Stellar Evolution

I. Solar Nebula Theory

The most commonly accepted theory regarding the formation of the Solar System

Solar Nebula Theory says that the process starts with a rotating cloud of gas that contracts and flattens to form a disk of dust and gas around a forming star at its center. Planets grow from the dust and gas in the disk and are left behind when disk clears.

II. Birth of Stars

Stars are born from interstellar molecular clouds

Perturbed clouds collapse under their own gravity and grow increasingly dense

Protostar -> Dense core causes temperature to rise, star continues -> accretion disks -> Heat causes angular momentum to grow

1-10 million years after initial collapse, nuclear burning turns on. Star stabilizes between pressure and gravity

These stars are very similar to our Sun

Six layers to the sun:

Core, Radiative Zone, Convection Zone, Photosphere, Chromosphere, Corona

Sunspots occur due to the magnetic field at work in the Convection Zone

Solar Dynamo – 11 year cycle

The Sun is powered due to thermonuclear fusion of hydrogen, resulting in Helium ash and neutrinos.

III. Planets

2 Types of planets

Terrestrial-land

Jovian-gas

Formation of planets

Condensation creates Planetessimals

Accretion creates larger Planetessimals

Agglomeration creates Protoplanets

Radioactive decay causes differentiation

Out-gassing created our atmosphere

Jovian planets can hold onto more gas because cooler gas allows more ices andsilicates to coalesce.

IV. Asteroids, Comets and Meteorites

What are they? The residues of the planet formation process.

What interest do they hold for us? "Unevolved objects."

Where are they? Asteroid Belt between Jupiter and Mars; inner and outer solar system orbits.

How could they influence the further evolution of our solar system? Possible impacts with the planets.

V. The Cycle of Stellar Death and Birth

Fusion reactions, beginning with hydrogen, occur in the core of stars. Once they have used up their nuclear fuel, they die. Their remains become spread out throughout space and eventually the heavy elements synthesized by one generation of stars become the raw material for new generations of stars. The cycle of stellar death and birth continues.