

The NASA SCI Files™  
The Case of the  
Galactic Vacation

## Segment 4

As the tree house detectives wind up their investigation, they call on Bianca to learn more about the stars and galaxies. Bianca is beginning her internship at the Arecibo Observatory in Puerto Rico. Arecibo is the home of the largest radio telescope in the world. Dr. D, who just happens to be at Arecibo, gives Bianca a tour of the night sky and helps her understand the differences among stars. The next day, Bianca meets with Dr. Daniel Altschuler, Dr. Tapasi Ghosh, and Dr. Jose Alonso, who help her understand how a radio telescope works and how it is used to study the stars, planets, and other objects in the universe. After a successful internship and a great time in Puerto Rico, Bianca heads home to help the rest of the detectives wrap up their project and create an "out-of-this-world" vacation.

## Objectives

The students will

- understand how a telescope works.
- understand the conditions necessary for life on planets outside our solar system.
- be able to identify two types of stars.
- be able to identify constellations.
- understand that stars are various colors.
- identify three types of galaxies.
- learn how a radio telescope works.
- learn the importance for searching for life in the universe.

## Vocabulary

**constellation**—a grouping of stars that has a shape resembling an animal, mythological character, or other object and thus is named for it

**dwarf star**—a star that in comparison to other stars gives off an ordinary or small amount of energy and has small mass and size

**extraterrestrial**—coming from or existing outside the Earth or its atmosphere

**galaxy**—a massive grouping of gas, dust, and stars in space held together by gravity

**giant star**—a late stage in a star's life cycle in which the core has contracted and grown hotter, causing its outer layers to expand

**nebula**—a large cloud of gas and dust in space that is the beginning of a star

**radio telescope**—an instrument that uses a large antenna to gather radio waves from space for use in studying space objects and communicating with artificial satellites and probes

**radio waves**—electromagnetic waves having long wavelengths; we use them to transmit voice, music, video, and data over distances

**reflecting telescope**—an optical instrument that uses a concave mirror, a flat mirror, and a convex lens to magnify distant objects

**star**—a ball-shaped gaseous celestial body (such as the Sun) of great mass that shines by its own light

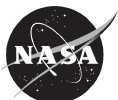
## Video Component

### Implementation Strategy

The NASA SCI Files™ is designed to enhance and enrich the existing curriculum. Two to three days of class time are suggested for each segment to fully use video, resources, activities, and web site.

### Before Viewing

1. Prior to viewing Segment 4 of *The Case of the Galactic Vacation*, discuss the previous segment to review the problem and what the tree house detectives have learned thus far. Download a copy of the Problem Board from the NASA SCI Files™ web site in the tree house section and have students use it to sort the information learned so far.
2. Review the list of questions and issues that the students created prior to viewing Segment 3 and determine which, if any, were answered in the video or in the students' own research.
3. Revise and correct any misconceptions that may have been dispelled during Segment 3. Use tools located on the Web, as was previously mentioned in Segment 3.
4. Focus Questions—Print the questions from the web site ahead of time for students to copy into their science journals. Encourage students to take notes during the program to answer the questions. An icon will appear when the answer is near.



## View Segment 4 of the Video

For optimal educational benefit, view *The Case of the Galactic Vacation* in 15-minute segments and not in its entirety. If you are viewing a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

## After Viewing

1. At the end of Segment 4, lead students in a discussion of the focus questions for Segment 4.
2. Have students discuss and reflect upon the process that the tree house detectives used to design their "out-of-this-world" vacation. The following instructional tools located in the educator's area of the web site may aid in the discussion: Experimental Inquiry Process Flowchart and/or Scientific Method Flowchart.
3. Choose activities from the educator guide and web site to reinforce concepts discussed in the segment. Pinpoint areas in your curriculum that may need to be reinforced and use activities to aid student understanding in those areas.

4. Wrap up the featured online Problem-Based Learning investigation. Evaluate the students' or teams' final product, generated to represent the online PBL investigation. Sample evaluation tools can be found in the educator area of the web site under the main menu topic "Tools" by clicking on the "Instructional Tools."
5. Have students write in their journals what they have learned about our solar system, the Moon, Mars, stars, galaxies, and/or the problem-solving process and share their entry with a partner or the class.

### Careers

telescope operator  
atomic scientist  
biomedical engineer  
technician  
payload specialist

## Resources

### Books

Berger, Melvin and Gilda Berger: *Do Stars Have Points?: Questions and Answers About Stars and Planets (Scholastic Question-And-Answer)*. Scholastic, 1999, ISBN: 0439085705.

Berger, Melvin and Gilda Berger: *Can You hear a Shout in Space?: Questions and Answers About Space Exploration (Scholastic Question-And-Answer)*. Scholastic, 2001, ISBN: 0439148790.

Dickinson, Terrence: *Exploring the Night Sky: The Equinox Astronomy Guide for Beginners*. Firefly Books, 1988, ISBN: 092065668.

Gribbin, John R. and Mary Gribbin: *Eyewitness: Time & Space*. DK Publishing, 2000, ISBN: 0789455781.

Jackson, Ellen: *Looking for Life in the Universe*. Houghton Mifflin Company, 2002, ISBN: 0618128948.

