**Prof Robert L. Zimmerman**  
Elementary Astronomy, ASTR 123  
Cosmology  
The Evolution of Galaxies and the Universe  
Spring 2004, Columbia Room 150 14:00 to 14:50 M,W,F

**Prof Robert L. Zimmerman:** Office Wil 448, bob@zim.uoregon.edu  
Office Hours: 10:30-11:30 M, W, & F  
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**Graders:**  
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**Text:** Astronomy Today by Eric Chaisson & Steve McMillan  
Web page for the Text http://www.prenhall.com/chaisson

### Approximate Outline

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading (chapters)</th>
<th>Assign</th>
<th>Tests</th>
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<tr>
<td>1 (3/29)</td>
<td>Overview and Introduction (No Class Friday, 4/4)</td>
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<td>2 (4/5)</td>
<td>The Milky Way Galaxy</td>
<td>23</td>
<td>Assign #1</td>
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<td>3 (4/12)</td>
<td>Normal Galaxies</td>
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<td>Assign #2</td>
<td>TEST #1(4/16,Friday)</td>
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<td>4 (4/19)</td>
<td>Normal Galaxies</td>
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<td>5 (4/26)</td>
<td>Active Galaxies and Quasars</td>
<td>25</td>
<td>Assign #4</td>
<td>TEST #2 (5/7,Fri)</td>
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<td>6 (5/3)</td>
<td>Active Galaxies and Quasars</td>
<td>25</td>
<td>Assign #5</td>
<td>TEST #3 (5/28 Fri)</td>
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<td>7 (5/10)</td>
<td>Cosmology</td>
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<td>Assign #6</td>
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<td>8 (5/17)</td>
<td>Cosmology</td>
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<td>Assign #7</td>
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<td>9 (5/24, Monday Holiday)</td>
<td>The Early Universe</td>
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<td>TEST #3</td>
<td>(5/28 Fri)</td>
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<td>10 (5/31 Dead Week)</td>
<td>Life in the Universe</td>
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<td>11 (6/7 Final Week)</td>
<td>Final---Tuesday, 6/8 at 15:15 (3:15 PM, Col 150)</td>
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**Midterm Exams:** There will be three weekly exams and one final. Each weekly exam is worth 40 points and covers only the material to the previous exam. The test questions come from the lectures
and book. There will not be any makeup exams because your grade is based on your two best scores.

**Final:** The final is worth 80 points and covers the complete term. The questions for the final are comprehensive but are closely related to the questions covered in the three midterm tests and the last week of lectures. You must take the final!

**Web Assignments:** There will be a "Web Assignment" about once each week. The Web assignments are designed to expand your exposure to astronomy and to the latest findings. There is two parts to the assignment: i. In part one you are asked to explain some basic concepts ii. In part two you are asked to return various images with brief explanations of the images. All images must be placed in a word processor and under the pictures you must include a brief description of the image and the URL where you located the image. You only get full credit if the assignment is handed in on time and it is complete. You must do your own work and you must personally hand in your own paper. **You cannot copy or xerox another person’s report and replace their name with yours even if you do the assignment together!** A reduction of points will occur if it is not turned in on time, not done with a word processor, or it is xeroxed from another paper. The web assignment is worth approximately 6 or so points.

**Returned Work:** All work will be returned in the basement of Willamette Hall. At the bottom of the stairs there are shelves where your work will be returned. Your grades are posted on the bulletin board to the right of the shelves.

**Attendance:** Attendance is REQUIRED. To encourage attendance short questions worth about four points may be asked during the term.

**Extra Credit:** You may write a report for extra credit. The report must consist of no less than 4 double spaced pages (not including pictures) on any topic covered during the term (The Galaxies, Active Galaxies, Quasars and Cosmology). The material can come from the Web. Add pictures from the Web to your paper. You must cite the web URLs used in your report and images. The report is due the last class lecture of dead week. The extra credit does not give you any additional points but if you are on the borderline it may increase your final grade. The extra credit may increase your grade by changing an F+ to a D-, a D+ to a C-, B+ to A and etc. The extra credit is strongly advised.

