

Physics 108 – Astronomy Laboratory

Fall Semester 2016 and Spring Semester 2017

Instructor

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University email is preferable to a phone call, and will provide you with a written response you can save.

Each section has a teaching assistant who is in charge of that section and who can answer most questions that come up. These assistants will provide you with their contact information during class, or you can check Blackboard for contact information for all sections. Our assistants are trained to help you with the laboratory experiments and with understanding the fundamental ideas behind them. They grade your work each week, and update the class records.

Objectives

This course offers a “hands-on” opportunity to learn by exploration and discovery how physicists and astronomers have arrived at their current understanding of the universe. There will be guided exercises with class-room and computer-based resources, and use of images and data from the university’s telescopes in Kentucky and Australia. Our overall objective is for you to learn how thoughtful reasoning about experiments and observations is the foundation of physics and astronomy. It meets the University’s General Education Requirements for a Natural Science laboratory. There is a separate optional Physics 107 Elementary Astronomy course which should be taken concurrently or before taking this lab. Both 107 and 108 are also offered online.

As with other General Education Natural Science classes, the objective of this course is to incorporate astronomy into your critical thinking skills, and to understand how the methods of science work. We will do that by exploring how physics and astronomy help us unravel the underlying mysteries of the Universe, and to

1. Help you understand (and cope with) astronomy encountered in everyday life: seasons, solar energy, and the GPS in your cell phone.
2. Provide a basis for understanding the latest developments about astronomy you will hear in the news.
3. Recognize that while physics does not fully explain the universe, it does predict the effects of intangible invisible things, even though nobody knows what they really are ... yet. (That is, not to fret when something seems incomprehensible, since science itself still does not explain everything, and has to rely on predictable behaviors of

invisible things such as gravity and the energy and matter in the universe which nobody completely understands.)

4. Present you with mysteries not yet solved, or with contradictory or untested theories, so that you may solve them in the future and win a Nobel Prize. (There is plenty of astronomy that we do not yet know, as mentioned above.)
5. Teach physics and astronomy that you may apply to make life better for yourself and others now, and in the future. (The long term future of our Sun and the near future stability of our planet's atmosphere.)
6. Open your mind to new discovery by knowing that the universe should be understandable.

Requirements

The lab will offer a scaffold of topics, one each week, for the duration of the semester. Once you have some experience with the lab, many of them will be available on any lab day, and you may choose one you have not done from those. Collaborate with other students in the lab, take your time to understand, ask questions when you need help, and remember the objective is to learn how to observe, reason, and use your growing knowledge and skill to solve problems. We are not expecting you to find an exact “right” answer. We do require active participation during the lab sessions to receive full credit.

You are expected to attend *every* meeting of your lab class. Your work must be done during the class. We will not accept, under any circumstances, work that is prepared beforehand and brought to class, or work that is unfinished and returned in a mailbox or at a later class.

We do not permit doing more than one unit in a single class session. If you miss your regularly scheduled lab you may make it up by attending another lab section, or one of the occasional night sessions at the campus observatory. However there is some leeway in the grading to allow for one or two missed labs (see below).

Websites

The University's Blackboard system is the University's gateway to Distance Education programs:

<http://blackboard.louisville.edu/>

Use your University *User ID* and *Password* to log into Blackboard for announcements. For this Astronomy Laboratory class you have access to the lab materials through the class website given below. A convenient click to link to the site will be provided on Blackboard. This site is open to everyone without a password. It will offer updated information for use in preparing for labs, and links to other sites of interest.

Textbook and Course Content

There is no textbook for this course. The content is provided on-line for free through

http://prancer.physics.louisville.edu/astrowiki/index.php/Elementary_Astronomy_Laboratory_Activities

You may read the on-line version with any device that displays a web page. Wireless service is available in the labs so if you have your own laptop, tablet, or network enabled phone you may use them in the lab. Files in *pdf* format are exported from the wiki site from the drop-down “Actions” menu and a click a “Print as PDF”. Saved files may be viewed in an e-reader such as a Kindle device, or printed for reference. Since these offerings may change or be edited during the semester, use the on-line version whenever possible.

