PHYS375 Fall 2024 Secs. 0101 0103
Experimental Physics III: Electromagnetic Waves, Optics and Modern Physics

Lecture:	MW 14:00 – 14:50**;** Toll (PHY) Rm 1402
Lab	MTu 15:00 – 17:50; Toll (PHY) Rm 3115
Instructor:	Prof. Wendell T. Hill, III
Email:	via ELMS (https://elms.umd.edu)
Office:	IPST Bldg (#085) Rm 2120
Office Hours:	Wednesdays after lecture and by appointment
Prerequisite:	PHYS273 and PHYS276
Credits:	3
Grading Method:	Regular, Pass-Fail, Audit
Course Web:	via ELMS (https://elms.umd.edu); the syllabus, schedule, announcements, time-sensitive information and grades will be posted, and where you will upload your all work to be graded.

TAs

TA	Email	Office	Office Hr
Samyak Gothi (0101)	sgothi@umd.edu	TBD	TBD
Vennela Vuruputuri (0103)	vennela@umd.edu	TBD	TBD

Learning Outcomes: PHYS375 is a three (3) credit course, with two 50 min lectures and a 3-hr, hands-on lab each week. The primary objective is to learn physics through quantitative experimental investigation. Students will learn about the properties of light, and how it is measured, controlled and used to study other phenomenon in nature. The course will involve employing computer-based data-acquisition, instrumentation control and data analysis, which will require MATLAB scripts to be written. Students will also use MATLAB to create publication-worthy plots of data. (No prior knowledge of MATLAB is required; learning MATLAB will be part of the course.) As this course requires careful measurements to be made, which always involves uncertainties, students will learn how to write MATLAB scripts for curve fitting and statistical assessment (e.g., χ^2 analysis) of data and how to identify and handle systematic and correlated uncertainties. There are five experiments covering the following fundamental subjects in optics:

- Introductory lab on controlling experiments with MATLAB and the properties of laser beams;
- Reflection and refraction of light from flat surfaces, and the index of refraction;
- Refraction of light through curved surfaces, lenses and measuring focal lengths;
- Polarization of light, polarizers and optical activity;
- Interference and interferometers; and
- Diffraction.

Lectures will complement the lab experiments with a theoretical foundation of the subjects.

Course components:

Lectures – You are responsible for all information presented in the weekly lectures. While Lecture Notes will be posted on ELMS, these outlines will not generally be sufficient to grasp the essences of the material needed to do the homework and perform the labs. It is highly recommended that you attend lecture. If you miss a lecture, you will need to get lecture notes from a classmate. Due to my travel schedule some lectures will either be prerecorded, presented online or given by a guest lecturer. Pop quizzes will be given a few times in lecture; because these are pop quizzes and intended to increase your knowledge and assess attendance, there will be no makeups unless you have a valid, university-endorsed

reason and an appropriate note explaining your absence. I will try to avoid major holidays for these quizzes. Let me know in advance if you will have an excused absence and I will try to accommodate you.

Lab – Lab activities are planned each week except the week except as indicated in the schedule; some weeks will be reserved for makeups. As mentioned above, you will perform six (6) experiments including the introductory experiment (Exp 0). Please download the manual for each experiment from ELMS. Here is a picture of the ELMS' assignment page showing where to retrieve the manual and submit completed components:

