Unit 8: Cosmology

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **1-2 weeks**
Status: **Published**

Summary

Cosmology is the study of the universe on the grandest scale. Students will learn about the Big Bang, the CMB, and the expansion of the universe. This unit seeks to describe the universe as a whole. Our understanding of how the universe came to be and what its future looks like has changed dramatically in recent years. Cosmologists once thought the universe's rate of expansion was slowing down, but now recent evidence reveals it is accelerating. This new understanding serves as an introduction to how scientists seek new answers to questions, such as: How did the universe begin? What is the shape of the universe? What will the universe look like in the future? What is the eventual fate of the Universe? What information do we have from the Cosmic Microwave Background? How do the laws of physics explain why there is more matter in the universe than antimatter? Is there life out there? Students will investigate questions on the edge of modern cosmology.

Revision Date: July 2024

9.4.12.CI	Creativity and Innovation
1	Make sense of problems and persevere in solving them
P.1	Act as a responsible and contributing community members and employee.
P.3	Consider the environmental, social and economic impacts of decisions.
2	Reason abstractly and quantitatively
P.4	Demonstrate creativity and innovation.
3	Construct viable arguments and critique the reasoning of others
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
P.6	Model integrity, ethical leadership and effective management.
4	Model with mathematics
9.4.12.CT	Critical Thinking and Problem-solving
P.7	Plan education and career paths aligned to personal goals.
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
5	Use appropriate tools strategically
6	Attend to precision
7	Look for and make use of structure
8	Look for and express regularity in repeated reasoning
W.IW.9–10.2	Write informative/explanatory texts (including the narration of historical events, scientific procedures/experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom

	and the energy released during the processes of fission, fusion, and radioactive decay.
HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Essential Questions/Enduring Understandings

Essential Questions:

How does cosmology help scientists understand the formation, growth, and possible future of the universe?

What is the Big Bang Theory to the birth and formation of the universe?

What are the possibilities that extraterrestrial life exists in the universe?

Enduring Understandings:

Much of what is known about the universe is theoretical, yet confirmed by current scientific knowledge.

Our universe is composed of much of dark matter & forces driven by enormous amounts of dark energy.

Discoveries from the Hubble and James Webb Space telescopes help scientists further understand

the universe.

Objectives

Students will know Olber's Paradox and its resolution.
Students will know the cosmological principle.
Students will know Edwin Hubble's idea on the expansion of the universe.
Students will know what evidence there is to support the Big Bang Theory.
Students will know how the big bang theory explains the age, structure and evolution of the universe.
Students will know why the night sky is dark.
Students will know and analyze the Drake Equation calculating the probability of intelligent life in the universe.

Students will be skilled at applying the basic assumptions of homogeneity, isotropy, and universality to our universe.
Students will be skilled at predicting the possibility of alien life existing in the universe.

Learning Plan

Profile: Edwin Hubble

ISLE Cycle - Age of the Universe

ISLE Cycle - Olber's Paradox and the Cosmic Microwave Background

Activity: Formation of the Universe and Galaxies

Gravitational Waves reading and discussion

Assessment

Formative Assessment:

Do Now &/or Start-Up Questions, Discussions

Understanding during ISLE Cycle activities

Explanations on the existence and functions of the universe based on dark matter and dark energy.

Descriptions on how the universe works and what will be the ultimate demise of our universe.

Exit Ticket Submission

Alternative Assessment:

Using the Drake Equation to calculate the probability of making contact with extraterrestrial intelligence

Writing Assignment: Sending a message to ET: What information would you include?

Summative Assessment:

Topic & Vocabulary Quizzes

Unit Tests

Benchmark Assessment:

Final Exam

Materials

quantitative/qualitative lab equipment for activities, experiments
related astronomy maps, charts
supplementary interactive multimedia, internet websites, videos

Textbook: The Cosmic Perspective - 10th Edition

Integrated Accommodation and Modifications

https://docs.google.com/spreadsheets/d/1VPJNV9-GTZxi5VPcYkvEMPdHR8D8wTBI7zIj1BWYpek/edit?usp=drive_link