Captioned Media Program
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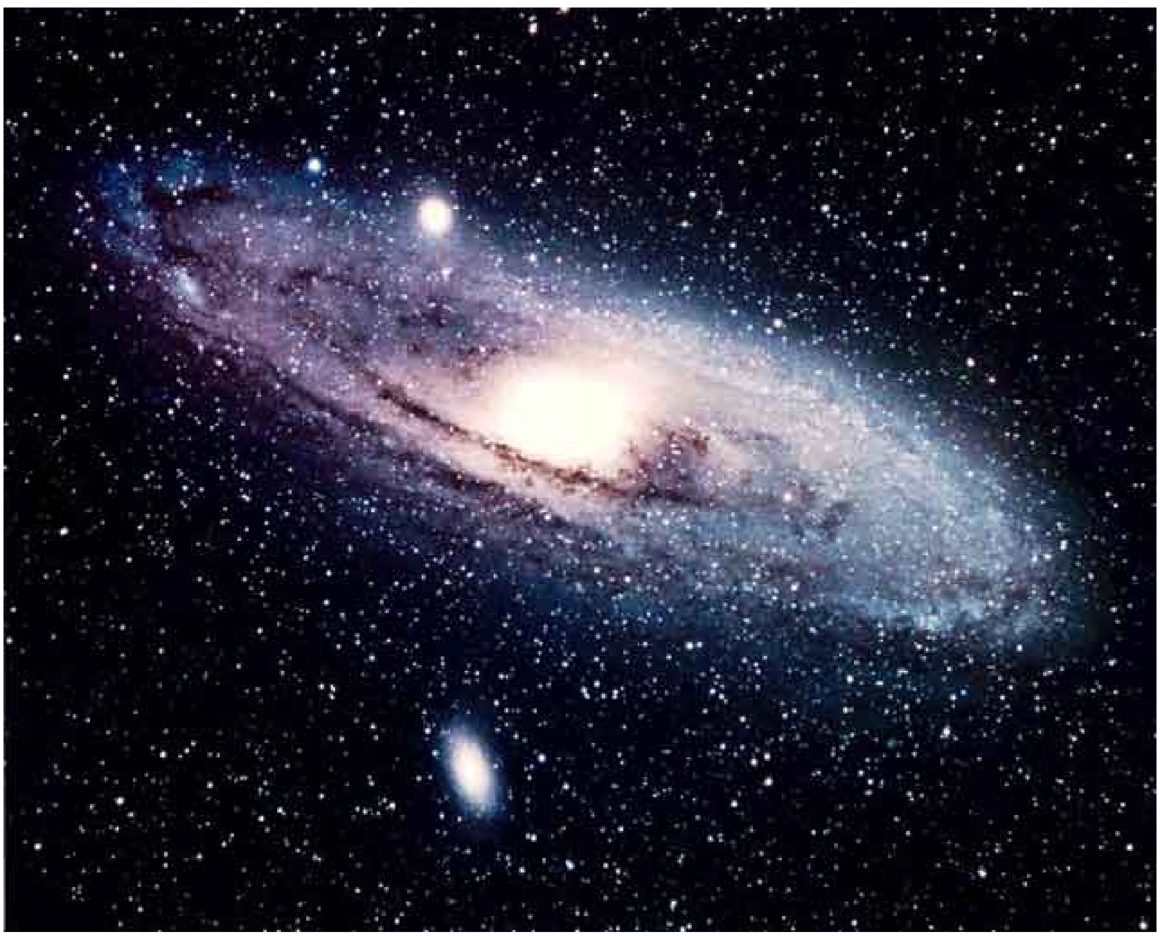
#10438
STARLIGHT

CLEARVUE/SVE, 2000
Grade Level: 9-13+
18 Minutes
2 Instructional Graphics Included



CAPTIONED MEDIA PROGRAM RELATED RESOURCES

#3310 THE UNIVERSE
#9091 DESTINATION COSMOS: EPISODE #18 "STARDUST"
#10593 WHAT'S UP IN SPACE? STARS

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STARS OF THE UNIVERSE: STARLIGHT

Intended for Junior and Senior High School Students

CLEARVUE/eav

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Introduction

Our knowledge of stars is the result of a complex interplay and flow of facts, ideas, and models among several areas of study: observational astronomy, mechanics, spectroscopy, radiation physics, nuclear physics, and theoretical physics.

