

Family Space Day Overview – Galaxies

Family Space Day is a three hour event. The activities are set up so that children and parents can select the order in which they undertake activities. Parents and children are encouraged to learn, play, and explore *together*.

Objectives of the Day

Children will:

- explore what galaxies are and about their different parts.
- learn that different components within our solar system and beyond are different sizes, distances, and ages.
- understand that galaxies are systems, and include smaller parts or components. Galaxies also are parts of larger systems.

Activities

- **Station 1: Galaxy Hall Posters**
Children and their parents view 7 posters and respond to the poster questions to learn more about galaxies and to prepare for the daily activities.
- **Station 2: Cosmic Quest Card Game**
Children order images of representative features within and outside of our solar system by distance and size to learn about the different components and how far away they are. Older children order the images by age, learning that different objects in our galaxy and beyond are different ages.
- **Station 3: My Place in Space**
Children gain an understanding that they are part of a galaxy – The Milky Way – and how immense it truly is. They explore how smaller systems exist within larger systems as they build a collage of their place in space!
- **Station 4: Paper Plate Galaxy**
Children make and decorate a spiral galaxy mobile and learn its different parts.
- **Station 5: Glitter Galaxies**
Children will learn about the different types of galaxies and make a representation using glitter!
- **Station 6: Coloring Sheets and Games**
Children can relax and color and play simple games related to galaxies.
- **Station 7: Reading Room**
Children and their parents can browse and read a selection of books about galaxies (refer to book list for suggested reading).

Other Materials

- *Facilitator Information – Galaxies*
- *Explore Galaxies – Book and Website References*
- *All About Galaxies – A Galaxy Fact Sheet*

Facilitator Information

(All you need to know about galaxies to survive the day)

What is a galaxy?

Galaxies are large collections of stars and gas and dust. They have millions to billions of stars, all held into a cluster by gravitational attraction. Most galaxies are flat, but there are different shapes — some are spirals, some are elliptical, and some are irregular.

Our Galaxy

The **Milky Way** is a galaxy, a slowly rotating cluster of more than 200,000,000,000 stars! Our Milky Way Galaxy looks a little like a pinwheel. It is a spiral galaxy, about 100,000 light years across. Spiral galaxies have: a bulge in the center (called the nuclear bulge) that contains the nucleus; a wide, flat disk with distinct spiral arms containing stars; and a surrounding halo of stars. There are several “spiral arms” in our Milky Way: Sagittarius, Cygnus, Perseus, and Orion.

Where are we in the Milky Way Galaxy?

We are in one of the **spiral arms**, about 30,000 light years from the center of the Milky Way Galaxy — or about two-thirds of the way from the center.

Can you see the Milky Way?

Yes! On a very dark night, away from bright lights, you can see a faint, hazy — or milky — band in the sky. This is the Milky Way. The hazy appearance is because there are so many stars that are very distant; your eye cannot distinguish the stars as separate points of light. By using binoculars or a telescope, you can see the individual stars. The Milky Way is like a big, flat disk in space. We are looking into the wide part of the disk when we look at the band across the sky. All of the stars that we see with our naked eyes — approximately 6000 — are part of our Milky Way Galaxy.

Where did our galaxy come from?

Our galaxy is believed to have formed from an immense, churning, slowly rotating, cloud of dust and hydrogen and helium gas that was perhaps 300,000 light years across. Gradually, the cloud began to collapse, becoming more dense in the center. Pockets of more dense material formed in swirling portions. These became dense enough to be sites of early star formation, distributed throughout the cloud — the stars and clusters of the galaxy’s halo. The early stars formed from the hydrogen and helium. As they aged, they evolved and created new, heavier, more metallic elements. When these stars eventually exploded in huge supernovas, they released the heavier elements back to the cloud.

As the rotating cloud collapsed further, it began to flatten into a slowly spinning disk. More and more stars formed from the dust and gas enriched in the heavier elements. These are the metal-rich stars in our galaxy’s center bulge and scattered

throughout its disk. Stars still are forming, evolving, and dying, each contributing to the gas and dust within our galaxy — each contributing to the formation of other stars.

Are there other galaxies?

Yes! There are billions of other galaxies in our universe. We can even see a few, including the Andromeda Galaxy, and (from the southern hemisphere) the Large and Small Magellanic Clouds.

Galaxies are organized into clusters. Our Milky Way Galaxy is part of a Local Group, a cluster of about 35 galaxies, including the larger Andromeda Galaxy, which is about 3 million light years away. There are other clusters of galaxies, and the clusters can be grouped into clusters of clusters — superclusters. The Local Supercluster is about 100 million light years across, and contains our Local Group and the Virgo cluster.

Galaxy Hall Posters

Galaxies are collections of stars and gas and dust. They have different components and shapes. Galaxies are organized into clusters. Our Milky Way Galaxy is part of a cluster – our local group - of about 35 galaxies, including the larger Andromeda Galaxy, which is about 3 million light years away,

In this activity, you and your child will view posters and respond to the poster questions to learn more about galaxies and to prepare for the daily activities.

