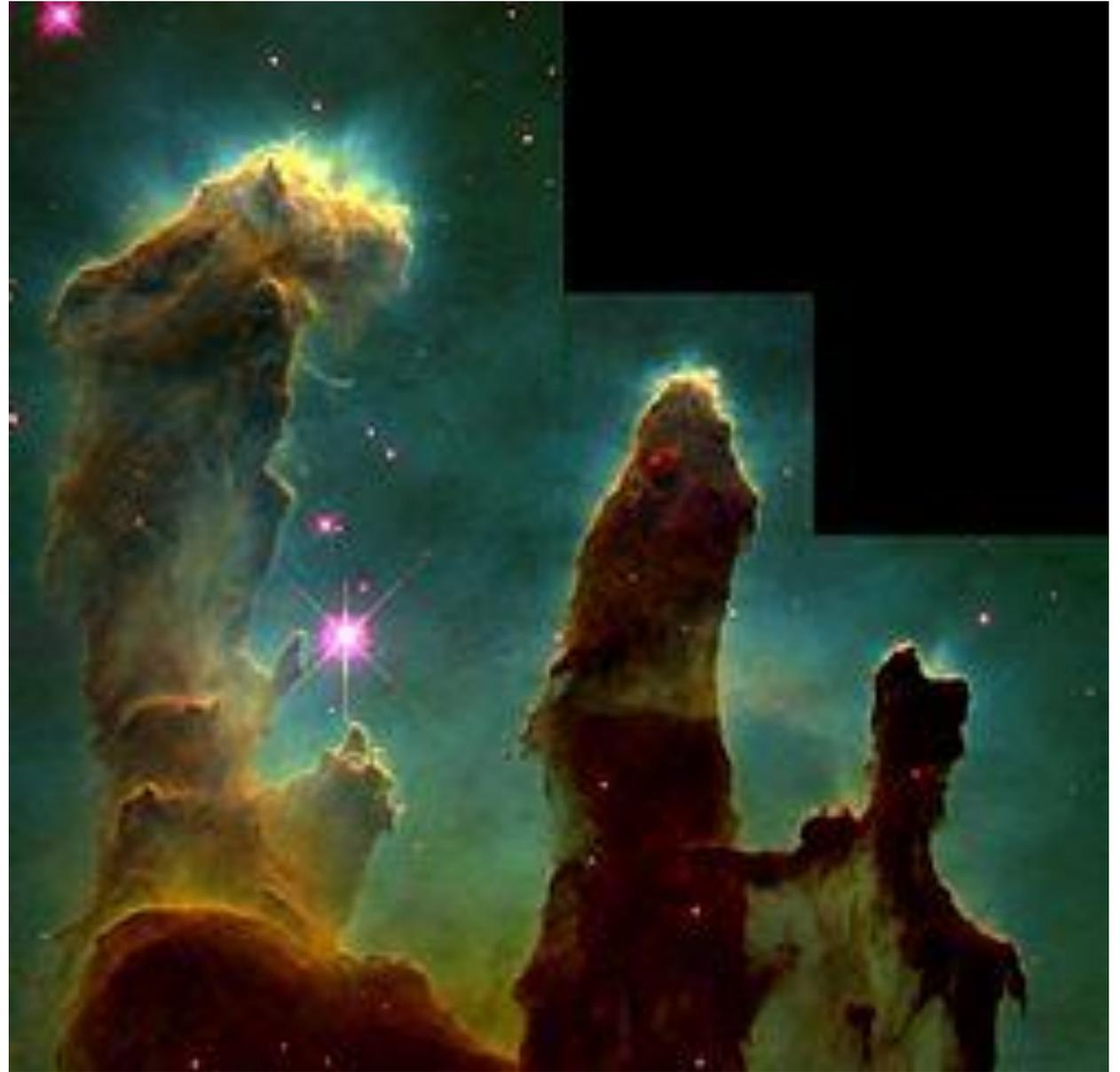


[https://www.youtube.com/watch?v=PVOAClyk\\_xQI](https://www.youtube.com/watch?v=PVOAClyk_xQI)

