Earth's Place in the Universe

Universe: All matter and space was created 13 billion years ago by the Big Bang

Everything is pulled together by gravity

Galaxy: system of stars, gas, dust, and planets. There are 100 billion in the universe. We are in the Milky Way Galaxy
MS-ESS1-3

Galaxies are in motion and are rotating around the galaxy's center of mass
MS-ESS1-2

Stars: Gaseous bodies where nuclear fusion occurs and light is given off

Some stars are brighter than others due to their size and composition

How bright stars appear to us is a combination of the star's brightness and distance from Earth
5-ESS1-1

The Sun is a star

The Sun is 1.3 million times the size of planet Earth and is 99.86% of mass in the solar system
MS-ESS1-3

Planets orbit stars because stars are much more massive than planets. In our system, planetary orbits are almost circular

The closer the planet is to the Sun the less time it takes to complete 1 revolution (orbit) around the Sun, for the Earth, one revolution takes ~365.25 days

The orbit of planets causes different stars to be seen in different times of the year
1-ESS1-1

Seasons and the amount of daylight in a given day are caused by the tilt of the Earth and where the Earth is in its revolution around the Sun
1-ESS1-2, 3-ESS2-1

When it is winter in the southern hemisphere it is summer in the northern hemisphere

Each planet rotates on its axis at different rates, for the Earth, one rotation takes ~24 hours

The rotation of planets causes the sun to appear to move across the sky, stars to move across the sky, and causes day and night
1-ESS1-1

The sun "moving" across the sky changes the shadows seen on Earth
5-ESS1-2

Planets have sufficient mass for self-gravity.

There are gaseous planets and rocky planets

"Jovian" planets (gaseous planets) were formed from gases condensing to icy particles that accumulate from gravity

Gaseous planets are found farther from stars

Gaseous planets distance from Sun:
Jupiter: 778,570,000 km
Saturn: 1,433,530,000 km
Uranus: 2,872,460,000 km
Neptune: 4,495,060,000 km
MS-ESS1-3

"Terrestrial" planets (rocky planets) are made from gases condensed to rocky particles that accumulate from gravity

Earth is a rocky planet

Rocky planets are found close to stars

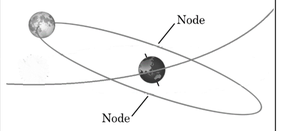
Rocky planets distance from Sun:
Mercury: 57,910,000 km
Venus: 108,210,000 km
Earth: 149,600,000 km
Mars: 227,920,000 km
MS-ESS1-3

Planets (much larger) are sometimes orbited by moons (much smaller)

The Earth has one moon

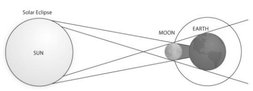
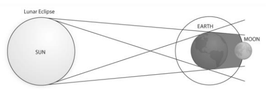
There is a cyclic pattern of lunar phases that repeats approximately every 29 days
MS-ESS1-1 (F)

Moon/Earth orbit is not in plane with Earth/Sun orbit



1-ESS1-1, MS-ESS1-1

When the Moon gets between the Earth and Sun, there is a solar eclipse only seen during the day



When the Earth gets between the Moon and Sun, there is a lunar eclipse seen only at night