What You Need:

- 7 sheets of poster board in different colors
- Large print-outs of the questions
- Color images of galaxies related to the questions
- Cover sheets for the answers
- Glue or tape to adhere the questions to the poster board

What to Do:

Each of the following questions should be made into a big, bold, colorful poster with related images. Make sure the answer is on the poster, but covered by a page labeled "lift me" that hides the answer.

Can we see other galaxies?

Yes

But only a very few! *Andromeda* is the closest that we can see. It is part of our local group.

How Many Stars are in our Milky Way Galaxy?

- A) 2
- B) 143
- C) Billions
- D) None, only planets

Answer: Billions! We can see about 5000 of them. All the stars we see are in our

What is a galaxy?

- A) Collection of stars, gas and dust
- B) A Soccer team on the planet Ursa
- C) Collection of planets around a star

Answer: Collection of stars, gas and dust.

Where is Earth in our Milky Way Galaxy?

We are in one of the spiral arms about two-thirds of the way from the center.

What is our galaxy called?

- A) Babe Ruth galaxy
- B) Butterfinger galaxy
- C) Snickers galaxy
- D) Milky Way Galaxy

Answer: Milky Way Galaxy

All the stars that we can see with our naked eyes are in our galaxy.

Which of the following are components of the Milky Way Galaxy?

- E) Spiral arms
- F) Billions of Stars
- G) Nucleus
- H) All of the above

Answer: All of the above

What Shapes are Galaxies?

Broccoli and Carrot Shaped

Irregular, Elliptical and Spiral

Rectangular, Circular, and Triangular

Answer: Irregular, Elliptical and Spiral. The Milky Way is a spiral galaxy!

Possible Poster Images

Images can be found at:

Hubble Galaxy Images

http://hubblesite.org/gallery/album/galaxy_collection/

National Optical Astronomy Observatory

http://www.noao.edu/image_gallery/galaxies.html

Princeton University

http://www.astro.princeton.edu/~frei/Gcat_htm/cat_ims.htm

Ohio State University

<http://www.astronomy.ohio-state.edu/Gallery/galimgs.html>

Cosmic Quest!

Challenge your child to think about the different objects in our solar system, galaxy, and beyond. How far away are they? How big are they?

In this activity, you and your child will learn the order of different objects in our solar system from closest to Earth to farthest, and from smallest to largest. Older children may want to learn about the relative ages.

What You Need:

- Pictures of different objects in our solar system and galaxy
- Thinking cap
- Answer Sheet

What to Do:

- Invite your child to place the pictures in order from smallest to largest. As they create the order, ask them to share their thinking.
- Next, help your child place the pictures in order from closest to the Earth to farthest and discuss their responses.
- Finally, for older children, invite them to place the pictures in order from youngest to oldest.

Smallest to Biggest Answers:

1. Hubble Telescope – 40 feet long (12 meters)
2. Moon – 2,000 miles in diameter (3,200 kilometers)
3. Saturn – 75,000 miles in diameter (121,000 kilometers)
4. Sun – 875,000 miles in diameter (1,408,000 kilometers)
5. Pleiades – 60 trillion miles across the cluster (1 X 10¹⁴ kilometers)
6. Galaxy – 600 thousand, trillion miles across (1 X 10¹⁸ kilometers)
7. Hubble galaxies – 600 million, trillion miles across the cluster (1 X 10²¹ kilometers)

It's hard to tell the size of objects from many of the images we see because they look about the same size in the pictures. But the Sun is much larger than Saturn or any of the planets. In fact, a million Earths would fit inside the Sun.

Children may also wonder whether, in the image of the Pleiades, they should be thinking about the sizes of the individual stars, or all the stars in the picture. For this picture and the Hubble galaxies, the challenge is to figure out the relative size of the "field of view" – all the stars or galaxies in the cluster.

Closest to Earth to farthest answer:

1. Telescope – 350 miles above Earth's surface (560 kilometers)
2. Moon – 250,000 miles (402,000 kilometers)
3. Sun – 93 million miles (1.5×10^8 kilometers)
4. Saturn – 120 million miles (at its closest) (1.3×10^9 kilometers)
5. Pleiades – 2,400 trillion miles (4×10^{15} kilometers)
6. Galaxy – 200 million, trillion miles (3×10^{20} kilometers)
7. Hubble galaxies – 30 billion, trillion miles (5×10^{22} kilometers)

Figuring out the relative distances of the Sun and Saturn requires knowledge about the relative orbits of the planets. Depending on how much astronomy background you and your child have had, the Pleiades may be placed inside the solar system or as the farthest objects in space. In general, most children (and adults) have a hard time understanding the relative distances of the last three objects!

