

PHY102: Astronomy, Cosmology and Astrophysics

Gustavus Adolphus College

Spring Semester 2009

Instructor: Dr. Steven Mellema

Office: Olin Hall 210

Office Hours: MTWRF 10:30 AM - 12:30 PM

Phone: 933-7306

Email: mellema@gustavus.edu

Textbooks (Required):

- *The Cosmic Perspective, Fifth Edition* by Bennett, Donahue, Schneider and Voit, ©2008, Pearson Addison-Wesley
- *PHY102 Lab Manual Spring 2009*, by Steve Mellema and Chuck Niederriter
- *Star and Planet Locator*, from Edmund Scientific

Course Objectives:

1. Achieve an understanding of “how we know what we know” in science and in astronomy.
2. Come to an understanding of your own, personal position in the universe.
3. Examine the relationship between scientific knowledge and other types of knowledge.
4. Understand the social context of science, and astronomy in particular, both historically and contemporarily.
5. Learn critical thinking, quantitative reasoning and problem-solving skills and be able to apply them successfully to the solution of scientific problems.

Achievement of these objectives will be demonstrated through writings (answers to group problems, papers, exams, and lab reports) as well as participation in class discussions.

Course Policy and Evaluation:

1. **Lecture Schedule:** The regular class meeting time is Monday, Wednesday and Friday during 2nd period (9:00-9:50 AM). Class periods will be used for discussion, lecture, problem solving, etc. Attached is a daily calendar of activities for the course. When a reading assignment is listed for a class discussion, the **reading is expected to be completed before coming to the class.**
2. **Group Problems:** Frequently, students will work together, in assigned groups of 2-3 members, to cooperatively solve problems. Only one group solution will be submitted, with all group members receiving the same grade. There will be no make-up for group problems missed due to absence.
3. **Homework:** Homework assignments will be administered using the [Mastering Astronomy](http://www.masteringastronomy.com) website associated with our textbook. These will be assigned periodically and will have fixed due dates/times. You should register at the www.masteringastronomy.com website as soon as possible using the Student Access kit that came with your textbook. Our Class ID is **PHY102S09**.
4. **Labs:** Each student must register for and attend a laboratory class weekly on **either** Tuesday or Thursday during the same class period, 9-9:50 am.
 - a. **Pre-Lab Quizzes:** On days when a lab experiment is scheduled, there will be a pre-lab quiz based upon the lab handout for that experiment. This quiz will be administered via the [WebAssign](#) program on the World Wide Web. The quiz must be completed by each student

before coming to lab, and the WebAssign assignment for that day will expire 15 minutes before lab begins, i.e. at 8:45 AM.

- b. **Lab Experiments:** Attendance at lab experiments is required. Lab reports will only be accepted from those who signed the lab attendance sheet. Generally, the 50-minute lab period will be long enough for students to take the necessary data, but additional work time will be needed outside of class to finish the analysis and write the lab report.
- c. **Evening Observing Labs:** Each student will also be required to complete four evening observing laboratory exercises, one during each month of the semester.
- d. **Lab Reports:** Although lab work will be carried out in groups, each student must submit an individual lab report. While data will undoubtedly be shared among lab-group members, all calculations, conclusions and answers to questions are expected to be done by the individual submitting the report. Lab reports will be worth 10 points each for in-class labs and 20 points each for evening observing labs.

5. **Extra-Credit Video Reports:** Throughout the semester, a series of videos will be presented in the evenings. Attendance is optional, but any student who attends a video presentation and submits a 1-2 page summary paper (**summarizing** the video and **relating** it to the course discussions) will receive extra credit of up to 5 points toward the next exam score. (Video extra credit points may not carry over past the next exam, and no exam score can ever exceed 100%.)

6. **Exams:** There will be four one-hour exams during the course of the semester (see schedule below) and a two-hour, comprehensive final exam. Students must arrange **in advance** to take an exam at other than the scheduled time, and may do so **only** for a valid health or school-related reason. (It is the responsibility of the student to inform the instructor during the first week of the semester regarding any anticipated absences due to required field trips, athletic events, musical performances, or other extra-curricular activities.) Exams missed without pre-arrangement are entered as zero credit and cannot be made up.

7. **Attendance:** Students are expected to attend all class periods, and are responsible for all announcements and assignments made during class.

8. **Academic Honesty:** Having signed and agreed to abide by the College's Honor Code, students thereby pledge that, in all academic exercises, examinations, papers, and reports, they shall submit their own work. In the context of this course, students are expected to collaborate and to discuss their out-of-class assignments. However, submitting under one's own name work that is merely copied from another is a violation of the Honor Code. (The full text of the Gustavus Academic Honor Code Policy may be found in the Gustavus Academic Bulletin 2005-2006, pp. 32-33).

9. **Evaluation:** Grades will be assigned using the following as a guide:

40% Hour Exams (10% each)	15% Homework	5% Pre-Lab Quizzes
15% Final Exam	10% Group Problems	15% Lab Reports

Final course grades will be use the following scale as a guide:

94-100 A	90-94 A-	86-90 B+	82-86 B	78-82 B-
74-78 C+	70-74 C	66-70 C-	62-66 D+	58-62 D
				0-58 F

12. **Incompletes:** A grade of incomplete will **only** be given for work not completed due to circumstances beyond the control of the student (*this is the College policy*).