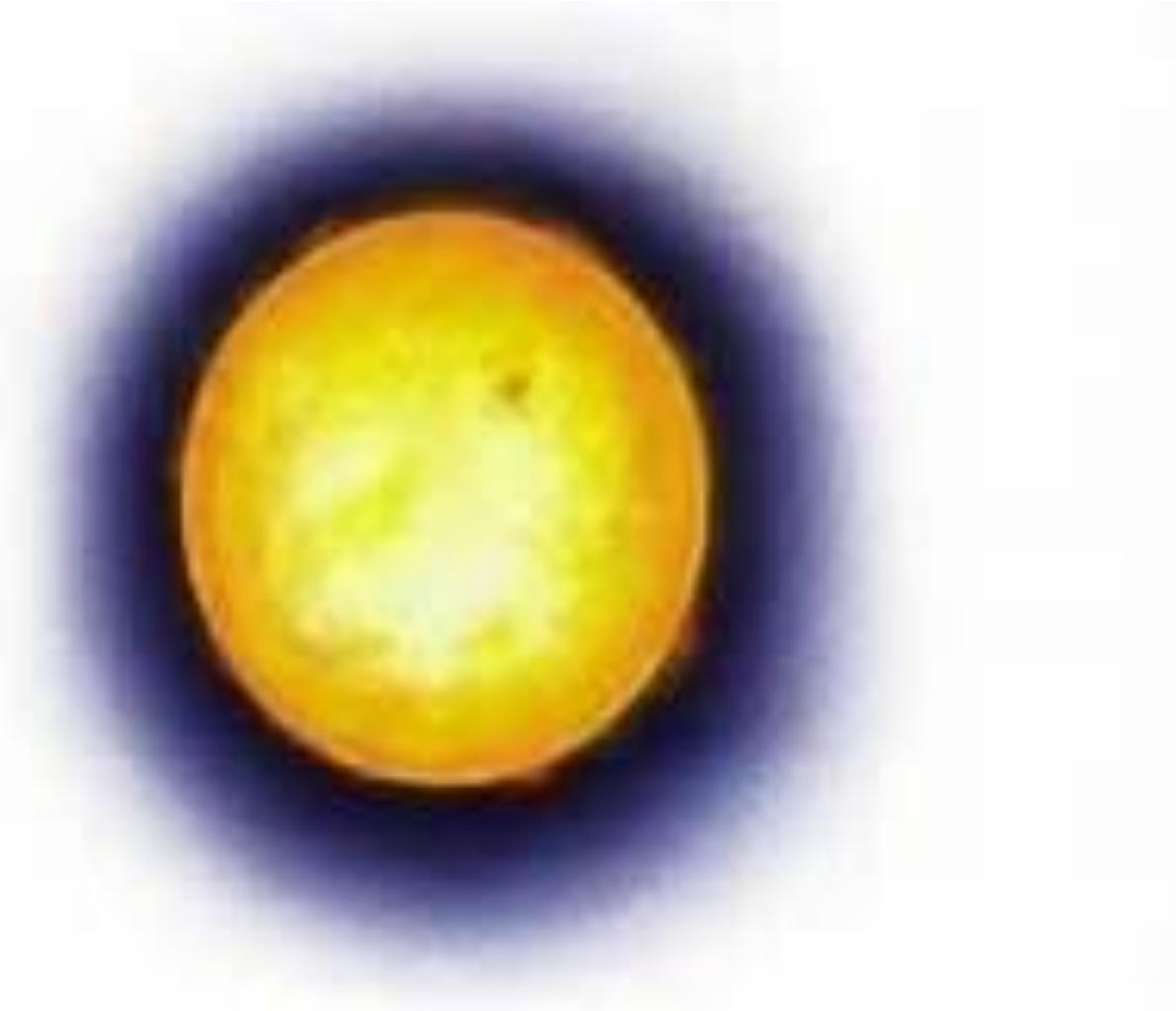
[https://www.youtube.com/watch?v=d57C2drB\\_wc](https://www.youtube.com/watch?v=d57C2drB_wc)

