

ASTRONOMY 89

Stars, Galaxies, and the Cosmos

Fall 2019

Course Information

Meeting Time: Monday, Wednesday and Friday, 2-2:50 PM
102 Thaw Hall

Credits: 3

Prerequisites: None

Instructor Information

Lecturer: Prof. Jeffrey Newman

Email: janevman@pitt.edu

Office: 310 Allen Hall

Office Hours: 3 – 4 PM Wednesday, 3:30-4:30 PM Thursday, or by appointment

Teaching Assistant: Robert (Bob) Caddy

Email: r.caddy@pitt.edu

Office: Allen 500

Office Hours: 1-3 PM Thursday

Textbook

Openstax Astronomy by Fraknoi, Morrison, and Wolff

(available for free at <https://openstax.org/details/books/astronomy>)

Course Description

The Universe in which we live is unimaginably vast but understandable through the same physical laws that govern our existence here on Earth. This course will provide an introduction to our current knowledge of the Universe on large scales, covering the breadth of the field of astronomy. By exploring topics ranging from objects within our own Solar System to the nearest neighboring stars and their alien worlds to the farthest galaxies newly formed after the Big Bang, this course will help you to understand better both everyday life and the cosmos. We will learn about the birth, life, and death of stars; the nature of black holes; the properties of our own Milky Way galaxy and other galaxies; and finally will expand our vision to investigate the origin and ultimate fate of the Universe and the question of whether there is other life beyond Earth.

This is a self-contained course for students not majoring in the physical sciences.

Part of this course includes an evening tour of the University of Pittsburgh's Allegheny Observatory. A percentage of the course grade will be based on participation in that tour. On any one evening only a small fraction of the class will go to the observatory, so it should be possible to accommodate students' evening schedules. The purpose of these trips will be to tour the facility and observe the night sky with telescopes.

Course Objectives

By the end of this course, you should be able to explain, among other things:

- What the major motions of the Earth are, and how they relate (or do not relate) to the day and seasons.
- Why the constellations seen in the sky vary over the course of the year.
- How fundamental laws of nature can describe the motion of objects through space.
- How we can measure the properties of distant stars and galaxies using observations from the Earth and space.
- Why the Sun shines, and why it will not do so forever.
- How stars form and die.
- How planets around other stars are discovered and characterized.
- Where black holes come from, and how they bend space and time.
- How the Milky Way Galaxy we live in is like or unlike other galaxies.
- Why we believe many galaxies have black holes at their center.
- What we know about what the Universe is made of, how it began, and its ultimate fate.
- What factors may determine the abundance of intelligent life forms in the Universe.

By the end of the course, you should also be comfortable with using proportional relationships to explain how one quantity varies when another is changed (no calculators should be needed for this course, though you are welcome to use them).

More broadly, you should gain sufficient background to understand popular articles on astronomy such as those in common online news sources and explain them to your friends and family. We live in exciting times, and the pace of scientific discovery will only continue to increase.

Course Structure

Lectures will be interspersed with demonstrations, lecture questions using a classroom response (clicker) system, and small-group discussions. **Students are expected to have read the relevant sections of the textbook (listed on Courseweb) before class.** Lectures and recitation activities are a supplement to the textbook, not a replacement. Some clicker questions may test whether you have done the reading before the relevant material is covered in lecture.

Recitations

A key component of the learning in this course will be based on a set of “lecture tutorials”: ~20-30 minute exercises that you will work on in small groups (typically 3 people) during weekly recitation sessions. Group exercises such as these have been found to greatly increase learning and retention of knowledge; **your active participation in these activities, working together with other students, is vital to their success.** Exams will focus more greatly on the contents of the tutorials than other material, as they generally explore key concepts in the class.

Grading

Grades will be weighted as:

75%	Best 3 of 4 exam grades
10%	Lecture Questions (see below)
10%	Recitation questionnaires
5%	Trip to Allegheny Observatory

A grade above 90 will be guaranteed to be an A- or better, above 80 a B- or better, above 70 a C- or better, etc. It is possible that grades will be curved to be more generous than this, depending upon how well grades correspond to achievement of learning objectives. I anticipate that there will be no forms of extra credit in the class.

Exams:

There will be a total of four exams in this class. Each exam will be comprised of 30 to 50 multiple-choice questions, and will cover approximately one quarter of the course material. If you must miss an exam, it will be the exam grade dropped; there should be no make-up exams.

