

ASTRONOMY 88

Stonehenge to Hubble

Fall 2017

Course Information

Meeting Time: Tuesday & Thursday, 1 - 2:15 PM; Alumni Hall, Room 343

Credits: 3 *Prerequisites:* None

Instructor Information

Lecturer: Prof. Jeffrey Newman

Email: jnewman@pitt.edu

Office: 310 Allen Hall

Office Hours: To be determined, or by appointment

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Office Hours: To be determined

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 an unimaginably vast and rich place that is understandable through the same physical laws that govern our existence here on Earth. This course will provide an introduction to astronomy with more emphasis on historical context and the Solar System than Astronomy 89 (*Stars, Galaxies, and the Cosmos*). 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 both the everyday world and our entire Universe. 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.

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

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 recitation. These sorts of exercises have been found to greatly increase learning and retention of knowledge; your active participation is vital. Exams will focus more greatly on the contents of the tutorials than other material, as they generally explore key concepts in the class.

Course Objectives

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

- Key milestones in the development of the science of astronomy from ancient times to the present day.
- 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.
- What the distinguishing characteristics of terrestrial planets, giant planets, dwarf planets, asteroids, and comets are, and how our Solar System formed
- 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 extrasolar planets 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 the Universe is made of, how it began, and its ultimate fate.

- What factors 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).

More broadly, you should gain sufficient background to understand popular articles on astronomy such as those in Scientific American and the New York Times Science section and explain them to your friends and family. We live in exciting times, and the pace of scientific discovery will only continue to increase.

Classroom Policies

- 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.

Grading

Grades will be weighted as:

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|-----|------------------------------------|
| 75% | Exam grades (25% each for 3 exams) |
| 10% | Lecture Questions (see below) |
| 10% | Recitation |
| 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 expect that there will be no forms of extra credit in the class.

Exams:

There will be a total of three exams in this class. Each exam will be comprised of 40 to 60 multiple-choice questions, and will cover approximately one third of the course material. Although exams are not strictly cumulative, the material covered later in the course will build on earlier topics. Each exam will constitute 25% of your final course grade.

Some exam questions (below 10% of the total) will use basic arithmetic / proportionalities. If you feel like you would benefit from 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. Non-graphing calculators are permitted in exams, but should **not** be necessary to answer these questions. Use of cell phones, iPods, or any other supplementary devices, electronic or otherwise, will NOT be permitted during exams.

Exams are expected to take place on the following dates:

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|---------|---|
| Exam 1: | Tuesday Oct 3rd |
| Exam 2: | Tuesday Nov 7th |
| Exam 3: | Thursday Dec 7 th OR Monday Dec 11 th |

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.**

Make-up exams will only be given under extremely special circumstances, such as illness or University-approved travel, and will require a written confirmation from, for example, a medical doctor. See below for details.

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.

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 will provide lists of suggested homework problems; the answers will be available online or discussed in recitation. 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.

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.

Instructions for the clicker system

Alumni Hall 343 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 Alumni Hall 343 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.
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 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.

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).

Other Policies

Missed Assignments/Exams: By default, missed assignments (including exams) earn a zero grade. If you are aware of an impending conflict with the scheduled time of an exam or other assignment, you should let me know as early in the semester as possible. In these cases, accommodations will be provided as long as the circumstances are reasonable and you can provide appropriate documentation.

In cases where prior arrangements have not been made, missed exams can only be made up in cases of **documented emergency**, and only if you contact me within **48 hours** of the missed exam.

Academic Integrity: All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty will be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be subject to the process outlined in the University Guidelines on Academic Integrity (<http://www.as.pitt.edu/fac/policies/academic-integrity>).

Disability Services: If you have a disability that requires special testing accommodations or other class-room modifications, you need to notify both the instructor and Disability Resources and Services no later than the second week of the term. You may be asked to provide documentation of your

disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call (412) 648-7890 (Voice or TTD) to schedule an appointment. The Disability Resources and Services office is located in 140 William Pitt Union on the Oakland campus.

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.

Note: The schedule and procedures in this course are subject to change. Any changes will be posted on the ASTRON 0088 *Courseweb* site and announced in class in the case of major changes.