

Chapter 25 – The Solar System

Section 1 – Exploring the Solar System (Part 1)

The Mayan ruin of El Caracol, also known as “The Observatory,” is located on the Yucatan peninsula. It is thought that the Mayans used El Caracol for astronomical observations.



Models of the Solar System

Ancient observers noticed that most objects in the sky seem to be in a state of slow but steady motion.

- The sun and moon appear to rise in the east and set in the west.
- The stars move across the sky in a fixed pattern.

Most ancient people concluded that Earth was stationary, and the sun, moon, and stars moved around Earth.

Models of the Solar System

Ancient observers noticed that a few bright starlike objects seemed to wander slowly among the fixed patterns of stars.

These objects were called planets, from the Greek word for “wanderers.”

The ancients knew of the five planets that can be seen with the unaided eye: Mercury, Venus, Mars, Jupiter, and Saturn.

Models of the Solar System



How are the geocentric and heliocentric models of the solar system different?

Models of the Solar System

Geocentric Model

Most ancient Greeks thought that all the stars and planets lay on the inside of a giant sphere that revolved around Earth once a day.

Such a model is called a **geocentric** model.



In a geocentric model, Earth is stationary while objects in the sky move around it.

Models of the Solar System

Heliocentric Model

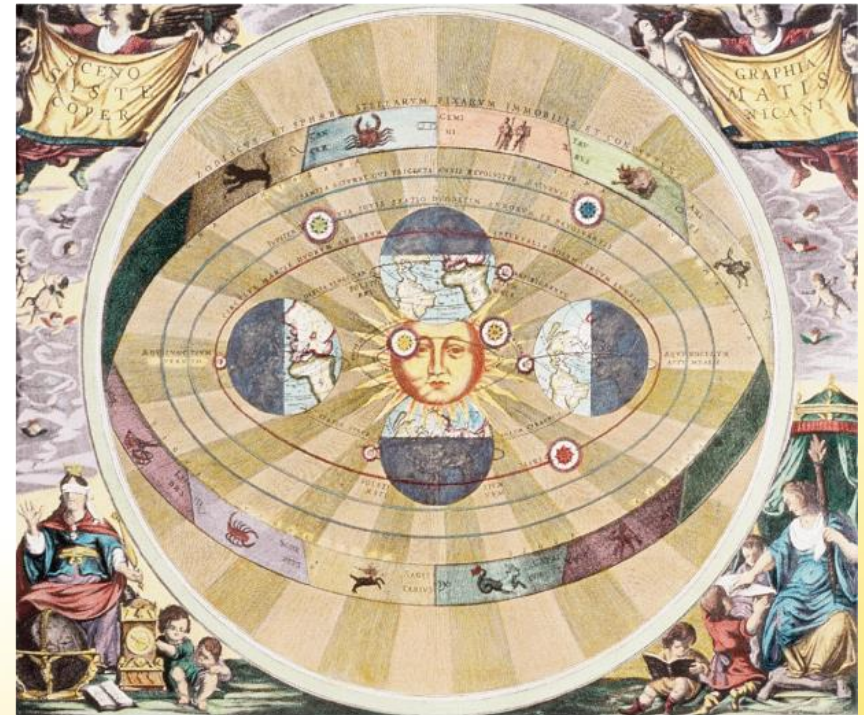
The Greek astronomer Aristarchus developed a **heliocentric** model, with the sun at the center.

 **In a heliocentric model, Earth and the other planets revolve around the sun.**

- His model was not accepted by most ancient Greeks.
- The geocentric model could explain all observations made at that time.

Models of the Solar System

Andreas Cellarius drew these maps of the geocentric model (left) and heliocentric model (right) in the 1660s.



Models of the Solar System

In the early 1500s, Nicolaus Copernicus realized that the motion of the planets could be more simply explained if they are revolving around the sun rather than around Earth.

The observations of Italian scientist Galileo Galilei and other scientists later proved that the heliocentric model was correct.

Models of the Solar System

The apparent motions of the sun, moon, and stars result from Earth's daily rotation on its axis.

- As Earth rotates, it seems that we are stationary and all of the objects in the sky are spinning around us.
- The northern stars appear to circle around the North Star because Earth's axis points toward a spot in the sky close to that star.

Planetary Orbits



What keeps the planets in orbit around the sun?



