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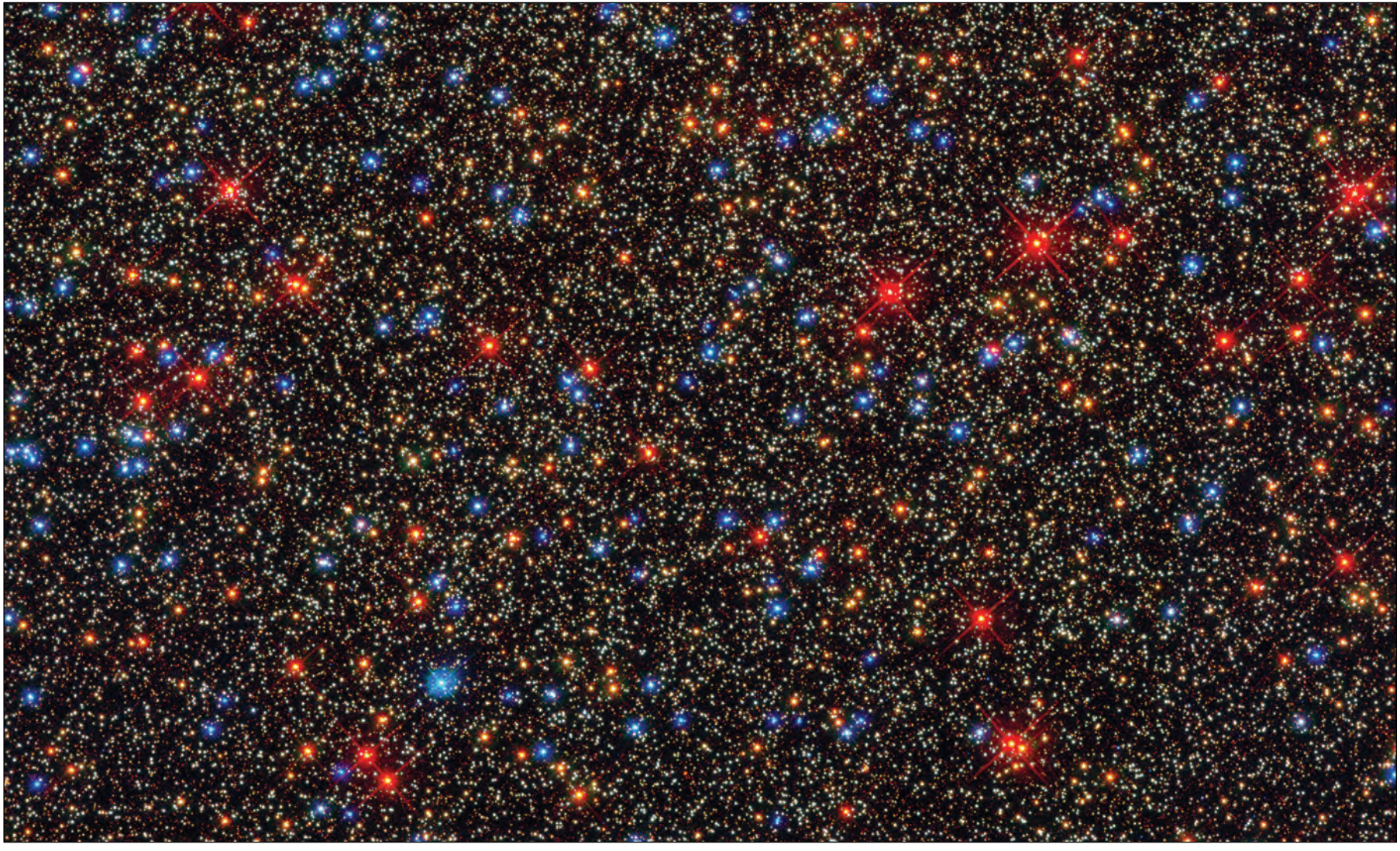

Core of Omega Centauri (NGC 5139)

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Colorful Stars Galore in the Gigantic Star Cluster Omega Centauri

The Hubble Space Telescope snapped this panoramic view of a colorful assortment of 100,000 stars residing in the crowded core of a giant star cluster. This is one of the first images taken by the new Wide Field Camera 3 (WFC3), installed aboard Hubble in May 2009, during Servicing Mission 4.