Children often struggle with the distance of the Hubble Space telescope; after all, it takes images of very distant objects. How far away is the Hubble Space telescope? Many people believe that it is beyond the orbit of the Moon, but it's actually only 350 miles above the Earth's surface – very close indeed. That's high enough for a clear view above the Earth's atmosphere, but low enough to enable it to be serviced by the astronauts aboard the space shuttle.

Many people think the beautiful Pleiades cluster of stars must be farther away than a cluster of galaxies, because they look smaller. But all the stars we see in the night sky are much closer than even the nearest galaxy. A galaxy is a "city" of many billions of stars. Galaxies are so far away that we can't make out the individual stars in them. In fact, the roughly 6,000 stars we can see with our naked eyes are just among the closest of the billions of stars in our own galaxy, the Milky Way.

Youngest to Oldest Answers:

1. Telescope – a few years (1990)
2. Pleiades – 80 million years
3. Moon – 4.55 billion years (*probably formed when a giant impactor struck Earth!*)
4. Saturn – 4.56 billion years
5. Sun – 4.56 billion years (*all planets and our Sun formed at the same time*)
6. Galaxy – 10 billion years
7. Hubble galaxies – older than 10 billion years

We tend to think of stars as having been around for a very long time. In fact, our sun is billions of years old. But new stars, like those in the Pleiades, are continually being born. The Pleiades stars are only about 80 million years old.

Which is older, the Sun or the Hubble galaxies? It depends on what you mean by "age." The Sun is about 4.5 billion years old. But the Hubble "deep-field" galaxies are among the most ancient and distant objects we can see in the sky. The light from them has taken about 10 billion years to reach us. So they were born long before our Sun.

On the other hand, the Hubble deep field galaxies are young galaxies! Because of light's travel time, we see these galaxies as they were when they formed, only a few billion years after the Big Bang. Many of the stars in the galaxies in this image may be younger than our Sun, so we are looking at the "baby pictures" of objects that are now old.

For a great online pictorial tour through our Universe, go to:
http://cfa-www.harvard.edu/seuforum/opis_tour_earth.htm

This activity was modified from NASA's Structure and Evolution of the Universe Education Forum's Cosmic Survey:

<http://cfa-www.harvard.edu/seuforum/learningresources.htm>

Our Moon



Site: <http://photojournal.jpl.nasa.gov/catalog/PIA00405>

Hubble Space Telescope



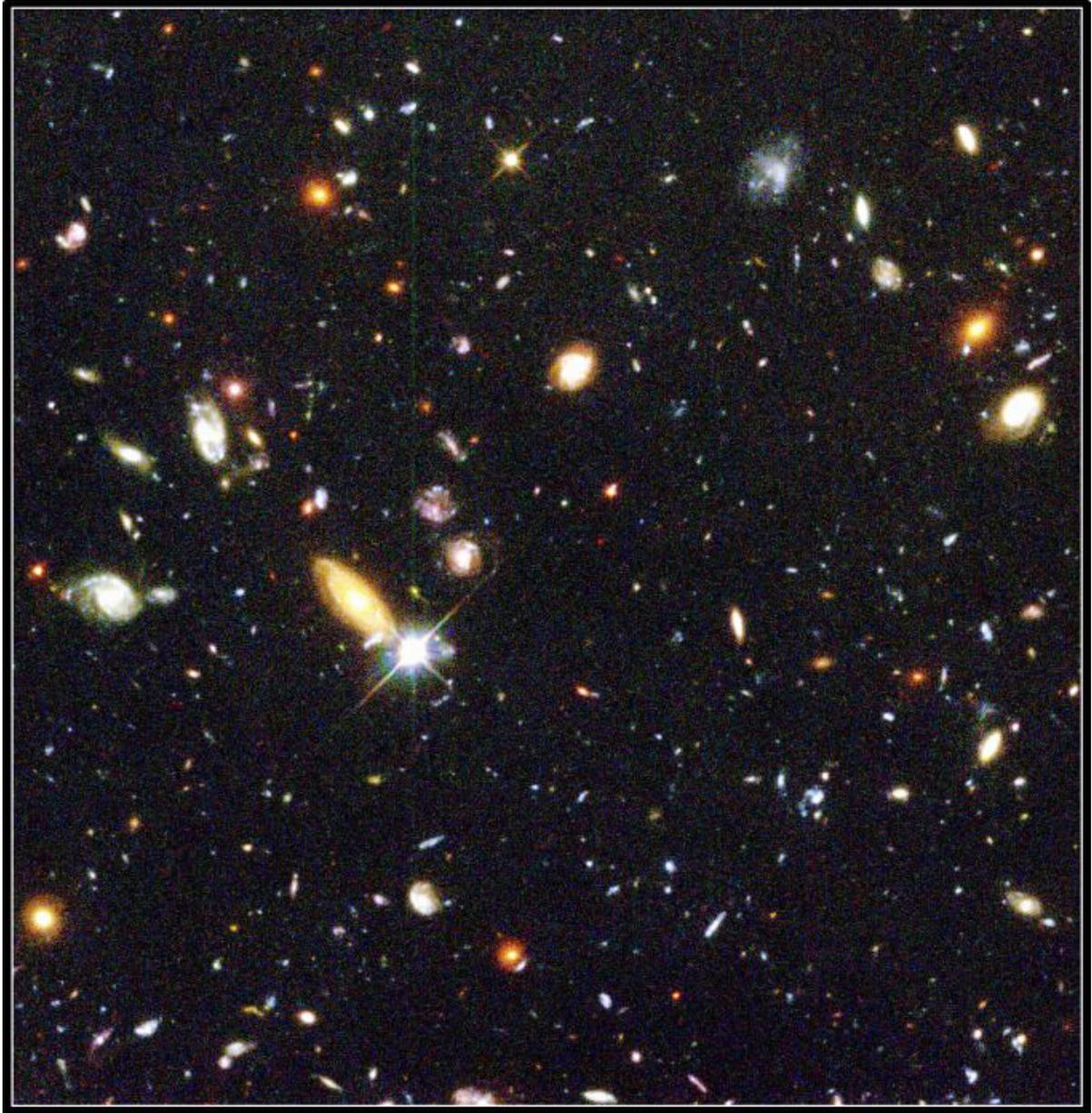
Site: http://www.nasa.gov/audience/forkids/home/F_Hubble_Space_Telescope.html