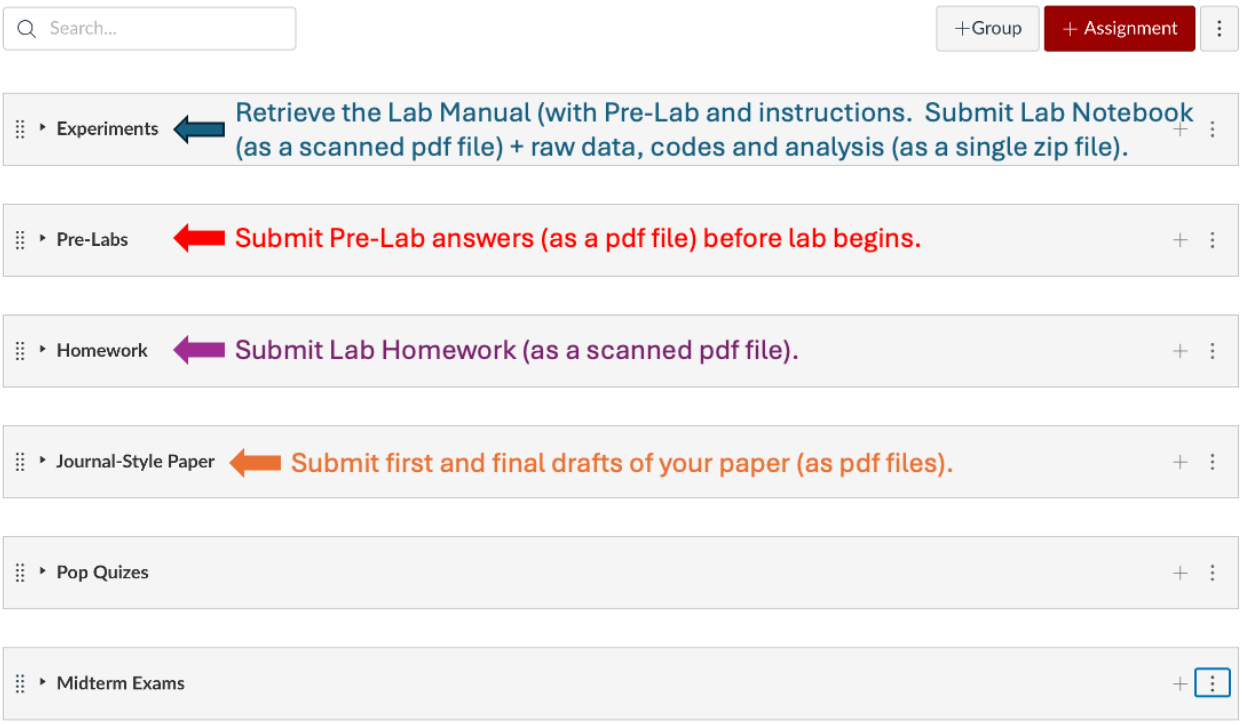


Fig. 1: ELMS Assignment page.

You will have two weeks to complete each experiment. The downloaded material will consist of PreLab questions for Exps. 1-5 (no PreLab for Exp 0); PreLab questions are intended to help you plan to do your experiment and understand the material, what to measure and questions to be addressed during the analysis. **Answers to the PreLab questions are due before each lab begin; no credit with be earned for pre-lab answers submitted after the lab period begins.** Some PreLab questions may request you to generate short MATLAB codes and output, while other will require you to solve problems or derive expressions on paper. Submit your codes and output directly. **You do not have to type your answers**; it is acceptable to submit **pdf** images of your hand-written solutions – **they must be legible to receive full credit, however**. Submit your PreLab answers/solutions as a **.pdf** file to ELMS under the "PreLab" tab as shown in Fig. 1. Please use the following this naming convention for your file:

LastName_FirstName_PreLab_Exp#.pdf

After each experiment you must create a Lab Notebook, consisting of your notes of what you did, the setup (photo), the steps you took, salient and representative plots (not necessarily the raw scans, but replots of scans in "normal" units (typically SI units) to show the features you studied, experimental analysis, and your conclusions; all requested plots and answers to questions are to be included as well. Your Lab Notebook should be divided into clearly labeled sections with section headers that correspond to the various parts of the experiment (i.e., Part A.1, Part A.2, etc.). When propagating errors, please include the formulae you derive. When answering requested questions, please state verbatim the

question you are answering, and use complete, grammatically correct sentences. The notes can be handwritten (must be legible) or typed. You should include everything necessary to repeat the experiments from these notes alone a year from now without relying on your memory (see Example Lab Notebook). In addition, you must collect all you supporting material should be organized into folders – all raw data, MATLAB scripts used to perform the experiment and analyze your data and any useful data files generated during the analysis. The Lab Notebook and support material must be submitted to ELMS for grading before the next experiment begins in two parts: (i) a **.pdf** file (Lab Notebook) and (ii) a **.zip** folder file (support material). The **.zip folder file** should not include the **.pdf file** as this would prevent the use of SpeedGrader in ELMS! Please use the following this naming convention for your files:

LastName_FirstName_Notebook_Exp#.pdf
LastName_FirstName_ZipFolder_Exp#.zip

Homework – There will be approximately five (5) homework assignments that you will download from ELMS from the "Homework" Assignment tab. Photos of the handwritten solutions are acceptable but must be legible. The assignments will be done on paper and submitted as a **.pdf** file using the same naming format given above:

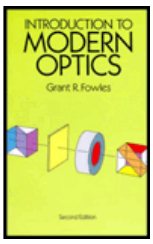
LastName_FirstName_Homework_Assig#.pdf

Paper– You will write a paper on specific parts of Exp 2. This should be written in the form of a journal-style paper describing your investigation of laser light traversing lenses. You are required to turn in first and final drafts of your paper (see schedule for due dates). More information and examples of what to write will be given near the time you perform Exp 2. You will receive detailed comments on your first draft. If you choose not to turn in a first draft, the maximum credit you will receive on you paper will be 50%!