What You Hand In

Each experiment or investigation has a description of what you are to do, and there is a separate answer sheet that will be supplied in class for you to fill out. The experiments pose a central question which you are to answer by working with others. We encourage you to ask the assistant when you need help, and discuss the issues with those in your group, but you should think through the questions and respond with your own ideas in your own words. *What you hand in to us must reflect your own effort.* If there is time, we will be glad to advise you on improving your work before we accept it for credit. All work must be done during the two hour lab period, and must be handed in personally to the assistant before you leave. *Lab work which is handed in by another student, left on a desk, left later in mailboxes or under doors, or brought to another session will not be accepted.*

Grading

Each unit should take about 1 to 2 hours to complete properly. Letter grades will be based on an average of the *best* 11 scores with a scale of **A** (90 or more); **B** (80 to 89); **C** (70 to 79); and **D** (60 to 69). We do not use \pm grading for the lab.

The score for each topic will be based on completeness and accuracy in response to the questions raised, on originality and creativity, the degree of understanding expressed by your work, and your active participation in the group. We may ask that you to reconsider your responses before you leave the lab session and we assign a final score for credit. Remember, our purpose is to help you learn and understand by observation and reason, not to hear an echo of a precisely “correct” textbook answer. This learning process is supported by the group’s interaction and your dynamic participation is required.

We compute the final class grade based on the best 11 scores for the labs. This means that with 13 lab opportunities you may miss a lab without a grade penalty unless you miss more than 2. However, *you are still expected to participate in all the scheduled lab classes* unless you have an excused absence. In the event of a lab canceled due to weather or another university issue, we will reduce the number of scores averaged so there will be no affect on your grade. By fully participating in all labs you will improve your grade and also have an opportunity to do more of the activities that are offered.

Caveats

We reserve the right to make changes in the syllabus when necessary to meet learning objectives, when new astronomical discoveries occur, or when there is a technical or software issue that requires a change in content or methodology. Any changes will be announced by email and posted in the current online syllabus and schedule.

Title IX/Clery Act Notification

Sexual misconduct (including sexual harassment, sexual assault, and any other nonconsensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain confidential support from the PEACC Program (502.852.2663), Counseling Center (502.852.6585), and Campus Health Services (502.852.6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (502-852-5787) or University of Louisville Police (502.852.6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is not confidential under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.

For more information, see the Sexual Misconduct Resource Guide here <http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure>.

Topics available this semester

Working in small groups of about 3 students each, for the first lab class everyone will learn about identifying constellations and becoming familiar with the night sky. After that, each week you and your group will select for yourselves a topic from those offered. Many of these are available during every lab session.

Early in the semester your lab assistant will advise on how to select and request that one of our telescopes observe an object in the sky for you. These data, usually in the form of digital images, will be made available for you to analyze and discuss later in the semester. It is essential to get these requests submitted soon after becoming familiar with the sky, so think about what you might like to explore in more detail while you do the first few activities.

1. Identify constellations
2. Watch the sky
3. Under Namibian Skies
4. Night sky using Stellarium
5. Use a remote telescope: requests or live, and analyzing results (a two-part activity)
6. Travel to Mars, Jupiter, Saturn, and Uranus
7. Survey galaxies in the universe
8. Survey galaxies in Virgo
9. The Earth rotates
10. Our dynamic sun (may use the roof top solar telescope)
11. Light and telescopes
12. Experiment with CCD camera images
13. Use a CCD camera
14. Spectra
15. Observing planets and the Moon with a telescope (live remote or with the telescope on the roof)
16. Explore Mars
17. Observe satellites of Jupiter, Saturn, and Uranus
18. Follow Proxima Centauri
19. Colors of stars in Messier 34
20. Variable stars in Messier 3

21. Measure a nearby supernova

22. Track cosmic rays in a cloud chamber (last lab of the term)

Class schedule version of August 17, 2016