

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



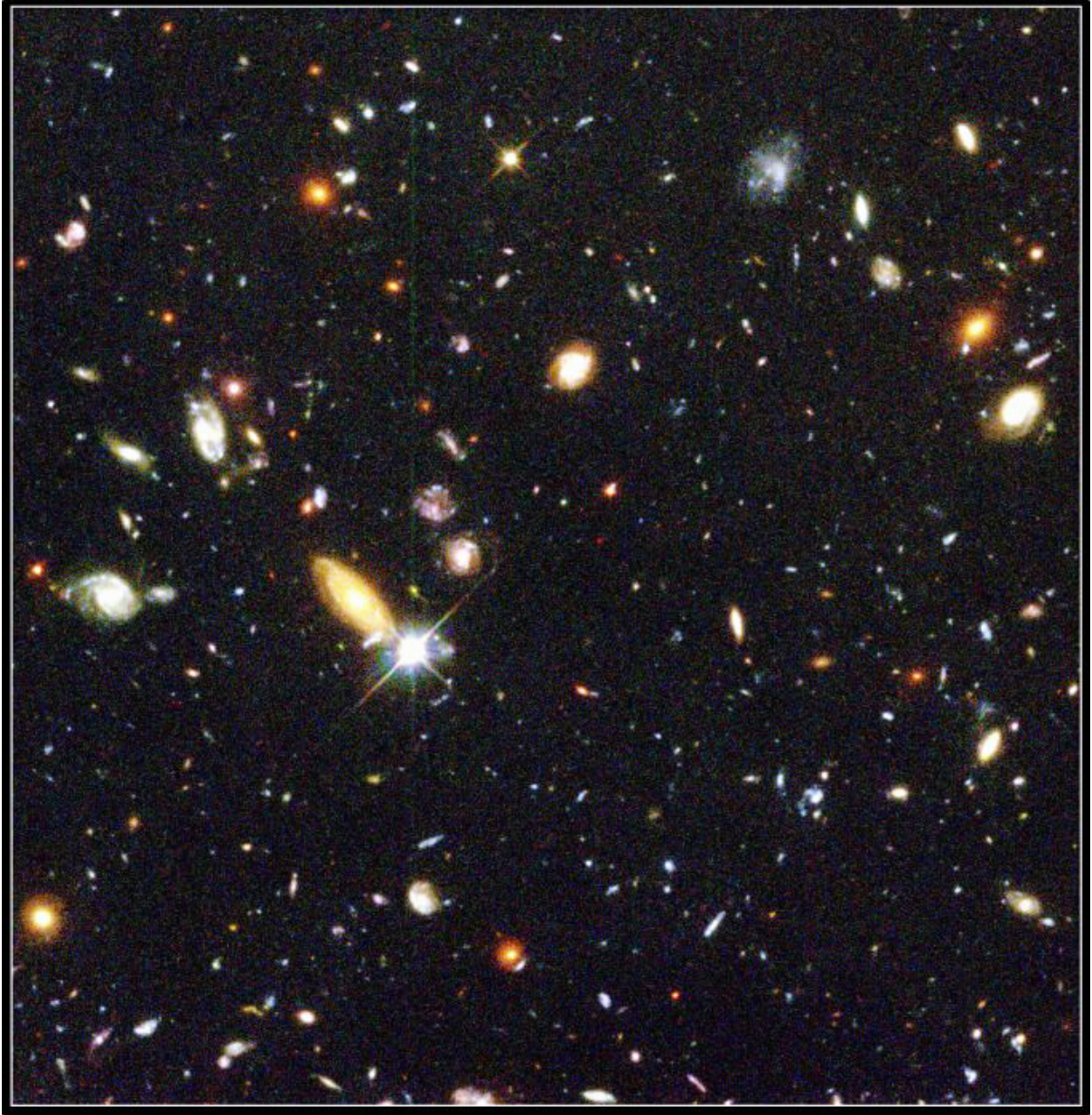
Site: http://www.nasa.gov/audience/forkids/home/F_Hubble_Space_Telescope.html