Lippincott, Kristen: *Eyewitness: Astronomy*. DK Publishing, 2000, ISBN: 0789448882.

McDonald, Kim: *Life in Outer Space: The Search for Extraterrestrials (Space Explorer)*. Raintree/Steck-Vaughn, 2000, ISBN: 0739822233.

Simon, Seymour: *Galaxies*. William Morrow & Company Library, 1988, ASIN: 0688080049.

Simon, Seymour: *The Universe*. Harper Trophy, 2000, ISBN: 0064437523.

Stott, Carole and Clint Twist: *Backpack Books: 1001 Facts About Space*. DK Publishing, 2002, ISBN: 0789484501.

Thompson, C. E.: *Glow-In-The-Dark Constellations: A Field Guide for Young Stargazers*. Grosset & Dunlap, 1999, ISBN: 0448412535.

## Resources (concluded)

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### Web Sites

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#### **NASA Star Child**

This web site is a learning center for young astronomers written on two levels. Explore the solar system, universe, and other space stuff. This site is also offered in Spanish.

<http://kids.msfc.nasa.gov/Sites/ExternSite.asp?url=http%3A%2F%2Fstarchild%2Egsfc%2Enasa%2Egov%2F>

#### **NASA's Observatorium**

This web site is full of Earth and space data with pictures of the Earth, planets, stars, and other cool stuff, as well as the stories behind the images.

Students can play games and teachers can find a wealth of lesson plans and information.

<http://kids.msfc.nasa.gov/Sites/ExternSite.asp?url=http%3A%2F%2Fobserve%2Earc%2Enasa%2Egov%2F>

#### **NASA's Astro-Venture**

Transport yourself to the future and work for NASA as you search for and build a planet with the necessary characteristics for human habitation. Also available are student fact sheets, trading cards, classroom lessons, and much more.

<http://kids.msfc.nasa.gov/Sites/ExternSite.asp?url=http%3A%2F%2Fastroventure%2Earc%2Enasa%2Egov%2F>

#### **NASA SpaceKids™**

Visit this site to send your name to Mars, organize a star gazing party, learn about Solar Max, and much more. There is also a junior astronomer club, a teacher corner, and web cast of meteor showers to view.

<http://spacekids.hq.nasa.gov/>

#### **Amazing Space: Galaxies**

Visit this site to learn about galaxies. Click on "Galaxies Galore, Games and More" and learn about our Milky Way galaxy, play games, count galaxies in deep space, and much more.

<http://amazing-space.stsci.edu/capture/galaxies/>

#### **New Views of the Universe**

The companion site to Hubble Space Telescope: New Views of the Universe, a Smithsonian traveling exhibition. This web site takes visitors on a journey into Hubble's amazing universe through cool pictures, interactives, and movies.

<http://hstexhibit.stsci.edu>

#### **The Hubble Telescope**

Share in Hubble's remarkable discoveries with the latest in Hubble news, pictures, information, and resources.

<http://hubble.stsci.edu/>



# Activities and Worksheets

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<b>In the Guide</b>	<b>Counting Your Lucky Stars</b> Sample a star field to estimate the number of stars in the universe. ....	.60
	<b>Just a Wobble Away</b> Create a solar system to learn how astronomers identify new planets in other star systems. ....	.62
	<b>Pictures in the Sky</b> Create constellation viewfinders and learn to recognize star patterns. ....	.63
	<b>No Planets in the Planetarium</b> Create a classroom planetarium. ....	.65
	<b>Galaxy Go Round</b> Create your own mini Milky Way Galaxy to understand its movement. ....	.66
	<b>Hello! Anyone Out There?</b> Create your own messages to send into space. ....	.67
	<b>Lost in Space</b> Search for the astronomy terms in this spacey word find. ....	.68
	<b>Crossing Space Puzzle</b> Create your own crossword puzzle. ....	.69
	<b>Answer Key</b> .....	.70
<b>On the Web</b>	<b>Galaxies Galore</b> Create mini galaxies to learn the three basic shapes of galaxies.	
	<b>Signals from Space</b> Look for radio waves to understand how astronomers search for intelligent extraterrestrial life.	



# Counting Your Lucky Stars

## Problem

To understand how astronomers use sampling to estimate the number of stars in the universe

## Background

There are two principal ways of gathering data: using census (counting) or sampling. Sometimes it is impractical to count every single item such as each character on a classified ad page in the newspaper. Instead, you can count the number of characters in a small area and then mathematically calculate an estimate of the total number on the page. This method is called sampling. Astronomers use sampling to estimate the number of stars in a galaxy and even in the universe.

## Materials

Star Field Sheet  
(p. 61)  
pencils  
scissors  
science journal

## Procedure

1. Observe the Star Field Sheet and estimate the number of stars it contains. Record your estimate in the chart below.
2. On the Star Field Sheet, cut out the sampling window along the solid lines.
3. Fold the window in half, with the pattern lines on the outside, and cut along the dashed lines. Unfold the window.
4. Hold the window about 30 cm above the Star Field Sheet and drop. Make sure the window lands completely within the boundaries of the star field. If not, drop the window again.
5. Count the number of stars within the window, being careful not to bump or move the window. Count any stars that have at least 50% of their area in the window. Record the number of stars in the chart below.
6. Repeat steps 3-5 for two more trials.
7. Average the number of stars sampled and record.
8. Look at the Star Field Sheet and count the number of squares that make up the star field.
9. Multiply the number of squares in the star field by the average number of stars you counted in your samplings.
10. To find out how close your sampling is to the actual number of stars, divide the squares among your classmates and have each person count the stars in his/her square. Record in a class chart and find the sum of all the squares.

