**Physics 407 Senior Laboratory in Modern Physics**  
Spring 2015, Rooms PH 220 & 236  
Monday and Wednesday 13:30 - 17:00

Instructor: Phil Rubin  
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Phone: 703.993.3815 (least effective)  
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Office Hours: Monday and Wednesday 10:30-12:00  
Prerequisites: PHYS 263, 305, 308  
Co-requisite: PHYS 402

Please note:

- All e-mail communication from the instructor concerning this course will be to GMU accounts only.
- If you are a student with a disability and require academic accommodations, please see me and contact the Office of Disability Resources at 703.993.2474. All academic accommodations must be arranged through that office.

Course Goals:

1. To gain experience in scientific practice
   - experimental design
   - instrumentation
   - data collection
   - data analysis
   - interpretation
   - communication
2. To fulfill the writing-intensive requirement for the Physics major:
   - writing instruction
   - instructor feedback
   - writing assignments totaling at least 3500 words

Expectations

- Safety Qualification (2 quizzes: 10%)
  - Lab safety (5%)
  - Radiation safety (5%)
• Skills Competency (2 tests, 1 technical note: 50%)
  – Instrumentation (15%)
  – Data Acquisition and Electronics (20%)
  – Data Analysis (15%)

• Experimental Perspicacity (1 research proposal, 1 research paper: 40%)
  1. Design (20%)
  2. Experiment (20%)

Grading:

A+=100-96.67   A=96.66-93.33   A-=93.32-90
B+=89.99-86.67 B=86.66-83.33   B-=83.32-80
C+=79.99-76.67 C=76.66-73.33   C-=73.32-70
D=69.99-60
F<60

Activities Outline

1. Orientation: course overview, laboratory and radiation safety lectures, and discussions on experimental physics.

2. Laboratory and radiation safety: Lecture notes and supplemental readings are available on-line. Passing quizzes in both general laboratory safety and radiation safety at the 90% level or higher is a foundational requirement of this course. Quizzes will be offered at the beginning of each class meeting beginning with the second meeting until everyone reaches the required level. Scores (fractions of correct answers) of each individual’s completed quizzes are multiplied each time another quiz is taken, and account for 10% of the final grade.

3. Skill-development: On-line reading and exercise guides for basic instrumentation, electronics, data acquisition, and data analysis should be completed. When they are, examinations on instrumentation and data analysis may be taken. These are one-sit, 60-minute tests for which only notebooks and relevant reading guide may be consulted. The score is the fraction of correct answers. Each exam accounts for 15% of the final grade.

Further, an individual project of your own design integrating data acquisition may be completed. A layout and simulation of a simple circuit must precede construction of the circuit whose output should be recorded and stored by a LabView virtual instrument. All of this work will be described in a technical note worth 20%.

The exams and the technical paper must be completed by the end of class on 18 March.
4. Research Proposal: Plan, design, and cost-out (money and time) a “realistic” experiment of your choosing.

The Research Proposal is due by the end of class on 16 April.

5. Research Paper: Perform, analyze, and report on one of the classic modern physics experiments: for example, photoelectric effect, compton scattering, charge-to-mass ratio of the electron.

The Research Paper is due by the end of class on 4 May.

Notebooks: Complete records of all activities must be kept as evidence for the veracity of reported results. These records should be permanent and referable in case questions arise either later in an investigation or subsequent to publication in any form. Typically, a notebook, of the sort without loose paper, such as a bound composition notebook is preferred. A spiral notebook is acceptable, but a three-ring binder is not. Pages in the notebook should be numbered consecutively, either by the manufacturer or by hand, and never removed from the notebook. Entries should never be erased or blacked/whited out. A single line through a mistake is all that is necessary. The notebook is often left at the site of a running experiment, so that there is no chance that it can be lost or damaged during transport. You must be able to produce such a record for the work you present in this course or else face a grade of zero (0) for the work reported.

Disruptive Behavior: Misbehavior of any sort, including cell-phone use, unauthorized computer use, and eating or drinking in the laboratory or classroom, will not be tolerated. Such actions are grounds for dismissal from the classroom and the grading of a zero (0) on the assignment due that day. Cell phones must be turned off before entering the classroom and laboratory and remain off and out of sight.

Honor Code Violations: Science is impossible when dishonesty, in any manifestation, exists. It's the worst possible conduct a scientist can display. Dishonesty of any sort (cheating, plagiarism, lying, stealing), as determined by the instructor, will result in an automatic F in the course, without recourse to appeal. Those so accused will be reported to the honor council for further disciplinary action. Regardless of the results of council actions, the failing grade stands. Don’t cheat. Don’t even look like you’re cheating.

The GMU Honor Code: http://www.gmu.edu/catalog/9798/honorcode.html#code