Sixth Grade Solar System and Universe Unit
Parent Background Information

Historical Views of the Solar System

Early astronomers, working without technology like telescopes and under the influence of the Church, posited that the Earth was at the center of the solar system. From what they could observe, the sun and other planetary bodies revolved around the Earth. This is known as the **geocentric theory.** It wasn't until Galileo developed the telescope, and other scientists and mathematicians added new evidence, that Copernicus was able to put forward his **heliocentric theory** that the sun is in the center of our solar system and all other planetary bodies revolve around it.

Scientific Views for the Creation of the Universe

There have been two main scientific theories about the creation of the universe. The Steady State Theory is a view that the universe is always expanding but maintaining a constant average density as matter is being continuously created to form new stars and galaxies at the same rate that old ones become unobservable and recede. In this theory, the universe has no beginning or end in time. The Big Bang Theory was proposed by Belgian astronomer Georges Lamaitre. The theory states that about 13.7 billion years ago all the matter in the universe was concentrated into a single incredibly tiny point called a singularity. Due to unknown reasons, the singularity began to enlarge rapidly in a hot explosion, and it is still expanding today. Evidence for the Big Bang includes:

- all the galaxies are moving away from us
- the further away a galaxy is, the faster it is moving away.

Scientists have also detected cosmic microwave background radiation received from all parts of the Universe that is thought to be the heat left over from the original explosion.

Our Solar System

The planets in our solar system can be categorized into the inner and outer planters. The inner planets are small, rocky, and closely spaced (in space terms!) while the outer planets are large, gaseous, and spaced farther apart from each other (and from the inner planets). The only planet that can support life is Earth, with it's habitable temperature range, atmosphere composed of nitrogen and oxygen, and presence of liquid water.

There are also comets, meteoroids, and asteroids in our solar system. Comets are balls of rock and ice (coma) that grow tails as they approach the sun in the course of their highly elliptical orbits. As comets heat up, gas and dust are expelled and trail behind them. The sun illuminates this trail, causing it to glow. The glowing trails are visible in the night sky. Short-period comets such as Halley's are perturbed from the so-called Kuiper Belt out beyond the orbit of Neptune and pass through the inner solar system once or twice in a human lifetime. Long-period comets come from the Oort Cloud, which rings the outer reaches of the solar system, and pass near the sun once every hundreds or thousands of years. Asteroids are essentially chunks of rock that measure in size from a few feet to several miles in diameter. They are usually found in the Asteroid Belt between Mars and Jupiter. Sometimes one asteroid can smash into another. This can cause small pieces of the asteroid to break off. Those pieces are called meteoroids**.** If a meteoroid comes close enough to Earth and enters the Earth's atmosphere, it vaporizes and turns into a meteor: a beautiful streak of light in the sky. Because of their

appearance, these streaks of light some people call meteors "shooting stars." If a meteor does not completely burn up in the Earth's atmosphere and hits Earth's surface it's called a meteorite.

Planetary Motion

In the late 1600's, Sir Isaac Newton formulated three **laws of motion** and the **law of universal gravitation**. He concluded that inertia (the tendency of objects to continue moving in the same direction) and the force of gravitational attraction keep the planets in their orbits. As planets move along their elliptical orbital paths, they are pulled toward the Sun by its gravitational force. If the Sun had no gravitational force, the planets would not orbit the Sun, but would move away from the Sun in a straight line. Newton's law of universal gravitation states that the force of gravitational attraction between two objects is proportional to the product of the masses of the objects divided by the square of the distance between them. In other words, if two objects are moved twice as far apart, the gravitational attraction between them will be four times less. Newton's work with gravity helped to explain what Kepler had discovered earlier—that planets move faster when they are closer to the Sun and slower when they are farther away. As a planet's distance from the Sun increases, the gravitational attraction between the planet and the Sun decreases. With a smaller gravitational attraction, the speed necessary for the planet to continue in orbit decreases.

Our Place in Space

The Sun, Earth, and other planets are orbiting in a spiral arm of the Milky Galaxy at a distance of 30,000 light years from the galactic core. The Sun is just one of 200 billion other stars moving around this core. The Milky Way is one of 20 galaxies that together comprise the "Local Group." This group of galaxies is made up of 2 giant spiral galaxies (The Milky Way and Andromeda) and small irregular galaxies with names or numerical designations. The Local Group is part of a larger group of galaxies called the Virgo Cluster. This group holds about a dozen local groups. The Virgo Cluster is one of several galaxy clusters that together make up the Virgo Supercluster. And, the Virgo Supercluster is one of a string of other superclusters that makes up a Filament. The Universe is a network of long Filaments that outline huge voids of empty space, as seen in the image below.