	Prediction	Average	Number of squares in the Star Field	Approximate Number of Stars in Star Field	Actual Number of Stars
Trial 1					
Trial 2					
Trial 3					
Total:					

Multiply average number of stars by number of squares.

## Conclusion

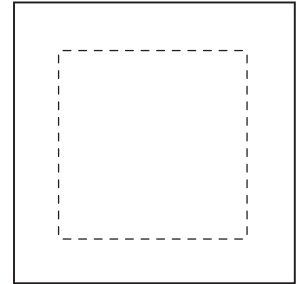
1. How did your prediction compare to the approximate number of stars determined by sampling?
2. How did the approximate number of stars determined by sampling compare to the actual number of stars?
3. Why would astronomers use sampling to estimate the number of stars in the night sky?
4. What could you do to improve the accuracy of the sampling?
5. How else could sampling be used?



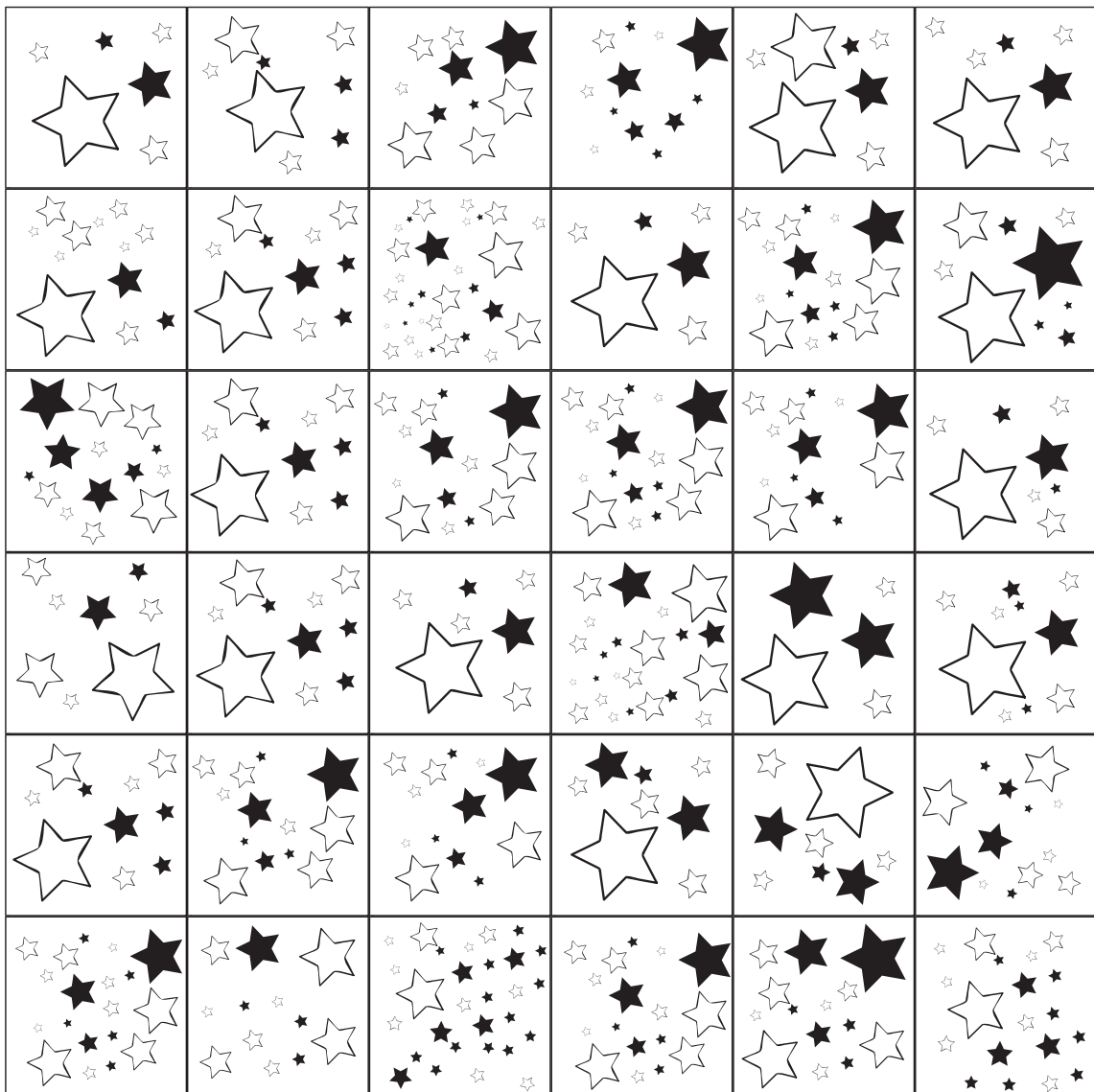
# Counting Your Lucky Stars (concluded)

## Extension

Conduct this experiment using the classified ad section of a local newspaper. Instead of stars, the students will be determining the number of characters on a page. Spaces don't count. To determine the actual number of characters on the page, cut the page into enough pieces for all students to have one and have them count the characters in their own sections.



