PHYS 1040: Elementary Astronomy
Course Syllabus
Weber State University, Spring Semester 2008

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Lectures: *MWF, 9:00am-9:50am*, Ott Planetarium (Lind 203)
Textbook: *Universe: the Definitive Visual Guide*, ed. Martin Rees
Webpage: `aeon.physics.weber.edu/slarson/classes/phys1040/`

1 Introduction

"Astronomy is a science for everyone. Anyone who looks at the sky and contemplates its wonders is an astronomer."
$\sim$ David Levy, in *The Sky: A User's Guide*

Welcome to astronomy! I'm sure many of you are in this class for different reasons. Some of you are finally taking the opportunity to have a class in astronomy which may have been a passion of yours since childhood; some of you want to know more about astronomy than what you've learned from watching reruns of *Star Trek*; and still some of you are fulfilling basic science requirements so you can graduate. Whatever the reason you are in this class, you are about to embark on a study of one of the oldest scientific disciplines.

Astronomy has been a part of virtually every culture since antiquity, beginning from simple mythology of the constellations and an understanding of the passing of the seasons as marked by the heavenly motions, now grown into an international modern scientific enterprise which explains exotic phenomena such as black holes, quasars and dark matter. Unlike other scientific disciplines, astronomy is not an experimental endeavour. There are few controlled experiments which can be carried out and repeated in laboratories. Virtually everything we know about the Cosmos has been learned through observations from the confines of our small world. As such, our explorations this semester will be journeys which begin in our minds; we will venture out into the most distant reaches of the Universe unfettered by conventional limitations on speed and space travel. We will not be afraid to extrapolate and speculate about the nature of the distant Cosmos, but we will be careful to distinguish between speculation and fact.

This course will be difficult in many instances, and it will bend your brains in directions you are not used to bending. But I fully expect each of you will survive with a better appreciation of the role astronomy and astrophysics plays in the world today. If all goes well, we will transmogrify astronomy from a mystery that fills the dark space behind the streetlights at night, into a cheerful and comfortable companion that will be part of your identity long after you graduate from Weber State and have gone on to fill whatever professional role in society you are destined for.

2 Our Intended Schedule

There are as many different ways to explore astronomy and the Universe as there are people who have contemplated the wonders of the Cosmos. Every text and every instructor is different. Our journey through the Universe this semester will be (for the most part) from the very distant parts of the Cosmos inward toward our own Solar system and home. From the perspective of reading the text, our path will be a winding one, but the book is well suited to reading a few pages at a time, and will be a valuable companion on our voyage. A rough schedule for the semester is shown below. We will attempt to stay on schedule, but it is subject to change depending on how long we spend on each topic (that is to say, depending on how many questions you ask each day in lecture – it's your course, so ask away!).

The listed reading is suggested sections of our text related to the discussion. Astronomy is very interwoven, and you will find many instances where the topics of discussion are revisited in many sections of the text.

