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

<table>
<thead>
<tr>
<th>INSTR.</th>
<th>LABORATORY</th>
<th>CREDITS</th>
<th>LEVEL</th>
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<tbody>
<tr>
<td><strong>Acoustics and Aeronautics</strong></td>
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<tr>
<td>PM AR-4</td>
<td>Subsonic wind tunnel</td>
<td>1.5</td>
<td>S</td>
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<tr>
<td><strong>Circuits</strong></td>
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<tr>
<td>DR C-1</td>
<td>Transistor amplifiers</td>
<td>2.0</td>
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<tr>
<td>DR C-7</td>
<td>Non-linear Oscillator</td>
<td>2.0</td>
<td>A</td>
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<tr>
<td>DR C-8</td>
<td>Lumped transmission line; cut-off and dispersion</td>
<td>1.5</td>
<td>S</td>
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<tr>
<td>GH C-9</td>
<td>Radio frequency transmission line study</td>
<td>2.0</td>
<td>A</td>
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<tr>
<td>DR C-10</td>
<td>Microwaves: components, phenomena, optical characteristics</td>
<td>2.0</td>
<td>S</td>
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<tr>
<td>GH C-11</td>
<td>Transmission line studies with nanosecond pulse techniques</td>
<td>1.5</td>
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<tr>
<td>GH C-12</td>
<td>Microwave Resonant Circuits</td>
<td>2.0</td>
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<tr>
<td>PM C-13</td>
<td>Quantitative Studies of Electronic Noise</td>
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<td><strong>Physical Electronics</strong></td>
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<tr>
<td>DH E-4</td>
<td>Stern-Gerlach experiment, space quantization</td>
<td>1.5</td>
<td>S</td>
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<tr>
<td>PM E-5</td>
<td>Critical potential in Hg and scattering in Argon</td>
<td>1.5</td>
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<td>PM E-10</td>
<td>Photoelectric effect; h/e, Einstein relation</td>
<td>1.5</td>
<td>S</td>
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<tr>
<td>E-12</td>
<td>Electron lens: magnetic and electrostatic types</td>
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<td>PM E-15</td>
<td>e/M: mass spectrograph with alkali metal ions</td>
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<tr>
<td><strong>General</strong></td>
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<tr>
<td>DR G-7</td>
<td>Nuclear magnetic resonance</td>
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<tr>
<td>DR G-7a</td>
<td>Pulsed NMR; spin echo</td>
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<tr>
<td>DR G-7b</td>
<td>Pulsed NMR; advanced with computerized data acquisition system</td>
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<td>PM G-8</td>
<td>G: gravitational constant; the Cavendish balance</td>
<td>1.5</td>
<td>S</td>
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<tr>
<td>GH G-10</td>
<td>Brownian motion (static and kinetic), Avogadro's number</td>
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<tr>
<td><strong>Heat and Mechanics</strong></td>
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<tr>
<td>DH H-4</td>
<td>Specific heat discontinuities; order and phase transitions</td>
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<td>A</td>
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<td>PM H-5</td>
<td>Liquid and vapor densities in CCl₄; critical temperature</td>
<td>1.5</td>
<td>S</td>
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<td>M-3</td>
<td>Mechanical resonance: forced and free oscillations</td>
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<tr>
<td><strong>Nuclear</strong></td>
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<tr>
<td>DR N-0</td>
<td>Gamma ray spectroscopy: pulse height analyzer</td>
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<tr>
<td>DR N-1</td>
<td>Gamma ray absorption</td>
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<td>DR N-2</td>
<td>Alpha particle range in air and Helium</td>
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<td>S</td>
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<tr>
<td>DH N-4</td>
<td>Rutherford scattering of alpha particles</td>
<td>2.0</td>
<td>S</td>
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<tr>
<td>DR N-12</td>
<td>Annihilation radiation: coincidence experiments</td>
<td>2.0</td>
<td>A</td>
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<tr>
<td>GH N-15</td>
<td>μ meson lifetime (2 set-ups)</td>
<td>2.0</td>
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</tbody>
</table>
### Optics

- **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 2.0 A
- **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) 2.0 A

### Spectroscopy

- **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 N2 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

- **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

- **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