



NGC 346 in the Small Magellanic Cloud

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The development of a star cluster

This one image illustrates the rite of passage for a cluster of developing stars: from its sheltered growth in a dark cloud of dust and gas to its powerful debut as a grouping of young stars to its settlement into adulthood.

Clusters of thousands of stars begin to grow inside dark, dense, and cold clouds of gas. These hidden stellar nurseries, called dark nebulae, appear black in astronomical photographs. Astronomers notice the clouds only because they block the light of background stars. Once the stars are born, however, the cloud begins to glow.

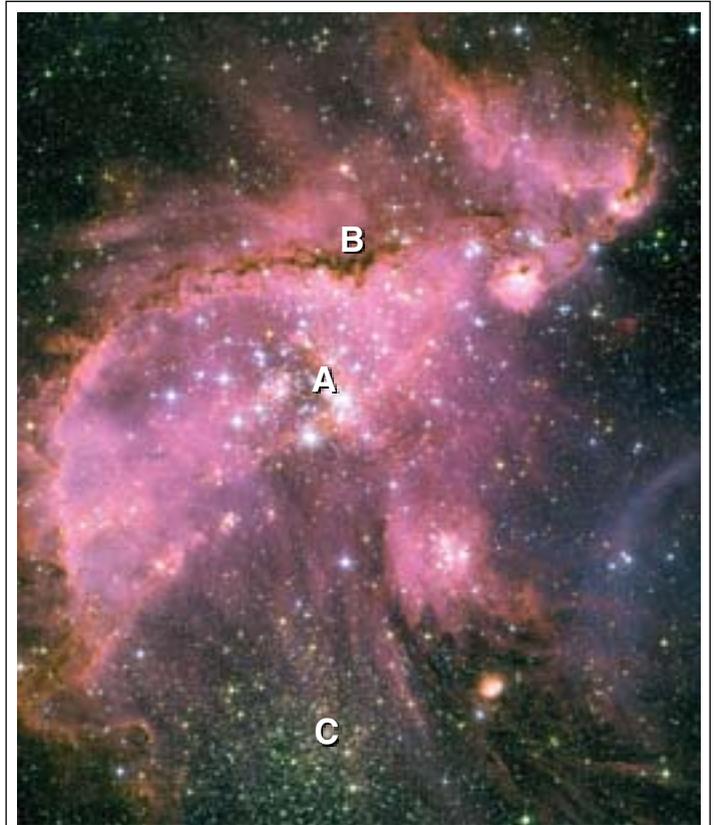
This Hubble Space Telescope image shows a young star cluster entering the spotlight as it emerges from its gaseous nursery. These stars are about 3 to 5 million years old, which is relatively young compared with the 4.5-billion-year age of our Sun. The nebula, called NGC 346, is located in a nearby dwarf galaxy, the Small Magellanic Cloud.

The bright blue stars in the center are destroying the cloud that was their stellar nursery. Their energetic ultraviolet light heats the gas, making it glow. The beautiful pink color in the image is really the energized gas of the nursery being eaten away by the intense radiation.

The boundary between the cold gas and the heated gas appears as a dark ridge, with a bright border that runs across the upper center and down the left side of the image. As time passes, the entire cloud will be heated by the young stars' powerful radiation. Without any cold gas, star formation will cease.

The result will be a cluster of stars somewhat like the one that appears at bottom, center. This cluster is about the same age as our Sun and is dominated by yellow stars. The hotter stars, such as the blue stars from its youth, have already exhausted their energy and died out.

NGC 346, therefore, is a picture book of star formation, showing the dark clouds where stars are born to their emergence as young stars to their passage into maturity.



NGC 346. **A**, This cluster of hot, young, massive stars formed 3 to 5 million years ago. The ultraviolet light emitted by these stars is shaping the gas and dust around them. **B**, This ridge of denser gas and dust is resisting erosion by the energetic outflow from nearby, hot, young stars. **C**, This cluster of cooler, older stars formed 4.5 billion years ago.

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

VOCABULARY

Cluster: A group of stars born at almost the same time and place. Cluster stars are gravitationally bound to each other and could remain together for billions of years.

Nebula: A cloud of gas and dust located between stars and/or surrounding stars. Nebulae are often places where stars form.

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.

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FAST FACTS

Constellation: Tucana.

Distance from Earth: 210,000 light-years.

Credit: NASA, ESA, and A. Nota (STScI/ESA).

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.





In Search of ... Stellar Populations

Description

Using the “NGC 346 in the Small Magellanic Cloud” lithograph, engage your students in a Level One Inquiry activity to compare young and old stars. A Level One Inquiry activity can help prepare students to be more independent thinkers. Students conduct research to answer questions they have about young stars.