Required Course Material:

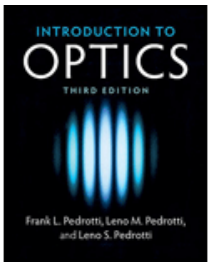
Lab Manual – Download from ELMS.

Recommended Texts:



Introduction to Modern Optics
Grant R. Fowles
Dover Publications

ISBN10: 0486659577
ISBN13: 9780486659572



Introduction to Optics
Frank L. Pedrotti, Leno M. Pedrotti, Leno S. Pedrotti
Cambridge University Press

ISBN10: 1108428266
ISBN13: 9781108428262

Grade Budget on Assessed Material:

PreLab (10%) – The pre-lab questions are due biweekly at 3:00 PM, before the start of each new experiment. They are to be submitted into the **PreLab Assignment** section. **Late pre-lab submissions will not be accepted.**

Lab Notebooks & support data (30%) – The **.pdf** and **.zip files** are due biweekly at 3 PM, before the start of next experiment. **If either file is submitted late, a 3% penalty per day starting at 3:01 PM will be assessed.**

Homework (20%) – Homework assignments are due approximately every two weeks on Fridays at 11:59 PM; see schedule for specific dates. **Late submission will be assessed a 10% penalty per day.**

Paper (20%) – This will be a journal-style paper (i.e., Physical Review #) based on results from Exp 2. Specifically, the subject of the paper will be measuring the focal lengths of a converging and diverging lenses. The paper must include setting up a telescope to create a nearly parallel beam and determining the uncertainty with which you made your measurements. See schedule for due dates.

Exams (20%) – There will be two in-class exams – the first just after spring break and the second the last lecture period.

Attendance, Religious Observances, and University Closures:

Your TA and I will be mindful of who attends lectures, labs and office hours. Participating in these class elements will be beneficial not only to help you learn the material, consistent attendance will be view favorably in borderline cases. The effort you put forth throughout the course will have a positive influence on grade decisions in borderline cases. Your final grade will reflect you being consistently present and on time.

If you have to miss a lecture deadline (e.g., an exam) for a religious observance, illness or other legitimate reason, please notify me as soon as possible, preferably in advance so a makeup or other arrangements can be arranged.

URL for UMD policy on excused absence:

https://president.umd.edu/administration/policies/section-v-student-affairs/v-100g

If the university is closed due to inclement weather or some emergency situation on an exam day at the time of the exam, the exam will be given at the next regularly scheduled meeting of the class, e.g., if the university is closed on Friday at 15:00, the exam will be given the following Monday, assuming the campus is open on Monday. Check ELMS for updates and any deviations from this general rule.

Academic Integrity:

Learning to solve physics problems can be challenging and tedious. Often students find it beneficial to work with a partner or in small groups. Physics is a community effort so working together is encouraged and authorized, unless specifically stated otherwise. That said, it is crucial that each of you create and submit your own work. Always write your assignments in your own words. In taking this course, it is assumed that you have agreed to the university honor pledge:

I pledge on my honor that I have not given or received
any unauthorized assistance on this assessment.

For more information on the university's code of academic integrity, please visit the following URL:

https://president.umd.edu/sites/president.umd.edu/files/files/documents/policies/III-100A.pdf

Other Campus Policies:

http://www.ugst.umd.edu/courserelatedpolicies.html

Accessibility & Disability Service:

Accommodations will be provided to enable students with disabilities to participate fully in the course. Please discuss any needs with me at the beginning of the semester so that appropriate arrangements can be made. Students who are registered with ADS and plan to take exams at their facilities should provide the pertinent authorization forms (electronic format is fine) at least one week prior to each exam.

https://www.counseling.umd.edu/ads/

Tutoring:

Society of Physics Students – https://omse.umd.edu/tutoring/.
Office of Multi-Ethnic Student Education – https://forms.gle/x7ms6zCHxtWpFnrq7.