

ASTRONOMY 89

Stars, Galaxies, and the Cosmos

Fall 2020

Course Information

Meeting Time: Monday, Wednesday and Friday, 2:20-3:10 PM

Online, no classroom

Credits: 3

Prerequisites: Any MATH Course, Math Placement Score of 61 or greater, SAT math score of 620 or greater, or ACT math score of 27 or Greater.

Instructor Information

Instructor: **Professor Jeffrey Newman** Email: jnewman@pitt.edu

Office: N/A

Office Hours: 3:30-4:30 PM Thursday, 3:30 – 4:30 PM Friday,
or by appointment, <https://pitt.zoom.us/j/93950592178> , passcode
15260

Website: <https://jnewman-pitt-edu.github.io>

Teaching Assistants: **Helena Richie** Email: helenarichie@pitt.edu

Office: N/A

Office Hours: Thursday 4:30-5:30 PM,
<https://pitt.zoom.us/j/94821205041> , passcode 65535

Melanie Good Email: mlgood@pitt.edu

Office: N/A

Office Hours: Thursday 12-1 PM,
<https://pitt.zoom.us/j/95983203417>

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.

Textbook

Openstax Astronomy by Fraknoi, Morrison, and Wolff
(this book is available for free at <https://openstax.org/details/books/astronomy>)

Course Rationale

This is a self-contained course providing an introduction to the science of astronomy for students not majoring in the physical sciences. Students who are interested in an Astronomy or Physics and Astronomy major should take ASTRON 113 instead. This class fulfills a Dietrich School Natural Science General Education Requirement and a School of Computing and Information Polymathic Contexts: Science NonSeq. General Education Requirement.

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 studied
- 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 able to use proportional relationships to explain how one quantity of interest varies when another is changed (no

calculators should be needed for this course, though you are welcome to use them).

Most fundamentally, in this class 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

This class will be delivered entirely online, structured such that students who cannot attend at class times can still take part in it fully.

I expect that lectures will be recorded in segments which will be posted well ahead of class times (so they can be viewed regardless of your location this semester). After you complete a lecture there will be a quiz to help you see whether you are meeting the class' learning goals and help me find out if there is any material students are having trouble with.

Class time will then be used for live, recorded Zoom sessions to answer any questions students have about the posted lectures (either from class discussion boards or asked live), discuss recent quiz questions people may have found difficult, etc. Recitations will focus on working in smaller groups on lecture tutorials which are intended to help you learn the most important material in the class. These lecture tutorials will be submitted as homework assignments following recitations. For students who cannot attend recitations, there will be a separate discussion board for each group on Canvas that can be used to work together on the lecture tutorials.

Students are expected to have read the relevant sections of the textbook (listed on Canvas) before watching the relevant lecture videos. Lectures and recitation activities are a supplement to the textbook, not a replacement.

We will deviate from these expectations if technology requires, however.

Assessment Information

Grading

Grades will be weighted as:

45%	Exams (3 exams, each worth 15% of your final grade)
20%	Lecture tutorials
15%	Post-lecture quizzes

5%	Post-lecture surveys
15%	Short writing assignments (2 or 3, 2-3 paragraphs each)

Exams:

There will be a total of three exams in this class. I expect that each exam will be comprised of 25 to 40 multiple-choice or matching questions and a small number of short-answer questions. Each will cover approximately one third of the course material.

Some exam questions (10% of the total or less) 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 Canvas 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, web pages outside of Canvas, textbooks, search engines, tutoring services, or any other supplementary devices or materials, electronic or otherwise, is NOT permitted during exams and will be treated as academic dishonesty.** I will provide all equations needed, etc. with the exam questions.

Exams are expected to take place on the following dates:

Exam 1:	Monday, September 21
Exam 2:	Monday, October 19
Exam 3:	Week of November 30 (finals week)

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.**

Lecture Tutorials and 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 (up to 7 people) in Zoom breakout rooms during weekly recitation sessions, or using group chat on Canvas if you are unable to join the recitation time. 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.

Lecture tutorials will be turned in as homework on Canvas (though you should generally have completed them during recitation), due Sunday night at midnight Eastern time. They will be graded for completeness/effort rather than technical correctness. Your lowest lecture tutorial grade will be dropped from the average.

