

Physics 284 Modern Physics Laboratory

Fall 2015

Tuesdays, 11:00 – 1:40 PM , Faraday 121A

Instructor:

Professor George Coutrakon,

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Web Site

<http://webcourses.niu.edu> (Blackboard course page)

Grades and class materials such as lab instructions will be placed on the Blackboard course page.

Lab Instructions

Instructions for all the labs are available on the web and should be downloaded and read before starting the lab.

Grading

The laboratory grade will be based on 6 experiments and 7 equally weighted lab reports. The 7th report uses the results of 3 of the experiments. There are six standard labs and one report that combines data from three of them to determine fundamental constants, h , e , and m_e . The reports should be approximately 4-6 pages in length (including figures and data tables). Limit the theory discussion to $\frac{1}{2}$ page in the introduction. General guidelines for how to complete lab reports and a breakdown of how lab reports will be graded are provided on the class web page. Each lab instruction sheet will also have some specific guidelines. **Lab reports are due one week after the completion of the lab.** There will be 2 weeks allotted for each experiment. Reports submitted late without prior permission will be marked down 10% per week and will not be accepted more than 2 weeks after the due date or 1 week before the beginning of final exam week, whichever occurs sooner. Pre-lab questions count for 10% of the grade and should be turned in with lab report.

Lab Notebooks

All students are expected to keep a lab notebook. Since students will work in teams of two, or occasional three, they should either purchase a lab notebook with carbon paper, or make photocopies at the end of class, so that each student retains a copy of the notes. A copy of the relevant pages of the lab notebook should be attached to the back of each lab

report. It is each student's responsibility to make sure that they obtain a copy of all the notes from each lab.

Calendar:

Aug. 25	Introduction to 1 st two Labs, lab writing and error analysis
Sept. 1	Photo-electric effect and spectrometer Labs with Na and H lamps
Sept. 8	Photo-electric effect and spectrometer Labs
15	Photo-electric effect and spectrometer Labs, 1st lab due
22	Photo-electric effect and spectrometer Labs
29	E/M and Michaelson Morley Labs, lab lecture, 2nd lab due
Oct. 6	E/M and Michaelson Morley Labs
13	E/M and Michaelson Morley Labs, 3rd lab due
20	E/M and Michaelson Morley Labs, Intro. Talk on rad. lab
27	Lab lectures on BB radiation and radioactivity lab, 4th lab due, start exp. 5 and 6
Nov. 3	Black Body Radiation and Radioactive Isotope Labs, report due on e,m and h
10	Black Body Radiation and Radioactive Isotope Labs,
17	Black Body Radiation and Radioactive Isotope Labs, 5th lab report due
24	Black Body and Radioactive Isotope Labs, only 6th report will be accepted after 11-24
Dec. 2	6th lab report due

Optics Labs

Michaelson Interferometer
Spectrometer with diffraction Grating
Photoelectric Effect

Atomic and Nuclear Labs

Black Body Radiation
Electron charge to mass ratio
Radioactive Decay

Some Independent Project Lab Ideas (feel free to come up with your own)

- a) Comparison of the spectrum of a fluorescent light bulb with an incandescent light bulb using the spectrometer.
- b) Electronic measurement of light intensity using a photodiode.
- c) Observation of the Meissner effect in a superconductor.
- d) Automation of an experiment using the Labview software and an interface board.
- e) Observation of magnetic domains.
- f) Measurement of the spectrum of a star using the observatory.
- g) Measurement of the flux or energy spectrum of cosmic rays.
- h) Measurement of the spectrum of beta particles.
- i) Observation of alpha-decay tracks in a cloud chamber.
- j) Measurement of Compton scattering of x-rays.
- k) Measurement of electron diffraction with electron microscope. (Need to obtain permission from Dr. Ito)
- l) Try to use a Michelson interferometer to measure the width of the Hg line. Compare this with an estimation based on a diffractometer.
- m) Put together measurements from the e/m experiment, the spectrum of hydrogen with the spectrometer (which provides a value of the Rydberg constant) and the h/e experiment (photoelectric effect) to obtain values for m , e and h independently instead of just their ratios.
- n) Compare the accuracy of the spectrometer used in the spectrometer lab with a newer model spectrometer the department is thinking of buying to replace them. See if the new one is better or worse.