**Intermediate Experimental Physics II: UA 74 (Spring 2017)**

**Instructor:** Prof. Andrew Kent  
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Office hours: Monday 5-6:30 PM and by appointment

**Pre or Co-requisite:** Intermediate Experimental Physics I (PHYS-UA 73).  
**Lecture:** Monday, 3:30-4:45 PM, Meyer Hall, Room 122

**Lab Instructor:** David Mykytyn, E-mail: dwm261@nyu.edu  
Office room 537, Meyer Hall  
Office hours: TBD

**Lab Sections:**  
2. Tuesday 3:30 PM-6:30 PM  
3. Thursday 9:15 AM – 12:15 PM

*Labs begin the week of January 30, 2016.*

**Website:** [http://classes.nyu.edu/](http://classes.nyu.edu/)

**Course Description**  
This is the second of two intermediate-level laboratory courses that covers topics in modern physics and experimental techniques. Classic experiments that illustrate fundamental physics principles are conducted and analyzed. In addition, a goal is to further knowledge of data analysis methods introduced in Introductory Experimental Physics I (PHYS-UA 71), II (PHYS-UA 72) and Intermediate Experimental Physics I (PHYS-UA 73).

**Texts**

- Descriptions of the labs: [http://physics.nyu.edu/~physlab/Lab_Main](http://physics.nyu.edu/~physlab/Lab_Main).
- Laboratory Notebook.
- Introduction to Python for Science, D. Pine, can be found at [http://physics.nyu.edu/~physlab/Lab_Main/PythonMan.pdf](http://physics.nyu.edu/~physlab/Lab_Main/PythonMan.pdf)

**Additional texts (optional)**


**Grading**

The relative weights of components of the course grade are:

- Laboratory Reports* 60%
- Lab activities (quizzes and participation): 10%
- Midterm 10%
- Final Exam 20%
- Total: 100%
Grading of lab reports: 10 pts for each lab report will be as follows:

- 2 points for handing in the lab on time, completing all portions of the lab report.
- 3 points for an explanation of the experiment and the physics underlying it. The 3 point maximum will only be given for reports that go beyond paraphrasing what is in the lab manual.
- 5 points for the analysis of the data, including uncertainties, sources of error and propagation of both. If your data is far from what is expected you should try to understand why. At the very least, you should perform multiple runs of the experiment to determine the experimental uncertainties and to try to understand whether there is something systemically incorrect in the experiment (i.e. uncontrolled experimental parameters, poor alignment of a detector or a laser, etc.) Experimental results that are far from expectations and without any possible explanation or justification will be heavily marked down.
- Up to a 2 point bonus will be awarded for conducting and analyzing an original experiment.

Lab reports are due 1 week after you complete the experiment.

Course Schedule

- The first lecture will be on Monday, January 23\textsuperscript{th}
- The first laboratory meeting will be the week of January 30\textsuperscript{th}

Lab Schedule

There is just one experimental setup of each lab. So students rotate through the laboratories and the lecture is not (necessarily) in the order of the labs.

Experiments:
- Frank Hertz
- Photoelectric effect
- Michelson Interferometer
- Electron Spin Resonance
- Nuclear Spectroscopy
- Half-life
- Two slit interference
- Compton Scattering
- X-ray lab Bragg Diffraction
- Magnetic torque
- Seismometer
- Speed of light

Students will do 8 labs. The required labs are in bold: Frank Hertz, Michelson Interferometer, Electron Spin Resonance, X-ray lab Bragg Diffraction and Speed of light. Students conduct 3 additional labs chosen from the above list.

Notes:
- The lab experiments are all set up during the semester
- Two students do the experiments together and share data
- Everyone turns in their own lab report indicating their lab partners
- There is no textbook for the course. Information will be provided in the lab manuals, in lecture, on the Classes website and in handouts.
Lecture Topics:

1. Introduction to the course and labs
2. Blackbody radiation, Rayleigh-Jeans law, the ultraviolet catastrophe
3. Photons, Planck’s law, the Cosmic Microwave Background (CMB) radiation
4. Photoelectric effect, XPS and ARPES
5. Curve fitting
6. Spin resonance and magnetic resonance imaging
7. Radioactivity, doses and physiological effect
8. Crystal lattices and x-ray diffraction
9. Speed of light and the Michelson-Morley experiment
10. Bolometers, resistance, Wheatstone bridge, voltage/current measurements and digital electronics
11. Electronic states in metals, semiconductors and insulators
12. Semiconductors: doping, p-n junctions, detecting light (photons) light emitting diodes, transistors
13. Review