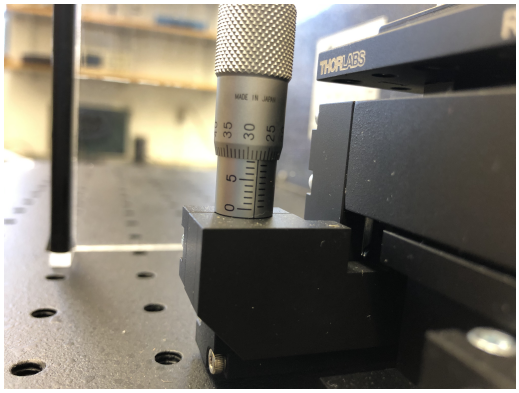
Physics 338 - Advanced Lab

Lafayette College, Spring 2020



Professor

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Office hours: M 3-4pm
Tu 1-4pm

Class meeting times

Lecture: Tu Th 11:00am-12:15pm in HSC 017
Lab: Students work independently

About this course

Physics is an experimentally-based science. Experiments have often paved the way for scientific revolution, and they remain the final arbiter among competing theories. However, experiments are rarely as straightforward as one might believe based on typical textbook descriptions, so it is important for an educated scientist to develop an understanding of, and an appreciation for, reliable, quality research.

In this course, you will perform experiments from a variety of areas of physics, with emphasis on understanding the underlying physics, designing experiments, statistically analyzing observations, and writing reports.

Prerequisites

Physics 218 and Math 264 are prerequisties for this course. Either may be waived with permission from the instructor.

Expectations and workload

The student work in this course is in full compliance with the federal definition of a four credit hour course. The federal course credit rule requires a total of 180 hours (12 hours/week) of student work over an approximately 15-week semester for a full unit (four credit hour) course. See the Registrar's Office web site for the full policy and practice statement (http://registrar.lafayette.edu/additional-resources/cep-course-proposal/)

You should therefore expect to spend about 12 hours/week on this course: 3 hours in lecture, and 9 hours working in the lab, on data analysis, or on your reports.

Course materials

It is recommended that you have access to John R. Taylor's An Introduction to Error Analysis, which you may have from a previous course.

Course Website

I will use moodle to post class handouts and assignments: `http://moodle.lafayette.edu`.

I will use moodle to send email to the class if necessary (e.g. weather delays, assignment clarifications, etc.) so please check your Lafayette email regularly.

Learning Outcomes

After completing this course, you should be able to

- Perform and interpret basic experiments involving magnetic properties of materials,
- Interpret spectroscopic results in terms of fundamental energy levels,
- Use Fourier methods to detect small signals,
- Develop and refine appropriate experimental protocols,
- Estimate uncertainties in measurements, and use those uncertainties properly in experimental analysis, and
- Communicate results in standard journal article form.

Since Phys 338 counts as a writing course under the College's Common Course of Study, you should also be able to

- W2: Identify and employ a range of strategies for discovering, developing, organizing, revising, and editing.
- W3: Identify and apply the discourse conventions of a chosen academic discipline(s) or fields(s) (including conventions of genre, format, citation, structure, and vocabulary).

Grades

Grades on various assignments serve multiple purposes:

- To provide feedback on your performance on given assessments (e.g. formal and informal reports). Your performance on such assessments should reflect your understanding of the material, i.e. the degree to which you have met learning outcomes.
- To provide more immediate incentives for certain behaviors which are beneficial to your learning (e.g. keeping a lab notebook, turning in assignments on time) or to the class as a whole (e.g. participating in peer review).

Thus, your final course grade should reflect a combination of how well you understand the material and how well you complete required tasks. Your final course grade does NOT indicate your value as a person, and also does not determine your future success in life.

Your final course grade will be determined as follows:

Magnetic susceptibility informal report:	10%
ESR informal report	10%
Nuclear informal report	10%
Iodine formal report	20%
Fourier project formal report	20%
Lab notebook	10%
Community engagement component	15%
Colloquium attendance	5%

Detailed description of course components

Lab Notebook:

You are required to keep an accurate and complete log of your work in this course in a laboratory **notebook**. This notebook must contain all the information needed to analyze the experiment, as was the case in your introductory physics course. I will collect the lab notebooks at the end of the semester to check for completion.

