PHYS 1040: Elementary Astronomy
Course Syllabus
Utah State University, Fall Semester 2011

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Office Hours: M 2:00pm-3:00pm; TR 9:00am-10:00am; W 11:00am-Noon
If these times clash with your schedule, stop by any time you see my door is open, or contact me to make an appointment when we can chat.

Lectures: *TR, 1:30pm-2:45pm*, ESLC 130
Textbook: *The Essential Cosmic Perspective*, Bennett, Donahue, Schneider and Voit
Webpage: <www.physics.usu.edu/shane/classes/phys1040/>
Mastering Astronomy Course ID: usu1040fall2011
Other Requirements: Scientific Calculator. And probably caffeine. :-)

Observatory Hours: *MTWTh*: Dark until ~10pm (call 435-797-2942 for updates)

Supplemental Instruction (SI): Maggie Jensen (na.j@aggiemail.usu.edu)
Times: T 6:30pm (ENGR 106); W 4:30pm (ENGR 106)

1 Introduction

"Astronomy is a science for everyone. Anyone who looks at the sky and contemplates its wonders is an astronomer." ~ 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 Utah 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. 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 follows our intended 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	30 Aug, 1 Sept	Introduction to astronomy, Ancient Astronomy, Sky Motions ~CH 1,2,3
2	6, 8 Sept	Light & Gravity, The Big Bang ~CH 4,5
3	13, 15 Sept 13 Sept	Cosmology & Fate of the Cosmos ~CH 17 ***Observing 1 Due***
4	20, 22 Sept	Dark Matter, Quasars & AGN ~CH 16, 15
5	27, 29 Sept 29 Sept	Super Massive Black Holes ▶ **Midterm Exam 1** in class
6	4, 6 Oct 4 Oct	Galaxies, Galaxy Evolution, the Milky Way ~CH 15, 14 ***Observing 2 Due***
7	11, 13 Oct	Stellar Astrophysics, Stellar Evolution ~CH 11, 12
8	18 Oct 20 Oct	Stellar Graveyard (~CH 13) *No class, Friday Schedule*
9	25, 27 Oct 25 Oct	Star Clusters, Binary and Variable Stars ***Observing 3 Due***
10	1, 3 Nov	Compact Stellar Remnants, Interstellar Medium
11	8, 10 Nov 8 Nov	Extrasolar planets ~CH 6 ▶ **Midterm Exam 2** in class
12	15, 17 Nov 15 Nov	Sun, Comets/Asteroids/Debris ~CH 10, 9 ***Observing 4 Due***
14	22 Nov 24 Nov	Jovian Worlds [CH 8] *No Class – Thanksgiving Holiday*
13	29 Nov 1 Dec	Terrestrial Worlds [CH 7] ▶ **1 DEC: TERM PROJECTS PRESENTATIONS**
15	6, 8 Dec 6 Dec	FRONTIERS: SETI & Astrobiology [CH 18] FRONTIERS: Building starships ***Observing 5 Due***
Final Exam: **Tue, 13 December 2011, 1:30pm - 3:20pm**		

3 Work, Work, Work

- **READING:** When you took Shakespeare, did your teacher come to class, open up *A Midsummer Night's Dream* and start reading? I didn't think so. Nor will I lecture straight from the textbook. You paid a significant sum for your text, so I encourage you to get your money's worth out of it by *reading it*. The projected reading is listed in the class schedule. If necessary, I will direct you to specific sections to read. This fluid arrangement will allow us to adjust our pace and schedule as needed. There is far more material in the book than we could ever hope to cover directly in lecture, but you will be responsible for all the assigned reading; it is fair game on homework and exams. The exception to this is mathematical principles in astronomy. Mathematical principles that we will need during our exploration of astronomy will be covered in class.

- **HOMEWORK:** Each week, you will be assigned a series of 10 to 20 homework problems via the online homework system, *Mastering Astronomy*. Please enter the system using your A-number, so grades can be properly correlated. *No late homework will be accepted by the online system.* 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!*

- **EXAMS:** Exams will be constructed to reflect the other work you are doing in the class, and will be extremely similar in content to your homework (that's a hint – *do the homework!*).

- **OBSERVING PROJECTS:** You will each complete **five** projects related to observing the sky. The projects will consist of (a) Constellation Observing (**required**), (b) one Light Pollution activity (**required**), and (c) ***three other*** projects of your choice from the *Guidestars* manual. *Guidestars* 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 Logan. 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 near the end of the semester we will have a poster-presentation day. On that day, we will split the lecture period in half. 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. Halfway through, we'll all switch roles. During the time 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. This is a major portion of your grade, and must be more than pretty pictures with some captions. All told, the amount of information on your poster should be comparable to 4-5 typewritten pages (as well as some pretty pictures and captions).

- **MATHEMATICS:** You will need to have a scientific calculator for this course (one with a square root [$\sqrt{}$] key, as well as trig and log functions). Astronomy requires some basic mathematics, and my expectation is for you to be fluent in mathematics at a level sufficient to gain admission to the University. This means you should be familiar with common mathematical operations and notation, such as scientific notation (10^4 and 10^{-13}), powers and roots (x^3 and $T^{1/4}$), simple algebra operations, and logarithms. If you feel uncomfortable with your mathematics preparation, or feel like you need a bit of extra help, you should