Lecture 1: Introduction to course and introduction to solar system

Definitions:

Solar system: All of the material (planets, moons, comets, asteroids, etc.) that is gravitationally bound to our star (the sun, or Sol)

Star: A gaseous sphere that produces enough heat in its interior by nuclear fusion to withstand the force of gravity

Planet: From a Greek word meaning wanderer. Originally, the little points of light that moved through the constellations. Now, reasonably large (but not too large) objects that orbit the sun.

The solar system that I learned about in grade school consisted of 9 planets orbiting the sun in a plane with all of the planets going around the sun the same direction.

The inner solar system consisted of 4 terrestrial (Earth-like) planets; the outer solar system consisted of 4 Jovian (Jupiter-like) planets and Pluto. An asteroid belt separated the inner and outer solar systems, and there were comets somewhere past the planets of the outer solar system

Terrestrial Planets

Mercury
Venus
Earth
Mars

and then there is our Moon

<u>Asteroids</u>

asteroid-- rocky or metallic object in orbit around the sun

includes:

Main Belt asteroid: between Mars & Jupiter *Near-Earth asteroid (NEA):* planet-crossing
Trojan asteroid: Jupiter's orbit

origin:

mostly material that never accreted into a larger object; survivors of the planetary sweep-up process

Jovian Planets: Jupiter, Saturn, Uranus, Neptune

Moons of Jupiter – Io and Europa are larger than Pluto, Callisto is only slightly smaller than Mercury, and Ganymede is larger than Mercury – three of these may have liquid water layers in their interiors

<u>Titan</u>

- bigger than Mercury
- 2nd largest moon in solar system
- only moon with a significant atmosphere
- organic chemistry in atmosphere

Kuiper Belt– region of space beyond Neptune that is populated by larger objects (KBOs) and is a source of short period (<200 yr) comets

Transneptunian – any body farther from the sun than the planet Neptune

Typical orbital features of classical KBOs:

1. Relatively low inclination orbits (<30 degrees)
2. Prograde revolution around sun, like other planets

Hypothesis:

KBOs formed as part of normal planet-forming process, but didn't grow as large as Jovian planets.

Perhaps to make a Jovian planet you have to grow a sufficiently large ice embryo to have gas collapse onto the embryo.

Comets

comet-- icy object in orbit around the sun;
shows *coma* (gas cloud) when sufficiently close to sun

origin: icy material that never accreted into a larger object; survivors of the planetary sweep-up process

includes:

short period comet
long period comet
Kuiper Belt comet
Oort Cloud comet

Usually small, but some are planet-sized

So when we look at our solar system, we see:

- A star
- Objects made of rock and metal (terrestrial planets, some moons, asteroids)
- Very large objects made mostly of gas/fluid (Jovian planets)
- Objects made of rocky material plus ices (Pluto, KBOs, some moons, comets

Among the things we want to explore this term is WHY our solar system looks like this – what we might expect other planetary systems to look like, and what conditions we might need or have on any of these objects for life to originate, exist, or evolve.