

Lecture 22: The Family of the Sun



This lecture presents an introduction to our Solar System.

- The Sun
- Terrestrial Planets
- Jovian Planets
- Dwarf Planets
- Giant Moons
- Trans-Neptunian Objects
- Asteroids, Comets, & Meteoroids

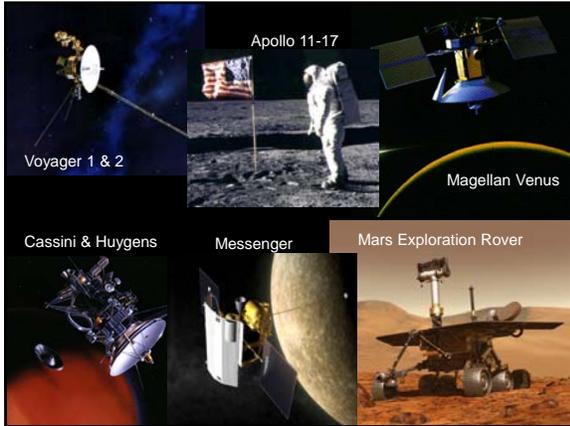
The planets all lie in nearly the same plane and orbit in the same general direction.

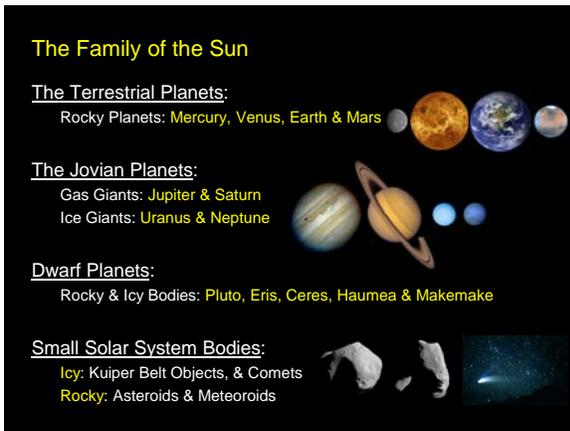
We currently live in the Golden Age of Space Exploration.

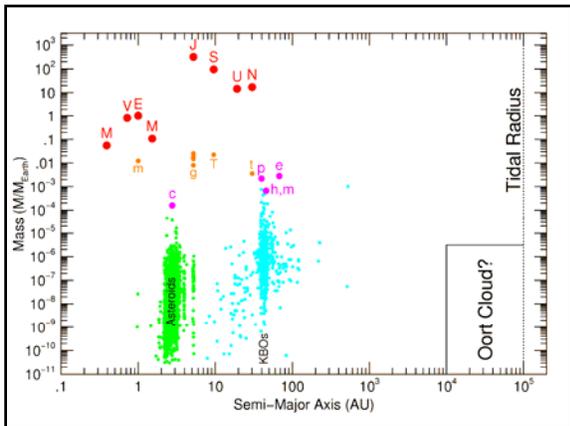
The Solar System has been explored with robotic spacecraft & astronauts:

- Landed men on the Moon
- Robotic landers on Moon, Venus, Mars, Titan & an asteroid
- Rocks returned from the Moon
- Probed Atmospheres of Venus, Mars, Jupiter, & Titan
- Flown spacecraft by all planets
- Extensive exploration of Mars in progress
- Mapped Venus & Titan with radar
- Flown by asteroids & comets
- Spacecraft on the way to Pluto and the Kuiper Belt

