

Syllabus for ASTR116: Spring 2016

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Lecture: MWF 10:45-11:50am
Lab: Tues. 1:40-4:40
Class: Lecture #5475 and Lab #5476

Goals of the Course

This course is an introductory survey of the science of astronomy. Students completing Astronomy 116 are expected to have an ordered understanding of the development of the human quest for knowledge of the heavens, of the ways in which modern astronomers know the Universe and of the important current questions and issues in astronomy. They are expected to learn basic information about the Sun, the solar system, stars, galaxies and modern cosmology, as well as to develop a basic understanding of physical principles underlying astronomical research. They should be able to identify objects in the night sky and develop the foundation for a lifetime of appreciation and enjoyment of the heavens.

Textbook and Readings. The textbook for the course is *Discovering the Essential Universe*, 5th edition, by Neil F. Comins, published by W. H. Freeman and Co., 2012. Additional readings from other sources may be assigned from time to time, and some videos that supplement the readings and lectures will be shown.

Blackboard: I will post all lectures, lab reports, homework assignments, and exam solutions on our **ASTR116 blackboard conference**. Similar information is also posted on my website at *www.philsegre.com*.

Office Hours: My office is in room 220 of the Oxford Science building. My office hours each week are **Wed. 1-4** and **Thurs. 1-4**. I have an open door policy: if I am in the office and the door is open, feel free to come in. We can talk about physics and homework assignments, your student life, and anything else you would like to chat about. You can also email me or talk with me in class to make individual appointments.

Homework: Questions, exercises, etc., will be assigned in class. Such assignments will be turned in for a grade and students are expected to follow the Honor Code.

Additional Materials. Students will need scientific calculators for laboratory and class work.

Daily reading: After each class, I will assign the reading that you should do before coming to class the next time. By doing the reading before coming to class, you will be better prepared to follow the material covered in class.

Tests and Exams:

The tests in Astronomy 116 will include objective questions, some of which will be quantitative in nature. A few questions will require Algebra to solve equations used in class. Some questions may stress reasoning with principles. Three tests will be given, during class time, on the following dates:

Exams: Test 1 - Monday, Feb. 8
Test 2 - Monday, Feb. 29
Test 3 - Monday, April 4

Grade Breakdown:

Two tests count 15% each, and the lowest test counts 10%, Total 40%
Labs Reports: 15%
Lab Quizzes: 5%
Homework: 10%
Class Participation: 10%
Final Exam 20%

The course grades will be determined, as follows: 90-100 A, A- : 80-90 B+, B, B- : 70-80 C+, C, C- : 60-70 D : Fewer than 60, F.

Grades of A-, B+, B-, C+, C-, D+ will be assigned for sums of points near the ends of the grade ranges; example, (79.5-82.5) B-, (82.5-86.5) B, and (86.5-89.5) B+.

Attendance: I find attendance and class participation to be vital for this course. I will take attendance every lecture class. You will find the homework much easier to do if you come to class and you actively participate by asking questions. You are allowed 4 absences regardless of whether you have a valid reason for them or not. Therefore, I recommend that you save those for when you really need them (e.g. you get sick) instead of skipping class. If you exceed the 4 absences, I will deduct 2% off of your final grade for every additional absence. Being late for a class, or having your cell phone ring in the middle of one, is distracting not only for you but also for me and for your classmates. Students who are late for class for more than 10 min will generally not be allowed to attend that days lecture and will be considered absent. ATTENDANCE IS MANDATORY FOR LAB SESSIONS.

Use of Computers/Cell Phones/Tablets in class: My policy is simple, during lectures, unless I specifically say otherwise,

- No Computers
- No Tablets
- No Cell Phones

are allowed to be used.

Working with the Honor Code: The Oxford College Honor Code applies to this course as follows:

- Quizzes and exams: The work presented in these assignments should be your own. No collaboration permitted. You are expected to follow the instructions given by me and abide by the Honor Code. Sharing calculators, pencils, etc., is not allowed.
- Lab report, lab project: On these assignments you can only collaborate with your lab partner.
- Homework assignments: It is fine to work together on homework assignments but students are expected to solve and understand the problems themselves.
- Study groups: You are encouraged to form study groups and study concepts together and explain to each other things that you were not clear about from class or from your reading assignments.

