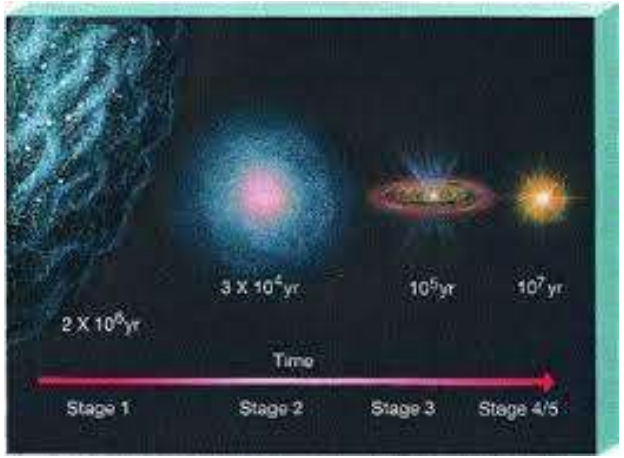
Physics Honors:
Our Solar System

A Collapsing Interstellar Cloud

- Interstellar clouds are made out of hydrogen and helium
- The cloud starts to pull together because of gravity
- As the cloud collapses, it starts to spin. The spinning draws it into a flattened disk



Central Star

- Centripetal motion will pull the majority of the hydrogen and helium to the center of the solar system.
- Once enough pressure forms, hydrogen fusion will occur, sparking the star to life

Planetesimals

- Colliding particles in the early solar system merged to form **planetesimals**—space objects built of solid particles that can form planets through collisions.

Gas Giants Form

The first planet to develop was Jupiter.

Jupiter formed by merged icy planetesimals that contained mostly lighter elements.

Saturn, Neptune and Uranus formed the same way, but they aren’t as large because Jupiter had collected so much material.

The Gas Giant Planets

- The four outer planets are called **gas giant planets** These large, gaseous planets are very cold on their surface, all have rings, and lots of moons
  - Jupiter
  - Saturn
  - Uranus
  - Neptune

Terrestrial Planets Form

- Planets that formed in the inner part of the main disk were composed primarily of heavier elements, so the inner planets are rocky and dense.

Planetesimals --Debris

- Material that did not get turned into planets and satellites is called debris.
- Some debris that was not ejected from the solar system became comets or asteroids
  - Comets are icy debris
  - Asteroids are rocky debris

Terrestrial Planets

- The four inner planets are called **terrestrial planets** because they are similar in density to Earth and have solid, rocky surfaces.
  - Venus
  - Mercury
  - Earth
  - Mars

Dwarf Planets

- In the early 2000s, astronomers began to detect large objects in the region of the then-planet Pluto, about 40 AU from the Sun, called the Kuiper belt.
- In 2003 an object, now known as Eris, was discovered that was larger than Pluto.

Dwarf Planets

- The International Astronomical Union (IAU) chose to create a new classification of objects in space called **dwarf planet,** which is an object that is
  - spherical in shape
  - orbits the Sun
  - not a satellite (like a moon)
  - has not cleared the area of its orbit of smaller debris (like a planet)


Moon
Pluto
Eris
Haumea
Ceres
Makemake

Small Solar System Bodies

Rocky planetesimals between Mars and Jupiter are called the asteroid belt.

- Objects beyond the orbit of Neptune have been called trans-Neptunian objects, Kuiper belt objects, comets, and members of the Oort cloud.
- The IAU calls all these objects, collectively, small solar system bodies.

Asteroids, Meteoroids, Meteors, and Meteorites

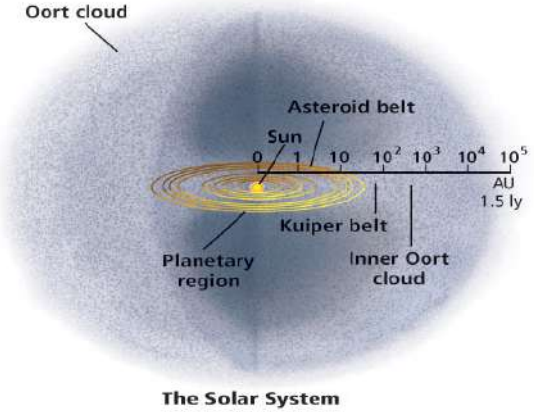
- There are thousands of asteroids orbiting the Sun between Mars and Jupiter. As asteroids orbit, they collide and break into fragments.
- An asteroid fragment is called a **meteoroid**.

Asteroids, Meteoroids, Meteors, and Meteorites

- When a meteoroid passes through the atmosphere, the air around it is heated up, producing a streak of light called a **meteor**.
- If the meteoroid does not burn up completely and part of it hits the ground, the part that hits the ground is called a **meteorite**.

Kuiper Belt

- The **Kuiper belt** is a group of small solar system bodies that are mostly rock and ice.
- Most of these bodies probably formed in this region—30 to 50 AU from the Sun—from the material left over from the formation of the Sun and planets.



