

Syllabus

Lab sessions: Science Center 104W, 2:00 – 5:00 PM
Section M, Monday; Section T, Tuesday

We start the week of January 26.

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Office Hours: Tuesday 10:30 – 11:30 AM, Friday 9 – 10 AM
Or by appointment

Grading: Your lab grade comprises 25% of your Physics 110 course grade. It will be determined 100% by your weekly lab scores.

As noted below, lab is a collaborative activity. We begin each lab by discussing, as a group, the lab's "Preliminary Questions," which are posted beforehand on Blackboard. These review the concepts needed to understand each day's lab. We expect students to review these preliminary questions beforehand, and to enter lab prepared for pre-lab discussion. Students then complete their lab work in teams of 2 to 4, with each team turning in a joint lab report, for which they receive a common grade (on a 100 point scale). We expect each lab partner to participate fully in the measurements, analysis, and writing of the lab. Should our expectations be disappointed – should students begin entering lab unprepared, or shirking their full lab responsibilities – we reserve the right to change our grading scheme, to introduce individual grades for pre-lab discussion and post-lab analysis.

Lab Format: Each lab has a standard format:

Purpose: Gives our goals for what you will learn, and what skills you should demonstrate mastery of, in this lab.

Preliminary Questions: Physics 111 lab places a different emphasis on topics than does the lecture, since for physics 111 topics, the richness of theoretical analysis and of empirical measurement diverge. Physics 111 lectures cover a broad scope of phenomena, and develop sophisticated mathematical tools to analyze them. Physics 111 lab, instead, emphasizes building deeper practical experience and physical intuition for the segments of the course (namely electronics and optics) that are experientially alien to many students. These set a foundation of intuitive familiarity, and ready visualization of the physical objects of study. They also build practical skill with physical systems endemic to modern technology and to future science lab work.

Because of this divergence, Physics 111 lecture and lab do not run 'in synch'; instead, the latter half of Physics 111 lab introduces optics material not yet covered in lecture. In this section of the course, short background summaries of the relevant material will be posted beforehand on Blackboard, along with the usual preliminary questions for lab. Students should read these background summaries before lab and, as always, consider the lab's preliminary questions beforehand, in preparation for pre-lab discussion. However, optics labs will begin with a short tutorial on this new material; we'll work through the preliminary questions together without the expectation | as in the other portions of the course – that students have mastered them before lab. Preliminary questions are always for discussion only; you needn't write up or turn in your answers.

Equipment: A list of the equipment necessary to complete the lab. All equipment will be set out in back of the lab; your first job as a team will be to gather everything on this equipment list and bring it to your work table.

Procedure: This is the central part of the lab: step-by-step instructions of what you are to do, how you are to do it, and what data and analysis you need to record. **Read these instructions either in their entirety before you start the lab.**

The steps are numbered so that for every numbered step, with number 1 or greater, you need to record some bit of data or respond to some question. Your data, calculations, and responses will go in your Data & Analysis Table, the last page of the lab. Fill these in as you go, before advancing to the next step; however, don't just rely on the Data & Analysis Table to guess what to do or write next. Always read the next instruction first in the Procedure section!

Your last item in Procedures will always tell you exactly what materials you need to staple together and hand in before leaving lab.

Data & Analysis Table: This will always appear as the last page(s) of the lab. Complete only one copy of this, as a team. Always show correct units for any physical quantity, and proper significant figures (keeping several digits more than significant for intermediate quantities). In each "how obtained" row, you should show whether a quantity was directly measured, estimated, or calculated; if calculated, you should state the formula or method used (such as computer linear regression, or a stated graph). In an Excel spreadsheet, you should show both the algebraic formula used (in terms of your variable names) and the Excel formula you used to implement that formula. Your data tables' "how obtained" row, for any calculated quantity, should be completely prescriptive: a reader of your lab report should know exactly how you found each quantity, without reference to the lab instructions, and without any unstated unit conversions. For any "derivation," you must show your reasoning completely, with each logical step clear and correct, and proper units in all calculations. For any uncertainty, tell how you obtained it: by estimating uncertainty of a direct measurement, by propagating errors (show), or as a standard deviation. For evaluative questions, answer in complete sentences and support your conclusions; don't just conclude that your result agrees or disagrees with predictions, but say on what basis you determine (dis)agreement. If you disagree with a prediction or another measurement in your lab, you must acknowledge the disagreement and suggest which systematic errors or invalid assumptions in your experiment could plausibly explain the discrepancy you observe. (Your explanation cannot be a nebulous acknowledgment of 'human error', but show either 1) how experimental uncertainties are larger than you calculated, or 2) bias pushes the measurement in the direction of your error.)

For failing to meet any of these expectations, in any Data & Analysis Table entry or question, in any lab throughout the semester, YOU WILL LOSE POINTS. Significant points for the lab are attributed to significant figures, units, and clear, well-thought out explanations.

For each lab, you submit your team's Data & Analysis Table, and any supporting graphs or output, before leaving lab.

Missed labs and Make-ups: Lab should be missed only by prior agreement, for a College-excusable reason; and made up in another MTTh weekly session for that lab when possible. Lab missed without prior agreement should involve truly dire emergency or illness, and be made up (if excused) in another MTTh weekly session for that lab if possible. When the emergency, illness, or College-excusable conflict precludes making up the lab, we will simply exempt you from the affected lab – provided the number of labs missed over the course of the semester remains 2 or less.

Honor Code: Lab is a cooperative activity, yet you are individually responsible for your learning and your results. You are honor bound to participate in, and personally understand, all procedures and calculations completed by your lab team; to assume the full variety of roles during each lab (not being designated measurer, scribe, assembler, or calculator, but rotating through each role); to discuss all evaluative questions and compose your team responses together; and to record measurements and results honestly.

Web Resources: All lab handouts are available online, on blackboard.

Calendar

We will complete the following labs:

Week 1 (1/26, 1/27)	Measuring Electric Potential and Field
Week 2 (2/2, 2/3)	Resistance: Ohmic & Non-ohmic Devices
Week 3 (2/9, 2/10)	Resistance in DC circuits: Series, Parallel, Kirchoff
Week 4 (2/16, 2/17)	Capacitors and RC Circuits
Week 5 (2/23, 2/24)	Magnetic Fields: Slinky and Earth
Week 6 (3/2, 3/3)	AC Circuits: Reactance of C and L
Week of (3/9, 3/10)	SPRING BREAK: No lab
Week 7 (3/16, 3/17)	LRC Circuits: Phasors and Resonance
Week 8 (3/23, 3/24)	Geometric Optics: Reflection and Refraction
Week 9 (3/30, 3/31)	Geometric Optics: Lenses
Week 10 (4/6, 4/7)	Physical Optics: Interference and Diffraction
Week 11 (4/13, 4/14)	Polarization
Week of (4/20, 4/21)	Sound Waves