

From Stonehenge to Hubble

ASTRON 0088, Spring 2016

Instructor:	Dr. David Nero
Office:	221B Allen Hall
Office Hours:	Tuesday and Thursday 10:30am–12:00pm Other times by appointment.
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Meeting Times:	Monday, Wednesday, and Friday 11:00–11:50am in 343 Alumni Hall
Class Website:	CourseWeb (courseweb.pitt.edu)
Textbook:	None required. Optional supplement: <i>Coming of Age in the Milky Way</i> , by Timothy Ferris Optional supplement: <i>The Essential Cosmic Perspective</i> , by Jeffrey Bennett (any edition)
Homework:	Sapling Learning (linked to from CourseWeb) Cost is \$38.

Course Description

ASTRON 0088 provides a historical perspective of our place in the universe. After a brief introduction on the nature of science, we start with a description of the nighttime sky, both as viewed by the ancients, and in terms of a contemporary practical understanding. Next, we will follow the evolution of the beliefs in earth's place in the cosmos, beginning with the ancient Greeks, up through the Renaissance and the birth of modern astronomy. The remainder of the course applies a historical context to the major discoveries of modern astronomy: the search for life on other planets, the life and death of the Sun and other stars, and the discovery that our universe began 14 billion years ago and has been expanding ever since.

Course Learning Objectives

- Describe the major historical figures and their contributions to the development of understanding of the universe.
- Understand the scientific principles used to study the universe.
- Identify objects in the universe, understanding them in terms of their sizes, ages, and distances from earth.
- Describe how the evolution of the universe has influenced the development of life on earth.

Classroom Requirements

1. **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.
2. **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.

Policies

Attendance Policy: Attendance will be recorded, but not graded.

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 classroom 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.

Grade Scale

If you achieve the following final grade percentages in the course, you will receive at least:

Percentage	Minimum Grade
90%	A-
80%	B-
70%	C-
60%	D-

Only the top few students will earn an A+. Given the amount of available extra credit, I don't anticipate curving the grade.

Grading

	%	Points
10 Online Homework	10%	100 (10 ea.)
10 In-Class Exercises	10%	100 (10 ea.)
14 Recitation Activities	14%	140 (10 ea.)
1 Visit to Observatory	6%	60
2 Midterm Exams	30%	300 (150 ea.)
1 Final Exam	30%	300
Total:	100%	1000

In addition to the above, there will also be extra credit opportunities (described in the next section).

Think Pair Share Questions (ungraded)

Several times during each class, I will pose Think Pair Share (TPS) questions. TPSs are multiple-choice questions that will be answered by pressing a key on a hand-held radio transmitter or “clicker.” You are encouraged to discuss your answer with your neighbor while answering. TPSs are not graded, however, your participation will be used to record attendance.

Clickers: The lecture hall is equipped with set of clickers for student use. At the beginning of each class, you are to pick up your assigned clicker from the bins at the front of the room. Likewise, you are to return your clicker to the bins at the end of class, since other students in other classes will use the same clicker. Under no circumstances are you to remove the clicker from the classroom or to take a clicker other than the one assigned to you. If your clicker is missing, then you need to let me know before you leave. Clickers will be checked after each class, and students will be held responsible if their assigned clicker has gone missing.

Online Homework

Homework will be posted on the online homework system Sapling Learning. You will be prompted to create an account when you first access the homework. The cost is \$38, but you will have the option to begin a free trial for the first two weeks of the course. Unlike other assignments, homework may be completed late for reduced credit (20% penalty per day).

In-Class Exercises

During some lectures, there will be a graded In-Class Exercise (ICE). An ICE is a question that I pose for the class to answer in one or two paragraphs (about half of a hand-written page). The questions will require thought and understanding rather than memorization (in fact, you are encouraged to look at your lecture notes). It may be that an ICE does not have a single “correct answer”, but several possibilities.

Students will work in teams of up to 3 students. Each group submits a single written answer.