Week #	Dates	Sections & topic
1	7-11 January	Introduction to astronomy The View from Home (p. 56-69) Ancient Astronomy (p. 82-88)
2	14-18 January	Light, Matter & Gravity (p. 28-43) Modern Astronomical Instruments (p. 90-11) Big Bang & Inflation (p. 22-23, 46-51)
3	21 January 23-25 January	*Martin Luther King Day – no class* The Evolution & Fate of the Universe (p. 54-55) Dark Matter & Dark Energy
4	28 Jan - 1 Feb	Structure Formation (p. 324-325) Review, squash confusion **Midterm Exam 1**
5	4-8 February	Quasars & Active Galaxies (p. 310-315) Supermassive Black Holes Galaxies & Galaxy Clusters (p. 316-323)
6	11-15 February	Galactic Mergers & Evolution (p. 294-309) The Milky Way & the Local Group (p. 226-229) The Galactic Halo & Globular Clusters
7	18 February 20-22 February	*President's Day – no class* Stellar astrophysics (p. 230-231, 246-253) Stellar Birth & Evolution (p. 232-245)
8	25-29 February	Stellar Death & the Graveyard (p. 262-269) Review, eradicate panic **Midterm Exam 2**
9	3-7 March	Stellar Groups & Clusters (p. 284-289) Binary stars & Variable stars (p. 272-283) Distance Ladder
10	10-14 March	**Spring Break**
11	17-21 March	Pulsars & Neutron Stars Stellar-mass Black Holes Between the stars: Gas, Dust & Clouds
12	24-28 March	Extrasolar planets (p. 116-117, 290-291) Astrobiology & SETI (p. 52-53) Review, remain calm
13	31 Mar - 4 Apr	**Midterm Exam 3** The Sun (p. 120-123) The Fringes & Debris (p. 204-223)
14	7-11 April	TERM PROJECTS PRESENTATIONS TERM PROJECTS PRESENTATIONS Giant Worlds (p. 176-203)
15	14-18 April	Mercury & Venus (p. 124-137) Mars, Luna & Earth (p. 138-175) FRONTIERS: Giant Telescopes
16	21-25 April	FRONTIERS: Gravitational waves FRONTIERS: Building starships Review, make peace with astronomy
Final Exam: **Tue, 29 April 2007, 9:30am - 11:30am**		

3 Work, Work, Work

- ▷ **HOMEWORK:** Each week, I will post a series of homework questions on the website, which will be due the following week in class. The homework questions are designed to help you expand your thinking about astronomy, and prepare you for the kinds of questions you will see on exams. The homework questions are *not* exhaustive! *You are responsible for the material we cover in lecture, whether there is assigned homework on it or not!* The homework problems will be graded in the following way: Each homework problem will be worth a total of 3 points. 3 points will be awarded for a fully correct answer, 2 points for a mostly complete and generally correct answer, 1 point for an incorrect answer but a valiant effort, and a 0 for a lack of solution or concept. Solutions to all the problems will be posted on the website the day the homework sets are handed in. *No late homework will be accepted.*
- ▷ **MIDTERMS:** Midterm exams will be extremely similar in content to your homework (that's a hint – *do the homework!*). They will largely be multiple choice, short answer, or require simple drawings or calculations. They will be held in class on the indicated days.
- ▷ **OBSERVING PROJECTS:** You will each complete **two** projects of your choice related to observing the sky. The *Guidestars: Observing* file is available on the class website, and contains a variety of different activities for observing the sky. *Many of these projects require short, but repeated observations over long periods of time, so start soon!* You may choose to do any of the projects you like; there is also the option to make up your own projects, *but these must be okayed by me.* Astronomy is, of course, subject to the ability of our friends in meteorology to control the weather. Sometimes they forget to pay the weather bill and the skies are cloudy in Ogden. If this happens, or if you'd much rather do astronomy with a pen and paper, there are also several "armchair activities" which can be done at the comfort of your desk with a calculator and straight-edge.
- ▷ **TERM PROJECT:** You will each be required to complete a term project in the form of a poster report about a topic in astronomy or astrophysics that interests you. There is far too much astronomy for us to cover in one semester, and almost certainly there are things you will be interested in that we will not get to talk about. Perhaps you are fascinated by *blazars*, or have an abiding interest in *stellar cartography ("uranography")*, or maybe you've always wanted to know more about *cryovolcanism on Saturn's mysterious moon Enceladus*. Each of you will pick a topic of interest to you, and at the end of the semester we will have two poster-presentation days. Each day, half the class will set up their posters, while the rest of us wander around and learn about what is on the posters. You will explain about your topic, and answer questions from those of us wandering about the room. On the days you are not presenting, you will record your impressions of the posters you view, and record constructive criticism about what was good about the posters and suggestions that would have made the poster presentation more effective. Roughly 2/3 of your project grade will be based on your poster, and the other 1/3 will be based on your comments for your peers.

