

A stylized illustration of the solar system. On the left, a large, fiery orange and red sun dominates the frame. Several white elliptical orbits curve across the dark space. Planets are placed along these orbits: Mercury (small grey sphere), Venus (orange sphere), Earth (blue and white sphere), Mars (small red sphere), Jupiter (large orange and white banded sphere), Saturn (yellow sphere with prominent rings), Uranus (light blue sphere), and Neptune (darker blue sphere). The background is a deep black with some subtle light effects and a bright sun flare on the far right.

Orbits in the Solar System

Poll everywhere



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Poll everywhere

results

Solar system



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- Solar system has eight planets.
- Many smaller bodies in the Solar system.
- All planets, except Mercury and Venus have their own moons.
- Many, many smaller bodies between the planets.

Inner planets

- 4 closest planets to the Sun.
- Inside the asteroid belt.
- Let's take a look at their orbits and rotations.

Inner planets

Inner planets animation

Orbits and rotations of the Inner planets



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What do you notice?



Formation of the Moon

- Moon is thought to have formed when a planetesimal (Theia) collided with Earth in the early Solar System.
- Let's look at a model of this formation hypothesis.

Formation of the Moon

Formation of the Moon model

Formation of the Moon

Evolution of the Moon video

Asteroid belt

- Many irregularly shaped objects between Mars and Jupiter.
- Sizes spanning ~100 meters to ~100 kilometers.
- >200 known asteroids larger than 100 km.
- Some of their orbits cross the Earth's orbit, and can potentially impact us.
- Dwarf planets (e.g. Ceres, Vesta, Eros) live in the asteroid belt.
- Because of their size, asteroids are difficult to detect.

Asteroid belt

Asteroid discoveries over the years.

Asteroid belt

Dark biospheres video

Asteroid belt

Double Asteroid Redirection Test

- Can we redirect near Earth objects if we know it's going to hit us?
- In 2021, NASA launched a spacecraft designed to crash into an asteroid's moon to test this.
- The impact shortened the moon's orbit by 32 minutes, a resounding success.

Asteroid belt

DART mission video

Asteroid belt

- “Trojan asteroids” orbit in steady orbits both in front of, and behind Jupiter in its orbit.
- Due to the gravitational balance between the Sun and Jupiter, called Lagrange points.

Asteroid belt

Jupiter trojans animation

Asteroid belt

Bennu flyover

Outer Solar System

- Outer solar system contains the gas giant planets, asteroids, and Trans-Neptunian objects.

Outer Solar System

Galilean moons around Jupiter

Outer Solar System



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- Some asteroids live in the outer solar system, crossing Saturn's orbit.
- Called "centaurs."
- Some "minor planets" orbit beyond Neptune.
- Called Trans-Neptunian objects

Outer Solar System

Centaur orbits

Outer Solar System

Pluto system

Outer Solar System

NASA MU68 flyby

Announcements

- Homework due tonight.

Next time

- Phases and motion of the Moon

Outline



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College of Engineering
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- Poll everywhere
- Solar system
 - Inner solar system
 - Planet rotations
 - Moon formation
 - Evolution of the moon
 - Asteroid belt
 - Asteroid discoveries
 - Dark biosphere
 - DART mission
 - Trojan asteroids
 - Bennu flyover
 - Outer solar system
 - Galilean moons
 - Centaurs
 - Trans Neptunian objects
 - NASU MU68