Lab Reports:

For three of the experiments, you will submit a brief informal lab report. The report should be typed, though diagrams and calculations may be handwritten, as long as they are legible. These reports will not go through the peer-review and editing process.

For two of the experiments, you will submit a formal lab report in the style of a journal article. This report will have multiple drafts, and you will also use a peer-review process.

Community engagemnet:

This semester, we have the opportunity to work with a local 5th-grade class. The 5th-graders will be preparing for science fair projects during the course of the semester. Stay tuned for more information about this component of the course.

Colloquia:

Throughout the semester, there will be various talks hosted by the Physics Club. These are a valuable opportunity to learn about diverse areas of physics, and attendance at all of them is strongly encouraged. For this course, you should plan on attending at least two talks during the semester; attendance will count for 5% of the total grade.

Attendance:

Regular attendance is expected. It is **your** responsibility to keep advised of all assignments. If you will be absent, you should let me know in advance if possible.

Intellectual honesty

You are expected to abide by the principles of intellectual honesty outlined in the Lafayette Student Handbook (available from `http://studentlife.lafayette.edu`). Here are some guidelines specific to this course:

All work you turn in must be your own. In this course, you will do the labs individually rather than with partners. You are allowed and encouraged to discuss the experiments with your classmates, but make sure that your data and reports are all your own work.

For written reports, it is important that you cite any and all sources that you refer to for information. Inappropriate citation can be referred to the Dean's office as an academic honesty violation, so please ask me if you are unsure of how to cite your sources appropriately!

Inclusion statement

In Physics 338, all students are welcome. Students and professors bring diverse identities to class, and it is my intention that all students feel included in the intellectual community of the classroom.

Unfortunately, the history of science is full of exclusion, so it's important to be explicit about inclusion.

Please contact me if you feel your identity is not being honored in class, if you have a preferred name or pronouns that I am not aware of, you observe religious holidays which conflict with coursework, or if there is something else that I can or need to address. I am still learning, too, and your feedback is important to me.

Accommodation

It is important to me that nothing impedes your ability to do well in this course. If you have any disabilities which you feel may interfere with your ability to succeed and prosper in this class, please contact me to discuss ways of accommodating them.

Mandatory statement for any Lafayette course with a disability policy. In compliance with Lafayette College policy and equal access laws, I am available to discuss appropriate academic accommodations that you may require as a student with a disability. Requests for academic accommodations need to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students must register with the Office of the Dean of the College for disability verification and for determination of reasonable academic accommodations.

Mandatory Moodle privacy statement

Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.

Approximate schedule for Lafayette Spring 2020 PHYS338 course

*subject to change

Wk	Lec #	Date	Topic	Assignment due
1	1	28-Jan	Introduction	
	2	30-Jan	Magnetic susceptibility	
2	3	4-Feb	Linear curve fitting	
	4	6-Feb	Nonlinear curve fitting	
3	5	11-Feb	Electron spin resonance	
	6	13-Feb	ESR cont.	Magnetic susceptibility report
4	7	18-Feb	ESR cont.	
	8	20-Feb	Iodine spectroscopy	
5	9	25-Feb	Iodine, cont.	ESR report
	10	27-Feb	Writing a Journal Article	
6	11	3-Mar	Iodine anlaysis	
	12	5-Mar	Iodine, cont.	Iodine first draft
7	13	10-Mar	Iodine, cont.	
	14	12-Mar	Iodine, cont.	
		17-Mar	**Spring break**	
		19-Mar	**Spring break**	
8	15	24-Mar	Peer review	Iodine second draft
	16	26-Mar	Fourier anlaysis	Peer review reports
9	17	31-Mar	Fourier cont.	
	18	2-Apr	Fourier project intro	Iodine final report
10	19	7-Apr	Fourier project	
	20	9-Apr	Fourier project cont.	
11	21	14-Apr	Fourier project cont.	
	22	16-Apr	Fourier project cont.	
12	23	21-Apr	Fourier project cont.	Fourier project first draft
	24	23-Apr	Peer review	Peer review reports
13	25	28-Apr	Nuclear spectroscopy	
	26	30-Apr	Nuclear, cont.	Fourier project final report
14	27	5-May	Nuclear, cont.	
	28	7-May	Nuclear, cont.	
		Finals week		Nuclear report due