Whirlpool Galaxy



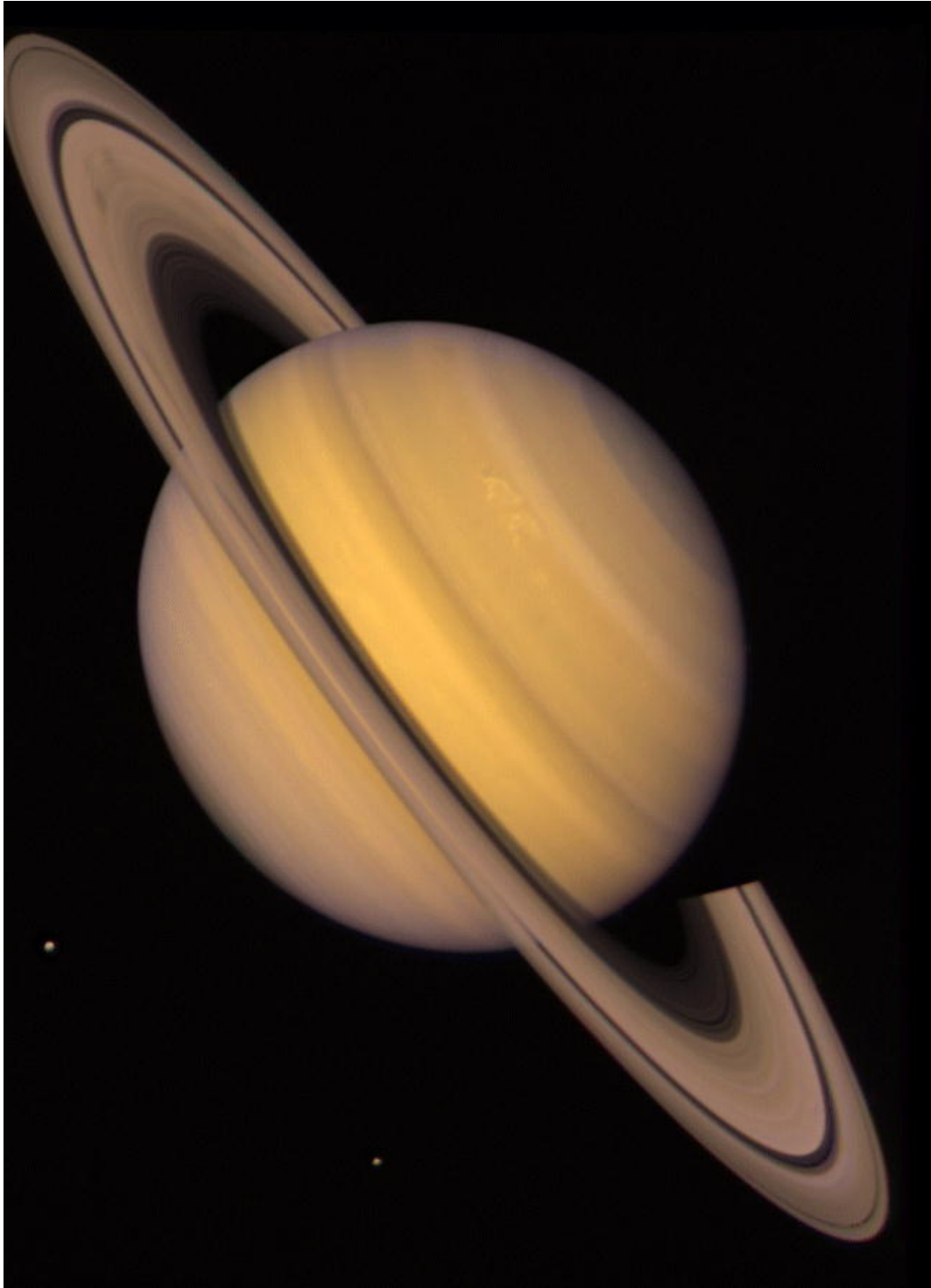
Site: <http://antwrp.gsfc.nasa.gov/apod/ap000724.html>

