

Physics 427, Fall 2018

“Do a little more of that work which you have confessed to be good, which you feel that society and your most Just Judge rightly demand of you. Cultivate the tree which you have found to bear fruit in your soil. *If you have any experiments you would like to try, try them.* Now’s your chance.”

—Henry David Thoreau, 1850. (emphasis added)

Administrivia

Instructor	Dr. Eric Ayars
Office	PhSc 124
Lecture	Mon, Fri 9AM–10AM, in PhSc 108.
Lab	Tues 11AM–2PM, in PhSc 108.
Individual Q&A	Schedule a weekly 15–minute slot by August 31.
Phone	898-6967
Email	eayars@csuchico.edu
Course Webpage	http://phys.csuchico.edu/ayars/427/



Required Materials

Lab Book	Bound quad-ruled notebook (Required)
Textbooks	<i>An Introduction to Error Analysis, 2nd ed.</i> , John R. Taylor (Required) <i>Building Scientific Apparatus, 4th ed.</i> , Moore, Davis, Coplan, & Greer (Recommended)

Course Structure

There are two aspects of this course. The first and most obvious aspect is to give you some exposure to advanced laboratory experiments, experimental techniques, and uncertainty analysis. The less obvious goal is to hone your skills in the areas of scientific writing and presentation.

Experimental work

This is a laboratory course. There is a lecture section, but you will spend much of your time in the laboratory. There are many experimental options,

covering topics such as chaotic motion, PID experiment control, nuclear safety, vacuum deposition techniques, and others; a more complete list is given on the course webpage. There is also opportunity to create your own experiment and do some truly original work! This can be challenging, but it's highly rewarding.

Written Communication

This is also a writing proficiency course, open only to students who have completed ENGL 130 (or its equivalent) with a grade of C- or higher. The specific goal of the writing proficiency aspect of this course is to provide training and experience in the types of writing used by physicists in the course of their profession. This experience will come in several forms:

- Summary lab reports: “We measured X using method Y and found a value of $Z \pm \zeta$.” These short summaries are the type of paper you would write to a supervisor in an industrial or research lab setting: typically all parties involved are familiar with the research question and the research methods so they can (and should) be lacking exhaustive detail.
- Full lab reports: These should explain in full detail what you did, how you did it, what results you obtained, how you estimated your uncertainty in those results, and where to go next. They should contain enough detail that another of your classmates could reproduce your work using only your lab report as a guide.
- Publications: Similar to full lab reports, but the target audience is the worldwide community of other physicists. In collaboration with Advanced Lab instructors at other universities across the country, I have arranged opportunity for you to submit one of your research papers for publication in the *Journal of Advanced Undergraduate Physics Laboratory Investigations* (JAUPLI). This journal gives you experience in all the aspects of the scientific publication process, including writing cover letters, preparing your document in the proper format, submitting it for peer review, making the changes suggested by reviewers, and re-submitting it for further review. (The only thing lacking is seeing your work in print at the end, since the “journal” doesn't actually exist!)

- Peer review: In addition to your submissions to JAUPLI, you will have multiple opportunities to write peer reviews of work submitted to JAUPLI by students at other universities.

All of this writing must be submitted in L^AT_EX, which is the standard document format for all scientific and mathematical publication.

Oral Communication

Each of you will be called upon to give impromptu “three-minute talks” about your experiment at randomly selected times during the semester. The target of these talks will vary: high-school students, Cardinal Ximinez, Nobel Laureates who just happen to be wandering through the lab,¹ or whomever I manage to round up for the day. You will be graded on how much these visitors think they understand of what you are doing.

In addition, there is a final oral presentation which will be given in the standard APS meeting format you would encounter at a national physics meeting.

Collaboration

Laboratory work generally benefits from collaborative effort, so group work is encouraged in the experiments you perform. Writing in a laboratory setting is frequently a collaborative effort as well, but for the purpose of maximizing the learning process in this course, I ask that your written assignments be an individual effort.

Grading

Your grade will usually be determined by a fairly predictable combination of effort in the lab, participation in lecture, quality of homework and written work, the completeness of your lab book, and your final presentation. But... Having your work published in a reputable, refereed science journal trumps all else and results in an automatic *A*.

¹Yes, this has happened. Always be prepared!