Some exam questions (below 10% of the total) will use basic arithmetic / proportionalities. If you feel like you would benefit from extra review, you are encouraged to consult the links that will be posted on the class Courseweb page to selected Kahn Academy modules that focus on the level of math in this course, and

to attend office hours from the instructor or TA to get extra help as needed. Non-graphing calculators are permitted in exams, but should **not** be necessary to answer these questions. Use of graphing calculators, cell phones, iPods, or any other supplementary devices, electronic or otherwise, will NOT be permitted during exams.

Exams are tentatively expected to take place on the following dates:

Exam 1:	Wednesday, September 18
Exam 2:	Friday, October 11
Exam 3:	Monday, November 4
Exam 4:	Friday, December 6

Exam dates are currently tentative. **Please inform me within the first two weeks of class if a religious holiday conflicts with one of these dates.** There will be no make-up exams (regardless of cause, a missed exam will be the one dropped; there will then be a positive adjustment to your overall exam average to compensate for the fact that you only had three chances to take an exam instead of four).

Students must bring their Pitt ID cards to all exams. The use of books, notes or other written materials, computers, cellular phones, and all devices that can render documents, graphics, or connect to the internet are absolutely prohibited.

Lecture Questions:

Several times during each class, I will show a multiple-choice question that will be answered by pressing a key on a hand-held radio transmitter or "clicker."

See below for details on how to use the clicker system. Incorrect answers will receive 80% credit, correct answers 100%, and no answer 0%. The lowest few scores will be dropped in calculating lecture question grades. In cases where lectures are recorded and made available online (due to travel by the instructor), I anticipate that clicker questions will be replaced by an online quiz.

Recitation:

Attendance at recitation sessions is required for the class. Most recitations will involve a group activity. Students will work in teams to answer questions requiring thought and understanding rather than memorization.

Additionally, recitations will include discussion of homework or example exam questions. Recitation grades will be based upon short writing and reasoning assignments every week, which will be graded for completeness/effort rather than technical correctness. Your lowest recitation grade will be dropped from the average.

Trip to Allegheny Observatory:

5% of your grade comes from attending a trip to the University of Pittsburgh's Allegheny Observatory, where you will be able to see historical and research telescopes and (weather permitting) view the sky through them. There will be free buses to the observatory for tours twice a week. There are a limited number of slots each night; sign up in recitation. On any one evening only a small fraction of the class will go to the observatory, so it should be possible to accommodate students' evening schedules. The purpose of these trips will be to tour the facility and make observations of the night sky with historical and modern telescopes.

Homework:

During the course of the semester, I may provide lists of suggested homework problems; the answers will be available online or discussed in recitation (they will not be graded directly). This is intended to help you prepare for the exams; e.g., the mathematical questions on exams may be easier versions of homework problems. Students are encouraged to collaborate on homework assignments, but collaboration on exams is strictly forbidden.

Classroom Policies and Code of Conduct

- Cell phones and all other electronic devices must be silenced. In addition, students are expected to refrain from excessive electronic communication during class. Laptops, tablets, and smart phones may be used for note taking or reference purposes. Watching videos, playing games, and/or browsing the Internet is not appropriate during lecture.
- Be courteous to your neighbors. Carrying on a conversation, habitually coming in late or leaving early, or misusing technology (as detailed above), are all disruptive to the class. Students who fail to show common courtesy will be asked to leave.
- Communication is key to a productive learning environment, and we can maintain productive communication by exhibiting respect for one another. The success of the course for yourself and others depends on all of our commitment to behavior that demonstrates respect for differences, understanding towards others and a willingness to listen and learn. For these reasons, it is unacceptable to harass, discriminate against, or abuse anyone because of race, ethnicity, gender, disability, religious affiliation, sexual orientation, or age. If you witness or are subject to such harassment, please report it to the instructor or to the [Office of Diversity and Inclusion](#).

Academic Integrity

Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and electronic devices.

All students are expected to adhere to the standards of academic honesty. Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity, from the February 1974 Senate Committee on Tenure and Academic Freedom reported to the Senate Council, will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score for the quiz or exam will be imposed. You may view the complete policy at www.cfo.pitt.edu/policies/policy/02/02-03-02.html.