Grade Level

High school: grades 10–12

Prerequisites

Students should be aware that gravity is a force of attraction between all masses in the universe. They should know that a star is a gaseous, self-luminous object held together by its own gravity and that stars vary in brightness, color, mass, temperature, and age.

Misconceptions

Teachers should be aware of the following common misconceptions and determine whether their students harbor any of them. Students may have misconceptions regarding the true nature of stars and think that all stars are exactly the same. All stars are not the same. Stars vary in brightness, color, mass, temperature, and age. For example, blue stars tend to be hot, bright, and very massive. They burn through their available fuel quickly and thus have short life spans. When they die, massive stars end their lives as supernovae. In contrast, yellow stars are cooler stars that slowly fuse hydrogen into helium and have a longer life span. When one of these stars dies, it gently puffs off its outer layers to form a planetary nebula and a white dwarf. Students may think that the only groups of stars that exist are galaxies, whereas star clusters are smaller groups of stars that reside within a galaxy.

Purpose

The purpose of this activity is to apply a Level One Inquiry technique, using images and text to compare young star to old stars. In this activity, the components of inquiry learning that students can practice are:

asking questions, planning and conducting investigations, using critical thinking skills, making comparisons, and communicating results. Students will make comparisons, formulate questions, and read for a purpose.

Materials

- “NGC 346 in the Small Magellanic Cloud” lithograph.
- Computer with Internet connection for researching answers.

Instructions for the Teacher

Preparation

- Obtain a lithograph for each student. Lithographs are available as PDF files at <http://amazing-space.stsci.edu/eds/tools/type/pictures.php>.
- Bookmark or identify as favorites the following suggested Web sites, and /or prepare a list of Web sites that students can access to obtain additional information about stellar populations.
 - Young Stars Sculpt Gas with Powerful Outflows:
<http://hubblesite.org/news/2005/35/>
 - Hubble Finds Infant Stars in Neighboring Galaxy:
<http://hubblesite.org/news/2005/04/>

Procedure

Evaluate your students’ misconceptions about stars by having them write down anything they know and understand about stars. Have students volunteer their ideas about stars. From those ideas, identify their misconceptions and discuss them with the class. Or, collect the papers containing their ideas about stars. From those ideas, compile a list of their misconceptions about stars and discuss them with the class.

Ask students to look at the images of NGC 346 and to write down three questions they want answered about the different colored/aged stars visible in this image. Compile a list of questions, and group students by common theme. Ask students to read the information on the back of the lithograph and check if any of their questions have been answered. Allow

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students to refine their questions by discussing them with their group. Have students use the Internet to research their questions. The Internet sites listed above can provide a starting point for their research. Instruct students on how to access other Web sites that may be appropriate.

Ask students to prepare a report in which they compare young stars to old stars. This report could be in the form of a slide show, a skit, a story, a graphic organizer, a Power Point presentation, or a written report—anything that conveys their understanding of the topic to another student, a group of students, or the entire class. Ask students to review their original questions to see if they were answered. Then ask them if they have any additional questions.

Instructions for the Student

Your teacher will ask you to write down things you know and understand about stars. You may be asked to share this information with the rest of the class. Study the images of the different colored/aged stars, and write down three questions about what you see in the images. Then read the back of the lithograph, and check if any of your questions were answered.

Your teacher will assign you to a group to research the answers to your questions. You can research your answers by using the Internet sites provided by your teacher. To demonstrate your understanding, your teacher will ask you to give a report that compares the similarities and differences between young and old stars. This report could be a slide show, a skit, a story, a graphic organizer, a Power Point presentation, or whatever presentation you think will communicate the information you learned about stars. You may be allowed to work individually or in small groups. You can make your presentations to another classmate, another group of students, or the entire class.

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At the conclusion of this activity, you will be asked to review your original list of questions and reflect on whether, through your research, they were answered fully, partially, or not at all. Your teacher also may ask if you thought of any other questions when you were researching the answers to your original questions.

Education Standards

Benchmarks for Science Literacy

American Association for the Advancement of Science:

<http://www.project2061.org/tools/benchol/bolframe.htm>

Grades 9–12:

The Physical Setting

A. The Universe

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

- The stars differ from each other in size, temperature, and age, but they appear to be made up of the same elements that are found on the earth and to behave according to the same physical principles. Unlike the sun, most stars are in systems of two or more stars orbiting around one another.

McREL Language Arts Standards and Benchmarks

<http://www.mcrel.org/compendium/standardDetails.asp?subjectID=7&standardID=7>

Reading Standard 7:

Level 4 (Grade 9–12)

1. Uses reading skills and strategies to understand a variety of informational texts (e.g., textbooks, biographical sketches, letters, diaries, directions, procedures, magazines, essays, primary source historical documents, editorials, news stories, periodicals, catalogs, job-related materials, schedules, speeches, memoranda, public documents, maps).