## Star Field Sheet



# Just a Wobble Away

## Problem

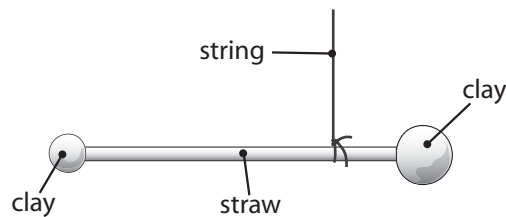
To learn how astronomers locate planets in other star systems

## Procedure

1. Loosely tie one end of the string around a drinking straw so that the knot slides back and forth along the straw.
2. Roll the clay to form a ball the size of a golf ball (represents a star).
3. Place the ball of clay on the end of the straw.
4. Roll the clay to form a ball the size of a marble (represents a planet).
5. Place the ball on the other end of the straw.
6. Due to the difference in the amount of clay, one side of the straw is heavier than the other side. Therefore, you will need to find the balance point for the string. Hold the free end of the string in one hand and move the knotted end of the string toward the outer edge until the straw with the clay balances.
7. Working with your partner, hold the string by the free end and let the straw spin freely. Have your partner at eye level to observe the spinning straw. Record observations.
8. Repeat, but this time have your partner stand approximately 3-4 meters away and observe the straw as it spins. Record observations.
9. Have your partner hold a second drinking straw vertically at arm's length between his/her eye and the spinning straw. Observe and record.
10. Repeat, having your partner hold the string while you observe.

## Materials

40-cm string  
2 plastic straws  
clay  
science journal



## Conclusion

1. What do the straw and clay represent?
2. What did you observe at eye level? From across the room? With the second straw?
3. If a planet is near a star, will it be easy to detect? Why or why not?



## Pictures in the Sky

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**Purpose** To learn to recognize star patterns called constellations

**Teacher Note** Number of canisters will vary, depending on how the activity is completed. It can be completed either in groups of four, with each student constructing four constellation finders, or each student can construct one.

**Procedure**

1. In your group divide the constellation patterns among you.
2. Using scissors, cut out the constellation patterns on the dotted line.
3. Place a pattern over the bottom of the film canister to align the solid circle with the outside rim of the canister.
4. Tape into place.
5. Using a pushpin, punch a small hole through the paper and the canister for each star in the pattern.
6. Hold the film canister to the light and look through it to make sure that you have punched the holes completely and light is seen through each.
7. Using a dot sticker, create a label for the canister with the name of the constellation and place it on the side of the canister.
8. Remove the paper from the canister.
9. Repeat steps 3-8 for any remaining constellation patterns.
10. Choose one of the canisters, read the name, and look through it to try to memorize the pattern. Slowly turn the canister counterclockwise and observe.
11. Exchange canisters within your group. Practice identifying the constellations.

### Materials

16 black 35-mm film canisters  
Constellation patterns (p. 64)  
scissors  
tape  
pushpin  
dot stickers (optional)  
science journal

**Conclusion**

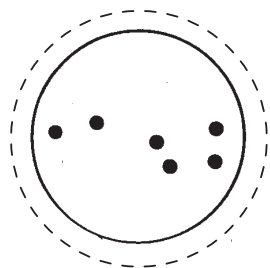
1. How did turning the canister affect the appearance of the constellation?
2. Why would constellations look different at different times of the night?

**Extension**

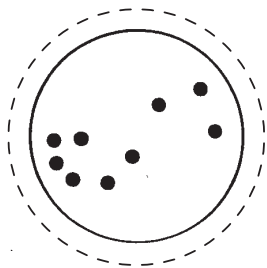
1. To have a larger viewing area, make a constellation viewfinder out of a shoe box and punch the constellations in black card stock paper that can be inserted in one end of the box (cut out a small section on one end of the box).
2. Organize a star party and observe the night sky to see how many constellations you can identify.
3. Contact your local astronomy club and arrange for volunteers to help students observe the sky with the use of telescopes.