# Interstellar Cloud





**Protostar**

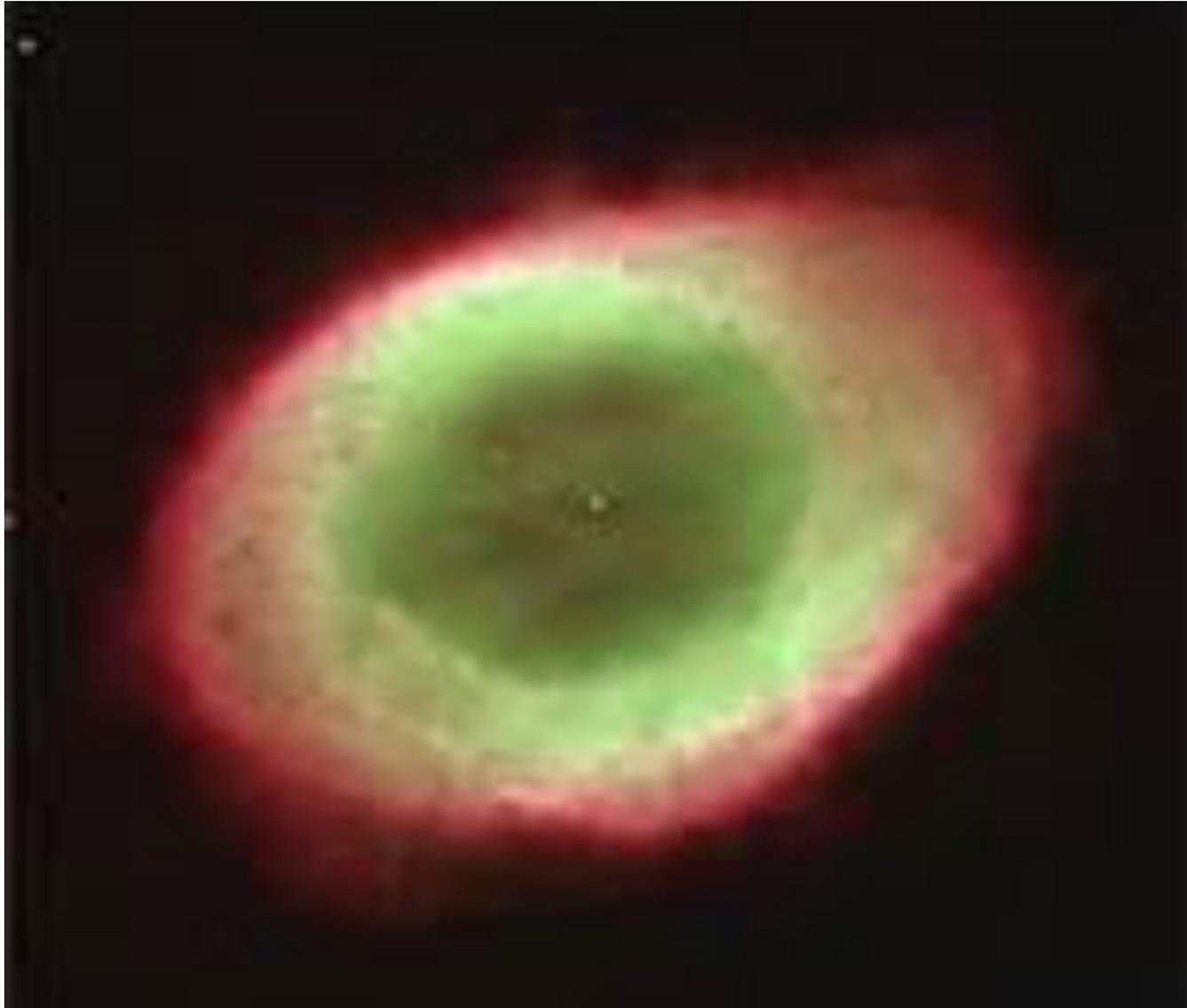


**Main Sequence Star**

# Red Giant



# Low Mass Stars

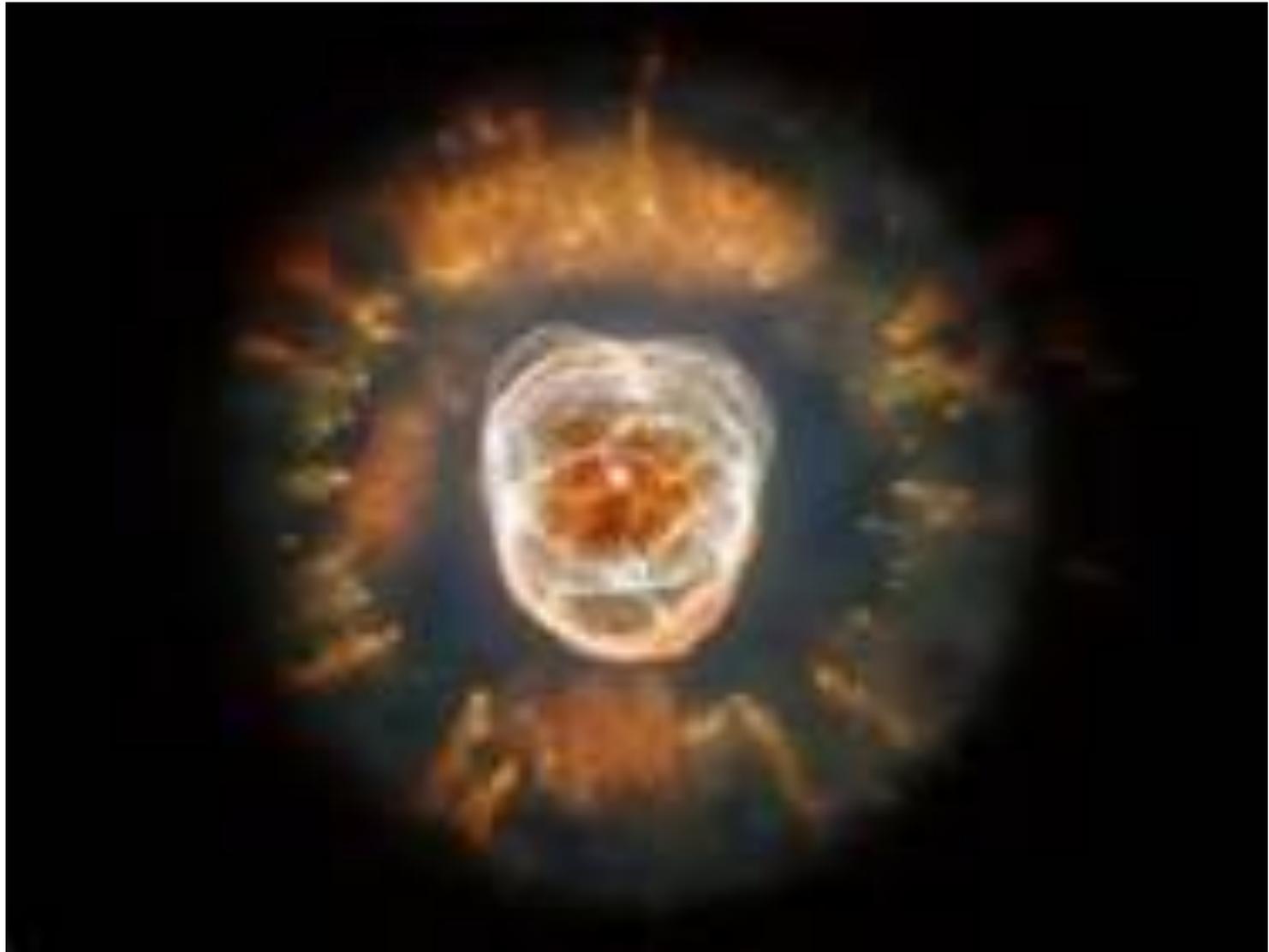




**White Dwarf - Low Mass Stars**



**Supernova – High Mass Stars**

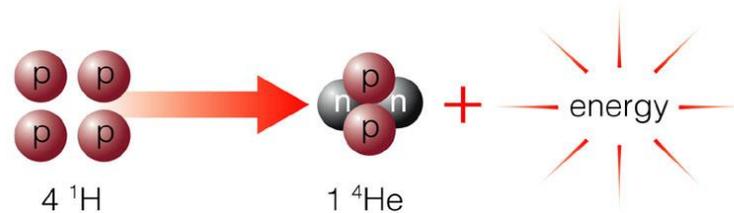
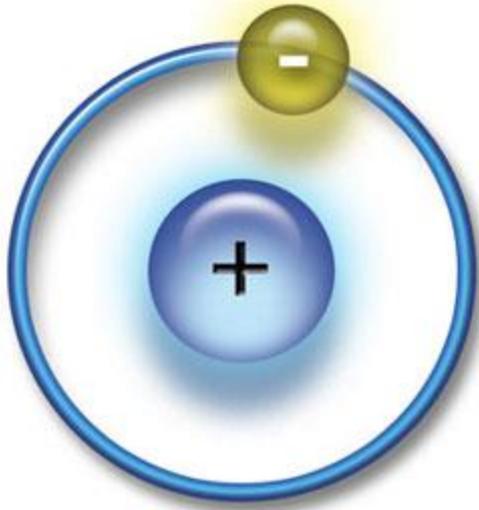


**Neutron Star – High Mass Stars**

# Black Hole – High Mass Stars



# Early Universe = a sea of atoms, mostly Hydrogen



Copyright © 2004 Pearson Education, publishing as Addison Wesley.