Whirlpool Galaxy



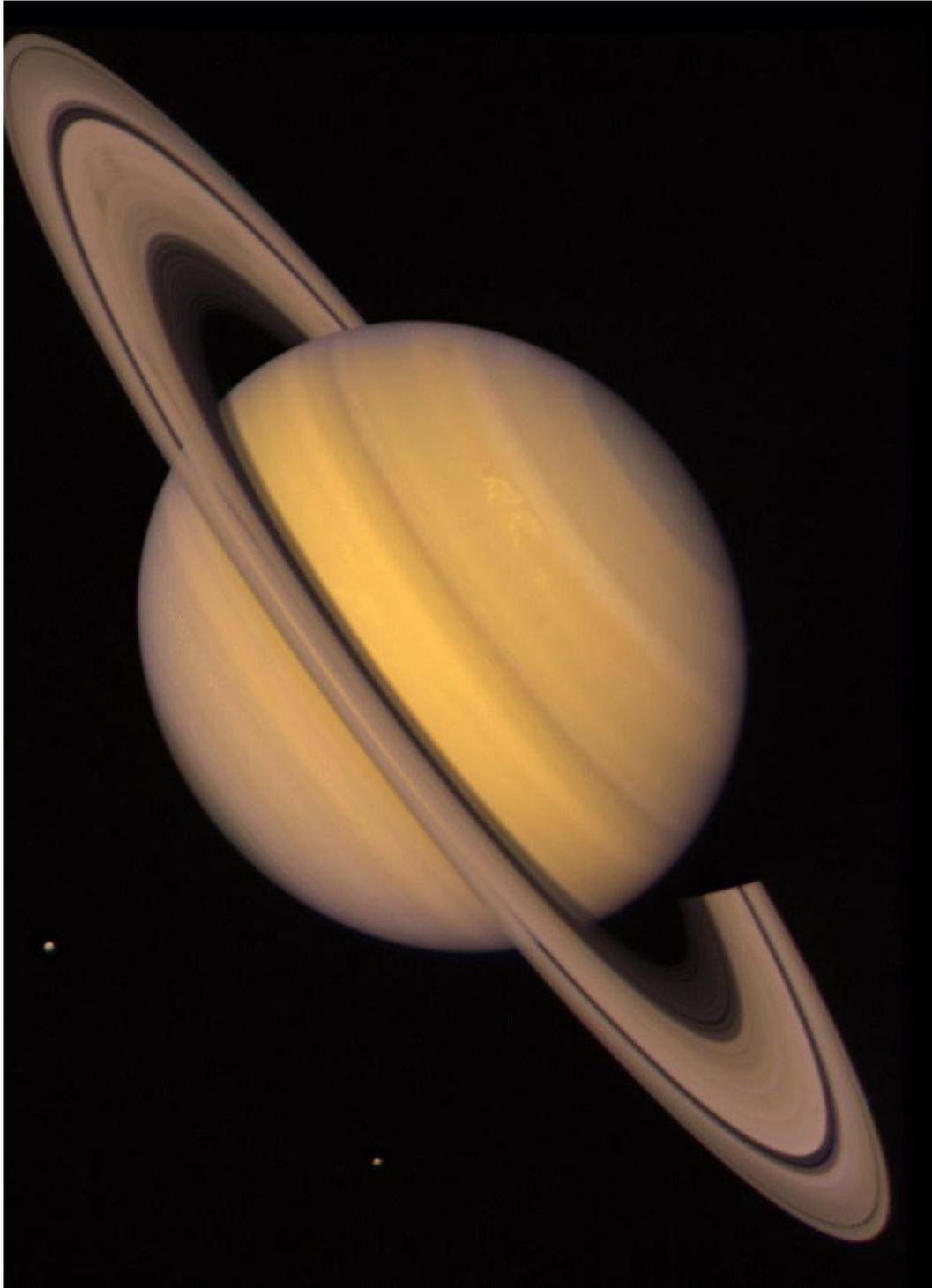
Site: <http://antwrp.gsfc.nasa.gov/apod/ap000724.html>