# Pictures in the Sky (concluded)

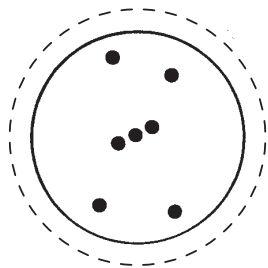
## Constellation Patterns



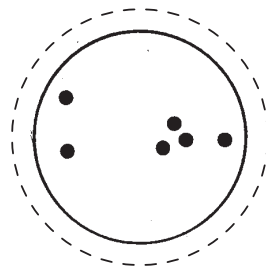
URSA MAJOR,  
the Great Bear



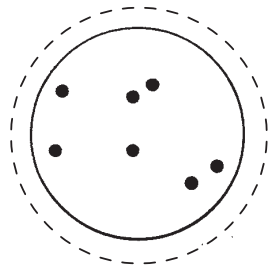
SCORPIUS,  
the Scorpion



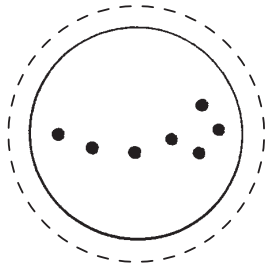
ORION,  
the Hunter



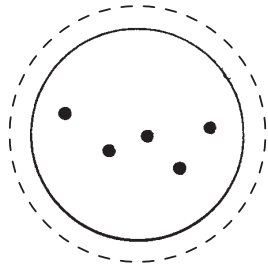
TAURUS,  
the Bull



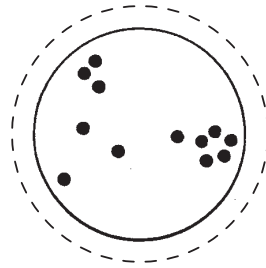
PEGASUS,  
the Flying Horse



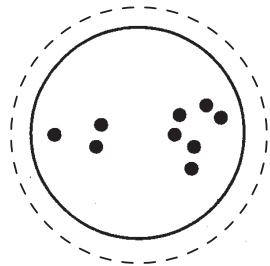
URSA MINOR,  
the Little Bear



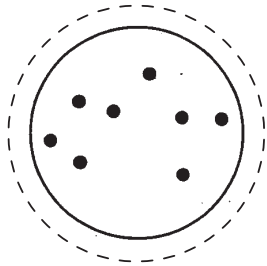
CASSIOPEIA,  
the Queen



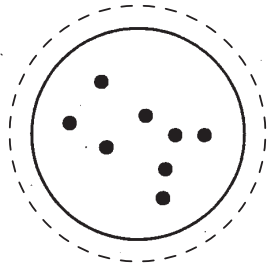
PISCES,  
the Fishes



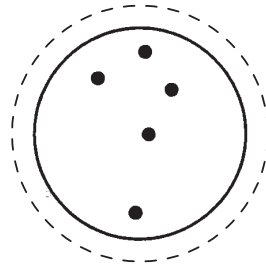
LEO,  
the Lion



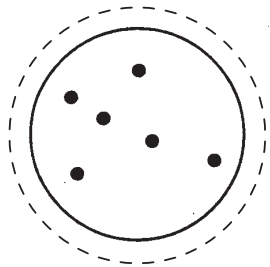
SAGITTARIUS,  
the Archer



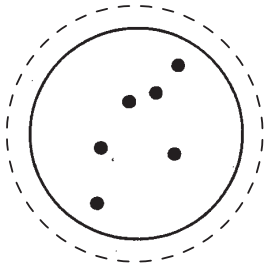
GEMINI,  
the Twins



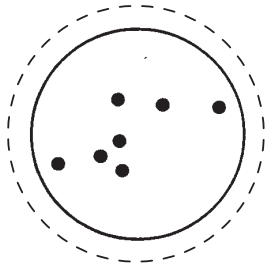
BOOTES,  
the Herdsman



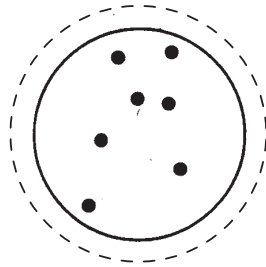
CYGNUS,  
the Swan



PERSEUS



CANIS MAJOR,  
the Big Dog



HERCULES

# No Planets in the Planetarium

## Problem

To create a classroom planetarium for students to observe a “night sky”

## Procedure

1. Fold tarp in half, lining up the sides as evenly as possible.
2. Using strong tape, such as duct tape, tape the two pieces of tarp together on both of the shorter sides of the tarp. See diagram 1.
3. On the longer side of the tarp, tape the edges together, leaving an opening large enough to fit a box fan plus 1 meter. See diagram 2.
4. Using a star chart, choose a portion of a night sky that you would like for the students to observe in the planetarium. You will not be able to create all of the constellations, so you might want to pick those that are more easily identified and recognized by students.
5. Use a permanent marker to draw the constellations on the outside of the top layer of the planetarium. Place the name of the constellation next to it.
6. With a pushpin, punch a hole through the top layer of the tarp at each star in the constellations.
7. If needed for better viewing, use a sharpened pencil to enlarge the holes slightly.
8. Once the constellations are completed, place a box fan at the far left of the opening in the tarp so that the air from the fan is blowing in to create a bubble. See diagram 3.
9. Secure the tarp by taping the top layer of the tarp to the top of the box fan.
10. Crawl into the tarp bubble and view the stars. Widen holes as necessary.
11. Provide star charts for the students and invite them to observe a night sky in the planetarium. This activity is best if a limited number of students go in at one time.