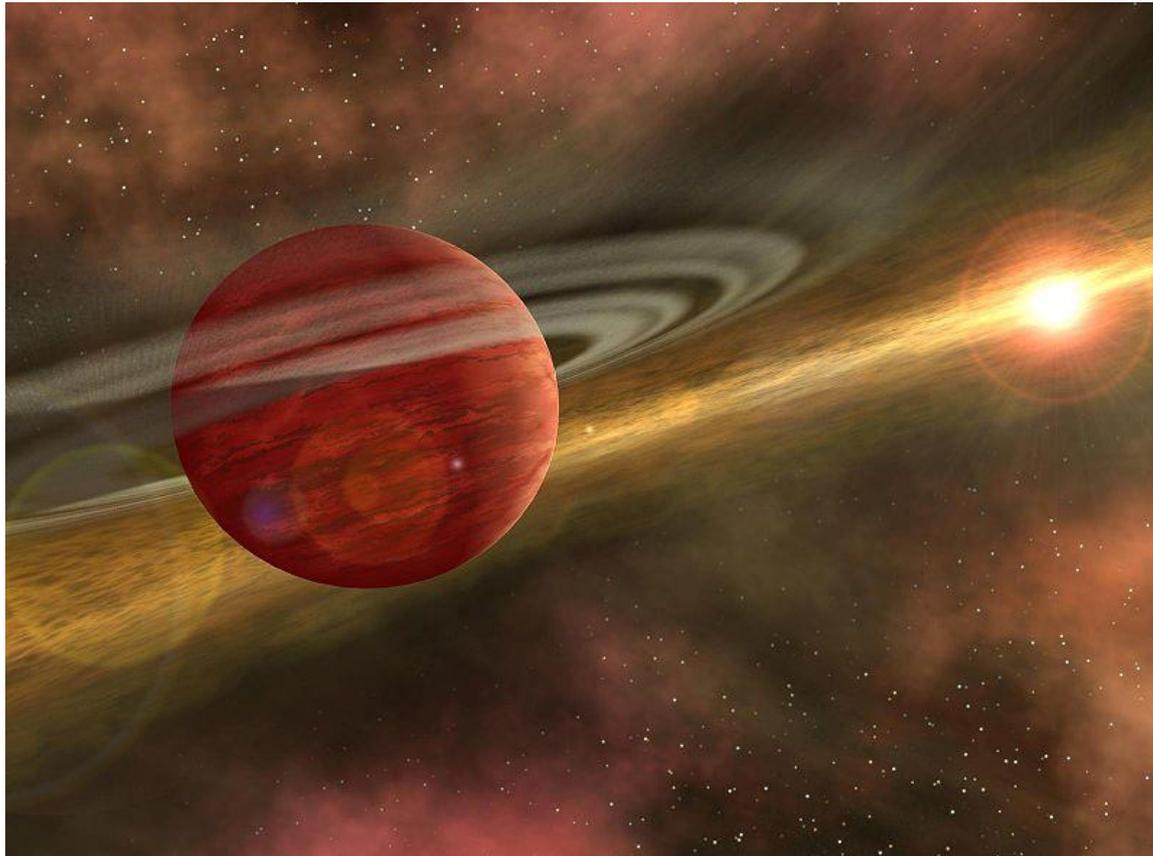
- 2 Hydrogen atoms combine to form H<sub>2</sub> molecules
  - 4 Hydrogen nuclei combine to make 1 nucleus of Helium
- This is Nuclear Fusion

During this process of fusing hydrogen to helium, a lot of Energy is released

This Heating flows from the core to the surface and escapes into space as starlight

# The Nebular Hypothesis

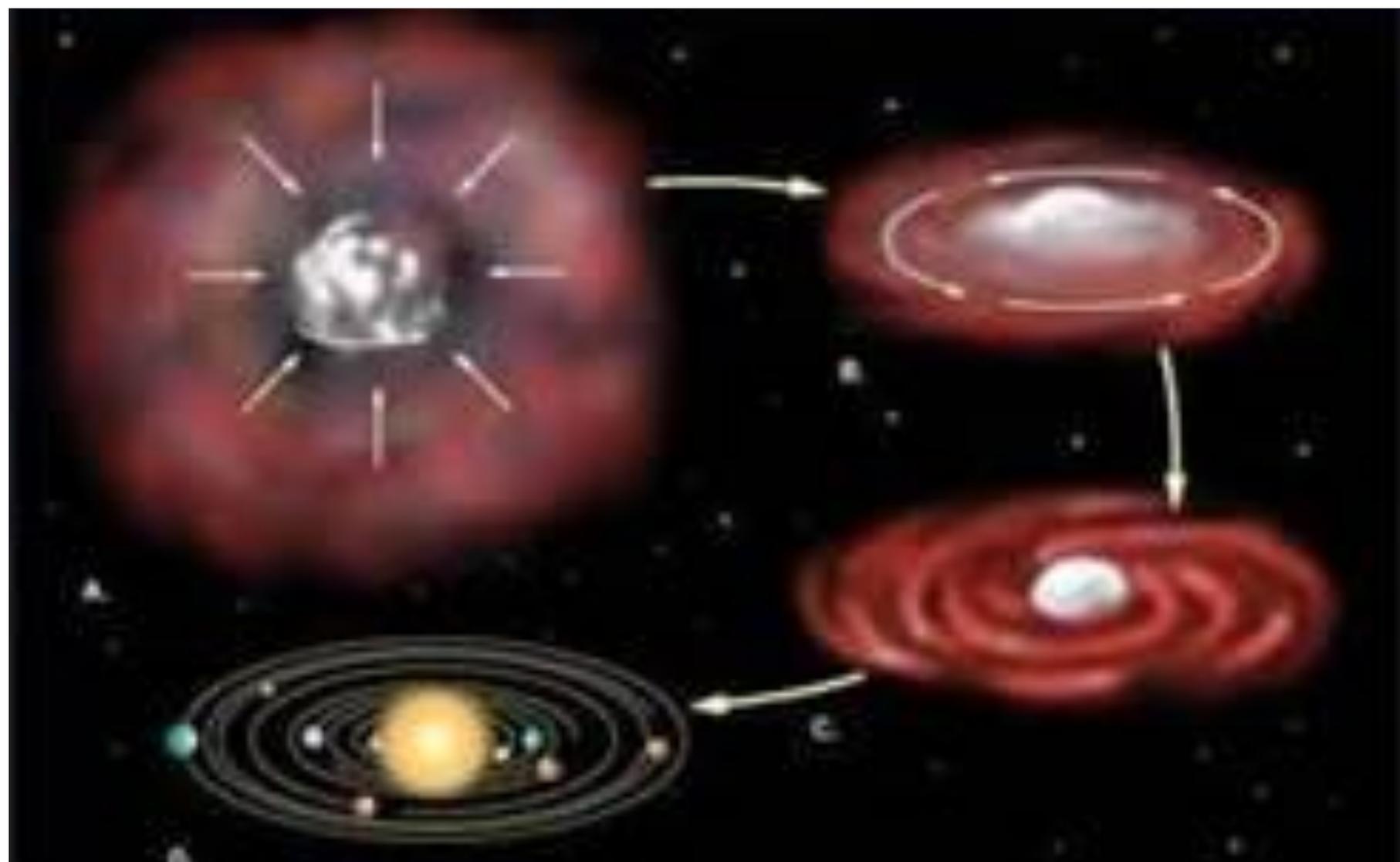
In cosmogony, the **Nebular Hypothesis** is the currently accepted argument about how a Solar System can form