Deep Field Galaxies



Site: http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-astro-galaxy.html

Saturn



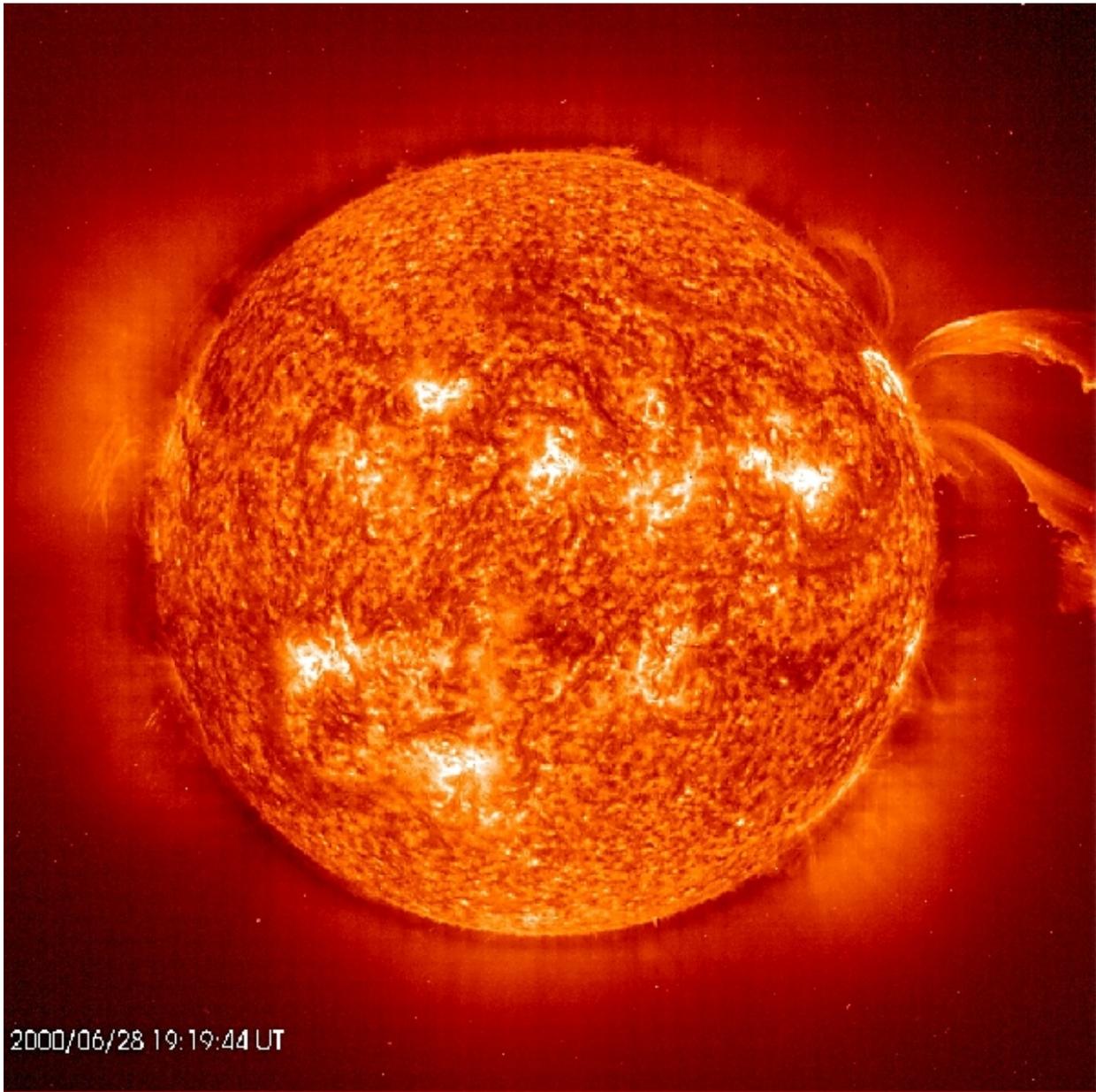
Site: <http://pds.jpl.nasa.gov/planets/captions/saturn/2moons.htm>

Pleiades Stars



Site: <http://antwrp.gsfc.nasa.gov/apod/ap021201.html>

Our Sun



Site: http://sohowww.nascom.nasa.gov/gallery/images/large/eit002_prev.jpg

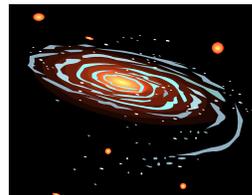
My Place in Space

There are billions of galaxies in the universe. Our **Galaxy**, the Milky Way, contains over 200 billion stars. Galaxies are organized into clusters. Our Milky Way Galaxy is part of a **Local Group**, a cluster of about 35 galaxies, including the larger Andromeda Galaxy, which is about 3 million light years away. There are other clusters of galaxies, and the clusters can be grouped into clusters of clusters called **superclusters**. The Local Supercluster is about 100 million light years across, and contains our Local Group and the Virgo cluster.