**Grades:** Your class score will be determined by throwing away your lowest midterm test and then adding all of your points (All Web Assignments +two midterm tests +Attendance Questions+ Final). Your grade will then be based on a class curve made from the total points.
Galaxies and the Expanding Universe CRN 35438 March 29, 2004

This introductory astronomy course covers the structure of our galaxy, the origin and evolution of galaxies, as well as the origin and evolution of the universe as a whole. This course requires minimal mathematics—some arithmetic and a little algebra.

Classes: Mondays, Wednesdays and Fridays 15:00 to 15:50 in Room 100 Willamette.

Instructor: Roger Haydock (haydock@darkwing), 172 Willamette Hall, 346-5221. Office hours – Tuesdays and Thursdays 08:30 to 09:30 or by appointment.

Assistant: Libby Schoene (eschoene@darkwing), office hours - Tuesdays and Thursdays 09:30-10:30, Room 219, Willamette Hall, 346-4780.


Homework: Prepare for each class by reading the assigned material in the text and answering the appropriate questions from the self-tests. After class reread the material and write out the answers to the questions on that material in Review and Discussion. Try a few of the relevant Problems. Be sure to use complete sentences as well as diagrams and formulas in answering the questions and problems. You should be spending about 6 hours per week, outside of class, studying the text, answering questions, and solving problems.

Midterms: Friday, April 16, and Friday, May 7, there will be midterms in class. Each midterm will consist of ten questions similar to Review and Discussion questions or the simpler Problems. The purpose of the midterms is to tell you how you are progressing with the course. Only your midterms which are better than your final examination will be averaged into your final grade.
Final Exam: **Thursday, June 10, at 15:15 in Room 100 Willamette is Required** for a pass or a grade. This examination will consist of twenty questions similar to **Review and Discussion** questions or the simpler **Problems**.

Project: Because this is a four credit course meeting three hours per week, each student is **required** to plan, conduct and report on a **quantitative** test of an astronomical principle covered by the course. Examples of the kind of observations appropriate for this project are observations of the Milky Way or other galaxies, as well as statistics of star distributions in various parts of the sky. Other kinds of observations are possible, but should be discussed in advance with the Instructor; originality is encouraged. Theories about the distributions of stars and galaxies are the sorts of principles which can be tested simply.

The grade for each project will be based on a written report, **due before the final exam**, of not more than 1,000 words, but which may contain sketches, graphs, photographs, equations, and so forth. Reports should be written so as to be understandable to other members of the class and should include an introduction to the principle being tested, a description of how the observations were made, the data obtained, and a discussion of whether or not the results support the principle under investigation.

The total effort on the project should be about 3 hours per week, or a total of 30 hours for the course.

**Grading:** The Final grade is **75% Exams + 25% Project**. The exam grade is the average (weighting individual questions equally) of the Final Exam and any Midterms which were better than the Final. The principle for grading exams is that demonstration of understanding of 2/3 or more of the material is an A, ½ or more a B, and 1/3 or more a C. The project is graded on the principle that a coherent report reflecting 30 hours of effort earns a B (A if the project is outstanding in some respect).

**Reading:** If you have time, visit the Science Library and read about what is new in science and astronomy. Some interesting magazines are *The New Scientist, Nature, Science, Science News, The Scientific American, Astronomy*, and *Sky and Telescope*.

**Course Plan:**

**March**

29 Introduction to the Class

31 Milky Way Galaxy Chapter 23

**April**

2 Spiral Arms

5 Galactic Center

7 Galactic Halo

9 Classification of Galaxies Chapter 24
12 Distribution of Galaxies
14 Hubble's Law
1 Initial Midterm covering Chapters 23 and 24
19 Seyfert Galaxies Chapter 25
21 Radio Galaxies
23 Quasars
26 Evolution of Galaxies
28 Big Bang Chapter 26
30 Relativity
May
3 The End of the Universe
5 Cosmic Background
7 Second Midterm covering Chapters 25, and 26
10 The Early Universe Chapter 27
1 Inflation
14 Formation of Atoms
17 Formation of Structure
19 Origin of Life Chapter 28
21 Evolution in the Solar System
24 no class
26 Search for Extraterrestrial Life
28 Intelligent Life
31 Review I
June
2 Review II
4 Review III
Final Exam at 15:15 in Room 100 Willamette covering Chapters 23 - 28.