In this program, viewers examine how our basic knowledge about stars has been gained from studying the light we receive from stars. The study of starlight not only reveals straightforward information like the varying brightness of stars, but it also shows other details, such as their spectra, intensity of radiation, surface temperature, relative speeds, and more. For these studies to continue, the distance of the star and its position in space has to be determined. Once this distance is known, a star's luminosity, or the amount of energy it radiates from its surface, can be found. This information can then be used to estimate the star's diameter. For some stars in binary relationships, Kepler's laws can be applied to determine their mass. Once a star's diameter and mass is known, volume and density can be calculated. Thus, by building on the information that they have, scientists can learn much about the basic properties of stars.

Learning Objectives

After completing the program and participating in discussion and activities, students will be able to:

- Discuss the ways that scientists of the past attempted to measure the distance of stars;
- Understand how telescopes have enabled scientists to use stellar parallax;
- Define cepheid variables and explain how they help determine the distance of stars;
- Explain the different aspects that affect the color and brightness of stars;
- Discuss how nuclear processes create the energy that radiate from stars; and
- Understand how both small and large stars are born and die.

Intended Audience

This program is intended for junior (grades 7 through 9) and senior high school (grades 10 through 12) students.

Presenting the Program

You may wish to follow this procedure in presenting the program.

1. Preview the program and familiarize yourself with this teacher's guide and the reproducible master(s). Review the learning objectives, discussion starters, and review questions.

2. Next, introduce students to the program, using the discussion starters to relate the upcoming information to what they already know.

3. Have students complete the program in its entirety the first time.

4. Check for understanding by discussing and reviewing the information and concepts presented in the program, using the review questions in this teacher's guide as an outline.

5. If time permits, allow students to complete the program a second time, pausing for discussion at points of interest.

6. Assign the enclosed reproducible worksheet(s) for guided and independent practice. Students may complete the activities alone, with a partner, or in a cooperative learning group. Choose the activities appropriate to your objectives and your students' level(s) of understanding. Be creative and integrate some activities of your own design that are based on concepts found in the program.

Target Vocabulary

big bang theory
binary stars
black hole
celestial objects
cepheid variable
color
eclipsing variable
energy
globular clusters
gravitational attraction
light-year
Milky Way
nuclear fusion
neutron star
open clusters
planets
protostar
radiative pressure
remnant core
stars
star clusters
star trails
sun
supernova
telescope
time-to-distance scale
universe
white dwarf

Discussion Starters

Pique students' curiousity in stars and starlight. Ask them to go outside one clear night and look for patterns and differences among the stars. Why do they think some are brighter? Does it have to do with size? Distance? How do stars form? How do they die?

Tell students that the program they are about to watch considers the many different things that scientists know about stars and how they gained this knowledge. As students watch, have them answer the questions on the "Starlight" worksheet, so you can engage in a class discussion after the program.

Review Questions & Activities

Use these discussion topics and questions to review the program material.

1. The Milky Way is shown in the introduction of the program. Of what is the Milky Way composed?

2. If two stars were five light years away from us, one four times brighter than the other, how much further away would the brighter one have to be moved to equal the brightness of the dimmer star?

3. Newton assumed that all stars give off the same amount of light as the sun. If this was the case, what would we see if they were all the same distance from us? What might we see if they were all at different distances from us?

4. The main stars in the constellation Cassiopeia appear as bright as each other. How can this be when one is actually 200 times brighter than the rest?

5. A change in the brightness of a star can have one of two causes. What can cause the brightness to change? How could you tell which one was actually causing the brightness of a particular star to change?

6. Why can't we see the different colors of stars by looking at them in the night sky, yet we can by looking at a photo of the same stars?

7. How is the spectrum of a star produced and recorded?

8. What is an absorption spectrum? How are they produced? Are all spectra of this type?

9. What is the relationship between emission spectra and absorption spectra?

10. Why are spectra important to astronomers?

11. Where does fusion occur in a star? What two conditions must be present for fusion to occur?

12. What are the differences between a blue star and the sun? Are blue stars more luminous than the sun?

13. Why are stars smaller than the sun dimmer and stars larger than the sun brighter?

14. How can two stars with the same surface temperature have very different luminosities?

15. What is a star cluster? How are the three clusters described in the video different from one another?

16. In about five billion years, the sun will expand to become a giant red star with a diameter about 100 times greater than its present one. Why will the sun so dramatically change its size?

17. What fusion reactions occur in the core of large stars?

18. What steps does a blue star go through during the last stages of its life?

19. Why are we all "children of a supernova"?

20. Access one or more of the Web sites cited in the "Internet Resources" section of the Further Learning Web site (www.clearvue.com/furtherlearning.com) by going to your school or library computer lab. As a group, go to one of the sites and explore the subject in more detail.

21. Assign the enclosed worksheet(s) to reinforce the skills students have learned from the program, the review questions, and the discussion activities.

