

## **Astronomy 116** **Spring 2013**

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Modern astronomy concerns itself with the Universe, its origin, its structure, its contents, its processes, its evolution and its ultimate fate. While modern astronomy attempts to explain the Universe in terms of physical principles, the ordered study of the heavens for the purpose of making predictions is as old as human civilization. Astronomy can thus claim to be the oldest of the natural sciences. This enterprise continues because humanity continues to believe that the Universe is comprehensible.

**Course Objectives.** 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 Universe*, 9<sup>th</sup> edition, by Neil F. Comins and William J. Kaufmann, published by W. H. Freeman and Co., 2012. Additional readings from other sources may be assigned from time to time, and some videos will be shown, that supplement the readings and lectures. You are asked to bring your textbook to class every class period since we will sometimes need to refer to tables, graphs and illustrations in the textbook during lectures.

**Laboratory.** Laboratory activities are designed to give the student opportunities for investigating nature with scientific methodology. The regular laboratory schedule will begin in the second week of classes, on **Tuesday Jan. 22<sup>nd</sup>**. All laboratory sessions will begin promptly at 1:40 p.m. in classroom 206 in Pierce Hall. 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. Normally the laboratory will last for three hours. **Attendance at laboratory sessions is mandatory. An absence from lab will result in a 10% reduction in the student's final lab grade.** The preparation needed for a particular laboratory session will be announced in class on the Tuesday preceding 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 own measurements and obtain his 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.

**Observation Requirements and Journal.** The student will be expected to observe, (supplemental or independent observations) outside the laboratory observation periods. Students will maintain a record of observations in a separate journal. Journals will be submitted and commented upon after the second laboratory observation and at the end of the course. Standards for the journal will be issued and discussed after the first observation.

**Tests.** 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:

Test 1 - Monday, Feb. 11  
Test 2 - Monday, March 4  
Test 3 - Tuesday, April 8

These dates are included on the attached calendar of textbook reading assignments.

**Grades:**

Two tests count 15% each, and lowest test counting 10%. – Total 40%  
Final Exam 25%  
Labs Reports: 15%  
Lab Quizzes: 10%  
Homework: 10%

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, (80-83) B-, (84-86) B, and (87-89) B+.

**Class Conference.** A conference, named 116 Astronomy, has been set up. Students should stay "tuned" to the conference. All Homework assignments, lab manuals, lab quizzes, exams and solutions will be posted in the ASTR116 blackboard conference. You can also visit my website at [philsegre.com](http://philsegre.com) (don't put www in front!), click on ASTR116 for lots of helpful information also for the class.

**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 16 & April 23).

**Homework and Other Assignments.** 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. A lab journal is required for observations.

**Absences.** Students will be asked to sign in at the beginning of each lecture class. Each student may be **absent three times** without penalty, but any additional cuts will result in a grade reduction of two points from your final grade for each additional absence. As stated above, attendance at laboratory is mandatory. If you miss a lab, you will need to

present proof of the situation. Acceptance of an absence will be determined by the instructor. Starting with the first absence from lab, the student will be subject to a reduction of 10% of the final lab grade. There will be an additional 10% reduction for each additional absence. Students are to be in class and lab on time. If you are tardy three times that will be charged as an absence.

**Office Hours.** Dr. Segre: Monday 2-5 pm and Thursday 2-5 pm, -- or see me after class for a time that is convenient for both of us.

**THE HONOR CODE OF OXFORD COLLEGE APPLIES TO ALL WORK SUBMITTED FOR CREDIT IN THIS COURSE.**

**Astro 116**  
**Weekly Class Outline: Spring 2013**  
**Instructor: Dr. Phil Segre**

<b>Week</b>	<b>Date</b>	<b>Lecture</b>	<b>Readings &amp; Information</b>
1	Jan 16	Introduction	<b><i>Discovering The Universe, 9<sup>th</sup> Ed.</i></b>
2	Jan 21	Celestial Sphere, Constellations, Earth's Motion, & Time	Chapt 1
		Magnitude, Moon Phases, Eclipses , Small Angle & Distance Formulas.	Chapt 1
3	Jan 28	History of Astronomy, Newton, Kepler's Laws, Mass & Energy	Chapt 2
		Light, & Telescopes	Chapt 3
4	Feb 4	Spectra I	Chapt 4
		Spectra II	Chapt 4
<b>5</b>	<b><i>Feb 11</i></b>	<b><i>Test 1</i></b>	<b><i>Chapters 1-4</i></b>
		Formation of solar system Terrestrial planets, Earth , Mercury & Moon	Chapt 5 & Chapt 6 Chapt 7
6	Feb 18	Venus & Mars	Chapt 7
		Jovian Planets	Chapt 8
7	Feb 25	Planetary Moons	Chapt 8
		Asteroids, Comets & Meteors	Chapt 9
		The Sun	Chapt 10
<b>8</b>	<b><i>Mar 4</i></b>	<b><i>Test 2</i></b>	<b><i>Chapters 5-10</i></b>
9	Mar 18	Formation of Stars, Main Sequence, HR Diagram	Chapt 11 Chapt 12
		Stellar Properties	Handout
10	Mar 25	Deaths of Low & High Mass Stars	Chapt 13
		Relativity & Black Holes	Chapt 14
11	April 1	Binaries, Variables, Nebulae, Star Clusters Gamma Ray Bursts	Chapt 11 Chapt 12
		Video	
<b>12</b>	<b><i>April 8</i></b>	<b><i>Test 3</i></b>	<b><i>Chapters 11-14</i></b>
		Milky way & Dark Matter	Chapt 15
13	April 15	Hubble's Law & Galaxies	Chapt 16
		Video	
14	April 22	Quasars, Active Galaxies & Distance Ladder.	Chapt 17
		Cosmology – Big Bang	Chapt 18
15	April 29	Search for Life - Review for final exam	Chapt 19
<b><i>Final</i></b>	<b><i>MAY 3</i></b>	<b><i>Final Exam 2-5pm</i></b>	

**Astro 116**  
**LABS: Spring 2013**  
**Instructor: Dr. Phil Segre**

1. The Night Sky. (*Voyager4.5*)
2. Equatorial System and Planetary Motion. (*Voyager4.5*)
3. Moon Lab and the Inverse Square Law of Light. (*Physics lab & 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. 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.

**VOYAGER 4.5 Computer Labs:**

We will use the *Voyager 4.5* astronomy computer program for these labs.

Note that for home use, you can buy Voyager 4.5 for \$99 from  
<http://www.carinasoft.com/store.html>

You can also buy the more stripped down program called Skygazer 4.5 for \$29, or you can use the FREE version of Skygazer 4.5 from  
<http://www.carinasoft.com/downloads.html>

**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/>