Courseweb and Other Resources

The University of Pittsburgh provides a web based resource called *Courseweb*, which is a portal to websites for individual courses. A *Courseweb* site for this course has been created, and from there you may view announcements, send email to the instructor or the TAs, and download course material such as the syllabus and lecture slides. **Reading and homework assignments will all be announced on Courseweb: <http://courseweb.pitt.edu/> . You should not expect them to be announced in class.**

Use your Pitt email username and password to login to Courseweb. If you have forgotten your username and password or need to set up an account, contact the help desk at 412-624-4357, or 4-HELP. Once you have logged into the system simply click on the link for this course to access the available material.

The Department of Physics and Astronomy provides free assistance for all students. The **Physics Exploration Center** allows students to operate some simple experiments and demonstrations. Within the Exploration Center is the **Physics Help Room** staffed with TAs who can answer homework related questions, explain basic concepts and help you with the math. This is a free service and you are encouraged to use it. The Physics Exploration Center and the Physics Help Room are both located in Thaw 312. In addition, tutoring is available through the Academic Support Center (WPU 311).

Instructions for the clicker system

Our classroom is equipped with a clicker response system. Near the beginning of the semester you will be assigned a number that corresponds to a particular pad. The pads will be stored in bins on two different carts at the front of the room so that you may pick up your pad as you enter the hall and then place it back there at the end of the lecture. The bins are color coded so that you may quickly identify the location on the cart for your pad. **Do not take the pads out of the classroom!** Many other classes use the same system and pads. If a pad is missing, the clicker system makes it easy to identify the student who used it last. The pads in this room will not work with other SRS systems on campus.

Please observe the following rules for the SRS:

1. Memorize your pad number, the bin color, and which cart it is in.
2. Pick up your pad as you enter the classroom.
3. If your pad is missing, check in bins of the same color as it may have been misplaced. If you still cannot find it, ask Prof. Newman which pad you may use as an alternate.
4. When the response system receives your answer your pad number will disappear from the non-response list on the computer screen. You may change your answer anytime the question is open by simply pushing a different key (A to E).
5. **Place the pad back in the proper bin at the end of lecture.** Form two lines, one on each side of the cart, and use the color codes to identify the side of the cart where your bin is located. **If there are any problems with your clicker on a particular day (not working or missing) fill out the problem sheet after class to get credit.**
6. Only use your own pad.

Entering answers for another student (or having another student answer for you) is clearly wrong.

Such behavior would be unethical and unfair, and will be treated as a violation of the University's Academic Integrity policies.

During the lecture I will pose one or more multiple choice questions that you will answer with your individual pad. You will be given some time to think about each question and, in many cases, discuss it with your neighbors. During this time the clicker system will pick up all the signals and tally the results. At the end of the time the answers from each student will be recorded and a summary of final results displayed. The questions are intended to motivate discussion with your peers and to provide me with feedback on how well you understand the material. You will receive full credit (100%) for each question you answer correctly and 80% for each question you answer incorrectly. Failure to answer a question at all results in no credit (0%), so it pays to answer the question even if you get it wrong. Each day will have equal weight toward your lecture question score. Your 3 lowest lecture question scores will be dropped.

Other Policies

Disability Services: If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Title IX: The Patsy T. Mink Equal Opportunity in Education Act (commonly referred to as Title IX) specifies that *"No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."*

As a professor I am a mandatory reporter, and I am required to report violations of Title IX that I observe or am made aware of to the University's Title IX office. Title IX violations include, but are not limited to, sexual harassment, sexual violence and verbal or sexual abuse. Within the classroom, behavior in violation might appear as: suggestive jokes or innuendos, inappropriate touching, and unwanted sexual behavior or advances, but **my capacity and obligation to report does not end at the classroom.**

Statement on Classroom Recording: To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Student Opinion of Teaching Surveys: Students in this class will be asked to complete a Student Opinion of Teaching Survey. Surveys will be sent via Pitt email and appear on your CourseWeb landing page during the last three weeks of class meeting days. Your responses are anonymous. Please take time to thoughtfully respond, your feedback is important to both me and the Department of Physics and Astronomy.

Note: The schedule and procedures in this course are subject to change. Any changes will be posted on the ASTRON 0089 Courseweb site and announced in class in the case of major changes.

Syllabus Addendum – Natural Science General Education Requirement

This course fulfills one Dietrich School of Arts and Sciences Natural Science General Education Requirement (GER) as described for the GERs starting Fall 2018 (term 2191). That GER reads as follows:

Three Courses in the Natural Sciences

These will be courses that introduce students to scientific principles and concepts rather than offering a simple codification of facts in a discipline or a history of a discipline. The courses may be interdisciplinary, and no more than two courses may have the same primary departmental sponsor.