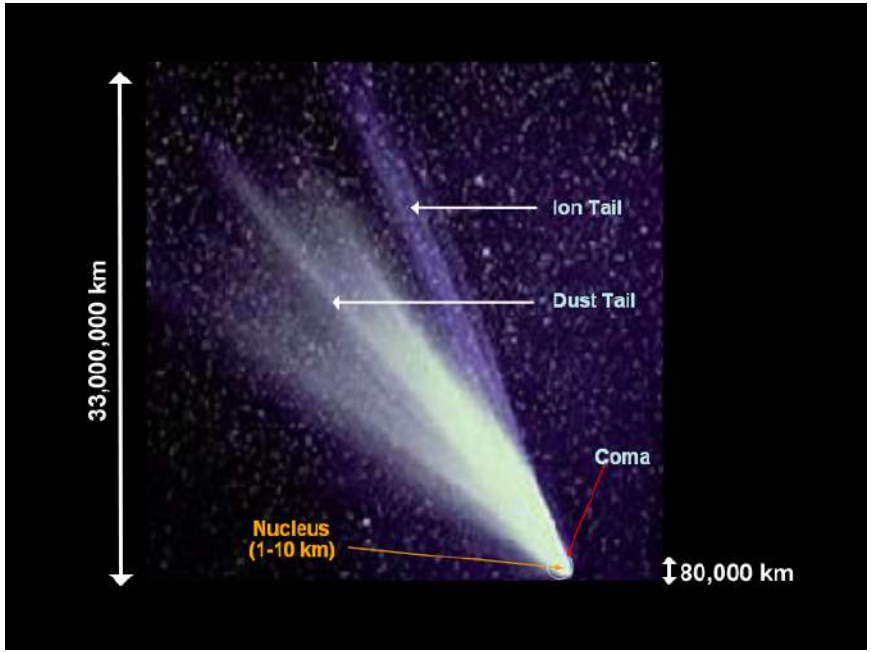
The Solar System

Comets and the Oort Cloud

- **Comets** are small, icy bodies that have highly eccentric orbits around the Sun.
- Ranging from 1 to 10 km in diameter, most comets orbit from the Kuiper belt to 100,000 AU from the Sun. The outermost region is known as the Oort cloud.

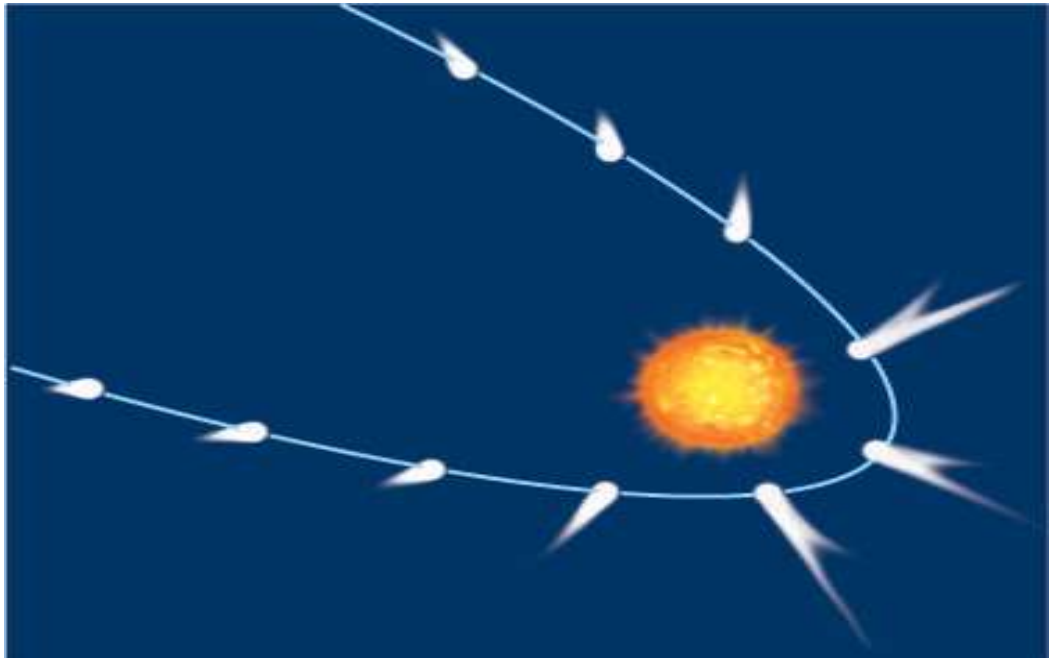
Comets

- When a comet comes within 3 AU of the Sun, it begins to evaporate and forms a head and one or more tails. The head is surrounded by an envelope of glowing gas, and it has a small solid core.


Ion Tail
Dust Tail
Coma
Nucleus
(1-10 km)
33,000,000 km
80,000 km

Comet structure

- A comet's tail always points away from the Sun and is driven by a stream of particles and radiation.



Periodic Comets

Comets that repeatedly return to the inner solar system are known as periodic comets.

Each time a periodic comet comes near the Sun, it loses some of its matter, leaving behind a trail of particles.
When Earth crosses the trail of a comet, particles left in the trail burn up in Earth's upper atmosphere, producing bright streaks of light called a **meteor shower**.