Astronomy 1101: The Nature of the Universe

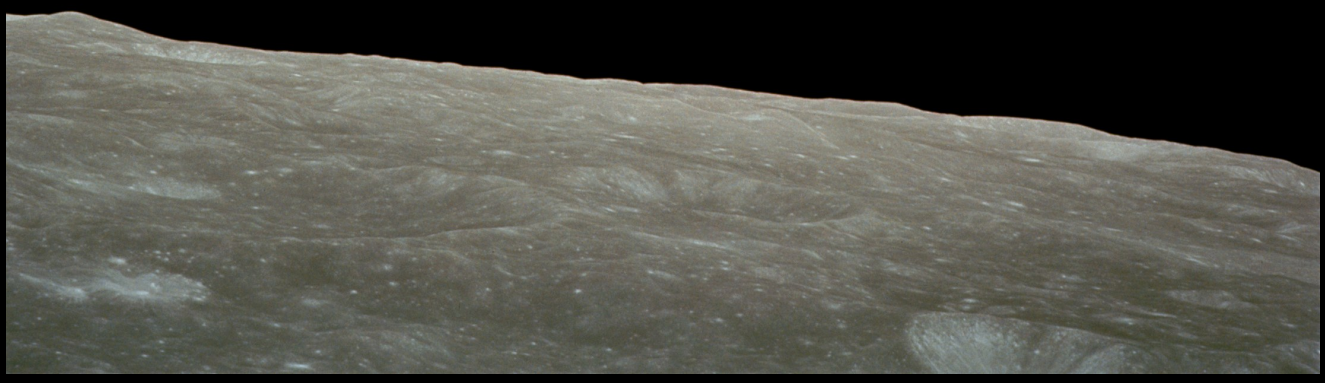
EXAMPLE SYLLABUS ONLY! (NOT OFFICIAL)

Spring 2014
11:15am MWF, Sections 1/wk
Uris Auditorium
4 Credits

Instructor: Everett Schlawin
208 Space Sciences
eas342@cornell.edu
Office Hr: 2-4pm Space Sciences 111
(and by appointment)

What if you were confined your entire life to be in just one room of one building and you could never touch, feel, smell or hear what was outside the room. Wouldn't you be curious what was outside the world that is your own room? Wouldn't you want to know everything you could about the comings and goings of the people out there? What they're up to? Wouldn't you want to interact with them, see them and talk with them? Wouldn't you want to look out the window and see the changing of the light, the weather and the seasons? Wouldn't you want to know just how many other rooms or spaces there might be out there? This is exactly a small scale version of what we experience when we do astronomy from the tiny planet we call Earth.

Earth from Apollo 8's orbit around the Moon



Even if you are the kind of person who wants to put their head down and go about their tangible day-to-day life, **you cannot escape the reality of the Universe outside the Earth**. The very chemicals that we are made of - these were forged in the interior of stars. You can't help being star stuff! Like it our not, you are a passenger on a spaceship: Spaceship Earth. This spaceship splats meteoroids across its windshield like snowflakes against a moving car. This spaceship revolves around the sun with a path determined by orbital mechanics. This spaceship travels in a galaxy dominated by dark matter. This spaceship moves in a Universe that is expanding in all directions. This spaceship is finite in size, energy and resources.

Aims

Students will…

- Acquire, apply and remember what is visible in the sky above them
- Know what is beyond what they can see with the naked eye
- Learn how physical principles and optical technology have vastly expanded our knowledge of the Universe
- Appreciate the physical scales of the Universe and the specialness and rarity of Earth-like life
- Use Astronomy content to understand how the scientific process works

By the end of this course, students will…

- Use the Sun, Moon and Constellations to locate North and estimate their latitude
- Describe the nature of the stars, galaxies, black holes and cosmology that are beyond our vision
- Calculate the physical properties of these above objects from their observables
- Describe the optical tools that astronomers use to measure the above observables
- Compare the relative size scales and timescales of the objects in the Universe as compared to our own sizes and lifetimes
- Apply the analytical tools of astronomy to an everyday phenomenon

