

Ph 77 - Advanced Physics Laboratory

Department of Physics, California Institute of Technology

- Introduction to the Advanced Lab -

Introduction

The *Electronics*, *Optics*, and *Atomic* tracks in Ph77 encompass separate eight-week sets of laboratory and prelab exercises focusing on general areas of experimental physics that have especially broad applications in research and industry. Our overarching goal is for you to gain familiarity with some of the equipment and laboratory techniques you are likely to encounter in a university lab or any laboratory program working with related technologies. Of course, we cannot cover every aspect of experimental physics in this short time, but we try to cover some especially common experimental areas along with a foundational description of measurement techniques and mathematical principles.

The syllabus on Canvas outlines the schedule and provides the needed lab handouts. We tried to design a set of relatively standalone modules that can be done in any order, and we have arranged the tracks to get maximum use out of the equipment we have available.

As the term progresses, you will be asked to create a series of *e-notebooks* that you will submit for grading every two weeks, following the schedule on Canvas. Penalties may apply for late submissions, as described on Canvas, so please be aware of the assignment due dates. You should make a separate e-notebook for each two-week submission, to be submitted as a .pdf file.

You are welcome to use Word, LaTeX, Google docs, or whatever software you wish to create your e-notebooks, and you will likely create additional content using Mathematica or other software tools. Notes made in handwriting are acceptable, but be aware that this is not how professional scientists normally work. All we ask is that each submission is contained in a *single* .pdf document that describes your prelab exercises, lab data, and analysis. Adobe Acrobat DC (free from Caltech IMSS) can combine multiple .pdf files into a single file for you to submit via Canvas. Please see the supplementary document *eNotebookExample.pdf* (available on Canvas) for tips on creating e-notebooks in Ph77.

While you are welcome to work with a lab partner (and seek help from others), please prepare your own .pdf submission. Specifically, do **not** make a single, joint submission with your lab partner. Of course, you may use some material created with your lab partner, but please note the extent of your collaborations within your submissions. Your grades will reflect the work done on your prelab problems and lab exercises together with the overall quality of your written presentation.

The Ph77 handouts are designed somewhat like software tutorials – you start with the easy stuff, take it step by step, and document progress as you go. The goal is to learn a set of practical experimental skills by using them in the lab and analyzing their underlying physical principles. This kind of learn-by-doing approach works well in the software realm, and it seems to be an especially efficient approach for learning laboratory techniques as well. Depending on your career ambitions, the skills you acquire in Ph77 may be useful in ways that you cannot foresee at this time. It is difficult to predict where your career path will lead you, but past experiences show that it is often useful to have some hands-on experience working in a laboratory environment.