## Materials

large, black, thick, plastic tarp  
strong tape  
box fan  
star chart  
marker  
pushpin

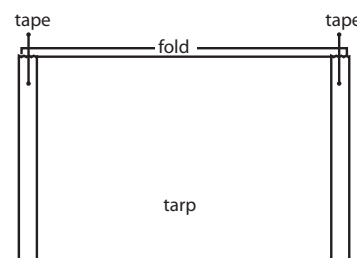


Diagram 1

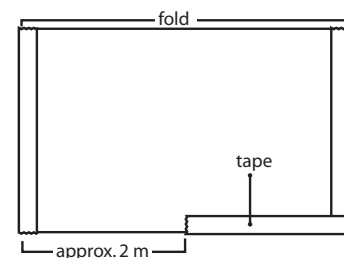


Diagram 2

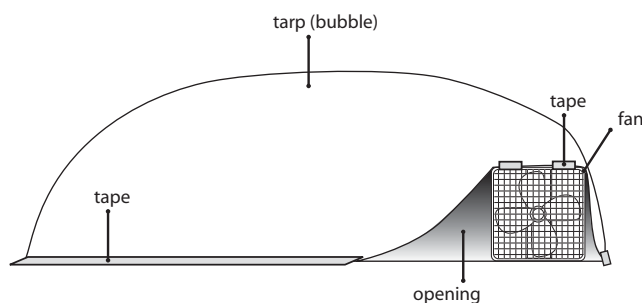


Diagram 3

## Extension

1. Invite parents to a “Star Party” and have the students give tours of the night sky.
2. Have the students research the constellations and identify the stars within each grouping.
3. Have students research various folklore related to the constellations and create reports, posters, plays, or songs explaining the myths.

# Galaxy Go Round

## Problem

To demonstrate the movement of the Milky Way Galaxy

## Background

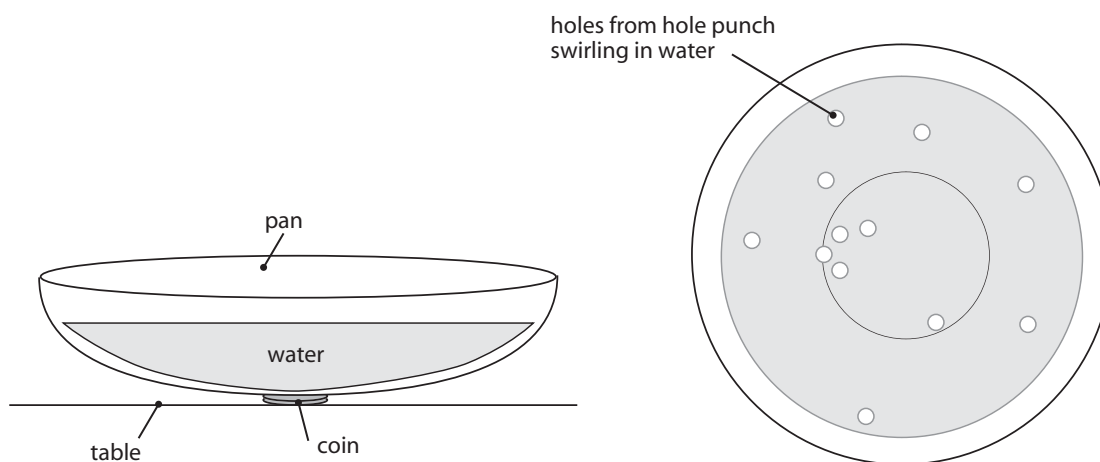
A galaxy is a cluster of stars, dust, and gas held together by gravity. Galaxies range in diameter from a few thousand to a half million light years. Large galaxies have more than a trillion stars, and small galaxies have fewer than a billion. Astronomers believe that there are billions of galaxies in the universe. Astronomers classify galaxies into three basic patterns: spiral, elliptical, and irregular. Elliptical galaxies contain mostly older stars and little or no gas to make new stars. They are ball or oval shaped and may have formed early in the universe's history. Irregular galaxies are small and shapeless, but many are still actively making new stars. Spiral galaxies are easy to identify with sweeping "arms" that contain gas and dust that make new stars. Our galaxy, the Milky Way, is a spiral galaxy.

## Materials

round pan  
coin  
water  
paper holes from  
hole punch

## Procedure

1. Place the pan on a table and put a coin under the center of the pan. Make sure the pan can spin easily.
2. Pour about 2 cm of water into the pan.
3. Carefully sprinkle the paper holes in the center of the pan.
4. Spin the pan slowly. Observe the dots and draw your observations in your science journal.



## Conclusion

1. What forms new stars?
2. What is the name of our galaxy?
3. Why are galaxies so hard to see in the night sky?

# Hello! Anyone Out There?

**Problem** To create a message to be sent into space and to understand the difficulty in creating and interpreting the message

**Teacher Prep** Have the students bring in magazines about a week before the project. The magazines should have pictures that show all aspects of life on Earth such as landscapes, people (different cultures), wildlife, technology, and so on. Scan the magazines for appropriate content

**Background** In 1977, NASA launched two Voyager spacecraft to fly by the outer planets in our solar system. Because scientists and engineers knew that Voyagers' paths would carry them beyond our solar system and hopefully, eventually among the stars, they placed an audio-video record onboard the craft with the "sights and sounds of Earth." The disk contained 118 photographs, 90 minutes of music from all around the world, and greetings in almost 60 languages. The disk is like a "message in a bottle" set to drift in space as a token of humanity's existence. As you might imagine, the committee given the task of selecting the images and music had lots of discussions on what to include, and they only had six weeks!

Throughout the history of man, we have tried to leave messages saying that "we were here." You can see evidence in cave drawings and ancient stone tablets. It is often difficult to understand these messages and sometimes we never know what they mean. But when we decipher the messages, we are very excited to have another piece of our past unlocked.