Star Trails around the North Celestial Pole from Arches National Park

Meeting Times

- Lectures – MWF, 11:15am
  - Lectures will involve both lecture style material as well as think pair share questions (with iClicker technology). These think-pair-share questions have been shown to improve student learning by clearing up misconceptions, engaging deeper thought processes and informing the instructor whether or not he is communicating effectively and at the right pace.
- Recitation Section – M 1:25, 2:30, 3:35, 7:30, Tu 2:30, 3:35 W 1:25, 2:30, 3:35, 7:30 Th 1:25, 2:30
  - Recitation sections are a great time to ask questions, clarify misunderstandings and hone your analytical tools. Course TAs will prepare activities that will help you learn the course content for the tests, homework assignments and beyond the end of the course.
- Celestial Navigation Test
  - To ensure all students learn the skills of finding North and their latitude using the sky, there will be a celestial navigation test with planetarium software. All students should learn these skills by the end of the semester so they may sign up here and re-take the test if they are unsatisfied with their grade.
    - http://www.astro.cornell.edu/A1011/celestial_nav_signup.html
- 3 Class Observing Labs – Attend 1
  - This is your opportunity to learn your celestial navigation skills and look at real celestial objects through a telescope. Be prepared for cold weather! Also, keep in mind that many objects will appear as gray fuzzy blobs in a telescope, not the breathtaking Hubble Images (like the one below). However, a backyard telescope offers you something Hubble cannot – the opportunity to biologically interact with photons from another galaxy!
  - Weather is out of our control, so the following 10 slots near new moon will be scheduled. Please keep at least one of these evenings free per week, especially if the weather looks clear. Notice will be given a few days ahead of promising time slots and the final call will be made by e-mail 12 hours in advance of a scheduled observing session.

Date	Time
T Sep 22	9pm-11pm
Th Sep 24	9pm-11pm
Sat, Sep 27	9pm-11pm
Tu Oct 21	9pm-11pm
Th Oct 23	9pm-11pm
Sat Oct 25	9pm-11pm
Tu Nov 18	7pm-9pm
Th Nov 20	7pm-9pm
Sat Nov 22	7pm-9pm
Tu Nov 25	7pm-9pm

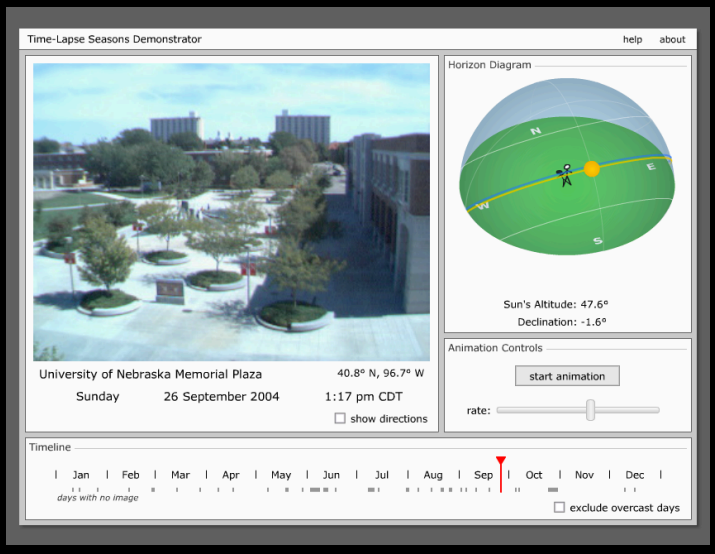
Requirements

Participation Policy: Students are expected to attend all possible lectures and recitation sections, but attendance participation means more than just being present. Students should be consistently monitoring their understanding, asking questions and participating in thinking exercises. Laptops, cell phones, tablets and smart watches should only be used for improving one's ability to learn, not as a distraction that takes the classes' mind off the relevant course material. To encourage everyone to maximize their learning potential, weekly section participation grades will be awarded with full credit to students who participate in classroom activities and zero credit for students who are absent or distract themselves or classmates from the learning process with inappropriate use of technology. To account for emergencies, job interviews or illnesses, 3 participation grades will be dropped for the whole semester.

Readings

- Text: "The Cosmic Perspective" – Bennett, Donahue, Schneider & Voit. Any edition will work, but the instructor will be aligning course material with edition 6
- Electronic Resources
  - SkyGazer comes with the above text, or you can use an excellent freeware program, Stellarium (see image below)
  - The University of Nebraska-Lincoln has the best collection of astronomy simulations on the web: (http://astro.unl.edu/animationsLinks.html). These are excellent ways to work through core concepts about the sky and the essential physics we will go through in this course. There are even concept questions you can go through that will be similar to the examinations in this course.