ICE Grading: ICEs are out of 10 possible points. A well reasoned and complete answer, showing insight into astronomy, earns the full 10 points. Scores of 7 to 9 are respectable, but indicate that the answer is either a bit incomplete, or that there is some minor misunderstanding. Scores of 6 and below indicate that either the answer is very incomplete, or that there is a serious misunderstanding. Be sure to correct this misunderstanding before exam time. There may be more than 10 ICEs. If so, your grade will be based on your 10 highest ICE scores.

Recitation Activities

Starting the second week of classes, each recitation will center around a group activity. As in ICEs, students will work in teams to answer questions requiring thought and understanding rather than memorization. Unlike ICEs, there will be multiple questions, instead of just one. Each group fills out and returns one copy of the activity.

Observatory Visit

The University of Pittsburgh’s own Allegheny Observatory has a rich history and conducts ongoing research today. As part of this course, you will visit the observatory once this semester, and write a short (one page) paper summarizing the experience. You will schedule your trip at recitation. Buses depart from Allen Hall in the evening and return to campus about three hours later. Detailed information about the available visit dates and bus schedules will be posted to CourseWeb in the coming weeks.

Exams

There will be two 50-minute midterm exams and a 110-minute cumulative final exam. Each of the exams is multiple-choice. All exams are closed book/notes.

Exam Corrections (Optional): For each of the two midterm exams (but not the final exam), students will have the opportunity to submit new answers for missed questions. When doing so, you must explain why your new answer is correct. Each corrected question will earn back half of the missed points. For example, if you start with a 70% on an exam, but successfully correct all of the mistakes, then your corrected grade will be 85%.

Answers to exams will not be posted until after corrections are due. It will be up to you to figure out which questions you missed by reviewing your notes, and talking with your classmates, TA, and/or me.

Extra Credit Opportunities

Student Feedback (+5 points)

Student feedback is important to me, so I would like to meet with small groups of students for this purpose. A feedback group will consist of six students, and will meet with me for 30 minutes at one of the times posted on CourseWeb in exchange for extra credit. If you wish to apply for one of these groups, sign up on CourseWeb. Groups will be filled on a first come, first served basis, so sign up soon (these fill up very quickly!).

Astronomy News Write-Ups (+5 points each, capped at 50 points)

Astronomy is an active field, with new discoveries occurring almost daily. Each week, you will have the opportunity to earn up to 5 points of extra credit by submitting a one page write-up about a recent astronomical news story of your choice. Full details are on CourseWeb.

Helpful Resources

- If you encounter difficulty in this course, the best thing to do is to visit me and/or your TA at office hours as early in the semester as possible (see CourseWeb for an up-to-date list of office hours). Sadly, we won't be able to help much if you wait until the end of the semester before seeking help.
- The department of Physics and Astronomy maintains the free *Physics Resource Room* in Thaw Hall 312. It is staffed with physics and astronomy graduate students. This is an ideal resource to help you with the trickier homework problems (as are office hours). Typical hours are 9am–4pm, weekdays. No appointment is needed.

List of Topics

Unit 1: The Sky

1. Introduction and Definitions
2. Scale
3. The Scientific Method
4. The Stars and Celestial Sphere
5. The Sun and Seasons
6. The Moon and Eclipses
7. Light
8. Telescopes

Unit 2: The Earth

1. Ancient Greek Astronomy
2. Ptolemy to Copernicus
3. Mapping the World
4. Tycho, Kepler, and Galileo
5. Newton's Laws
6. Classical Physics
7. Gravity and Tides
8. The Age of the Earth

Unit 3: The Planets

1. Filling Out the Solar System
2. Terrestrial Planets
3. Jovian Planets
4. Asteroids and Comets

5. Pluto and the Outer Solar System
6. The Birth of the Solar System
7. Exoplanets
8. The Search for Life in the Universe

Unit 4: The Sun and the Stars

1. The Stars are Other Suns
2. Why Does the Sun Shine?
3. Solar Storms
4. Types of Stars
5. Star Death
6. Einstein's Relativity
7. Stellar Remnants
8. The Milky Way

Unit 5: The Universe

1. Other Galaxies
2. The Cosmic Distance Ladder
3. Galaxy Evolution
4. The Expanding Universe
5. Dark Matter and Galaxy Clusters
6. The Beginning of the Universe
7. The End of the Universe
8. String Theory and Multiple Universes