**Procedure**

1. Your mission is to use 10 pictures from magazines to create a "we were here" message to be sent into space to any intelligent extraterrestrial life. This message needs to let other intelligent life know that we exist and what our world is like. Discuss the matter with your group members and come to an agreement on a message. You have 10 minutes.
2. Use scissors and cut out the chosen pictures. Decide how to arrange them on the large construction paper and glue them into place. You may not write any words on your message, only pictures. You have 10 minutes.
3. Decide upon a team name and write it on the back of the message.
4. On a sheet of notebook paper, write a paragraph summarizing the message you are trying to convey with your pictures. Put your team's name at the top of the paper, then date and sign it, being sure to include all team members' names. You have 10 minutes.
5. On the same day or a different day, imagine that you are intelligent extraterrestrial life. Your group will "intercept" a message by choosing one of the messages that have been completed.
6. As a group, try to make sense of the message and reach a consensus on what it says. Write a brief paragraph explaining what you think it is telling you. Remember that you know nothing about Earth and you can only use the pictures.
7. Once you are finished, share your findings with the class and then have the group who sent the message read its description. Compare the two messages.

**Conclusion**

1. How difficult was it to interpret the message?
2. What would have made it easier?
3. Would it be harder for a true extraterrestrial to understand a message sent from Earth than for an Earthling to understand a message sent by another Earthling? Why or why not?
4. What things might we have in common with other intelligent extraterrestrials?

## Materials

magazines with lots of pictures  
scissors  
glue or tape  
large construction paper  
pencil  
notebook paper  
science journal

