

Apogee Program Session 2

Course Title: Astronomy & Astrophysics: Beyond the Milky Way

Course Description

Explore the properties of stars, black holes, galaxies, and more; learn about the continuous expansion of the universe; and consider the possibility of extraterrestrial life! Students learn basic physics and mathematical concepts while studying topics such as stellar evolution and classification, solar physics and relativity. Students research galaxies, the lives of stars and contemporary theories about life and communication in the cosmos while learning about the tools and methods used to collect data in space.

Essential Questions

- How can the position and motion of celestial bodies be used to understand what we see in the night sky?
- How has our present universe evolved?
- How do astronomers learn about places in the universe they cannot visit?
- How can the laws of physics be used to explain the changes we see in stars, galaxies, and the universe?

Outcomes

Upon successful completion of this course, students will:

- Know current astronomical theories and the astronomers who contributed to the current understanding of the cosmos and the instruments used.
- Understand the evolution of the cosmos from big bang to astrobiology
- Apply what they have learned about the orbit and the moon and earth and the position of the sun to explain and predict the phases of the moon.
- Create a presentation of astronomy or astrophysics topic to audience of their peers
- Describe and apply the relationship between star temperature and its color.

Instructional Strategies

Because of the disparity in astronomy knowledge in students coming to this class, the pre-assessment will help determine which students need more challenge and which need more background. Methods to address this include flexible grouping, choice of readings at different levels, tiered assignments, and individualized homework choices.

Resources and Materials

- **Books**
Comins, Neil, and Kaufman, William J. *Discovering the Universe*, 2007 Edition 8 ISBN-13 978-1-4292-0519-1
- **Web sites**
- **NASA.gov** <http://www.nasa.gov/>
Includes images, videos and interactive features from the unique perspective of America's space agency as well as latest updates on NASA missions, ...

- Project ASTRO, Astronomical Society of the Pacific www.astrosociety.org This resource list includes a effective astronomy activities designed for K-12 classes and science projects focused on those activities that are either hands-on to encourage students to think for themselves,
- **Other Media**
- The Complete Cosmos - The Solar System / Discovery Into Deep Space DVD
- The Creation of the Universe DVD
- Voyage to the Planets and Beyond
- Danger: Solar Storm DVD by NOAA's Space Environment Center
- **Materials**
The course will also use materials and activities developed by Harvard Smithsonian Center for Astrophysics as well as materials from NASA developed for the Hubble Space Telescope, and material and activities from the Heliophysics Educator Ambassador program focused on in-depth learning experiences around Earth, Space, and Physical Science topics for educators teaching in middle and high school grades.

Student Assessment

- **Pre-Assessment**
In order to assess the level of present astronomy understanding and to be able to differentiate instruction for students a general astronomy test from Harvard Smithsonian Center for Astrophysics will be given.
- **Documentation of Learning –**
Creation of a Hertzsprung diagram,
Ability to build and use a telescope
Contrasting of a heliocentric and earth-centered universe
Creation of an in-depth power point presentation of selected topic
- **Post-Assessment**
To assess the growth knowledge of astronomy and astrophysics, the same test given as pre-test will be given as post-assessment

Schedule

Date	Topic(s)	In-class Activities	Assignments/Assessments
Sunday, July 17	Introductions	Meet and Greet -Expectations	Essay: Hopes, Fears, Expectations
Monday, July 18	Concept of the Cosmos	Moon modeling activity Motion of the sun activity with sun globe Classifying the stars of winter Pretest	Read Chapter 1 in Comins and answer Review Questions pages 32-33
Tuesday, July 19	Astronomy from the beginning: Babylon to Galileo	Moons of Jupiter activity Visit to the Northwestern Telescope compare early scientists Earth-centered universe Video about Galileo Homework panel discussion	Chapter 2 Review Questions pages 62 and 63

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Wednesday, July 20	Copernicus, Brahe, Kepler, and Einstein, Telescopes Research topics	Video of images from space-based telescopes. Build a telescope. Astronomers game	Read chapter 3 (Comins) and answer Review Questions on page 99-100 Research project topic due
Thursday, July 21	Nature of light/Spectra	Lab to use a spectroscope to identify absorption and emission lines, Aimes light/color lab; Research	Chapter 4 (Comins) and review question on page 122-123
Friday, July 22	Evolution of the Solar System	Pluto debate Solar system scale model activities, Research Video of Solar system	Read Chapter 5 or Chapter 6 and prepare a lesson to teach your lesson
Monday, July 25	Our Star, Sol Solar Physics and the Earth	Presentation of last night's readings Motion of the Sun activity Video of the sun. Sunspot activity Observe the path of the sun in the Arctic	Read Chapter 10 (Comins) an answer review questions on page 310.
Tuesday, July 26	Field Trip to Adler	Explore Adler. Talk to astronomer/ View 3-D show, and Deep Space Adventure	In your journal, list each topic we have learned and tell how the trip has extended your understanding in this area.
Wednesday, July 27	Stellar Physics: the properties of stars in a mass-luminosity diagram	Activity to create a H-R Diagram Solar Viewing Research Video about life cycle of stars	Read Chapter 11, 12, or 13 and prepare a presentation for the class. Cover all main ideas.
Thursday, July 28	Asteroids, meteors and comets: the composition and origin of asteroids, comets, and meteors	Research and power point presentation Making a comet Hunt for meteor particles	Read NASA information about asteroids, comets, and meteors and write a journal entry to specify what clues the three objects provide about the origin of the universe.
Friday, July 29	Galaxies	Galaxy video, Identify types of Galaxies. Use Hubble Images to see how galaxies are counted, research	Read Chapter 15 or 16 (Comins) and answer review questions and be prepared to discuss.
Monday, August 1	Black Holes, Worm Holes: evidence of violent activity in our universe	Black Holes video Research project Worm Hole debate/ story about trip into a black hole	Read Chapter 14 (Comins) answer questions on page 427.
Tuesday, August 2	SETI: methods used to search for extraterrestrial intelligence	Online research Choose a position regarding the existence of extraterrestrial life Defend your position with a paper and present information in debate form.	Complete research paper, work on presentation, begin to study for final exam

Date	Topic(s)	In-class Activities	Assignments/Assessments
Wednesday, August 3	Presentations, Review for final	Students will present the research they have been working on during this session and review	Study for final.
Thursday, August 4,	Class presentations, work on Expo Day presentation, evaluate each student presentation	Final exam and presentation of remaining research topics	
Friday, August 5	Expo	Expo	Enjoy the rest of your summer. Keep looking up. The sky is always full of wonders

CTD Statement on Third-Party Web Sites

Instructors are required to thoroughly review any third-party web sites they intend to use in their courses for inappropriate content. However, because web content continuously changes, CTD disclaims any responsibility for any of the content contained on third-party web sites used in course materials. If you become aware of anything that may be inappropriate, please notify CTD staff immediately.

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