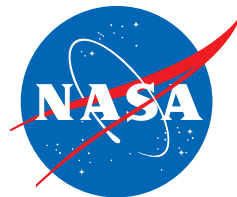


Interacting Galaxies Arp 273

National Aeronautics and
Space Administration



Interacting Galaxies Arp 273

A Galactic Rose

An encounter between this pair of galaxies, called Arp 273, has created twisted shapes, stretched spiral arms, and regions of intense star formation.

In this Hubble Space Telescope image, the larger galaxy has been distorted into a shape resembling a rose by the gravitational pull of the smaller companion galaxy. Along the stretched spiral arms are clusters of hot, young, blue stars. A flurry of star formation also can be seen in the core of the companion galaxy.

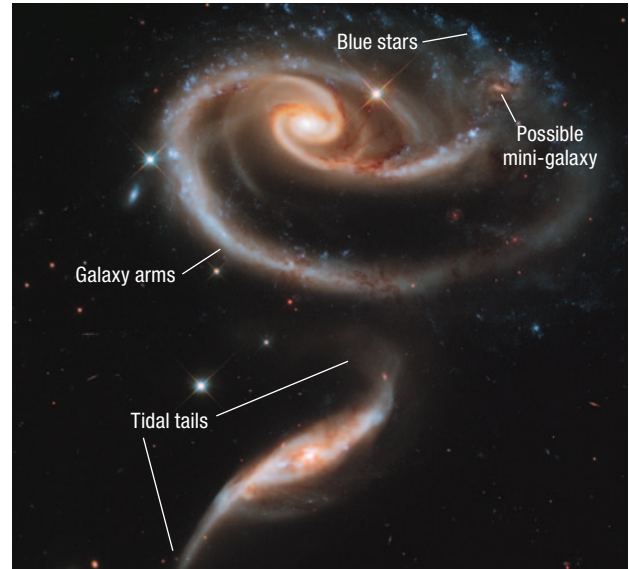
The uncommon spiral patterns in the large galaxy are a telltale sign of an interaction between the two galaxies. For example, the large, outer arm appears partially as a ring, a feature that is seen when interacting galaxies pass through one another. This feature suggests that the smaller companion actually dived deeply, but off-center, through the larger galaxy. A possible mini-galaxy is visible in the larger galaxy's spiral arm at upper right.

A thin bridge of material tens of thousands of light-years long stretches between the two galaxies due to gravitational tidal forces. The larger galaxy is roughly five times more massive than the smaller galaxy. In unequal pairs like this, the rapid passage of a companion galaxy produces the lopsided structure in the larger spiral.

Star formation in this type of encounter also typically begins in the smaller galaxies first. These galaxies generally have proportionately more gas from which to make new stars. Star formation also takes less time to spread throughout a smaller galaxy because of its size.

Arp 273 belongs to a collection of oddball galaxies compiled by astronomer Halton Arp in a book called the *Atlas of Peculiar Galaxies*, published in 1966. This dramatic image celebrates the 21st anniversary of Hubble's launch and deployment into orbit around Earth.

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



Anatomy of an encounter

This Hubble image of the interacting galaxies Arp 273 shows the telltale evidence of a galaxy encounter. Clusters of young blue stars surround the larger galaxy near the top of the image. The galaxy's spiral arms have been stretched like taffy by the gravity of another object. A possible miniature galaxy appears to be embedded in a spiral arm near the image's top right corner. The smaller galaxy near the bottom of the image did not fare too well in this galactic encounter, either. Tails of material have been pulled from the galaxy, and its pancake-shaped disk looks more elongated.

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

VOCABULARY:

Gravitational tidal force: A force that is caused when the gravity tugging on one side of a celestial body is stronger than that on the other side, causing the object to stretch. This force can exist between any two celestial objects that interact with each other. Tidal forces are so named because of their effect on Earth's oceans.

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.

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

National Aeronautics and Space Administration

Goddard Space Flight Center

8800 Greenbelt Road
Greenbelt, Maryland 20771

www.nasa.gov





In Search of ... Interacting Galaxies

Description

Use the “Interacting Galaxies Arp 273” 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 interaction of two galaxies. 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 about the interactions of the two galaxies. Teachers will suggest selected resources about galaxy interactions 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.

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 interacting galaxies:

Elliptical galaxy: A galaxy that is shaped like a football and contains mainly old stars with little gas or dust.

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

- “Interacting Galaxies Arp 273” lithograph.
- Computer with Internet connection for conducting research.

Instructions for the Teacher

Preparation

- Obtain copies of the lithograph for each student. The “Interacting Galaxies Arp 273” lithograph can be found at <http://amazing-space.stsci.edu/capture/galaxies/preview-arp273.php>.
- Preview the Overview page, found at: <http://amazing-space.stsci.edu/eds/overviews/print/lithos/arp273.php>. Use the “Related Materials” section to (1) become familiar with inquiry-based learning and/or (2) become familiar with interacting galaxies.
- Bookmark or identify as favorites the following suggested websites:
 - STScI: “Tales of ... A history of colliding galaxies: From oddballs to galaxy building blocks” http://amazing-space.stsci.edu/resources/tales/oddball_galaxies.php

In Search of ... Interacting Galaxies

- STScI: “ Telescopes From the Ground Up: Edwin Hubble’s discovery that other galaxies exist” http://amazing-space.stsci.edu/resources/explorations/groundup/lesson/scopes/mt_wilson/discovery.php
- STScI: The Star Witness news: Close Encounters of the Galactic Kind <http://amazing-space.stsci.edu/news/archive/2008/02>
- STScI: HubbleSite Interacting Galaxies news releases <http://hubblesite.org/newscenter/archive/releases/galaxy/interacting/>
- Halton Arp’s “Atlas of Peculiar Galaxies” <http://nedwww.ipac.caltech.edu/level5/Arp/frames.html>

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 images on the front and 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 above 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 the interactions of the two galaxies. 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 ques-

tions 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 images of the galaxies on the front and the back of the lithograph. 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 the interaction of the galaxies. Your teacher will direct you to work individually or in small groups. You may be instructed to make your presentation to another classmate, to another group of students, or to 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, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.

4. The Physical Setting

G. Force of Nature

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

- Gravitational force is an attraction between masses. The strength of the force is proportional to the masses and weakens rapidly with increasing distance between them.

National Aeronautics and Space Administration

Goddard Space Flight Center

8800 Greenbelt Road

Greenbelt, Maryland 20771

www.nasa.gov

LG-2011-09-142-GSFC 2/2

Educational Product

Educators & Students

Grades 11-12