# Lost in Space

## Word Bank

inner planet

solar system

axis

satellite

radio waves

light year

Apollo

gravity

star

galaxy

parallax

Moon

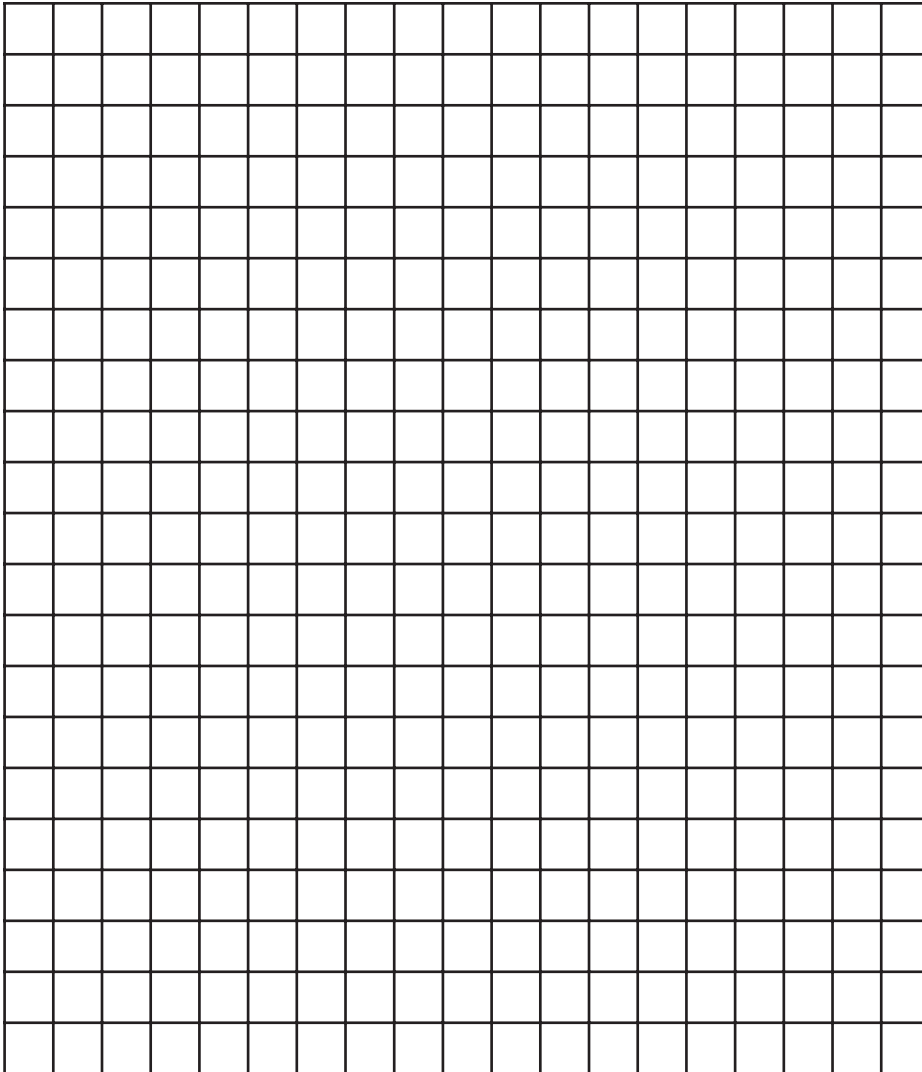
propulsion

telescope

P N C R U S T X A L L A R A P P A R A T U M  
 U R M O S P S M G P S A B E H A G U Y I O A  
 T A O E A O R P S W V C A C X N R O L O D N  
 E B F P T P E R O A K M E I C G I P N E C T  
 R N S A E E O M L V H T I H B A L C H T O L  
 C H E D L T O U A E R A U X S E L I S E N E  
 O K A I L O I R R S I N E T I A I I I O V E  
 A J I L I E S N S D C J A L P L L E U R E N  
 P L S T T I D J Y I B R S T R E T O R I R T  
 O R N T E C I R S N D A I E S I E V A T G I  
 L E O N E C I P T I T E E T H S L A R E E A  
 L Z I U I C K I E T H A X I S R E E P U N L  
 O N S D S H I N M P R I L T I S S I T I T L  
 Y G L A R S Z A A O V U O D R O C C Y A I I  
 K I U N R T S R T R A I D N R N O N H J K R  
 J S P Y K O G A L A X Y Y I I I P N B O N A  
 H F O T J O E R R E O P E L L C E I I D A E  
 P E R E M G Y A A R T C K C I B A T S T R Y  
 U E P S R G S I D V Z U U A E O I S H I C T  
 Y K I E I I T G A D I B I S B O L L I I I H  
 T E V E S B E K I S R T H Y O M J A C O N G  
 S I E M A I M O S C I N Y T C E T E T A L I  
 D G W I N R A D I O W A V E S I N Y I R P L  
 I N N E R P L A N E T K E L F U R O E T E M



# Crossing Space Puzzle



Create a crossword puzzle with the following terms and the grid below.

### Vocabulary

- inner planets
- outer planets
- light year
- parallax
- solar system
- Moon phases
- axis
- gravity
- propulsion
- satellite
- star
- radio telescope
- galaxy

### Add your own:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Across

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### Down

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_



# Answer Key

## Counting Your Lucky Stars

- Answers will vary.
- Answers will vary.
- Astronomers would use sampling to estimate the number of stars in the night sky because with billions of stars, it would be impossible to count them all in a person's lifetime.
- Answers will vary but might include that the number of trials could be increased. The more trials, the better the estimate. Securing the window to the paper so that it does not move would also help to increase the accuracy of the sampling.
- Sampling can be used in many ways, and some include counting populations of insects, estimating the number of people at a sporting event, and so on.

## Just a Wobble Away

- The straw and clay represent a solar system (star and planet).
- At eye level there was very little movement. From across the room, the wobble was very difficult to see. The second straw makes it easier to see.
- A planet near a star is difficult to detect because as a planet orbits a star, there is very little motion seen. It appears as only a slight wobble.

## Pictures in the Sky

- Turning the canister made the constellations appear upside down and sideways.
- Even though the stars remain in the same relative position, the Earth is turning; therefore, to an observer on Earth, constellations appear to move around the sky throughout the night.

## Galaxy Go Round

- Gas and dust make new stars.
- Our galaxy is the Milky Way Galaxy.
- Galaxies are difficult to see in the night sky because they are so far away.

## Hello! Anyone Out There?

- Answers will vary.
- Answers will vary but might include that it would have been easier if there were words that could be read and understood.

- Yes. People who live on Earth have a good understanding of humans and our world. If we were to interpret a message from our own planet, we would at least have a background of information to build upon. Extraterrestrials would not have any information from which they could begin to understand the message. They might not know what a car is or even a cloud.
- Answers will vary but might include things such as mathematical operations, prime numbers, the structure of atoms, engineering principals, knowledge of the universe, and so on.

## Lost in Space Answers

P N C R U S T X A L L A R A P P A R A T U M  
 U R M O S P S M G P S A B E H A G U Y I O A  
 T A O E A O R P S W V C A C X N R O L O D N  
 E B F P T P E R O A K M E I C G I P N E C T  
 R N S A E E O M L V H T I H B A L C H T O L  
 C H E D L T O U A E R A U X S E L I S E N E  
 O K A I L O I R R S I N E T I A I I I O V E  
 A J I L I E S N S D C J A L P L L E U R E N  
 P L S T T I D J Y I B R S T R E T O R I R T  
 O R N T E C I R S N D A I E S I E V A T G I  
 L E O N E C I P T I T E E T H S L A R E E A  
 L Z I U I C K I E T H A X I S R E E P U N L  
 O N S D S H I N M P R I L T I S S I T I T L  
 Y G L A R S Z A A O V U O D R O C C Y A I I  
 K I U N R T S R T R A I D N R N O N H J K R  
 J S P Y K O G A L A X Y Y I I I P N B O N A  
 H F O T J O E R R E O P E L L C E I I D A E  
 P E R E M G Y A A R T C K C I B A T S T R Y  
 U E P S R G S I D V Z U U A E O I S H I C T  
 Y K I E I I T G A D I B I S B O L L I I I H  
 T E V E S B E K I S R T H Y O M J A C O N G  
 S I E M A I M O S C I N Y T C E T E T A L I  
 D G W I N R A D I O W A V E S I N Y I R P L  
 I N N E R P L A N E T K E L F U R O E T E M

## On the Web

### Signals from Space

- Some reasons for static while listening to a radio when riding in a car are other electrical devices, power plants, lightning, power lines, poor connection, and so on.
- Some sources of interference for astronomers are other space matter, television and radio broadcasting, microwave communications, the radio receiver itself, satellites, and so on.
- Answers will vary.