In addition to work on the lecture tutorials, recitations will include discussion of mathematical relationships used in the class, discussion of example exam questions, and other exam preparation.

Students are encouraged to collaborate on lecture tutorials, but collaboration on exams is strictly forbidden.

Post-lecture quizzes and surveys:

After you view the videos for a lecture, there will be a quiz consisting of several multiple-choice and/or matching questions in order to help students assess their learning progress and enable me to identify any areas of difficulty.

I intend to rescale quiz grades such that incorrect answers will receive 60% credit, correct answers 100%, and no answer 0% (it looks like Canvas will not allow me to do this directly). The lowest four (**originally:** two) scores will be dropped in calculating lecture quiz grades.

A minimum of one time per week there will also be a post-lecture survey with a set of open-ended feedback questions for you to answer, graded for completion but not correctness. At minimum, the lowest post-lecture survey grade will be dropped.

Short Writing Assignments:

In order to assess whether you are developing the astronomy knowledge to understand news articles about new discoveries, over the course of the semester you will be asked to write two or three very short (2-3 paragraph) mini-essays or sets of answers to some guiding questions about articles you find online or other material. You will be provided with a rubric defining what we are looking for in these papers; they will be graded based on whether you satisfy the content requirements and show evidence of effort rather than for spelling, grammar, etc.

Grading Scale

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 do not anticipate there to be any forms of extra credit in the class.

Expectations for class attendance and participation

I recognize that it may not be feasible for all students to attend class at our nominal time. In that case, I encourage students to submit questions via the class discussion board if they cannot ask them live during our Zoom sessions. This class will be more interesting for everyone, and the material will be made more clear, if students are asking more questions. Students who regularly ask particularly interesting or thought-provoking questions or who regularly attend online office hours and ask for help when they need it will get extra consideration to be bumped to a higher grade if they are near a grade line.

Course Schedule

Weekly schedule

Reading and writing assignments will all be announced on Canvas:

<http://canvas.pitt.edu/> . **You should not expect them always to be announced in class.**

I anticipate that in a typical week the schedule should be:

- **Saturday:**
 - o By end of night: lecture videos for Monday posted, with associated quiz. Please post associated questions by Monday at noon
- **Sunday:**
 - o At midnight: Lecture tutorial from the preceding week is due (should generally be completed during recitation)
- **Monday:**
 - o 2:20 PM: Class session, with Q&A about lecture videos
 - o By end of night: lecture videos for Wednesday posted, with quiz and post-lecture survey. Please post associated questions by Wednesday at noon.
 - o At midnight: Monday lecture quiz due
- **Wednesday:**
 - o 2:20 PM: Class session, with Q&A about lecture videos
 - o By end of night: lecture videos for Friday posted, with quiz. Please post associated questions by Friday at noon.
 - o At midnight: Wednesday lecture quiz due
- **Thursday:**
 - o Some students have recitation
- **Friday:**
 - o Some students have recitation
 - o 2:20 PM: Class session, with Q&A about lecture videos
 - o At midnight: Friday lecture quiz due

Schedule of topics

It is difficult for me to anticipate the rate at which we will proceed this semester, so I will not provide dates below. The expected order in which we will cover topics is:

- the motion of the Sun, Moon, and stars as seen from the Earth; seasons, phases of the Moon, and eclipses
- The scientific method and the early history of astronomy
- Newton's laws of motion and gravity, and the orbits of the planets
- An overview of objects in the solar system: planets, dwarf planets, moons, asteroids, and comets
- The nature and types of light; telescopes
- The Sun and how it generates energy
- The broader population of stars
- The birth, life and death of stars
- Stellar remnants: white dwarfs, neutron stars, supernovae, and black holes
- Einstein's theories of relativity and how they explain black holes
- The Milky Way galaxy and other galaxies
- Cosmology: the study of the Universe as a whole – its contents, origins and fate
- Planets around stars beyond the Sun
- Life in the Universe

Policies

'Classroom' Policies and Conduct

- Be courteous to other students. As an example, carrying on a conversation while unmuted on zoom is disruptive to the class. Students who fail to show common courtesy when requested 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/gender identity, disability, religious affiliation, sexual orientation, age, etc. If you witness or are subject to such harassment, please report it to the instructor or to the [Office of Diversity and Inclusion](#).