In this activity, your child will gain an understanding that they are part of a galaxy – The Milky Way - and how immense it truly is. They will explore how smaller systems exist within larger systems as they build a collage of their place in space!

What You Need:

- My Place in Space Guide
- Pictures of Earth, the solar system, galaxies, and groups of galaxies
- White poster board
- Clear tape or glue sticks
- Crayons and markers
- Construction paper
- Craft items
- 1 small container of phosphorescent paint (with Q-tip for brush)
- Q-tip



What to Do:

- Ask the children what the parts of their family are. (Their answers may vary, but they probably will name brothers and sisters, pets, mothers and fathers, etc.) Are they part of their family system?
- Mention to them that their family is part of the community, and the community is part of the city, which is part of the state. Can they name other, bigger systems?
- Invite them to draw a few of these different systems on construction paper (themselves, their family, their community etc...).
- What is Earth a part of? What are other parts of the solar system? Are there other solar systems? What are they parts of? What is the biggest system they can think of? In nature, a system is a group of things that are related and influence each other.
- Provide each child with a poster board. We have provided a finished model for the children to observe.

What to Do (Cont'd):

- Let them pick and choose a set of images of Earth, the solar system, galaxies, and groups of galaxies. Ask them to place them in order of increasing system size.

What are the different components in one of their systems? (For example, the solar system contains planets and our Sun. The Milky Way Galaxy contains many stars and planets, including our solar system. Our Local Group includes our galaxy and other "close-by" galaxies like the Andromeda Galaxy.)

- Once they have placed their images in order (including the ones they drew!), have them glue or tape them onto the poster board starting with their picture and ending with the cluster of galaxies. Invite them to make a title for their collage.
- Have the children label each section with the component name (for example, 'family' or 'galaxy').
- Invite the children to further decorate their collage and to paint some of the stars and formations in their galaxies to make them glow in the dark!

Parent Prompts:

Ask the children to reflect on their place in space and think about these questions.

How many galaxies are in our universe?

How many stars are in our galaxy?

How many stars are in our solar system?

How many Earths are there?

Our Earth is an amazing place in the vastness of our galaxy. . . and universe — and we are unique individuals on our unique, tiny Earth!



My Place in Space

Child

What types of systems does the child belong to? (Family system, school system, athletic club, boys or girls club)



Family

What types of system does the family belong to? (Larger family system, community pool or club, church or synagogue)



Earth

What are some of Earth's systems? What systems does Earth belong to?



Solar System

If there are other suns and planets in the universe, why would *these* nine planets be considered a system? (they all revolve around the same star — our Sun!)



Milky Way Galaxy

What makes the *Milky Way* a "system"? (there are billions of stars — and perhaps other solar systems — grouped together, connected by their gravitational pull on each other)



Universe

Clusters of galaxies are observed in space. Andromeda is one of the galaxies in our **Local Group**. And there are clusters of clusters of galaxies (**Superclusters**). How many galaxies are there? Scientists estimate that there are billions of galaxies in our **universe**; our Milky Way Galaxy is only one of many!

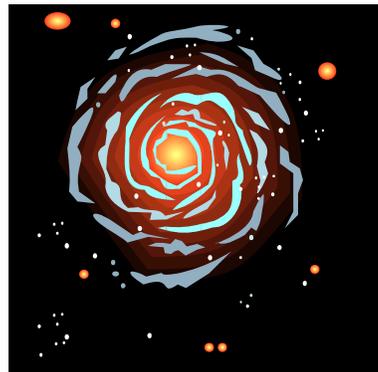
Paper Plate Galaxy

Galaxies are large collections of stars, gas, and dust that come in different shapes. We live in the Milky Way Galaxy which is a spiral galaxy – it looks like a pinwheel! Our Milky Way Galaxy is about 100,000 light years across, with a bulge in the center, a nucleus, a flat disk with distinct spiral arms, and a surrounding of halo stars. We do not have any pictures of our own galaxy, but astronomers can determine the shape using telescope observations and by comparing to the pictures we have of *other* galaxies.

You and your child will make a spiral galaxy mobile and learn its different parts.

