# Physics 284 Modern Physics Laboratory

## Spring 2015

Wednesdays, 12:00 – 2:50 PM , Faraday 121A

**Instructor:**
Professor George Coutrakon,
Office: Faraday Hall 218 (up one flight of stairs and turn right)
Phone: (815) 753-6481
Office hours: Tuesdays and Thursdays, 3:45 – 5:00 PM
email: gcoutrakon@niu.edu

**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 in before starting the lab.

**Grading**
The laboratory grade will be based on 7 equally weighted lab reports. 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 ½ 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.** Reports submitted late without prior permission will be marked down 10% per week and will not be accepted more than 3 weeks after the due date or 1 week before the beginning of final exam week, whichever occurs sooner.

**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:**

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| Jan. 14 | Introduction to 1st two Labs, lab writing and error analysis |
| 21 | Photo-electric effect and spectrometer Labs |
| 28 | Photo-electric effect and spectrometer Labs |
| Feb. 4 | Photo-electric effect and spectrometer Labs |
| 11 | Photo-electric effect and spectrometer Labs |
| 18 | E/M and Michaelson Morley Labs, Introduction lecture |
| 25 | E/M and Michaelson Morley Labs |
| Mar. 4 | E/M and Michaelson Morley Labs |
| 11 | Spring Break |
| 18 | E/M and Michaelson Morley Labs, Intro. Talk on rad. lab |
| 25 | Frank Hertz and Radioactive Isotope Labs, Radiation Safety talk by RSO |
| April 1 | Frank Hertz and Radioactive Isotope Labs |
| 8 | Frank Hertz and Radioactive Isotope Labs |
| 15 | Frank Hertz and Radioactive Isotope Labs |
| 22 | |

**Optics Labs**
Michaelson Interferometer
Spectrometer with diffraction Grating
Photoelectric Effect

**Atomic and Nuclear Labs**
Frank-Hertz Experiment
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) Measurment 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 affect) 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.