Late work and assignment submission

Exams will only be available at set times and late work will not be possible.

For post-lecture quizzes and surveys and lecture tutorials, late work will in general not be accepted. However, for each of these categories one or more of the lowest grades will be dropped, which can cover any occasional problems that happen.

For writing assignments, late work will only be guaranteed to be accepted if you make prior arrangements with the instructor. Otherwise, if turned after the due date, writing assignments may have their grades penalized or may not be graded.

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 programmable calculators. **Use of graphing calculators, cell phones, web pages outside of Canvas, textbooks, search engines, tutoring services, or any other supplementary devices or materials, electronic or otherwise, is NOT permitted during exams and will be treated as academic dishonesty.** A minimum sanction of a zero score for the quiz or exam will be imposed for violations of the Academic Integrity policy.

To learn more about Academic Integrity, visit the Academic Integrity Guide for an overview of the topic. For hands-on practice, complete the Understanding and Avoiding Plagiarism tutorial.

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.

Diversity and Inclusion

The University of Pittsburgh does not tolerate any form of discrimination, harassment, or retaliation based on disability, race, color, religion, national origin, ancestry, genetic information, marital status, familial status, sex, age, sexual orientation, veteran status or gender identity or other factors as stated in the University's Title IX policy. The University is committed to taking prompt action to end a hostile environment that interferes with the University's mission. For more information about policies, procedures, and practices, see:

<https://www.diversity.pitt.edu/civil-rights-title-ix-compliance/policies-procedures-and-practices> .

I ask that everyone in the class strive to help ensure that other members of this class can learn in a supportive and respectful environment. If there are instances of the aforementioned issues, please contact the Title IX Coordinator, by calling 412-648-7860, or e-mailing titleixcoordinator@pitt.edu. Reports can also be filed online: <https://www.diversity.pitt.edu/make-report/report-form>. You may also choose to report this to a faculty/staff member; keep in mind that as mandatory reporters they are required to communicate this to the University's Office of Diversity and Inclusion. If you wish to maintain complete confidentiality, you may also contact the University Counseling Center (412-648-7930).

Email Communication

Each student is issued a University e-mail address (username@pitt.edu) upon admittance. This e-mail address may be used by the University for official communication with students. Students are expected to read e-mail sent to this account on a regular basis. Failure to read and react to University communications in a timely manner does not absolve the student from knowing and complying with the content of the communications. The University provides an e-mail forwarding service that allows students to read their e-mail via other service providers (e.g., Hotmail, AOL, Yahoo). Students that choose to forward their e-mail from their pitt.edu address to another address do so at their own risk. If e-mail is lost as a result of forwarding, it does not absolve the student from responding to official communications sent to their University e-mail address.

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.

Take Care of Yourself

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep, and taking time to relax. Despite what you might hear, using your time to take care of yourself will actually help you achieve your academic goals more than spending too much time studying. All of us benefit from support and guidance during times of struggle. There are many helpful resources available at Pitt. An important part of the college experience is learning how to ask for help. Take the time to learn about all that's available and take advantage of it. Ask for support sooner rather than later – this always helps. If you or anyone you know experiences any academic stress, difficult life events, or difficult feelings like anxiety or depression, we strongly encourage you to seek support. Consider reaching out to a friend, faculty or family member you trust for assistance connecting to the support that can help.

The University Counseling Center is here for you: call 412-648-7930 and visit their website.

If you or someone you know is feeling suicidal, call someone immediately, day or night: University Counseling Center (UCC): 412 648-7930
University Counseling Center Mental Health Crisis Response: 412-648-7930 x1
Resolve Crisis Network: 888-796-8226 (888-7-YOU-CAN)

If the situation is life threatening, call the Police: On-campus: Pitt Police: 412-268-2121 Off-campus: 911

Copyright Notice

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unauthorized duplication or retransmission of course materials.

See [Library of Congress Copyright Office](#) and the [University Copyright Policy](#).

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