The image reveals a small region inside the massive globular cluster Omega Centauri, which boasts nearly 10 million stars. Globular clusters, ancient swarms of stars united by gravity, are the homesteaders of our Milky Way Galaxy. The stars in Omega Centauri are between 10 billion and 12 billion years old.

The story of stellar evolution is depicted by the wide variety of star colors and sizes within this image of the globular cluster. Most of the stars in this snapshot are yellow-white, like our Sun. They are adult stars that are shining by hydrogen fusion. The bright orange, red, and blue stars represent the final, flashy stages of life for Sun-like stars.

All of the stars in the image are cozy neighbors. The average distance between any two stars in the cluster's crowded core is roughly 13 times closer than our Sun's nearest stellar neighbor, Alpha Centauri. Although the stars are close together, WFC3 can resolve each of them as individual stars. If anyone lived in this globular cluster, they would behold a star-saturated sky that is roughly 100 times brighter than Earth's sky.

Omega Centauri is among the biggest and most massive of some 150 globular clusters orbiting within the Milky Way. It is one of the few globular clusters that can be seen with the unaided eye. The cluster resembles a small cloud in the southern sky and might easily be mistaken for a comet.

Credit: NASA, ESA, and the Hubble SM4 ERO Team

VOCABULARY:

Star: A huge ball of gas held together by gravity. The central core of a star is extremely hot and produces energy. Some of this energy is released as visible light, which makes the star glow. Stars come in different sizes, colors, and temperatures.

FAST FACTS:

Distance: 16,000 light-years away
Location: Constellation Centaurus

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Goddard Space Flight Center
8800 Greenbelt Road
Greenbelt, Maryland 20771

www.nasa.gov

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Starry splendor

This more complete Hubble view of the central region of Omega Centauri glitters with millions of stars. The white box outlines the Hubble image captured on the front of this lithograph. Omega Centauri is among the largest globular clusters orbiting within the Milky Way Galaxy. The monster grouping contains about 10 million stars. Globular clusters are the early building blocks of our Milky Way. The stars in Omega Centauri are between 10 billion and 12 billion years old.

Credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA)

You can get images and other information about the Hubble Space Telescope on the World Wide Web. Visit **http://www.stsci.edu/outreach** and follow the links.

The corresponding classroom activity for this lithograph can be found at: **http://amazing-space.stsci.edu** or may be obtained by contacting the Office of Public Outreach at the Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218.

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In Search of…Stellar Evolution

Description

Use the *Core of Omega Centauri (NGC 5139)* lithograph as the initial source of information to engage your students in a Level One Inquiry activity. Students will use the images and text on this lithograph to generate questions about the variety of colors of stars in the image. They will conduct research to answer their questions. This curriculum support tool is designed to be used as an introductory activity in a unit that incorporates scientific inquiry or has a stellar evolution theme.

About Inquiry-based Learning

The inquiry process is driven by a student's own curiosity, wonder, interest, or passion to understand an observation or solve a problem. It involves a process of exploring the natural or material world. This exploration prompts students to ask questions and make discoveries in the search for new insights. A Level One Inquiry activity uses questions and problem-solving methods directed by the teacher. In this activity, teachers will use the lithograph images to help students formulate questions about the variety of colors of stars. Teachers will suggest selected resources to help students answer their questions. Students will provide supporting evidence for their conclusions. This process can help prepare students to become more independent thinkers. Note: The preparation section below provides resources for inquiry-based learning.

Grade Level

High school, grades 9-12

Prerequisites

Students should be aware that all objects are attracted to other objects by the force of gravity. They should know that a star is a gaseous, self-luminous object held together by its own gravity.

Misconceptions

Teachers should be aware of the following common misconceptions and determine whether their students harbor any of them. Students may have misconceptions regarding stars and their evolution. They may not understand that stars vary in brightness, color, mass, temperature, and age. It is important to note that the stars in a globular cluster are much closer together than the stars in our stellar neighborhood. However, they are still trillions of miles apart.