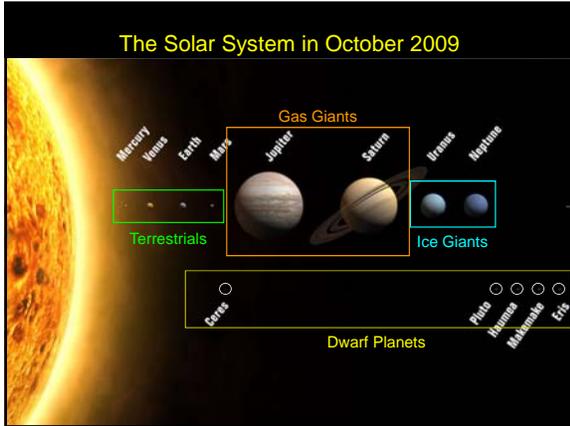
Lecture 22: The Family of the Sun

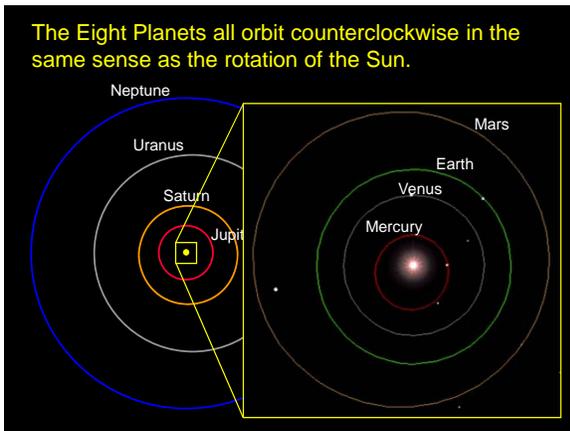


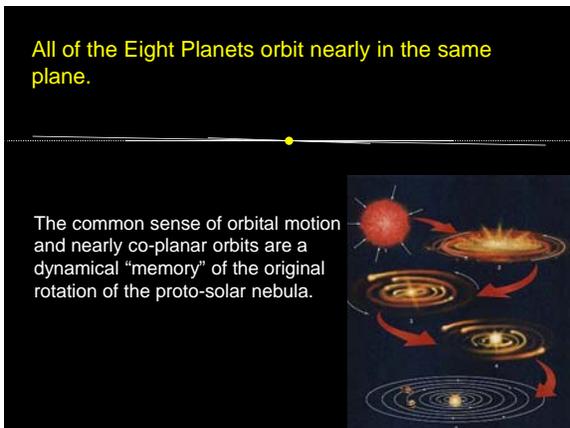




Lecture 22: The Family of the Sun







Lecture 22: The Family of the Sun

The Sun is a middle-aged, average star

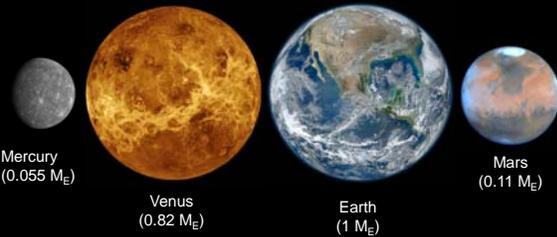
Mostly Hydrogen & Helium
99.8% of the Mass of the Solar System
~4.6 Gyr old

The Sun shines because it is hot:
Surface Temp ~5800 K
Emits mostly Visible, UV & IR light

Kept hot by nuclear fusion in its core:
Builds Helium from Hydrogen fusion.
Can shine for ~10 Gyr by Hydrogen fusion
another ~1 Gyr via Helium fusion

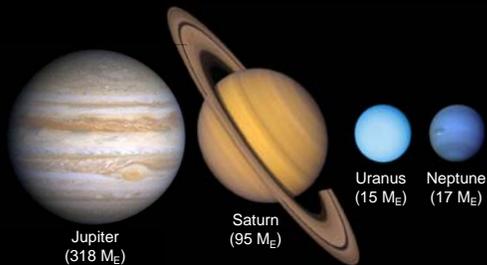


The Terrestrial Planets are the rocky planets found in the inner Solar System 0.4–1.5 AU from the Sun.



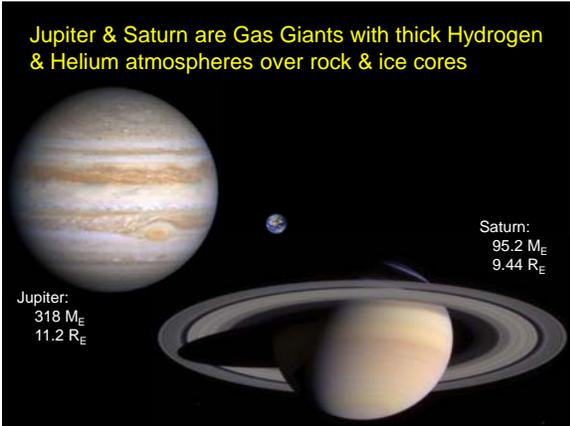
Composed of mostly Silicates and Iron with solid surfaces
All are High Density: 3.9 – 5.5 g/cc (rock & metal)

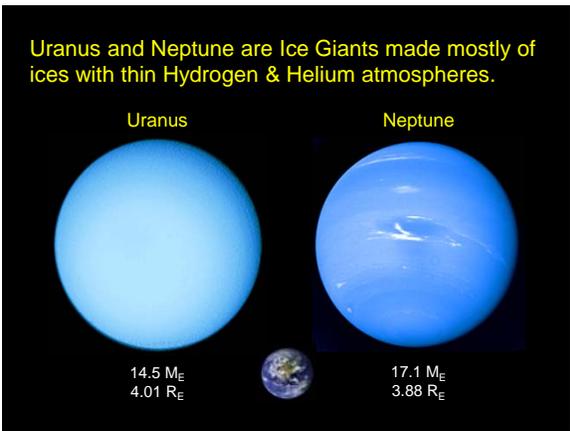
The Jovian Planets are the giants of the outer Solar System, located 5 – 30 AU from the Sun.