GLOSSARY

big bang theory—A cosmological theory that states at the beginning of time, all of the matter and energy in the universe was concentrated in a very dense state, from which it "exploded." The result was the expansion of the universe, which continues in the present day.

binary stars—A pair of stars that are held together by their mutual gravitational attraction and that revolve around their common center of mass.

black hole—A celestial object of such extremely intense gravity that it attracts everything near it. In some instances, it prevents everything, including light, from escaping.

cepheid variable—A class of variable stars that brighten and dim in an extremely regular fashion.

color—A property of light that depends on wavelength.

eclipsing variable—Eclipsing variables are not true variables but are binary star systems, such as pairs of stars revolving around a common center of mass.

energy—Usable power.

globular clusters—A group of stars near each other in space and resembling each other in certain characteristics that suggest a common origin for the group.

light-year—In astronomy, unit of length equal to the distance light travels in one sidereal year. It is 9.46 trillion km (about 6 million miles).

Milky Way—A large spiral galaxy of about a hundred billion stars arrayed in the form of a disk, with a central bulge (some 30,000 light-years across) of closely packed stars. The Milky Way is the galaxy that contains Earth.

nuclear fusion—The process by which the sun and most other stars radiate their great output of energy.

neutron star—An extremely small, extremely dense star, about double the sun's mass but only a few kilometers in radius, in the final stage of stellar evolution.

open clusters—A type of star cluster also called galactic clusters because of their wide distribution in our galaxy (the Milky Way).

planets—Any body (except a comet, meteoroid, or satellite) revolving in an orbit around the sun or around some other star.

star—A self-luminous, gaseous celestial body of great mass that produces energy by means of nuclear fusion reactions. Its shape is usually spherical, and its size may be as small as Earth or larger than Earth's orbit.

star cluster—A group of stars near each other in space and resembling each other in certain characteristics that suggest a common origin for the group.

sun—The celestial body around which Earth and other planets revolve, from which they receive heat and light. It has a mean distance from Earth of 93,000,000 miles (150,000,000 kilometers), a linear diameter of 864,000 miles (1,390,000 kilometers), a mass 332,000 times greater than Earth, and a mean density about one fourth that of Earth.

supernova—A massive star in the latter stages of stellar evolution that suddenly contracts and then explodes, increasing its energy output as much as a billion-fold.

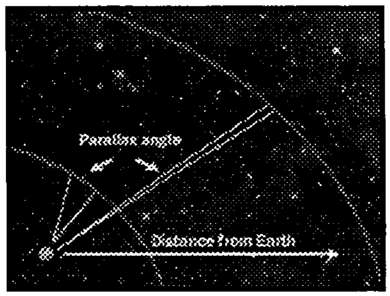
telescope—A usually tubular optical instrument for viewing distant objects by means of the refraction of light rays through a lens or the reflection of light rays by a concave mirror.

universe—The totality of matter and energy in existence.

white dwarf—A type of star that is abnormally faint for its white-hot temperature.

NOTES:

Stars of the Universe: Starlight



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Name____________________

STARLIGHT

While watching the video, answer the questions below. Be sure to write down any concepts you don't understand, so you can discuss them as a class after the program.

1. Why does the brightness of a star depend on its distance? How is this the same as the brightness of the headlight of a car?

2. Why do the closest stars appear to move "across" and "back" against the more distant stars?

3. How does knowing the distance of a star help us in understanding the light it gives off?

4. Astronomers talk about the brightness of a star, as well as its luminosity. Are they describing the same thing?

5. Why are cepheid variables so important to astronomers?

6. How is the spectrum of a hot star different from the spectrum of a cold star?

7. How are emission spectra produced?

8. What is the name of the process that produces energy in a star?

9. Is there a difference in the temperature of a small star compared to a larger star?

10. Why do large stars use their fuel at faster rates?

Name____________________

FURTHER RESEARCH

In groups of two or three, discuss the following questions and activities. Compose any written answers in paragraph form. Use the library or Internet for further research.

1. Draw the different kinds of stars discussed in the video on posterboard. Add text to the poster to describe the unique aspects of each star.

2. A camera is attached to a telescope to find the parallax shift of the nearest stars. Why would you have to take photos of the same area of the sky six months apart, over several years, to actually determine the parallax shift of the nearest stars? How would they appear on the photos? Why would using transparencies help in locating parallax shifts?

3. View torch lamps of different brightness through an A4 piece of grease-proof paper in a darkened room. Have your partner move the lamps until they both appear to have the same brightness. What can you conclude?

4. What two elements are present in the sun? Discuss some interesting facts about each of these elements. Are there other elements present in the sun? How would an astronomer find the answer to this question?

5. Find out the core temperature of the sun. Compare it with the core temperature reached inside a blue star that is 20 times more massive than the sun. Comment on what you find.