What You Need:

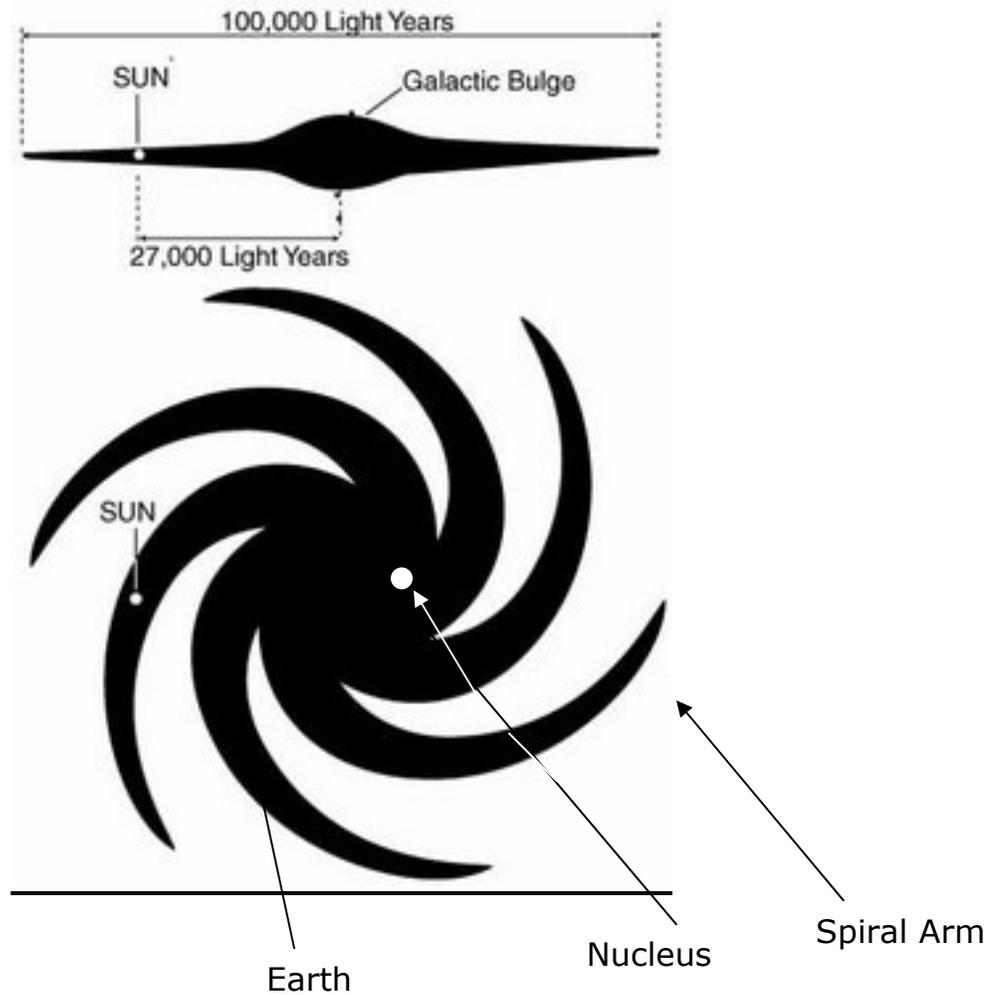
- Scissors
- Crayons
- Various craft items
- Glue
- Peppercorn
- Paper plate
- Yarn



What to Do:

- Poke or cut a hole in the center of the plate (*this will be used for hanging the galaxy*).
- Using the diagram provided for this activity as a guide, have your child draw and label the following parts of a galaxy: nucleus, spiral arm, and galactic center bulge.
- Cut out around the spiral arms
- At the plate (galaxy) scale, the Earth is merely a very, very small spec of dust! Glue a peppercorn on the plate to represent about where our solar system would be located in the Milky Way Galaxy. We are in one of the spiral arms about two-thirds of the way from the nucleus.
- Decorate your galaxy on both sides with stars and gas and dust using the various craft items available. Thread a piece of yarn through the center hole and knot it or tape it to the bottom of the plate; create a loop in the opposite end of the yarn. You are ready to hang your galaxy!

Milky Way Galaxy



Note: Our solar system is much, much smaller than the dot shown on this image!

Glitter Galaxies

A galaxy is a huge group of stars, dust, gas, and other celestial bodies pulled together by gravity. The three types of galaxies are spiral, elliptical, and irregular. Galaxies contain anywhere from 100 thousand to 3 trillion stars! Our solar system is part of the Milky Way galaxy which is a spiral galaxy.

In this activity, you and your child will create a galaxy using sand or glitter.

Elliptical



Spiral



Irregular



What You Need:

- Black construction paper
- Pencil or white crayon
- Glue
- Glitter (or sand)

What to Do:

- On black construction paper, draw one of the types of galaxies (spiral, irregular, or elliptical)
- Put glue along the lines of your galaxy.
- Sprinkle glitter or sand on the paper and shake the excess off.

Parent Prompts:

What shape is your galaxy?

