Fifth Grade – Planetary Research Station

California Science Content Standards
Earth Sciences

5. The solar system consists of planets and other bodies that orbit the Sun in predictable paths. As a basis for understanding this concept:
   a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.
   b. Students know the solar system includes the planet Earth, the Moon, the Sun, eight other planets and their satellites, and smaller objects, such as asteroids and comets.
   c. Students know the path of a planet around the Sun is due to the gravitational attraction between the Sun and the planet.

Program Script

1st Projection: 2005 Hurricane Season, Katrina, no audio

Welcome to the Planetary Research Station. This exhibit is not only an excellent teaching tool, but helps scientists gain a better understanding of, among other things, the characteristics of the Sun and planets in our solar system.

The pictures we see on the globe were taken from satellites during the 2005 hurricane season. It was the worst hurricane season the U.S. history!

Notice the concentration of clouds and several developing hurricanes in the central Atlantic area of the globe. The question is, “Why is there a rather heavy concentration of cloud cover in that area?” The answer is because this area receives the maximum amount of the Sun’s energy due to its position with respect to the Sun.

The Sun provides us with all our energy needs in the form of light and heat. Since the areas close to Earth’s equator receives most of that energy, it evaporates a lot of water from the water sources down below, mostly from the oceans, causing the skies above those areas to be specially rich in clouds—a great area for developing hurricanes!

So, you see, the Sun is the star, literally and really, of our family called the “Solar System” that we are going to explore next. But, before we do that I would like to remind you that the actual objects in the Solar System are of very different sizes, not the sizes you will be seeing on the projection globe which happens to be of one size only. The only two that are somewhat similar in size to each other in real-life are the planets Earth and Venus. Therefore, we will focus on the characteristics, not the sizes, of these objects.

2nd Projection: X-ray Sun

As an example, the Sun is the largest object in our solar system. The Sun, the star, is located at the center of our solar system and can fit a million Earths inside it.

3rd Projection: Yellow Sun with Solar System to Scale

Explain the size difference between the objects of the Solar System.

Go back to 2nd Projection: X-ray Sun

These pictures of the Sun were taken by a special camera on a satellite that is capable of seeing things in the X-ray range of the light energy given off by the Sun. So, these are extraordinary images!

Notice the yellow flashy spots on the Sun. The Sun is a burning ball of gas made mostly of hydrogen and helium gases. Huge amounts of energy are released during the process of changing hydrogen gas into helium gas. During this process, violent explosions on the surface of the Sun, called solar flares, spew this energy into space. Those yellow flashy spots you see on the globe are solar flares.

The planets in our solar system are in orbit around the Sun. (Have one student volunteer stand up and walk counterclockwise, as the Earth does, all the way around the Sun.) One complete orbit around the Sun equals a year on that planet. The farther a planet is from the Sun, or the slower it travels around the Sun, the longer is its year.

(Have all of the students stand up and do a slow turn in place, turning to the left, as the Earth spins counter-clockwise.) When a planet does a full turn on its axis, the amount of time that takes represents a full day on that planet. The parts of the planet that face away from the Sun are experiencing nighttime, but the entire rotation is called one day. For example, on Earth, one day is 24 hours long.

4th Projection: Mercury

This is Mercury, the first planet in our solar system. Mercury orbits around the Sun in about 88 Earth-days, and during that time, it only rotates on its axis about ½ way through its 360^{o} full turn. In other words, a full sunrise to sunrise day in Mercury is 176 Earth day long which is two Mercury years long.

Because of its slow rotation and its closeness to the Sun, Mercury experiences an extreme temperature difference of over 1000 degrees Fahrenheit between the day side and the night side of the planet.

Mercury is only slightly larger than the Earth's Moon and is the least explored planet in our solar system. It is a rocky, cratered planet with almost no atmosphere.

5th Projection: Venus

Venus is most similar to Earth in size, density and composition. However, compared to Earth, it spins backwards and at a very slow rate; one day on Venus lasts 243 Earth-days. Interestingly, a year on Venus is only about 225 Earth-days long. Can you imagine a place where a day is longer than a year?

Venus is very mysterious. We cannot see its surface because it is hidden by hot, deadly clouds of carbon dioxide and sulfuric acid. This thick cloud cover traps the heat from the Sun, making its surface even hotter than that of Mercury. Scientists use radar to determine what is underneath the thick clouds.

