

Advanced Physics Laboratory (PH491)

Fall 2002

Pre-requisite: 15 hours of physics including PH 255.

Instructor:

Andreas Piepke (202A Gallalee Hall; Tel.: 348-6066; Email: andreas@bama.ua.edu)

Office hours:

Tuesday 9:30-11:30 am. I have an open door policy feel free to come by if you want to talk to me outside my office hours.

Time and place:

The class will take place in room 321 Gallalee Hall Tuesday and Thursday 2:00 to 4:50 pm.

Textbook:

W.R. Leo, "Techniques for Nuclear and Particle Physics Experiments", Springer Verlag, ISBN 0-387-57280-5, second edition. This is a good source of information.

Additional information is available on the Physics 491 web site:

http://bama.ua.edu/~andreas/phys491_2002.html.

Attendance:

Each student has to be present at the scheduled lab.

Course Requirements:

This is a **W**-designated course. In order to receive a passing grade writing proficiency is required.

Writing itself will be graded and commented upon and become part of the assigned grade. A student who does not write with the skill normally required of an upper division student in the discipline will not be given a passing grade, no matter how well the student performs other course requirements. I am willing to instruct you by allowing revisions to you writing assignments. You may seek help from the Writing Center with regard to your writing.

You are expected to hand in at least four written reports on the experiments performed. One of these assignments will be graded and returned by mid-term.

Safety rules:

Each student will read and sign the “Safety Rules for the Advanced Physics Lab”.

Course Content:

Goal of this class is to work on and understand complex experimental problems. The students will perform and analyze experiments in modern physics. In the first half of the class the students will work on pre-prepared experiments:

- Gamma Ray Spectroscopy and Counting Statistics
- Decay of Radon Daughters sampled from Air
- Muon Decay
- Moessbauer Effect

Lab manuals will be provided for these experiments and students will be required to prepare written lab reports detailing their findings.

In the second half of the course the class will work on setting up a new experiment. We will try to set up a beta spectrometer to compare the energy-momentum relation given by special relativity to that derived from Newtonian mechanics. Like in a real research project we will have a budget and access to the department workshop to buy or build components of the experiment. Some of the measurements will be performed in my lab (Gallalee Hall, room 101).

We will hold group meetings on Tuesday during the lab hours to review the progress of the project. Every student is expected to give a 30 to 45 min seminar to the group on his/her subject in the project. Once finished the student/team is expected to turn in a lab report describing their work. No elaborate write-ups are required. However, because of the availability of computers in the Physics Computer Lab (room 332) use of computer graphics and a word processor is encouraged. Due date for the reports is one week

after finishing the work on the respective aspect of the experiment. There will be no final exam in this class. The group is expected to produce a written “Experiment Description” after conclusion of the work. This should allow future classes to operate the new experiment.

The Lab Report

All work done in the lab must be documented in a notebook such as e.g. National 43-648. Don't use scratch paper. Do your work in ink and date every page. Graphs may be done on separate pages or may be computer generated (preferred). Tape those graphs into your notebook. Whenever you are describing your work **quantify**. This is Physics, a quantitative science. Include everything you do into your lab book. Draw circuits and apparatus setups. Title graphs and label axes including units. Include units on **all** numerical values, they are meaningless otherwise. All numerical results obtained from an equation must be preceded by the written equation followed by the first set of data (with units!), substituted into the equation. The rest of the results may be presented in tabulated form.

Each measured number must be given with an *error*. Show in your write up how you propagate the error. This is particularly important.

Use scientific notation e.g. $(3.4 \pm 0.2) \cdot 10^{-4}$ and **metric units** only. Estimate preliminary results while still in the lab.

As in any scientific paper the write up must have a short summary at the end.

Grading:

Letter grades will be assigned to each student. They will be based 1/3 on the progress reports, 1/3 on the seminar given and 1/3 on the overall lab performance as judged by me. I reserve the right to lower the grades for late reports. To receive a passing grade the student will need the ability to describe the work done, in writing, in coherent logical and careful edited prose. Summary listings and collections of tables are not acceptable in a course with a **W** designation.