**Interplanetary Vagabonds**

**Meteors, Asteroids, Comets**

**Meteoroids, Meteors, Meteorites**
- Meteor: brief, bright streak of light in sky; shooting star
- Caused by (mostly small; typically raisin-sized) piece of material (meteoroid) entering atmosphere from space
- Friction of air molecules with object heats it and makes it glow as a meteor
- Most burn up in atmosphere; rocky ones reaching ground are called meteorites
- Source - asteroid and comet fragments

**Asteroids**
- Rocky and or metallic objects
- Most orbit in the Asteroid Belt - between orbits of Mars and Jupiter
- Largest is Ceres - Diameter about 1000 km.
- Most are much smaller (meter to kilometer size) and irregularly shaped
- Origin of asteroids - probably left over planetesimals and their fragments
- Prevented from forming planet by Jupiter’s disruptive gravitational influence
Comets

- Pale, fuzzy, elongated objects in night sky
- Structure - bright head and long tail
- Head consists of small (about 10 km) size nucleus - a solid icy, dusty core (dirty snowball)
- When near Sun, ices evaporate and frozen gases thaw to create coma: large diffuse “atmosphere” around nucleus
- Tail forms when near the Sun. Sun’s radiation pressure and solar wind blow material from coma out into long plume
Comets: Continued

- Tail points away from the Sun
- Light from the comet is reflected sunlight and fluorescence (solar UV radiation absorbed and re-emitted as visible light)
- Trillion or so comet nuclei reside in Oort cloud at extreme outer part of Solar system (40,000 -100,000 AU).
- Some nuclei may come from Kuiper Belt (flattened region beyond orbit of Neptune)

A Comet's Tail Points Away from the Sun

- Tail forms, pushed out by solar wind and radiation pressure, Detaches from core about 1 AU.
- Gas tail
- Dust tail
- Solar heating distilsices comet and ice disappearance
- Tail now points ahead of comet motion.
- Tail points away from Sun.

Comets: Continued

- Short Period Comets - such as Halley's appear periodically (Halley's every 76 years)
- Repeated passage by Sun evaporates ices and drives off gases
- Leaves orbiting trail of rocky and metallic dust and small particles because solids don't evaporate
- Meteor Showers occur when Earth passes through trail.
- Asteroids and Comets occasionally strike Earth and other objects in Solar System. Craters found from such events at many places on Earth.
- Impact about 65 million years ago may have exterminated the dinosaurs.

Oort Cloud

In 1950 Jan Oort noticed that...
- no comet has been observed with an orbit that indicates it came from interstellar space;
- orbits lie at a distance of about 50,000 AU, and
- there is no preferential direction.

From this he proposed that comets reside in a vast cloud at the outer reaches of the solar system. The statistics imply that it may contain many as a trillion comets. Unfortunately, since the individual comets are so small and at such large distances, we have no direct evidence about the Oort Cloud.

Open Science Issues

- The very existence of the Oort Cloud is only a working hypothesis.
- Our only evidence is very indirect!!!
- HST’s recent images seem to confirm the existence of the Kuiper Belt.
- But how many of them are there?
- What are they made of?

The proposed Pluto Express mission may be extended to include a fly-by of a Kuiper Belt.
This image of Jupiter was obtained by the Hubble Space Telescope's Wide Field Planetary Camera after numerous fragments of comet Shoemaker-Levy 9 had collided with the planet.