The Universe: Its Nature & History / PHYS-UA 7

The Universe: Its Nature and History provides an introduction to astronomy, with an emphasis on stars and galaxies. Mathematics at the level of high school or first-year algebra is used. Topics include the evolution stars, galaxies, and cosmology. This encompasses the Big Bang Theory of the Universe; the nature of stars and galaxies; white dwarfs, neutron stars and black holes; the structure and evolution of our Milky Way; galaxy clusters, the galaxy web and our place and role in the Universe. Topics from physics include motion, gravity, light, and matter. The story of astronomy is more than a description of what is "out there," but also addresses questions of human origins.

For Spring 2020, the instructor is Prof. Michael Blanton (`blantonnyu.edu`), whose office is 726 Broadway, Room 941. **OFFICE HOURS**. The T.A. is **WHO WHERE WHEN**.

Course Objectives:

- Learn how to absorb qualitative information about a variety of science topics and discuss it.
- Understand how we try to understand the natural world through observation, experimentation, and theory.
- Understand how light is a messenger carrying information about the cosmos.
- Understand how the sun and other stars generate energy.
- Understand the way that stars form and evolve into white dwarfs, neutron stars and black holes.
- Study astrophysical processes that create the elements of the periodic table, including those needed for life.
- Understand what a galaxy is, their varieties and how they are distributed in space.
- Understand how astronomers know how the Universe has changed over time.
- Understand the evidence for dark matter.
- Understand the expansion of the universe and its relation to the Big Bang, and the evidence for dark energy.

Required Materials:

- *Astronomy*, Senior Contributing Authors: Andrew Fraknoi, David Morrison, Sidney C. Wolff. A print version and a free ebook version are both available from OpenStax[1] or Amazon Kindle.
- While the course is mostly conceptual, we will do some quantitative work. Thus it is recommended you have a scientific calculator for use on homework and examinations.

Lectures are to help you learn the material, clarify what you are responsible for and to help you succeed on exams. Questions handed out each lecture and will form the basis of what you are responsible for from our twice-weekly meetings. Some of these questions are answered in your books, but all will be discussed in class.

Homework:

- Science readings. A major goal of this course is to expose you to the wealth of research that is going on and help you to engage with it. To this end, you will be required to submit weekly three-paragraph summaries of an article (somehow related to astronomy) that has appeared recently in the popular press. I will distribute three articles to choose from each week. These will be submitted via NYU Classes in the Assignments section.
- Textbook problem sets. Most weeks there will be a homework assignment coming from the end of each chapter. Specific assignments will bs posted to NYU Classes.

The course grade will be based on the science readings (10%), textbook problems (25%), the midterm exams (20% each), and the final exam (25%).

If you are ill and cannot take an examination, you must produce verifiable documentation from a physician, with physicians letterhead, that explaining that you were too ill to attend the examination. Students who are absent from a test during the semester without an excuse will receive a grade of zero on that test.

[1] `https://openstax.org/details/books/astronomy`

The classes will proceed as follows (subject to revision!).

Date	*Topic*	*Reading*	*Problem Sets*
2020-01-28 (T)	Science & the Universe	Ch. 1	
2020-01-30 (R)	Observing the Sky	Ch. 2.1	
2020-02-04 (T)	Orbits & Gravity	Ch. 3	
2020-02-06 (R)	Light & Spectra	Ch. 5.1–5.3	PS#1
2020-02-11 (T)	Atoms	Ch. 5.4–5.6	
2020-02-13 (R)	The Sun	Ch. 15	PS#2
2020-02-18 (T)	Nuclear Fusion	Ch. 16	—
2020-02-20 (R)	Analyzing Starlight	Ch. 17	PS#3
2020-02-25 (T)	Properties of Stars	Ch. 18	
2020-02-27 (R)	Measuring distance	Ch. 19	PS#4
2020-03-03 (T)	**Midterm #1**	—	
2020-03-05 (R)	Gas and dust in space	Ch. 20	
2020-03-10 (T)	Star and planet formation	Ch. 21.1–21.2	
2020-03-12 (R)	Exoplanets	Ch. 21.3–21.6	PS#5
2020-03-16	**Spring Break**	—	
2020-03-24 (T)	Stellar Evolution	Ch. 22	
2020-03-26 (R)	The Death of Stars	Ch. 23.1–23.3	PS#6
2020-03-31 (T)	The Death of Stars	Ch. 23.4–23.6	
2020-04-02 (R)	Black Holes	Ch. 24.5–24.7	PS#7
2020-04-07 (T)	The Milky Way	Ch. 25	
2020-04-09 (R)	The Milky Way	Ch. 25	PS#8
2020-04-14 (T)	**Midterm #2**	—	
2020-04-16 (R)	Galaxies	Ch. 26.1–26.3	
2020-04-21 (T)	Expansion of the Universe	Ch. 26.4–26.5	
2020-04-23 (R)	Supermassive Black Holes	Ch. 27	PS#9
2020-04-28 (T)	Evolution of Galaxies	Ch. 28.1–28.3	
2020-04-30 (R)	Galaxies & Dark Matter	Ch. 28.4–28.5	PS#10
2020-05-05 (T)	Big Bang	Ch. 29.1–29.3	
2020-05-07 (R)	Big Bang	Ch. 29.4–29.6	PS#11