Gravity and inertia combine to keep the planets in orbit around the sun.

Planetary Orbits

Johannes Kepler discovered that the orbit of a planet around the sun is not a circle, but an ellipse.

- An ellipse looks like an oval, or a circle that has been stretched out along one axis. Most planets' orbits are nearly circular, and so are only slightly elliptical.
- The plane of Earth's orbit is called the **ecliptic plane**.

Planetary Orbits

Newton's first law of motion states that an object in motion continues to move in a straight line at a constant speed unless acted upon by a force.

This property of matter is known as inertia.

Newton realized that the sun must be exerting a gravitational force on the planets that keeps them in orbit.

Section 1 – Exploring the Solar System (Part 2)

Components of the Solar System



What bodies make up the solar system?



Our solar system consists of the sun, the planets, their moons, and a variety of smaller objects that mostly revolve in the same plane around the sun.

Components of the Solar System

The ancients knew of six planets. Three more planets were discovered with the aid of telescopes:

- Uranus in 1781
- Neptune in 1846
- Pluto in 1930 (Pluto was later reclassified as a dwarf planet.)

Components of the Solar System

Except for Mercury and Venus, all of the planets have moons.

A **moon** is a relatively small natural body in space that revolves around a planet.

Components of the Solar System

The sun's mass is about 750 times greater than the mass of the rest of the solar system combined.

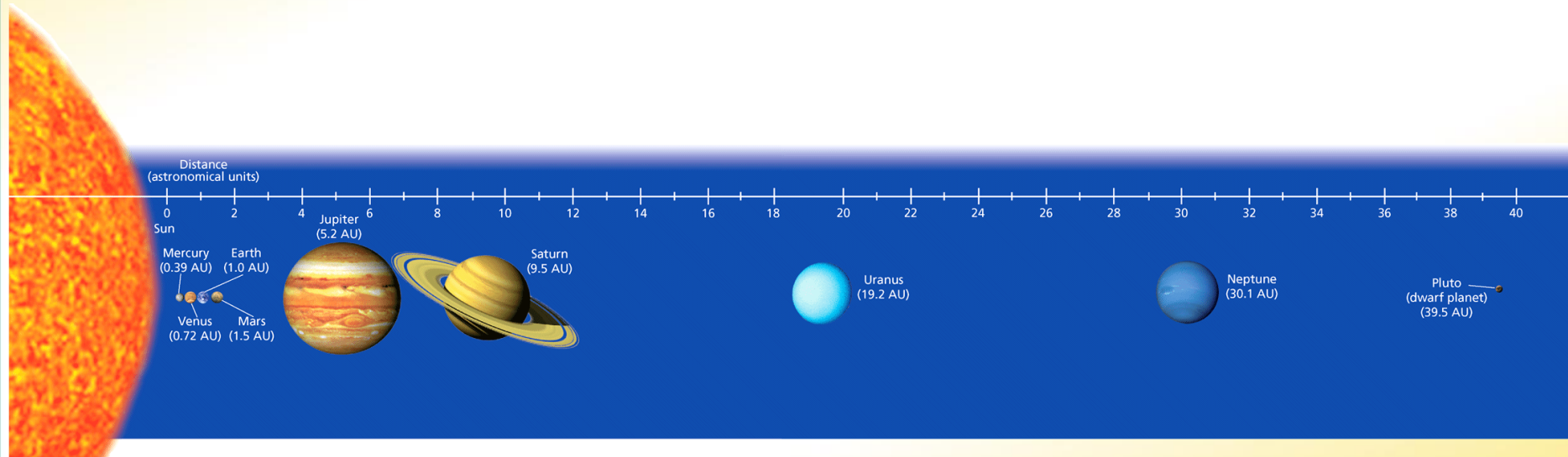
Unlike the sun, planets and moons don't produce their own light.

The nearby planets and moons are visible because sunlight is reflected from their surfaces.

25.1 Exploring the Solar System

Components of the Solar System

The planets orbit mostly in the same plane, though they do not line up as shown here.



Components of the Solar System

Distances between objects in the solar system are much larger than distances on Earth.

- Astronomers often use astronomical units to describe distances within the solar system.
- One **astronomical unit** (AU) equals the average distance from Earth to the sun—149,598,000 kilometers.

