

PHY 222: Investigating the Universe
Spring 2017

“It is paradoxical that many educators and parents still differentiate between a time for learning and a time for play without seeing the vital connection between them.” - Leo Buscaglia

Time: Tues./Thur. 3:30 pm - 4:20 pm, S281

Instructor: Dr. Jon M. Saken
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Office Hours: Tues./Thurs. 2:00 pm - 3:30 pm
Wed. 10:00 am - 12:00 pm

Final Exam: Tues., May 2, 12:45 pm - 2:45 pm

Catalog Description: (*2 hours*) A creative laboratory course designed to give students an opportunity to work with modern research equipment, with ample time to conduct experiments and/or investigate phenomenae of their choosing.

Fuller Course Description:

PHY 222 is a pure lab course. You will spend almost all of your time working with equipment that includes some of the most important tools of modern scientific research. Experimental equipment will vary somewhat year-to-year, depending on student interest and equipment availability. Some of the typical topics include particle accelerators, experiments with holograms, detecting and observing subatomic particles, and observing extra-solar planets.

Although plenty of suggestions for experiments and investigations will be provided via handouts for each set of equipment, you will be encouraged to deviate as far as you want from these suggestions to try out your own ideas or investigate the phenomenae you find most intriguing. Many more investigations are possible with the available equipment and creativity is strongly encouraged.

Every few weeks we will meet as a group to share our results and ideas, and discuss possible next steps, much as you would in any research collaboration. Building on the ideas of others is also strongly encouraged. Therefore, by taking this lab, you will have an opportunity to experience what it is like to conduct authentic scientific research.

Grading:

A	90 - 100
B	80 - 89
C	70 - 79
D	60 - 69
F	0 - 59

Evaluation:

Presentations	40%
Lab Reports	40%
Journal	20%

Presentations: At the end of each lab and in conjunction with your lab partner(s), you will prepare a brief (8-10 minute) presentation for the class on your experiment and results. Your presentation should include

- the principles behind the experiment,
- the equipment you used,
- your procedure - how you conducted the experiment,
- your data,
- your results/conclusions,
- what else you might want to do if you were to continue the experiment and/or what other related experiments you might wish to do.

In addition, you will be asked to briefly discuss how your experiment relates to current scientific research, how similar experiments are conducted by other investigators, what questions are being explored, etc. The idea is to put your experiment in context with the broader scientific community, and help your peers see the connection to other areas of research.

The first presentation will be considered a “practice” or “warm-up” presentation. Although you will receive a score and considerable feedback, it will not be counted towards your final grade.

A Note on the Presentations - Don't Panic! I understand that, for many people, getting up in front of an audience is extremely uncomfortable, to put it mildly. However, at some point almost all of us are required to do so. Therefore it can be very helpful to get some practice in a low-stakes, low-pressure environment. You are not expected to be an expert speaker and will be presenting in front of a very friendly and very understanding audience. Plenty of time will be available for discussions afterwards, so you will have an opportunity to explain any points that you feel might not have come out the way you wished. Also remember that the first presentation will be considered practice. So try to relax and have some fun with your presentation.

Lab Reports: One of the purposes of this class is to introduce you to formal, technical writing. Therefore, for each lab you will turn in a formal write-up of your work. It will cover pretty much the same information included in your presentation, except that in this case the report will be exclusively your own work and you will be able to include additional information (such as raw data, detailed analysis, etc.) that may not have made it into your presentation.

The lab reports should not be too long. Think of them as similar to a “Letters”-style academic paper, where you only have a few pages to make your point. Like the presentations, the first one will be for practice.

Journal: Whatever type of research you engage in, a proper lab journal is a critical part of your project. It is a detailed record of every step of your project that would allow you, or anyone else, to verify your results, troubleshoot problems, find errors, or extend your research.

Because learning to keep a lab journal is such an important skill for any researcher, we will make it a priority in this course. Keeping a good journal is not hard, so long as you develop the habit of using your journal all the time. So use it. All the time.

Detailed guidelines for keeping a lab journal will be available the first day of class, along with a scoring rubric.

University Policies:

By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to <http://www.marshall.edu/academic-affairs/policies/>.

Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

If you must miss a class contact me immediately. Also, be sure to let me know at least a week ahead of time if a university activity will require an absence from class.

Schedule: We will maintain a rotation of 2-3 weeks for experiments followed by a course meeting for presentations and dicussions. New experiments will begin the week following the presentations.

Course Goals:

Learning Outcomes <i>Students will:</i>	Practice	Assessment
Design their own experiments to answer their own scientific questions.	Lab activities	Presentations; Reports; Journals
Collaborate effectively with others in carrying out scientific investigations.	Lab activities	Presentations; Journals
Examine the role of experiments, observations, models, and theories in refining our understanding of the Universe.	Lab activities	Presentations; Reports; Journals
Compare the types, roles and degrees of uncertainty in science.	Lab activities	Presentations; Reports; Journals
Present the results of their investigations at an appropriate level for the indended audience.	Report & Presentation #1	Subsequent Reports & Presentations