Deep Field Galaxies



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

Saturn



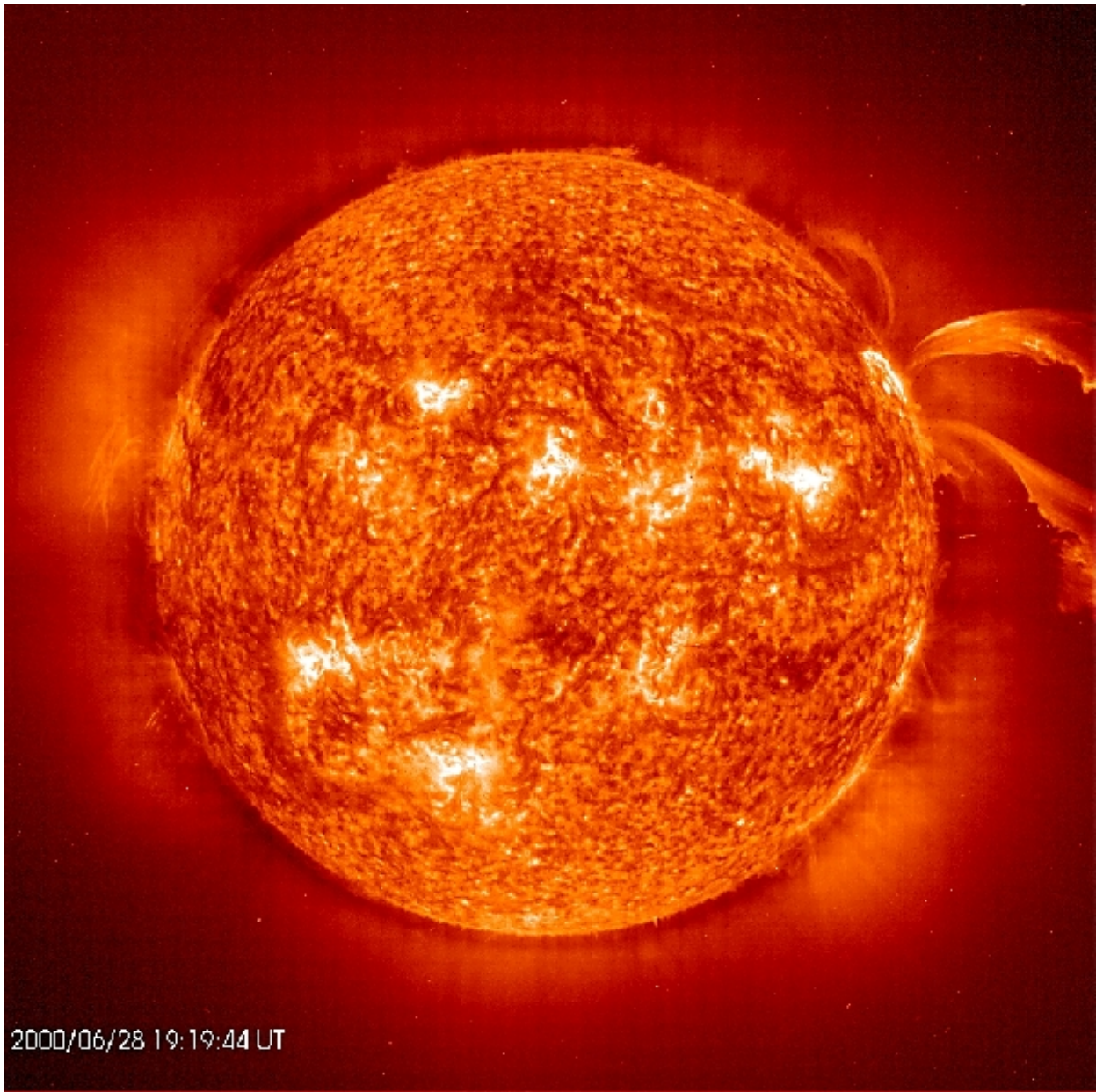
Site: <http://pds.jpl.nasa.gov/planets/captions/saturn/2moons.htm>

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