

Physics 407 Senior Laboratory in Modern Physics

Fall 2020, On-Line

Nominally, Monday and Wednesday 12:30 - 16:00

Instructor: Phil Rubin
Office: PH 253
Phone: 703.993.3815 (inaccessible)
E-mail: prubin@gmu.edu (only way)
“Office Hours”: By Appointment (send e-mail)
Website: <http://physics.gmu.edu/~rubinp/courses/407/>
Prerequisites: PHYS 251, 311, 312, 402
Requisites strictly enforced

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 or <http://ds.gmu.edu/> or at 703.993.2474. All academic accommodations must be arranged through that office: <https://ds.gmu.edu/forms/>
- Other relevant student services:
 - Writing Center: <https://writingcenter.gmu.edu/>
 - Counseling and Psychological Services: <https://caps.gmu.edu/>

Course Goals:

1. To fulfill the capstone requirement for the Physics major
 - (physics) knowledge integration
 - knowledge application
 - knowledge reinforcement
2. To demonstrate proficiency in scientific practice
 - experimental design
 - instrumentation
 - data collection
 - data analysis
 - interpretation
 - communication
3. To fulfill the writing-intensive requirement for the Physics major
 - writing instruction
 - instructor feedback
 - writing assignments totaling at least 3500 words

Writing-Intensive Course The Faculty Senate Writing Across the Curriculum Committee approved this course to fulfill the Writing Intensive (“WI”) requirement in physics major. Satisfying this physics major requirement involves completing

1. assigned writing exercises;
2. a ~1,000-word research proposal that has gone through at least one preliminary draft reviewed and commented upon by the instructor;
3. a ~1,000-word technical note that has gone through at least one preliminary draft reviewed and commented upon by the instructor;
4. a ~2,000-word research paper.

Expectations

- Writing [10%]
 1. Exercises (10%)
- Data and Uncertainty Analysis [20%]
 1. Exercises (20%)
- Modeling and Simulation [25%]
 1. Exercises (10%)
 2. Project (15%)
- Communication [3 Papers (2 with drafts); 3 Presentations: 45%]
 1. Research proposal [10% (draft required)]
 - Physics (2%)
 - Experimental design (3%)
 - Writing (5%)
 2. Technical paper [10% (draft required)]
 - Justification and statement of the problem (2%)
 - Description of the solution (3%)
 - Writing (5%)
 3. Research paper [20%]
 - Physics (2%)
 - Experimental design and methods (4%)
 - Data visualization and analysis (including uncertainties) (6%)
 - Writing (8%)
 4. Presentations [5%]
 - (a) Research proposal (1%)
 - (b) Technical talk (1%)
 - (c) Research project (3%)

Grading:

A+=100-93.33	A=93.32-86.67	A-=86.66-80
B+=79.99-73.33	B=73.32-66.67	B-=66.66-60
C+=59.99-53.33	C=53.32-46.67	C-=46.66-40
	D=39.99-20	
	F<20	

Course Activities Note: The University is closed on 7 September, 12 October, and 25 - 29 November. The course will not meet on those dates. However, there may be meeting(s) on Tuesday, 13 October.

1. Orientation: Overviews of course and experimental physics.
2. Data and error analysis: exercises
3. Modeling and simulation: exercises, project
4. Writing: exercises
5. Research proposal: Plan, design, and cost-out (money and time) your research project (see Research Paper, below). **The final draft of the Research Proposal is due by the end of class on Monday, 5 October (tentative). Research proposal presentations will be given on Wednesday, 7 October (tentative).**
6. Technical note: Describe, in detail, a component of your experiment's instrumentation (see Research Paper, below) in particular, some piece of electronics or data acquisition. The description should include a presentation of the problem the component solves, how it solves the problem, a schematic and simulation of the component to predict how it will work, an explanation of how to use the component, and an assessment of how the component solves the problem defined. **The final draft of the technical paper is due on Monday 9 November. Technical presentations will be given on Wednesday, 11 November.**
7. Research paper: Perform, analyze, and report on a classic modern physics experiments. **The Research Paper is due by the end of class on Monday, 30 November. Research presentations will be given on Wednesday, 2 December.**

Note that due dates are firm. **A full-grade deduction will be made for each day (or part thereof, beginning at 17:00 on the due date) a paper is late. No excuses.** Final drafts must be submitted in pdf. Preliminary drafts (of the research proposal and the technical note) are required. Failure to submit a draft results in no credit for the paper. Drafts must be submitted far enough in advance of a final draft due date to allow them to be reviewed and returned, and their comments incorporated into the final draft. Take into account that a review of a rough draft takes between 2 and 4 hours, depending

on the “roughness” of the draft, and thus that no more than two (i.e., one or two) rough drafts can be reviewed in a day. LibreOffice or Word formats are preferred for rough drafts, as comments in such documents can be recorded and embedded.

Religious Holidays Please inform the instructor within the first two weeks of the semester of dates of expected absences or lack of availability due to observances of major religious holidays.

<https://ulife.gmu.edu/religious-holiday-calendar/>

Diversity and Inclusion: George Mason University, the Department of Physics & Astronomy, and the instructor repudiate all manifestations of bigotry, intolerance, and discrimination. Please respect others as you would want them to respect you.

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:

<https://oai.gmu.edu/mason-honor-code/>