb (2 setups) | 2.0 | A |

**Solid State**

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|---|---|---|---|---|
| GH | SS-5 | p-n junction: photoeffect, Zener and tunnel diodes, e/k (2 set-ups) | 1.5 | A |
| PM | SS-6 | Internal friction: diffusion of O in Ta (2 set-ups) | 2.0 | S |
| PM | SS-9 | Resistivity and Hall effect in semiconductors | 2.0 | A |
| DH | SS-10 | Superconductivity | 2.0 | A |
| DH | SS-11 | Second sound propagation in liquid Helium (2 set-ups) | 2.0 | A |
| DR | SS-13 | High $T_c$ Superconductivity | 2.0 | |
| GH | SS-14 | Optical Transmission of Thin Films | 2.0 | |

**X-rays**

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|---|---|---|---|---|
| DH | X-1 | Introduction to X-rays: efficiency, intensity, absorption | 2.0 | S |
| DH | X-3 | Laue diffraction: picture and analysis, transmission, back reflection | 2.0 | |
| DH | X-6 | Powder picture | 1.5 | A |
| DH | X-7 | Diffractometer: lattice vibrations | 2.0 | A |
| DH | X-8 | Anomalous transmission | 2.0 | |

**S** is an experiment appropriate for a beginning P410 student and **A** is an advanced experiment. No letter means it is in between. These are strictly for your guidance in choosing labs and have no impact on grading or credit.

**Instructor Key:**

DH = Don Hartill GH = Georg Hoffstaetter PM = Paul McEuen DR = David Rubin