Exploring the Solar System



How is the solar system being explored today?



Modern technology, including complex telescopes, piloted spacecraft, and space probes, has allowed scientists to explore the solar system.

Exploring the Solar System

The first rockets powerful enough to escape Earth's atmosphere and enter space were developed in the 1940s and 1950s.

Exploring the Solar System

Travel to the Moon

The quest to reach the moon progressed through a series of increasingly complex missions.

- On July 20, 1969, Neil Armstrong, commander of the *Apollo 11* spacecraft, became the first person to set foot on the moon.
- The last lunar mission, *Apollo 17*, was completed in 1972.

Exploring the Solar System

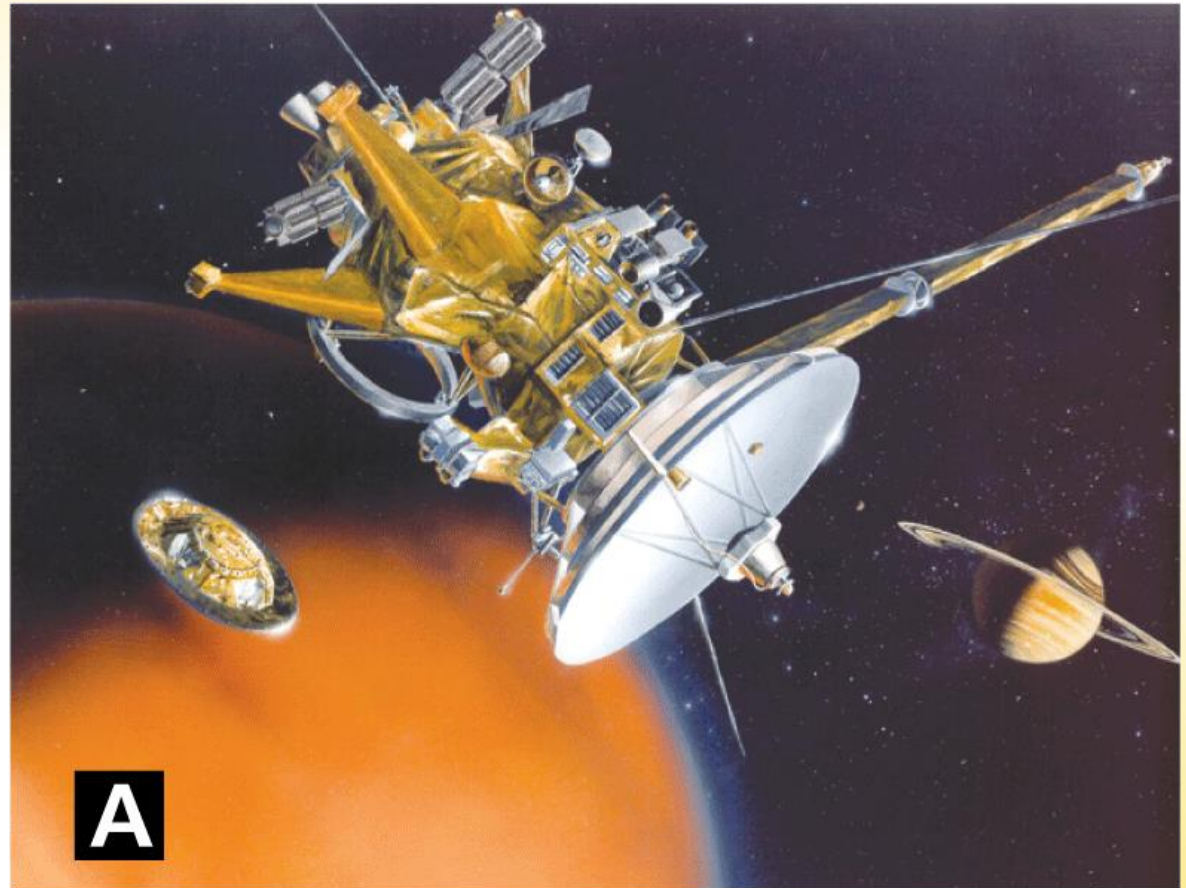
Recent Space Missions

Scientists have gathered much new information about various planets and moons.

- A **space probe** is an unpowered vehicle that carries scientific instruments into space and transmits information back to Earth.
- The Hubble Space Telescope has also provided many new views of the solar system and beyond.