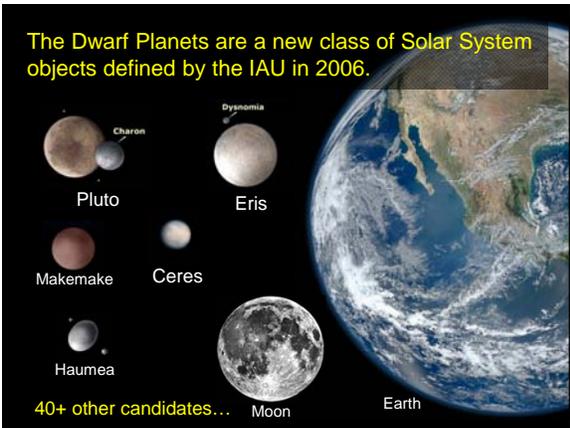


Composed of mostly gases and ices, with no solid surfaces
All are Low-Density: 0.7–1.6 g/cc (gas and gas+ice)

Lecture 22: The Family of the Sun

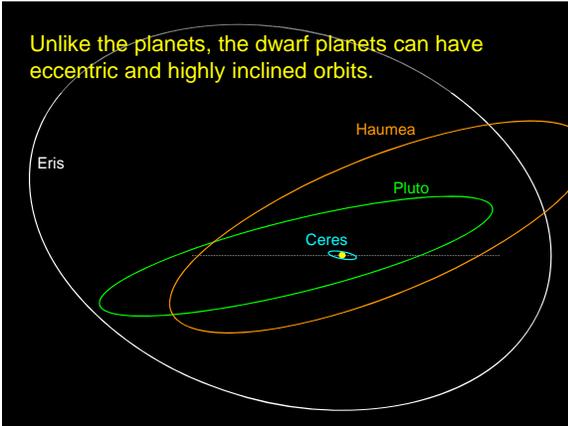


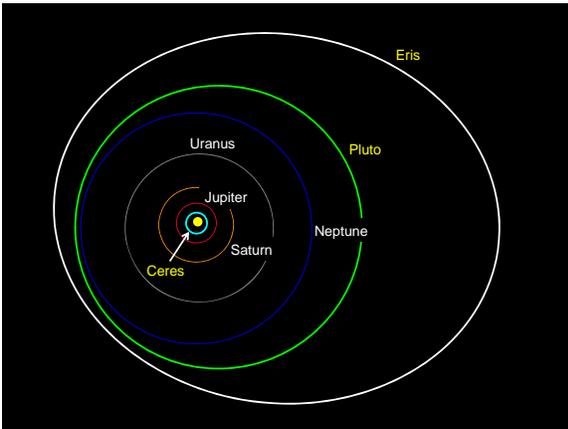




Lecture 22: The Family of the Sun

Unlike the planets, the dwarf planets can have eccentric and highly inclined orbits.





The Solar System has 7 Giant Moons, mostly found orbiting the giant planets of the outer solar system.



Lecture 22: The Family of the Sun

The Trans-Neptunian Objects are a numerous class of small, icy bodies that orbit beyond Neptune.

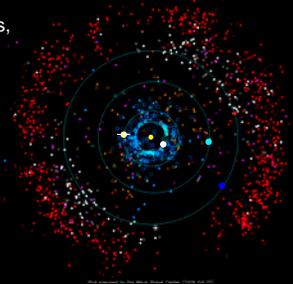
Composed mostly of ices: density 1.2–2 g/cc

Icy Dwarf Planets (Pluto, Eris, Haumea, & Makemake)

Kuiper Belt Objects (30 – 50AU)

Pluto's large moon Charon

Distant large icy bodies like Sedna & Quaoar



Largest known Trans-Neptunian Objects



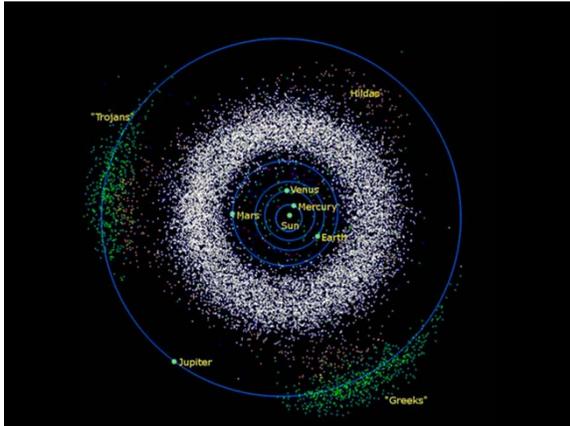
Asteroids are rocky or rock/metal aggregates found mostly in the Main Belt between Mars and Jupiter.



Made of rock & metal, some with ices (density 2–3 g/cc)

Range in size from a few 100km to large boulders (few meters)

Lecture 22: The Family of the Sun



Meteors are small bits of rock and/or metal ranging in size from grains of sand to boulders.

Stony Meteors:
mostly silicates

Iron Meteors:
mostly iron

Chondrites:
high Carbon content
and organic compounds
including amino acids

Meteor burning up in the Earth's atmosphere.

The image contains four photographs. On the left, three meteorite samples are shown: a brown, irregularly shaped stony meteorite; a dark, metallic iron meteorite; and a dark, irregularly shaped chondrite meteorite. On the right, a photograph shows a bright meteor streaking across a dark night sky.

Comets are low-density composites of rock and ice ("Dirty Snowballs").

Originate in the outer solar system (Kuiper Belt and Oort Cloud)

Develop long tails of gas & dust swept off them by sunlight and the solar wind when they pass near the Sun.

The image contains two photographs of comets. The left photograph shows a comet with a long, bright tail against a starry background. The right photograph is a close-up of a comet's nucleus and coma.