6th Projection: Blue Marble

Our planet Earth is an ocean planet. The abundance of life and water, particularly liquid water, makes it unique in our solar system. We are in a "life zone," just the right distance from the Sun to ensure that we always have liquid water. If we were further from the Sun, Earth's liquid water would turn into ice. If we were closer to the Sun, the liquid water would evaporate. Let me use this hoop to show you the shape of the Earth's orbit around the Sun. [Show the hoop and explain.] The hoop is a circle and while the Earth's orbit is not exactly a circle (it is elliptical) it is almost a circle. [Very slightly squeeze the hoop to make an ellipse.] The gravitational pull between the Sun and the Earth holds the Earth within the life zone.

The four seasons are a result of Earth's axis of rotation being tilted. During part of the year, the Northern Hemisphere is tilted toward the Sun while the Southern Hemisphere is tilted away, producing summer in the north and winter in the south. Six months later, the seasons are reversed.

7th Projection: Mars

Frozen water has also been found on the polar caps of Mars. The fourth of the rocky planets in the Solar System, Mars has many other special features, such as the tallest mountain, over three times taller than Mt. Everest and the biggest canyon, almost ten times as long as the Grand Canyon and about four times as deep!

Mars has two small moons. One of them, Phobos, is so close to Mars that due to the gravitational pull, it is being pulled closer to Mars at the rate of about 1.8 m (6 ft) per century. So, in about 50 million years it could either crash onto the Martian surface or break down into pieces forming a ring around Mars.

8th Projection: Jupiter

Jupiter is more than 1,000 times bigger than the Earth and is one of the gas giants made mainly of hydrogen and helium, similar to a star. However, it is suspected that Jupiter has a metallic core, possibly similar to Earth's core. The visible bands of color

are the result of very high velocity winds that flow in opposite directions to each other as shown in the next projection.

9th Projection: Jupiter Animation

Explain opposite flow of the atmospheric bands.

Go back to 8th Projection: Jupiter

Within these bands are storms, the most notable of which is the "Great Red Spot," a storm that has been observed for the past 300 years. Three Earth's could easily fit into the Great Red Spot.

10th Projection: Saturn

This projection shows the planet Saturn without its rings. In fact, four of the planets in our Solar System, Jupiter, Saturn, Uranus, and Neptune, have rings, but none as spectacular as Saturn. Saturn's rings are made mostly of ice and some rocky dust coated with ice.

Saturn is the second largest planet of our Solar System and is very similar to Jupiter (made mostly of hydrogen and helium), but with one thing that is very distinct—its density. Saturn is the only planet less dense than water. So, if you could drop Saturn into a bowl of water it will float!

11th Projection: Uranus

Uranus has the most unusual rotation in our Solar System; rather than spinning in an upright position, it appears to roll along like a ball as shown in our next projection.

12th Projection: Uranus Map

As a result, its rings might remind you of a bicycle wheel turning.

Also, because of its odd rotation, its polar regions get more of the Sun's energy than its Equator. However, due to its great distance from the Sun, the temperature differences between summer and winter on Uranus do not change greatly from one to the other.

Go back to 11th Projection: Uranus

Uranus' atmosphere is made mostly of hydrogen and helium with a small amount of methane. The vivid blue color it displays is due to the methane gas in its atmosphere.

13th Projection: Neptune

Neptune is probably most similar to Uranus, being made of various "ices" and rock, with small amounts of hydrogen, helium and methane in its atmosphere. However, it rotates upright, in a manner similar to most of the planets.

The winds that whip around Neptune are, on average, nine times faster than those on Earth, and are believed to be the strongest winds in the Solar System. Storms much like the Great Red Spot on Jupiter have been seen on Neptune, however, unlike the Great Red Spot on Jupiter, which has been observed for over 300 years, the storms on Neptune seem to come and go.

I hope you all enjoyed the tour of our Solar System. Visit us again to experience more adventures with the Planetary Research Station.

Current News

Projection: Play list “Chile_Earthquake”

An 8.8 magnitude earthquake (~80 times stronger than the Haiti earthquake of January 12. 2010) hit Chile on February 27, 2010 at 3:15 a.m. local time. The town of Concepcion near the epicenter is reported to have been devastated by the quake. Following that major tremor, there were a series of 5 to 6 magnitude aftershocks in the area as well as along the length of the Peru-Chile trench, a subducting plate boundary along the western margin of South America.

Although the Chilean earthquake was much stronger, the degree of devastation and loss of human life there, by preliminary estimates, are much lower than in Haiti.

I hope this dataset showcase has sparked your interest and that you have learned something new. To learn even more, visit us as often as you can.

Thank you.