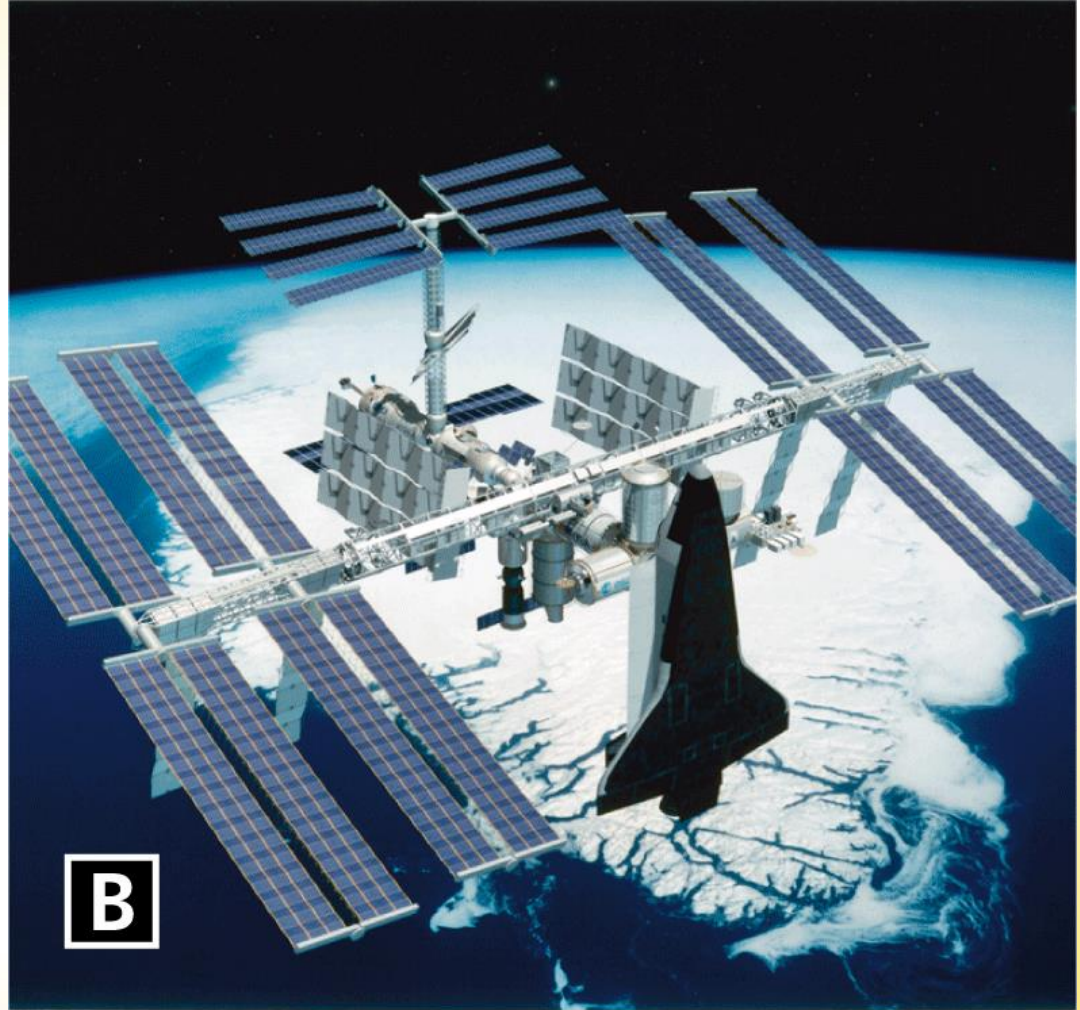
Exploring the Solar System

A. The space probe Cassini launches a probe to explore Saturn's largest moon, Titan, in this illustration.



Exploring the Solar System

B. A space shuttle is docked to the International Space Station in this computer-generated illustration.



Exploring the Solar System

Recent human space flight has centered on the near-Earth missions of the space shuttle.

The shuttle is a reusable space vehicle that is launched like a rocket but lands like an airplane.

The International Space Station is a permanent laboratory designed for research in space.

Astronauts from various countries are currently living aboard the partially completed structure, which is scheduled to be finished in 2010.