



**NGC 3314: A Tale of Two Galaxies**

# NGC 3314: A Tale of Two Galaxies

These two galaxies look like they are slamming into each other, but they are actually separated by many millions of light-years.

In this Hubble Space Telescope image, the two distant galaxies happen to line up from our point of view. Called NGC 3314, the system consists of a smaller, closer, face-on spiral galaxy that lies in front of another larger, more distant, tilted spiral galaxy. The image offers a detailed view of a rare pair of overlapping galaxies. The chance of two galaxies stacked up almost perfectly is about 1 in 100,000.

When astronomers first studied the galaxies in the 1960s, however, they thought the pair was interacting. Galaxies this close together on the sky are usually caught within each other's gravity. The gravitational tidal forces stretch the galaxies to produce twisted shapes and long tails. The galactic tug-of-war also triggers star formation, usually visible as bright blue stars and glowing gas clouds.

The two galaxies in NGC 3314 do not show such characteristics of a strong galaxy interaction. A study of the rotation patterns of the two galaxies also reveals that they are not gravitationally tugging on each other. In the 1980s astronomers discovered that the galaxies reside more than 20 million light-years from each other and are much too far apart to interact. Observations revealed that the background galaxy, NGC 3314B, is about 140 million light-years from Earth, while the foreground galaxy, NGC 3314A, is roughly 117 million light-years away.

The overlap of the galaxies means that NGC 3314A is illuminated from behind by the light of NGC 3314B. The dust lanes in the foreground galaxy, which are dark and hard to see in most spirals, stand out strongly in silhouette. Such dust clouds are usually only easily seen in infrared light.

Curiously, NGC 3314A does appear to have had an encounter with another galaxy, just not with NGC 3314B. Its gaseous spiral arms are stretched like taffy, and many new stars [the blue dots] appear around them. The most likely cause of the foreground galaxy's mildly distorted appearance is a grouping of nearby galaxies that are not part of this Hubble image.

NGC 3314 resides in the constellation Hydra.

*Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA)-ESA/Hubble Collaboration, and W. Keel (University of Alabama)*

## VOCABULARY

**Light-year:** The distance light will travel in a year — about 10 trillion kilometers or 6 trillion miles.

**Galaxy:** A collection of stars, gas, and dust bound together by gravity.

National Aeronautics and Space Administration

**Goddard Space Flight Center**

8800 Greenbelt Road

Greenbelt, Maryland 20771

[www.nasa.gov](http://www.nasa.gov)

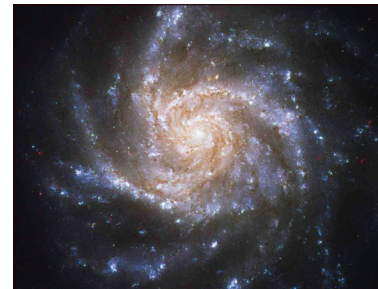


This Hubble image shows the two overlapping galaxies. NGC 3314A is in front and NGC 3314B is in the background.

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**The images below show how the two overlapping galaxies might appear if we could see them separately.**

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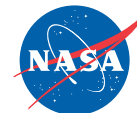
This Hubble image of NGC 3314A reveals how the overlapping galaxy NGC 3314A might look if it were seen alone in space.



NGC 3370, shown in this Hubble image, has the same general shape and orientation as the overlapping galaxy NGC 3314B.

You can get images and other information about the Hubble Space Telescope on the World Wide Web. Visit our website, <http://hubblesite.org/>, and follow the links.

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





## In Search of ... Nature's Deception: Overlapping Galaxies

### Description

Use the “NGC 3314: A Tale of Two Galaxies” 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 to determine how astronomers decide whether galaxies are interacting or overlapping. 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 that has a galaxy 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 to solve a problem. It involves a process of exploring the natural or material world. This exploration prompts students to ask questions and to 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 to determine how astronomers decide whether galaxies are interacting or overlapping. Teachers will suggest selected resources about galaxies to help students understand the differences between interacting and overlapping galaxies and to help them answer their questions. Students will provide supporting evidence for their conclusions. This process can help prepare students to become more independent thinkers.

### Grade Level

High school, grades 11–12.

### Prerequisites

Students should know that galaxies are huge collections of stars, gas, and dust held together by 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 galaxies. They may think all galaxies are the same and remain unchanged.

### Vocabulary

These are terms students may encounter while doing further research on overlapping and interacting galaxies:

**Overlapping galaxies:** Galaxies that have a visual alignment but are far away from each other and therefore are not gravitationally interacting.

**Galaxy interaction:** Galaxy interactions occur when gravity causes nearby galaxies to tug and pull on each other, distorting their shapes.

**Spiral galaxy:** A large pinwheel-shaped system of stars, dust, and gas clouds.

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

- “NGC 3314: A Tale of Two Galaxies” lithograph.
- Computer with Internet connection for conducting research.

## Instructions for the Teacher

### Preparation

- Obtain copies of the lithograph for each student. “NGC 3314: A Tale of Two Galaxies” lithograph can be found at <http://amazing-space.stsci.edu/capture/galaxies/preview-ngc3314.php>.
- Preview the Overview page, found at: <http://amazing-space.stsci.edu/eds/overviews/print/lithos/ngc3314.php>. Use the “Related Materials” section to (1) become familiar with inquiry-based learning and/or (2) become familiar with overlapping galaxies and galaxy interactions.
- Bookmark or identify as favorites the following suggested websites:
  - STScI: The Star Witness News: “Close Encounters of the Galactic Kind.” <http://amazing-space.stsci.edu/news/archive/2008/02>
  - STScI: “Tales of ... A history of colliding galaxies: From oddballs to galaxy building blocks.” [http://amazing-space.stsci.edu/resources/tales/oddball\\_galaxies.php](http://amazing-space.stsci.edu/resources/tales/oddball_galaxies.php)
  - STScI: HubbleSite interacting galaxies news releases. <http://hubblesite.org/newscenter/archive/releases/galaxy/interacting/>

# In Search of ... Overlapping Galaxies

## Procedure

Before beginning this activity, identify your students' misconceptions about galaxies 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 galaxies. From those ideas, identify their misconceptions and discuss them with the class. An alternative method is to collect your students' written ideas about galaxies. From those ideas, compile a list of their misconceptions and discuss them with the class.

Ask students to study the image on the front and the images on the 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 in the "Preparation" section 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 also should address how astronomers decide whether galaxies are interacting or overlapping. 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, to a group of students, or to 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 galaxies. You may be asked to share this information with the rest of the class. Study the image of the galaxies on the front of the lithograph, and then look at the images 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 interacting and overlapping galaxies. Your teacher will direct you to work individually or in small groups. You may be instructed to make your presentation to another student, to a group of students, or to the entire class.

## Education Standards

### National Science Education Standards

<http://books.nap.edu/html/nses/>

Science as Inquiry

Content Standard A:

As a result of activities in grades 9–12, all students should develop understandings about scientific inquiry:

- Scientists usually inquire about how physical, living, or designed systems function. Conceptual principles and knowledge guide scientific inquiries. Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists. Scientific explanations must adhere to criteria such as: a proposed explanation must be logically consistent; it must abide by the rules of evidence; it must be open to questions and possible modification; and it must be based on historical and current scientific knowledge.

### 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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Goddard Space Flight Center

8800 Greenbelt Road

Greenbelt, Maryland 20771

[www.nasa.gov](http://www.nasa.gov)

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Educational Product

Educators & Students

Grades 11–12