February

<i>Sun</i>	<i>Mon</i>	<i>Tue</i>	<i>Wed</i>	<i>Thu</i>	<i>Fri</i>	<i>Sat</i>
1	2	3	4	5	6	7
8	9 Syllabus; Introduction	10 Experiment 1: <i>Observation and Star Chart</i>	11 Chapter 1: <i>Our Place in the Universe</i>	12 Experiment 1: <i>Observation and Star Chart</i>	13 Chapter 2: <i>Discovering the Universe for Yourself</i>	14
15	16 Sections 3.1-3.3: <i>The History of Astronomy</i>	17 Experiment 2: <i>Introduction to Voyager: Skygazer</i>	18 Sections 3.4- end: <i>The Science of Astronomy</i>	19 Experiment 2: <i>Introduction to Voyager: Skygazer</i>	20 Sections 4.1-4.3: <i>Understanding Motion</i>	21
22	23 Sections 4.4- end: <i>Gravitation and Tides</i>	24 Experiment 3: <i>Introduction to Spectroscopy</i>	25 Sections 5.1-5.3: <i>Properties of Light and Matter</i>	26 Experiment 3: <i>Introduction to Spectroscopy</i>	27 Sections 5.4- end: <i>Learning from Light</i>	28

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March

<i>Sun</i>	<i>Mon</i>	<i>Tue</i>	<i>Wed</i>	<i>Thu</i>	<i>Fri</i>	<i>Sat</i>
1	2 Review: Chapters 1-5	3 Experiment 4: <i>Light, Brightness and Distance</i>	4 Hour Exam: Chapters 1-5	5 Experiment 4: <i>Light, Brightness and Distance</i>	6 Chapter 7: <i>Our Planetary System</i>	7
8	9 Chapter 8: <i>Formation of the Solar System</i>	10 Experiment 5: <i>The Moons of Jupiter</i>	11 Sections 9.1-9.4: <i>Planetary Geology; Mars, Mercury, and the Moon</i>	12 Experiment 5: <i>The Moons of Jupiter</i>	13 Sections 9.5- end: <i>Planetary Geology; Venus and Earth</i>	14
15	16 Sections 10.1- 10.4: <i>Planetary Atmospheres; Mars, Mercury and the Moon</i>	17 Experiment 6: <i>Rotation of Mercury</i>	18 Sections 10.5- end: <i>Planetary Atmospheres; Venus and Earth</i>	19 Experiment 6: <i>Rotation of Mercury</i>	20 Chapter 11: <i>Jovian Planet Systems</i>	21
22	23 No Class: Spring Break	24 No Class: Spring Break	25 No Class: Spring Break	26 No Class: Spring Break	27 No Class: Spring Break	28
29	30 Chapter 12: <i>Asteroids, Meteorites and Comets</i>	31 Experiment 7: <i>Discovery of Extrasolar Planets</i>				

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April

<i>Sun</i>	<i>Mon</i>	<i>Tue</i>	<i>Wed</i>	<i>Thu</i>	<i>Fri</i>	<i>Sat</i>
			1 Chapter 13: <i>Extrasolar Planets</i>	2 Experiment 7: <i>Discovery of Extrasolar Planets</i>	3 Review: Chapter 7-13	4
5	6 Hour Exam Chapters 7-13	7 Experiment 8: <i>Photoelectric Photometry of the Pleiades</i>	8 Chapter 14: <i>Our Star – the Sun</i>	9 Experiment 8: <i>Photoelectric Photometry of the Pleiades</i>	10 No Class: Easter Break	11
12	13 No Class: Easter Break	14 Experiment 9: <i>Classification of Stellar Spectra</i>	15 Chapter 15: <i>Surveying the Stars</i>	16 Experiment 9: <i>Classification of Stellar Spectra</i>	17 Chapter 16: <i>Star Birth</i>	18
19	20 Chapter 17: <i>The Lifetimes of Stars</i>	21 Experiment 10: <i>Properties of Stars</i>	22 Chapter 18: <i>Star Deaths</i>	23 Experiment 10: <i>Properties of Stars</i>	24 Review: Chapters 14-18	25
26	27 Hour Exam: Chapters 14-18	28 Experiment 11: <i>Radio Astronomy of Pulsars</i>	29 Sections 19.1-19.2: <i>Introduction to Our Galaxy</i>	30 Experiment 11: <i>Radio Astronomy of Pulsars</i>		

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May

<i>Sun</i>	<i>Mon</i>	<i>Tue</i>	<i>Wed</i>	<i>Thu</i>	<i>Fri</i>	<i>Sat</i>
					1 Sections 19.3- end: <i>Evolution and Structure of Our Galaxy</i>	2
3	4 Sections 20.1- 20.2: <i>Galaxies and Distances</i>	5 Experiment 12: <i>The Hubble Redshift- Distance Relation</i>	6 Sections 20.3- end: <i>Hubble's Law</i>	7 Experiment 12: <i>The Hubble Redshift- Distance Relation</i>	8 Sections 21.1- 21.2: <i>Lifetimes of Galaxies</i>	9
10	11 Sections 21.3- end: <i>Active Galactic Nuclei</i>	12 Experiment 13: <i>The Quest for Object X</i>	13 Sections 22.1- 22.2: <i>Dark Matter</i>	14 Experiment 13: <i>The Quest for Object X</i>	15 Sections 22.3- end: <i>Fate of the Universe?</i>	16
17	18 Chapter 23: <i>The Big Bang; Origin of the Universe?</i>	19 Review: Chapters 19-23	20 Hour Exam: Chapters 19-23	21 No Class: Reading Day	22 8:00-10:00 AM Comprehensive Final Exam	23
24	25	26	27	28	29	30

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