What do the grains of glitter or sand represent? (all the stars in the galaxy)

Coloring Sheets and Games

Enchanted Learning – Solar System Book

<http://www.enchantedlearning.com/subjects/astronomy/>

NASA Challenger – Planets & Sun

http://www.challenger.org/messengercelebration/downloads/Solar_System_Mobile.gif

Canadian Space Agency – Word Search

http://www.space.gc.ca/asc/eng/kidspace/games/find-a-word_astronomy.asp

NASA – Hubble Space Telescope

<http://www1.jsc.nasa.gov/er/seh/color.html#HUBBLE>

Explore Galaxies!

Websites

<http://www.enchantedlearning.com/subjects/astronomy/> (select galaxy or Milky Way)

Zoom Astronomy offers a half- to one-page explanation with accompanying images of each type of galaxy, along with information about our local group and galaxy clusters. A galaxy activity is also provided for younger learners, ages 5-10, and all materials are presented in a user-friendly, easy-to-understand format.

http://starchild.gsfc.nasa.gov/docs/StarChild/universe_level1/galaxies.html

Star Child shares information about galaxies for elementary children.

http://amazing-space.stsci.edu/resources/explorations/galaxies_galore/teacher/grabbag.html#activities

The resources at this site include Hubble images, numerous galaxy activities, scientific background, lesson plans, national standards, classroom activities, interactive galaxy games for kids, and lists of other resources such as books, videos, and Web sites. There's something here for all ages!

http://hubblesite.org/gallery/album/galaxy_collection/

Viewers of all ages will enjoy these fascinating images of galaxies from the Hubble telescope site.

http://www.windows.ucar.edu/tour/link=/the_universe/Galaxy.html

Windows to the Universe offers easily read information about galaxies for upper elementary to high school students. A lovely introduction.

<http://curious.astro.cornell.edu/galaxies.php>

Curious about Astronomy provides a brief primer on galaxies – their shapes and classification.

<http://seds.org/messier/galaxy.html> - Galaxies

<http://seds.org/Messier/more/mw.html> - Milky Way

For the seriously devoted ... more detailed information about galaxies from the Students for the Exploration and Development of Space.

<http://www.galaxyzoo.org/> - Galaxy Zoo

Calling all citizen scientists! Want to help scientists classify galaxies? Check out this site to get involved in online classification and analysis of galaxies using real data. The results are used in scientific research.

Explore Galaxies!

Books

Galaxies. Paul P. Sipiera, Children's Press, 1997, ISBN 0516203339.

Sipiera presents different types of galaxies and their structures, along with a short history about the Milky Way. Large print with numerous images, illustrations, and fun facts for ages 8–11.

The Milky Way (Galaxy). Gregory Vogt, Bridgestone Books, 2002, ISBN 0736813845.

Ages 8–12 will receive a good introduction to our galaxy and its components, images, a glossary of terms, and a short activity.

The Story of the Milky Way: A Cherokee Tale. Joseph Bruchac and Gayle Ross, Dial Books for Young Readers, 1995, ASIN 0803717377.

Native American tale told by a father to his children. This well-illustrated book is wonderful for reading aloud to ages 4–8.

Elinda Who Danced in the Sky: An Estonian Folktale. Lynn Moroney, Children's Book Press, 1990, ISBN 0892390662.

Lynn Moroney shares the story about Princess Elinda, who weaves an ethereal wedding veil that becomes the Milky Way. The colorful illustrations and simple text make for a great read-aloud for ages 5–12.

All About Galaxies

- Galaxies are large collections of stars and gas and dust.
- Most galaxies are flat, but there are different shapes — some are spirals, some are elliptical, and some are irregular.
- A light year is the distance that light can travel in one year in a vacuum — about 6 trillion miles or 9.46053×10^{12} kilometers (farther than we can imagine!).
- Our Milky Way Galaxy is a spiral galaxy (looks a little like a pinwheel) about 100,000 light years across, with a bulge in the center, a flat disk with distinct spiral arms, and a surrounding halo of stars.
- We are in one of the spiral arms about two-thirds of the way from the center.
- On a very dark night, away from bright lights, you can see the Milky Way as a faint, hazy — or milky — band in the sky.
- The hazy appearance is because there so many stars that are very distant; your eyes cannot distinguish the stars as separate points of light. By using binoculars or a telescope, you can see the individual stars.
- Ancient Greeks believed the faint band they observed in the sky was a stream of milk — this band became our Milky Way. Interestingly, the Greek word “galaktos” — translated to the word “galaxy” — means “milk.”
- All the stars we see with our unaided eyes – about 6000! - are part of our Milky Way Galaxy.
- Our galaxy slowly spins and our solar system spins with it.
- Our solar system takes about 250 million years to make one complete orbit around the center of the galaxy.
- A black hole may reside at the very center of our galaxy.
- Our nearest galactic neighbor is Canis Major, a small galaxy orbiting the Milky Way at a distance of about 25,000 light years.
- The Andromeda Galaxy can be seen as a small blur of light near the constellation Andromeda.
- The Andromeda Galaxy, one of our nearest neighbors, is bigger than the Milky Way.
- The Andromeda Galaxy is about 2 million light years away.
- There are billions of other galaxies in our universe.