The Universe (Grades 8-12)

DESCRIPTION

Beginning with the Big Bang, travel through time and observe the formation and evolution of stars, planets, and galaxies. We will discuss the foundations of modern cosmology and provide a comprehensive overview of objects in our universe.

OBJECTIVES

- Identify any planets visible to the unaided eye in the evening/morning sky and name at least three constellations visible after sunset
- Understand the meaning of "Cosmology" and learn the current scientific understanding about the origin and evolution of the universe—the Big Bang
- Discover the wide variety of phenomena of the universe – galaxies, stars, planets, visible matter and energy, dark matter and dark energy

OHIO'S LEARNING STANDARDS

GRADE 8

Science: Physical Science – Forces and Motion

- **8.PS.1**: Objects can experience a force due to an external field such as magnetic, electrostatic or gravitational fields.
- **8.PS.2**: Forces can act to change the motion of objects.

GRADE 9-12

Science: Physical Science – Energy and Waves

- **PW.EW.3**: Waves
    - Radiant energy and the electromagnetic spectrum
    - Doppler shift

Science: Physical Science – The Universe

- **PS.U.1**: History of the universe
- **PS.U.2**: Galaxies
- **PS.U.3**: Stars
    - Formation: stages of evolution
    - Fusion in stars

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1 Wade Oval Dr., University Circle, Cleveland, OH 44106

Before your Program

At the museum (in house) programs:

If this will be your first trip to the Museum for some of your students, you may want to discuss the following questions:

- What is a Museum? Why are we going to the Cleveland Museum of Natural History?
- How should we handle objects at the Museum?
- Use the vocabulary and additional resources provided in this Teacher Guide to preview or review program content with your class.

VOCABULARY

Big Bang – the current scientific model for the origin of the universe about 13 billion years ago. From an infinitely dense and compact state, the universe has been expanding ever since

cosmology – the branch of astronomy that deals with the origin, evolution, and ultimate fate of the universe

Doppler effect – a change in the frequency or wavelength of a wave due to the relative motion of the object emitting the wave to an observer. Sound and light waves behave similarly in that the wavelength is shortened when the emitting object is approaching, and lengthened when receding

energy – in physics terminology, "the capacity to do work". There are many kinds of energy: mechanical, thermal, electrical, chemical, nuclear. Recently discovered "dark energy" is a mysterious property of space that is causing the universe's expansion to speed up. Remarkably, dark energy makes up over two-thirds of the cosmic mass-energy budget

galaxy – a collection of stars, planets, and nebulae held together by gravity. Galaxies range in size from dwarf galaxies of only a few hundred thousand stars to enormous elliptical galaxies containing trillions of stars. Dark matter appears to be associated with galaxies

inflation theory – a Big Bang model that claims the very early universe expanded at an exponential rate greater than the speed of light. Inflation theory explains the vastness and apparent uniformity of the overall universe

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light-year – the distance that lights travels in a vacuum in a year, about 9.4 trillion kilometers or 6 trillion miles

mass-energy – the sum total of matter and energy in the universe. The contents of the universe (or "cosmic mass-energy budget") as currently estimated are: ordinary matter—5%; dark matter—27%; dark energy—68%

matter – anything that has mass. The matter that we are commonly familiar with—stars, planets, school buses, etc.—is primarily made of protons and neutrons. Ordinary matter can be converted into energy, and is considered its equivalent. Only a small fraction of matter in the universe is current observable. Exotic "dark matter" is possibly made up of an undiscovered elementary particle that formed shortly after the Big Bang

nebula – a cloud of gas and dust from which stars and planets form. Our Solar System formed from a nebula 4 ½ billion years ago

observatory – a building equipped with a telescope for viewing the real sky

planetarium – a machine that projects images of stars, the Sun, Moon, and planets onto a domed ceiling. The machine rotates to illustrate celestial movements. Also a room housing such a device

ONLINE RESOURCES FOR TEACHERS AND STUDENTS

Click the link below to find additional online resources for teachers and students. These websites are recommended by our Museum Educators and provide additional content information and some fun, interactive activities to share with your class.

CMNH Educators regularly review these links for quality. Web addresses often change so please notify us if any links have issues.

Shafran Planetarium & Mueller Observatory

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