Vocabulary

These are terms students may encounter while doing further research on stellar evolution.

Globular cluster: A tight-knit collection of many thousands, sometimes even millions, of stars born at almost the same time and place. A cluster can remain as a unit for billions of years because of the mutual gravitational attraction of its member stars.

See the lithograph for additional vocabulary terms.

Purpose

The purpose of this activity is to engage students in a Level One Inquiry activity with astronomical images and information. Students will gain experience using the Internet to search for information. They will practice the process skills of observing and analyzing. Students also will organize their material, present their findings, and reflect on what they have learned.

Materials

- *Core of Omega Centauri (NGC 5139)* lithograph
- Computer with Internet connection for conducting research

Instructions for the Teacher

Preparation

- Obtain copies of the lithograph for each student. *The Core of Omega Centauri (NGC 5139)* lithograph can be found at **http://amazing-space.stsci.edu/capture/stars/preview-omega-centauri.php.**
- Preview the Overview page at: **http://amazing-space.stsci.edu/eds/overviews/print/lithos/omega-centauri.php.** Use the "Related Materials" section to (1) become familiar with inquiry-based learning and/or (2) become familiar with stars and stellar evolution.
- Bookmark or identify as favorites the following suggested Websites:
  - Amazing Space: "Tales of ... Colorful stars galore inside globular star cluster Omega Centauri": **http://amazing-space.stsci.edu/resources/tales/omega_centauri.php**
  - Amazing Space: "Graphic Organizer: Comparison of globular and open star clusters": **http://amazing-space.stsci.edu/resources/organizers/starclusters.php**

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- HubbleSite: "Astronomers Find Suspected Medium-Size Black Hole in Omega Centauri": **http://hubblesite.org/newscenter/archive/releases/2008/14/full/**

Procedure

Before beginning this activity, identify your students' misconceptions about stars by having them write down anything they know and understand about this topic. Use those statements to evaluate your students' misconceptions. Have students volunteer their ideas about stars. From those ideas, identify their misconceptions and discuss them with the class. An alternative method is to collect your students' written ideas about stars. From those ideas, compile a list of their misconceptions and discuss them with the class.

Ask students to study the images on both the front and back of the lithograph. Then tell your students to write as many questions as they can about the stars visible in the images. Collect the questions and group them by common themes. Ask students to read the information on the back of the lithograph. Then ask them if they found the answers to any of their questions. Tell students to use the Internet to research their questions. The Internet sites listed on the preview page provide a starting point for their research. Tell students how to access other Websites.

Ask students to prepare presentations that include answers to their questions. Their presentations should also address the relationship between the variety of colors of stars in the image and the life cycle of stars. This presentation can be in the form of a skit, a story, a graphic organizer, a PowerPoint show, or a written report–any method that conveys a student's understanding of the topic to another student, a group of students, or the entire class. Students may work individually or in groups. Ask students to check whether their original questions were answered during their research or from talking with other students. Then ask students if they have any additional questions.

Instructions for the Student

Your teacher will ask you to write down what you know and understand about stars. You may be asked to share this information with the rest of the class. Study the image of the core of Omega Centauri on the front of the lithograph, and then look at the more complete image of the globular cluster on the back. Write down as many questions as you can about what you see in the images. Read the back of the lithograph to find answers to your questions.

Using your questions as a guide, conduct research on the Internet to find the answers to your questions. Your teacher will provide Websites to use for your research. Your teacher also will ask you to create a presentation to demonstrate your understanding of the material you collected through your research. The presentation could be a skit, a story, a graphic organizer, a PowerPoint show, or whatever format that will communicate the information you learned about stellar evolution. Your teacher will direct you to work individually or in small groups. You may make your presentation to another classmate, another group of students, or the entire class.

Education Standards

AAAS Benchmarks: Project 2061

http://www.project2061.org/publications/bsl/online/bolintro.htm

1. The Nature of Science

B. Scientific Inquiry

By the end of the 12th grade, students should know that:

- Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns.

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Educational Product

Educators & Students | Grades 9 –12