Religious Holidays: You need to tell me immediately if any religious holidays will interfere with the course, especially the final exam and tests.

ASTR116 Course Lecture Topics

All dates (except for the final) are approximate, although they should be accurate to within 1 class date.

WEEK	DATE	LECTURE	READINGS
#1	Jan. 13	Introduction	Chapter 1
2	Jan. 20	Celestial Sphere, Constellations, Earth's Motion	Chapter 1
		Magnitudes, Moon Phases, Eclipses, Distance Formulas	Chapter 1
3	Jan. 25	History of Astronomy, Newton's and Kepler's Laws	Chapter 2
		The Nature of Light & Telescopes	Chapter 3
4	Feb. 1	Blackbody Radiation	Chapter 3
		Atoms and Spectra	Chapter 3
5	Feb. 8	TEST # 1	Chapters 1-3
		Formation of Solar System, Terrestrial Planets & Moon	Chapter 4
6	Feb. 15	Venus and Mars	Chapter 5
		Jovian Planets	Chapter 6
7	Feb. 22	Planetary Moons	Chapter 7
		Asteroids, Comets and Meteors	Chapter 7
		The Sun	Chapter 8
8	Feb. 29	TEST # 2	Chapters 4-8
		Characterizing Stars, Formation of Stars, HR Diagram	Chapter 9
9	March 14	The Lives of Stars	Chapter 10
10	March 21	Deaths of Stars and Their Remnants	Chapter 11
		Relativity and Black Holes	Chapter 11
11	March 28	Binaries, Variables and Nebulae	Chapter 11
		Star Clusters and Gamma Ray Bursts	Chapters 11/12
12	April 4	TEST # 3	Chapters 9-11
		Galaxies, Milky Way and Dark Matter	Chapter 12
13	April 11	Hubble's Law and Galaxies	Chapter 12
		Superclusters	Chapter 12
14	April 18	Quasars, Active Galaxies and the Distance Ladder	Chapter 12
		Cosmology and the Big Bang	Chapter 13
15	April 25	Astrobiology: The Search for Life	Chapter 14
FINAL	May 2	Final Exam 10am-1pm	Chapters 1-14

Laboratory

The weekly Labs will consist of both in class activities as well as some nighttime observations with telescopes and cameras. Laboratory activities are designed to give the student opportunities for investigating nature with scientific methodology. The regular laboratory schedule will begin on Tuesday Jan. 19th. All laboratory sessions will begin promptly at 1:40 p.m. in room 217 in the science building. Students are expected to arrive on time for lab.

Laboratory work will consist of investigatory projects using the Voyager 4.5 software, CLEA labs, NAAP Labs, and observations. Attendance at laboratory sessions is mandatory. An absence from lab will result in a 10% reduction in the student's final lab grade. The lab manual needed for a particular laboratory session will be given out in class the week before the laboratory session.

Each student's work must be their own. Collaboration is permitted only in using laboratory apparatus, and observing the sky. During the in-class labs, you may discuss your calculations or procedure, but each student must do his/her own measurements and obtain his/her own results.

Laboratory Reports. Students will submit laboratory reports in connection with the computer projects mentioned above. All reports will require written work and will be judged on the quality of writing as well as on the presentation of the results of laboratory investigations. Standards for reports will be issued and discussed in laboratory. **Lab reports are due 1 week after performing the labs in class.** Failure to turn in assignments on the designated day will result in a reduction of 10% for each day the assignment is late.

Lab Quizzes. At the start of each lab period, you will taken a short quiz comprised of questions relating to

- post-lab quiz question: on the lab you did last week
- pre-lab quiz question: on the lab you are about to do, and
- general quiz questions: on recent lecture material

Oral Presentation. Students will prepare and give short, illustrated, oral presentations concerning a current topic in Astronomy. Details will be issued after midterm. The oral presentations will take place during the last laboratory sessions (April 18 and April 25).