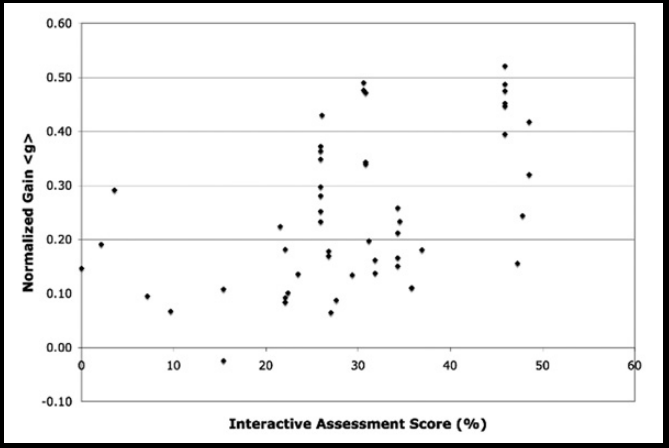
Stellarium looks a lot like the real night sky



The University of Nebraska-Lincoln tools help you visualize the relation between celestial objects and what you see from the ground.

Teaching Methodology

Research on how introductory astronomy students learn shows that classes that involve some active engagement methods – think pair share, lecture tutorials or hands on activities can improve student learning. While lectures have a limited capacity to improve students' gain in ability, interactive methods can take students beyond the lecture ceiling. I assume that the students who think through, and sometimes struggle through, the non-graded questions they are presented with will learn more than students who just pay attention to a 50-minute lecture. Finally, I assume that students will get the most out of the course by applying themselves in class and outside of class so I provide grade incentives for doing so. As astronomy professor Luke Keller of Ithaca College says, the brain is part of our body and has to be used to get better – on a sports team, no one is going to improve if they do not work out and work on their skills consistently.



Classes with low levels of interaction have a ceiling in the amount of learning at a gain of around 0.3, but classes with higher levels of interaction can go higher than this ceiling (Prather et al. *American Journal of Physics* 2008).

Assessment

Grades are a useful external motivator to help your learning process. They are designed to give you feedback about your learning and tell you where your strengths and weaknesses are. They are quantitative forms of feedback whose value is designed to measure your level of mastery.

Assessment Type	Rationale	Points	Description
Participation	The above **interactive methods** only work when you bring your previous knowledge, understandings AND misunderstandings to class.	25	See participation (previous page) with 3 grades dropped for emergencies
Homework Assignments	Most important method for developing your **analytical tools.** These are the skills that you can **take with you** outside the classroom.	25	Weekly assignments that improve your analytical and mathematical skills
Celestial Navigation	Course Outcome: **Learning to navigate** by using the night sky	20	Practical planetarium exam
Mid-term exams	This is where your knowledge about galaxies, stars, light, cosmology and the planets **sink in**. These help you achieve the content goals of the course.	15	The better of the two exams will be taken and the worse of the two dropped

Assessment (Continued)

Assessment Type	Rationale	Points	Explanation
Final Cumulative Exam	The final exam is where you **reinforce** the knowledge from the mid-term exams. Here is where you focus on the **core physical principles** and less on the details.	15	A cumulative exam with overlap with the previous midterm exams.
Total Possible		100	

How to Get the Most from this Course

Dark skies in Joshua Tree National Park. | Photo: Ross Manges/Flickr/Creative Commons License

The goal of this course is not to fill up your transcript with yet another letter grade. You should be using the course to prepare you for the time you have to solve an analytical problem, the time you look up at night in a national park or the time you read about a cool new discovery in the news. This means that you should be asking questions, finding out what parts of astronomy interest you and evaluating what you understand. The **most important tool** you can use to succeed in this course is **office hours** – go over a concept, an exam question or homework question that interests you (or troubles you) with either your Teaching Assistant or the course instructor.

Letter Grade Guide

This guide below based on previous Astronomy 1101 performance is intended to reduce some of the anxiety about not knowing what you will get for the course. If you have concerns about your grade, please see the instructor about what can be done to improve your performance as early in the semester as possible. The final grades assigned may need to be adjusted if the assessments are more difficult than intended.

Letter Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Points	95	90	85	80	75	70	65	60	55	50	45

Academic Integrity

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity, which the course instructor takes seriously. Any work submitted by a student in this course for academic credit will be the student's own work. However, collaboration on problem sets is highly encouraged.

You should study together and discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. Students are highly encouraged to work in groups to solve the homework problems. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Accommodations for students with disabilities

In compliance with the Cornell University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with Student Disability Services to verify their eligibility for appropriate accommodations.

Course Schedule

Month	Day	Topic	Readings/Programs
August	27	This course about the Universe	
August	29	The Night Sky I	Ch 1, Stellarium Program
September	1	The Night Sky II	Ch 2, Stellarium Program
	3	The Power of Units and Orders of Magnitude	
		To be continued for a real course…	