Carina Nebula Pillar

National Aeronautics and
Space Administration

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Hubble Captures View of 'Mystic Mountain'

To mark the 20th anniversary of Hubble's launch and deployment into Earth orbit, NASA and the Space Telescope Science Institute issued this stunning image. The new photograph is reminiscent of a craggy fantasy mountaintop surrounded by wispy clouds. The image captures the chaotic activity on a three-light-year-tall pillar of gas and dust that is being eaten away by the brilliant light from nearby colossal young stars. Those massive stars are located above the pillar, off the image.

Streamers of hot, ionized gas can be seen flowing off the ridges of the structure, and thin veils of gas and dust, illuminated by starlight, float around its towering peaks. Scorching radiation and fast winds (streams of charged particles) from the gigantic young stars in the nebula are shaping and compressing the pillar, causing new stars to form within it.

The new stars buried inside the pillar are firing off jets of gas that can be seen streaming from towering peaks. This turbulent cosmic pillar lies within a tempestuous stellar nursery called the Carina Nebula, located 7,500 light-years away in the southern constellation Carina.

The Carina Nebula is one of the largest and brightest nebulas in the sky. The nebula is home to some very massive stars, several times heftier than the Sun. One of those giant stars is Eta Carinae, which is 100 times more massive than the Sun and about 4 million times brighter. Eta Carinae is one of the brightest stars known and one of the most massive stars in the Milky Way Galaxy.

Credit: NASA, ESA, and M. Livio and the Hubble 20th Anniversary Team (STScI)

VOCABULARY:

Ionized: Atoms that have been converted to ions by removing or adding electrons. In astronomy, atoms are usually ionized when electrons are removed from neutral atoms, creating positive ions.

FAST FACTS:

Distance: 7,500 light-years away
Location: Southern constellation Carina

Close-up view of Carina Nebula Pillar

This image reveals long jets of gas shooting in opposite directions off the tip of a giant pillar of material. The jets are a signature of new star birth. The young star cannot be seen because it is buried deep inside the dense pillar. The jets are launched by a swirling disk of gas and dust around the young star. The disk dumps material onto the star. The star then heats up the material and eventually ejects it.
Credit: NASA, ESA, and M. Livio and the Hubble 20th Anniversary Team (STScI)

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

You can find the corresponding Classroom Activity for this lithograph at **http://amazing-space.stsci.edu/** or 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 … Star Formation

Description

Use the *Carina Nebula Pillar* 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 star formation. 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 star formation. Teachers will suggest selected resources about star formation 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 11-12

Prerequisites

Students should be aware that a star is a gaseous, self-luminous object held together by its own gravity. The core of a star is extremely hot and releases energy by fusing lighter atomic nuclei into heavier nuclei. Our Sun, the center of our solar system, is a yellow star of average temperature and size.

Misconceptions

Teachers should be aware of the following common misconceptions and determine whether their students harbor any of them. Students may have misconceptions about stars. They may think that all stars are the same, that stars live forever, or that all stars end their lives in the same way.

Vocabulary

These are terms students may encounter while doing further research on star formation.

Nebula: A cloud of gas and dust located between stars.

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.

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

- *Carina Nebula Pillar* lithograph
- Computer with Internet connection for conducting research

Instructions for the Teacher

Preparation

- Obtain copies of the lithograph for each student. The *Carina Nebula Pillar* lithograph can be found at **http://amazing-space.stsci.edu/capture/stars/preview-mystic-mountain.php.**
- Preview the Overview page at: **http://amazing-space.stsci.edu/eds/overviews/print/lithos/mystic-mountain.php.** Use the "Related Materials" section to (1) become familiar with inquiry-based learning and/or (2) become familiar with star formation.
- Bookmark or identify as favorites the following suggested Websites:
  - STScI: "HST Reveals Stunning Detail in Herbig-Haro Object": **http://hubblesite.org/newscenter/archive/releases/1993/17/text/**

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- STScI Background: "Hubble Space Telescope's Wide Field Camera Reveals Splendor of 'Supergiant' Nebula": **http://hubblesite.org/newscenter/archive/releases/2001/21/background/**
- STScI: "Tales of ... Extreme star birth in the Carina Nebula": **http://amazing-space.stsci.edu/resources/tales/carina.php**
- Hubblesite: "Starry-Eyed Hubble Celebrates 20 Years of Awe and Discovery": **http://hubble.stsci.edu/newscenter/archive/releases/2010/13/image/a/**

Procedure

Before beginning this activity, identify your students' misconceptions about star formation 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 star formation. From those ideas, identify their misconceptions and discuss them with the class. An alternative method is to collect your students' written ideas about star formation. 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 features 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 the answers to their questions. Their presentations should also address the process of star formation. 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 star formation. You may be asked to share this information with the rest of the class. Study the image of the Carina Nebula on the front of the lithograph, and then look at the image 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 star formation. 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

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