In Class Lab Schedule

1. The Night Sky. (Voyager4.5 software)
2. Equatorial System and Planetary Motion. (Voyager4.5)
3. Moon Lab and the Inverse Square Law of Light. (Physics lab and Handouts)
4. Jupiter's Mass. (CLEA)
5. Extrasolar Planets. (NAAP)
6. Hertzsprung-Russel (HR) Diagram. (Voyager4.5)
7. Atmospheric Retention (NAAP)
8. Classification of Stellar Spectra. (CLEA)
9. Variable Stars. (Handouts)
10. The Color Index of Stars. (CLEA)
11. Hubble's Law. (CLEA)

- **CLEA Computer Labs** All of the programs used to run the labs can be downloaded for FREE from the website at <http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html> Note: these labs contain .exe files and will NOT work on Mac computers.
- **NAAP Computer Labs** All of the programs used to run the labs can be downloaded for FREE from the website at <http://astro.unl.edu/naap/>

Astronomy Software Programs That You Need to Download to Your Computer:

On my webpage at <http://www.philsegre.com/astronomy-software>, I give links to many useful astronomy program that are free to download and use. Use this webpage to find and download the following required programs...

1. **LAPTOP - Skygazer4.5 DEMO:** The free sky planetarium software Skygazer4.5 DEMO, available for both Windows and Mac computers.
2. **LAPTOP - StarStax:** The free star trails program StarStax, available for both Windows and Mac computers.

Astronomy Software Apps That You Need to Download to Your Phone:

1. **iPhone - SkySafari 5:** \$0.99 – Planetarium software to visualize the night sky.
 - (a) **Android - SkySafari 4:** \$2.99 – Planetarium software to visualize the night sky.
2. **iPhone/Android - Planets:** Free – Details on the visibility of planets each day.
3. **iPhone/Android - MoonCalendar:** Free – Details on the phase of the Moon each day.
4. **iPhone - Moon Globe:** Free – Shows a detailed Map of the Lunar surface with names of significant features.
 - (a) **Android - Moon Atlas 3D:** Free – Details on the phase of the Moon each day.
5. **iPhone/Android - APOD:** Free – Astronomy Picture Of the Day. Beautiful photos from NASA.

Outdoor Telescope Labs:

We will be going outside several times during the semester to observe the Sun, the Moon, the Planets and the Stars. The exact dates will depend upon the weather, but the preferred night will be on Tuesdays. In some cases the outdoor observational labs will be in addition to the regular weekly in class labs, in some cases they will replace them. The observational labs will include taking photos and/or videos using telescopes and CCD cameras. Following the observational labs, you will typically do some image processing work on the computer back in the lab. Some of the observational labs include

1. Constellations, Star Trails and Star Colors – Can be done any clear evening.
2. The Moon – The best time is a few days *before* the Full Moon so that it is very high in the sky at 7-10pm. Full Moon Dates: Jan. 23, Feb. 22, March 23 and April 22, 2016.
3. The Pleiades Star Cluster – Visible in the evening until early April.
4. The Orion Nebula – Visible in the evening sky all semester.
5. The Andromeda Galaxy – Visible in the evening until early March. Best seen when no Moon is present.
6. The Sun – Can be done any clear day.
7. Spectroscopy of Stars – Can be done any clear evening.
8. Jupiter – Visible in the evening starting in March.
9. Saturn and Mars – These two planets will *not* be visible in the evening sky this semester.

**Note that to observe and photograph the night sky, we need the sky to be very dark, which occurs approximately 90 minutes after sunset. These times vary over the semester, and the approximate times when the sky becomes dark are: Jan. 15–7:15pm, Feb. 1–7:30pm, Feb. 15–7:45pm, March 1–8:00pm, March 15–9:15pm, April 1–9:30pm and April 15–9:45pm.

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