4 Grades derived from the work, work, work

All your work work work will be combined to make your final course grade with the following weights:

Homework & In-Class Activities	15%
Exams (3 total, 10% each)	30%
Final Exam (Cumulative)	20%
Observing Projects (2 total, 5% each)	10%
Term Project	25%
Total	100%

- ▷ **Late Homework:** There is no late homework. Assignments will not be accepted after the due date.
- ▷ **Midterm Exams:** *No make-up exams will be given* without prior permission from the instructor. The final exam will only be given at the scheduled time.
- ▷ **Cheating & Academic Dishonesty:** Cheating and academic dishonesty are among the most heinous crimes that can be perpetrated in the University setting; they are contrary in every way to our traditions of

open scholarship and learning, and offensive to the integrity and reputation of the faculty and your fellow students here at Weber State University. Academic dishonesty in any form will not be tolerated in this class. Violations that are deemed severe enough will result in an automatic fail of this course. You are encouraged to work together and discuss homework, and work collaboratively in your laboratory group. Assignments that are turned in, however, must be your own solutions to the work.

5 Final Ramblings

- ▷ **Questions:** If you have a question, *ask!* Either you are confused, or I am confused — in either case, we should probably clear things up! If the question isn't about a point of confusion, but is simply a matter of curiosity, *ask!* At worst, you'll start an interesting discussion about the intricacies of physics and become known as "that egghead who kept us from learning about black holes!" At best, you'll stump me and gain the adulation and adoration of your classmates. In any event, I will entertain any questions you have; if it moves far afield from the current topic of discussion, I will keep it on the side until we can return to it.
- ▷ **Office Hours:** Since I know astronomy will dominate your every waking thought, and that you'd really rather not think about macro-economics but would rather debate how black holes evolve after galactic mergers, I've provided a series of office hours and various times throughout the week. Please stop by to chat about whatever is on your mind, whether you're struggling with something we've covered in lecture, need some help on some homework, want to change your major to physics, or simply want to chat.
- ▷ **Astronomy is not a spectator sport!** Well, astronomy *is* a spectator sport, but the spectating is the science itself. Astronomy, like most of your other classes, requires practice and participation if you want to become proficient[1]. *Do the homework! Do your projects! Read! Ask questions!*
- ▷ **Students with disabilities:** Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in room 181 of the Student Service Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary. You are also welcome to discuss any special needs with me, though you are not required to do so.

6 Reading beyond this class

There will be an occasional evening when you've mastered all there is to master in astronomy, and there isn't anything on television except reruns of *Golden Girls*, and you find yourself thinking "If only I had something about *astronomy* to read, I wouldn't be so bored!"

What follows is a short, non-exhaustive list of interesting books to read, ranging from popular level books, to books on the history of some important and influential ideas in astronomy, to more serious books about the frontiers of astronomy today. The list is provided *for your enjoyment*! Nothing on it is required for this course.

- *Cosmos*, by Carl Sagan. Perhaps one of the most influential public level science books written in the last quarter century. This book explores many aspects of science, not just physics, and illustrates the profound interconnectedness of everything in the natural world.
- *Black Holes & Time Warps: Einstein's Outrageous Legacy*, by Kip Thorne. This is an excellent recounting of some of the most exciting research that has been done in relativity, gravity and black hole physics over the last few decades, much of which Kip Thorne has been at the center of.
- *Seeing in the Dark*, by Timothy Ferris. Written by one of today's most prominent science writers, this exploration of the secrets of the Universe is interwoven with tales of the author's own experiences under the night skies as an amateur astronomer.
- *The Backyard Astronomer's Guide*, by Terence Dickinson & Alan Dyer. If you want to continue observing the sky long after you've left this class, this is a great guidebook for getting you started, with topics ranging from telescopes, binoculars and accessories, to observing the naked-eye sky, suburban skies, observing planets, and exploring the deep sky.

[1] Here we use the common definition of proficient: *able to score well on exams!*