Science 3210 001: Introduction to Astronomy Course Syllabus

Instructor : Dr. Robert Fisher

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CLASS HOURS : Fridays, 9 AM - 12 Noon

1 Description

Since ancient times, mankind has gazed up at the night sky and wondered. How large is the universe? How old is it? Did it have a beginning, and if so, how old is it? Will it have an end? How did the Earth form and how did life originate?

In this class, we will delve into these deep mysteries. We will discuss what modern astronomers have learned about the nature of the universe, as well as what additional mysteries have been uncovered.

I wish to emphasize that my focus will always be on the conceptual content of the material. We will occasionally be discussing some results which are mathematical in nature. Mathematics is simply another language which describes conceptual content – albeit a highly precise one ideally suited to the description of the physical universe without the ambiguities of natural language. If your mathematics skills are slightly rusty, you have no need to worry – I will address any of your questions in lecture. In addition, the homeworks and exams will essentially be qualitative in nature.

2 Organization

Class will meet once a week (Friday, 9 AM - 12 Noon). Lectures will incorporate Peer Instruction (PI), an interactive teaching methodology which will be discussed in more detail on the first day of class. Each three hour meeting will be divided into three periods, divided by two short breaks.
I will be available to answer questions about life, the universe, and everything both before and after class, office hours, over the phone, and via e-mail. I will always respond to your e-mails within one weekday. If the matter is urgent and requires my attention within the day, please call me.

We will make at least one field trip to the Adler Planetarium. In addition, you will be responsible for completing a final project, which we will discuss later in the semester.

3 Course Objectives

By the end of this course, you will:

1. Be able to describe current scientific thinking as to how the universe originated, what it is composed of, and how it will eventually end.

2. Have a solid appreciation of the enormous diversity of important length and time scales in the cosmos.

3. Have achieved a high degree of scientific literacy.

4. Developed a broad expertise in basic astronomy, and have a deeper appreciation of astronomical developments which are reported in the press.

5. Have an appreciation for how life on Earth is intricately tied to the evolution of the cosmos.

4 Course Topics

1. Naked-Eye Astronomy


5. Death of Stars: White Dwarfs, Neutron Stars, Black Holes

6. Extragalactic Astronomy: The Sea of Galaxies

7. Cosmology and The Early Universe

8. Life In The Universe: Are We Alone?
5 Textbook and Additional Resources

The required textbook for the class is *The Cosmic Perspective*, by Bennett, Donahue, Scheider, and Voit, 4th edition. The textbook is available online from major retailers. This textbook is also published in many different versions – you will want the 4th edition with precisely that title.

With regards to additional resources, a few words of highly-biased but thoroughly grounded advice based on considerable personal experience. *Caveat emptor: less is more.*

Since the advent of the web, we have been inundated with enormous quantities of easily-accessible information on any topic imaginable. As a result, the greatest barrier to learning is no longer obtaining information, but rather discriminating between mountains of poorly thought-out and possibly inaccurate information and rare sources of thought-provoking, insightful information.

I recommend below a few entirely optional additional resources for you to learn about breaking developments in astronomy, and other topics not covered in your textbook. At the same time, I strongly caution that when learning about the *fundamentals* of a subject (particularly scientific subjects like physics and astronomy), it is generally far preferable to learn from the distilled wisdom of the greatest thinkers and teachers of that subject. Despite advances in technology, more often than not these are still contained in old-fashioned paper books than electronic webpages.

Noting these caveats, you will have access to the website associated with your textbook http://www.masteringastronomy.com as a strictly optional resource to practice your knowledge of the course material. The instructor code for this class is: MAFISHER0001. You will need this code to log onto the website.

Setting the Astronomy Picture of the Day http://antwrp.gsfc.nasa.gov/apod/astropix.html as your web browser’s start page is a fun and easy way to learn about various topics in astronomy. The page is updated once a day by professional astronomers, who include an authoritative, brief description of the picture of the day, which is chosen from all fields of astronomy.

An excellent resource for learning the night sky is the free open-source planetarium program Stellarium, available from http://www.stellarium.org, which supports Macintosh, Windows, and Linux. The CD-ROM for your textbook also includes similar software, though it is proprietary and not open-source.

In addition, there are several good sources of reporting on astronomical news. Online, I suggest taking a look at *Astronomy Now* and at the science pages of *The New York Times*. In print, I recommend *Astronomy Magazine* and *Scientific American*.

6 Grading

The course will be graded as follows:

50% Homework
30% Exams
10% Final Project
10% Participation

*Missing three or more lectures will result in an NCR for the course.* If you become ill or expect to have an extended absence for personal reasons, please make certain to notify the Office of Health Services (112 S. Michigan, 13th floor, 499-4288), who will in turn notify all of your instructors.

*Being repeatedly tardy may result in being assigned a missed lecture.* Late entries into the classroom can be quite disruptive to others. Please be respectful, and be on time for class.

Course homework will be due at the beginning of class. Late homework will not be accepted (barring excused absences as noted above); however, your single lowest homework grade will be dropped.

## 7 Schedule

In addition to the lectures listed below, we will also be hosting a guest lecturer or two, which I will announce later in the term. Also, the class will pick a topic for a mini-lecture by popular vote near the end of the term.

- **Week 1:** Historical Context, and Overview (Chapter 3, Chapter 1)
- **Week 2:** Naked-eye Astronomy (Chapter 2, S1)
- **Week 3:** Fundamental Astrophysical Concepts : The Nature of Energy and Matter, Space and Time (Chapters 4 - 5)
- **Week 4:** Solar Systems Galore : Our Own Solar System, and Other Planetary Systems. The Inner Solar System (Chapters 9 - 10)
- **Week 5:** Spring Break – Enjoy!
- **Week 6:** Midterm 1.
- **Week 8:** Stellar Structure : The Birth of Stars. (Chapter 16)
- **Week 9:** Spring Break – Enjoy!
- **Week 10:** Stellar Clusters and Stellar Structure : Stellar Alchemy. (Chapter 14)
- **Week 11:** Midterm 2
- **Week 12:** Death of Stars. Stellar Explosions, and Final Resting Places – White Dwarfs, Neutron Stars, Black Holes. (Chapters S2, S3, 18)
- **Week 13:** Extragalactic Astronomy : The Sea of Galaxies, Galaxy Evolution. (Chapters 19, 20, 21)
- **Week 14:** Cosmology and The Early Universe (Chapters 22, 23)
Week 14: Life In The Universe: Are We Alone? Review of Lectures since Midterm 2.
Final Project Presentations. (Chapter 24)
Week 15: Field Trip to Adler.
Week 16: Comprehensive Final Exam.

8 Reading List

You will benefit the most from lectures if you complete the reading material for that week prior to lecture. Afterwards, you may return and complete a second pass, reviewing the material once again with the benefit of exposure in lecture, prior to completing your homework.

Week 1: Chapter 3, Chapter 1
Week 2: Chapter 2, S1
Week 3: Chapters 4 - 5. Optional: Chapter 6.
Week 4: Chapters 9 - 10
Week 5: Chapters 11 - 12
Week 6: Midterm 1.
Week 7: Chapter 8, 13
Week 8: Chapter 16
Week 9. Spring Break – Enjoy!
Week 10: Chapter 14. Recommended: Read ahead to Chapters S2, S3.
Week 11: Chapters S2, S3, 18.
Week 12: Chapters 19, 20, 21
Week 13: Chapters 22, 23
Week 14: Chapter 24
Week 15: Field Trip
Week 16: Final Exam