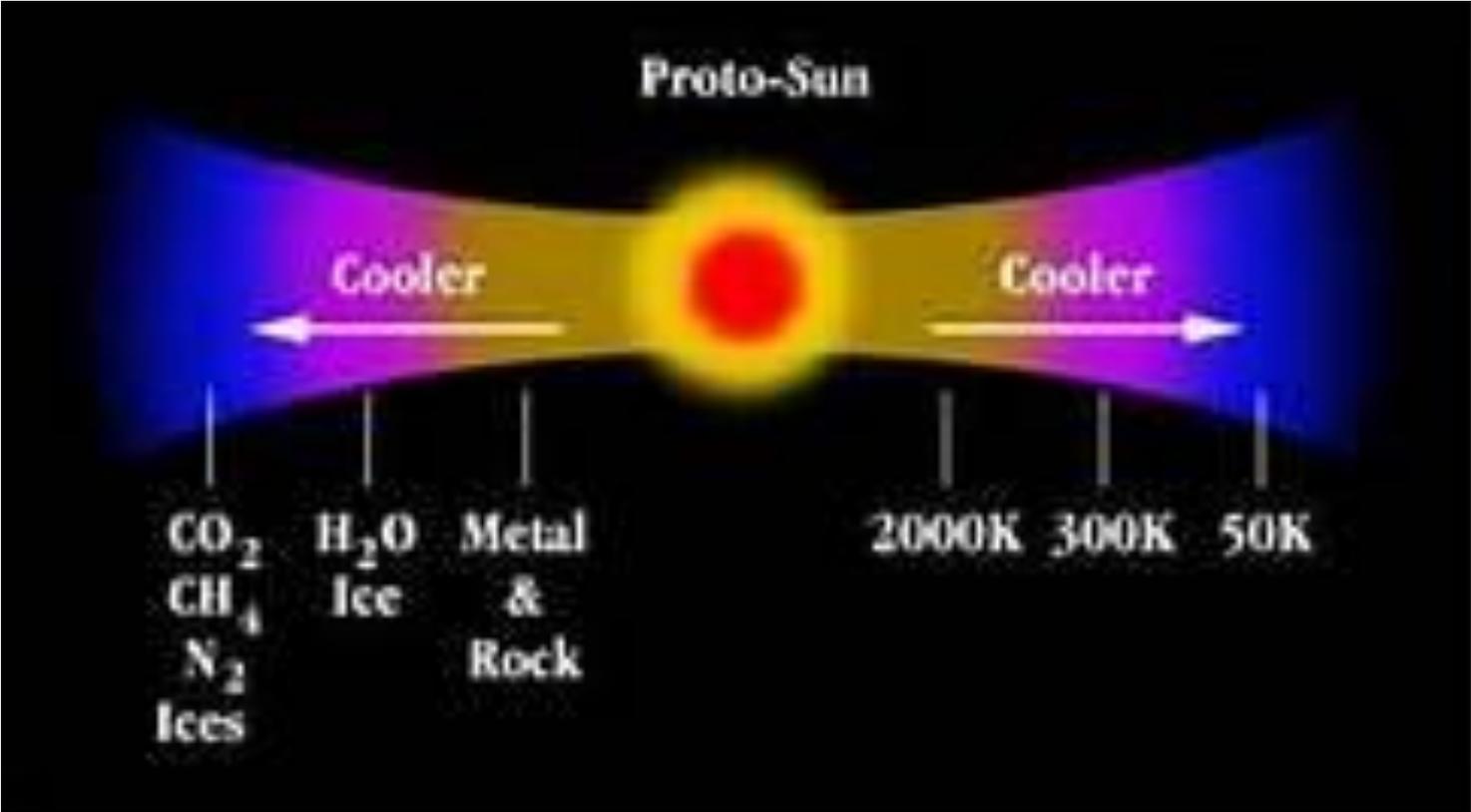


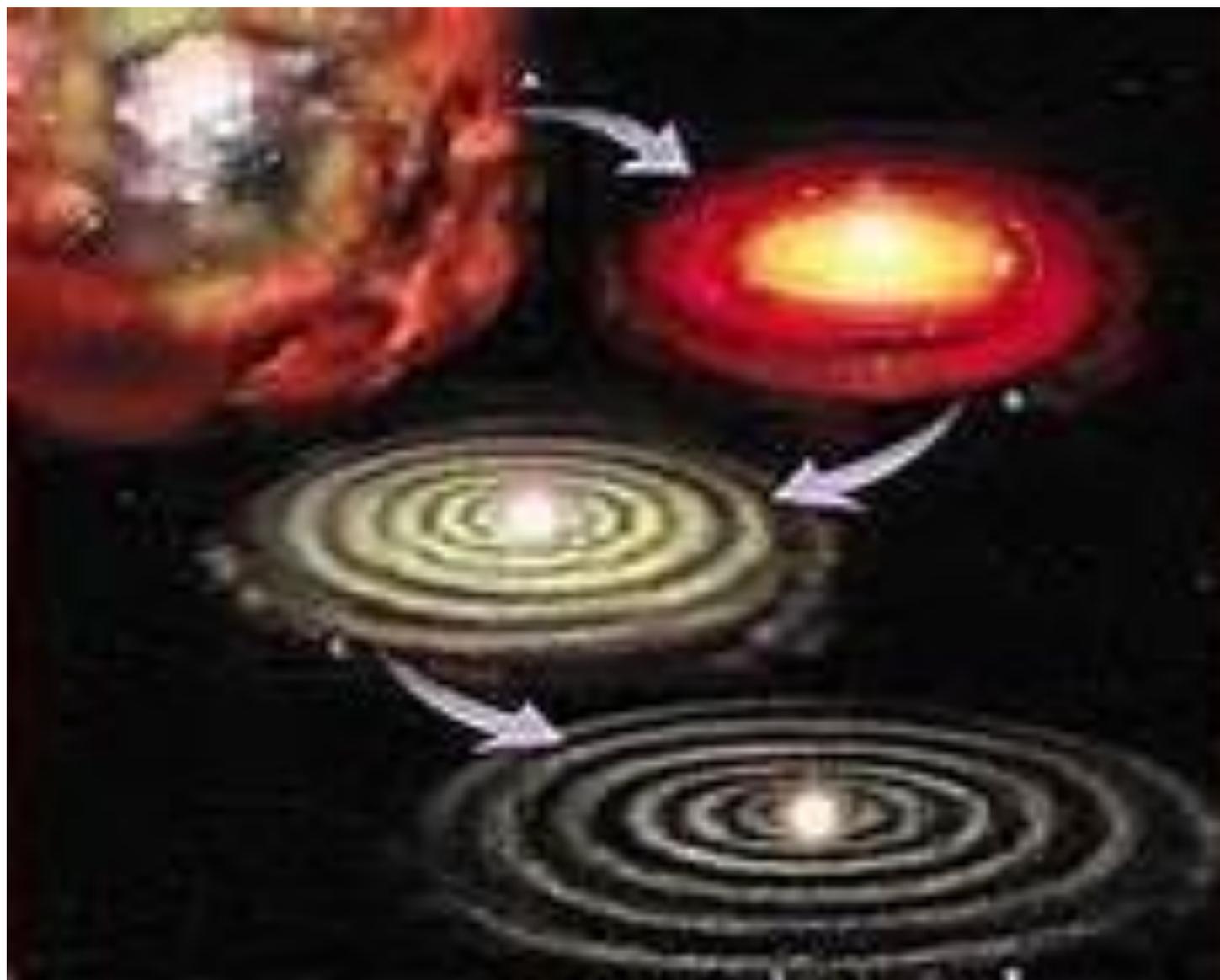
# Formation of Our Solar System

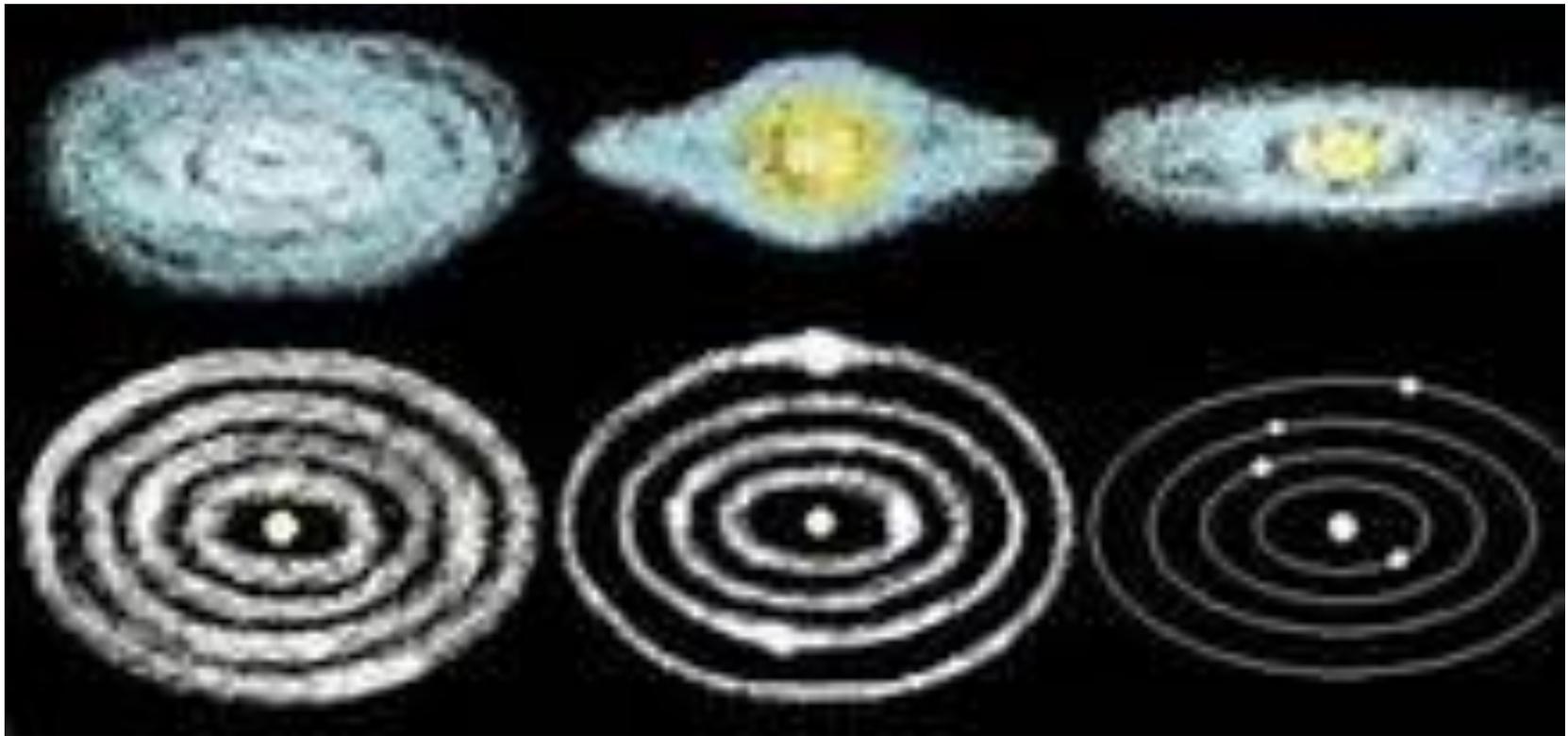
- During star formation, the interstellar cloud is pulled inward by its own gravity
- The contraction causes acceleration and the cloud flattens into a disk with a central bulge which becomes a protostar
- The dust (interstellar grains made of silicon, carbon, iron, and ice) and gas surrounding the protostar begins to condense
- Gas cools and molecules stick together to form solid particles, and the particles began to stick together into bigger pieces called Planetesimals
- In inner zone closest to the protostar, iron and silicate condensed
- In the outer zone, water, carbon dioxide, nitrogen condensed

- **Thus, chunks of rock/metal clumped in the inner system, forming the terrestrial planets**
- **Chunks of ice and volatiles clumped in the outer system, forming the gas giants**
- **The chunks collided to form planets, the collisions generated heat**
- **The heat turned some of the solids particles into liquids and the denser materials fell to the center of the planet – differentiation – forming cores and layers**
- **Once the center protostar became hot enough to begin nuclear reactions, it created a shock wave, referred to as solar wind that drove the extra gas and dust out of the system**





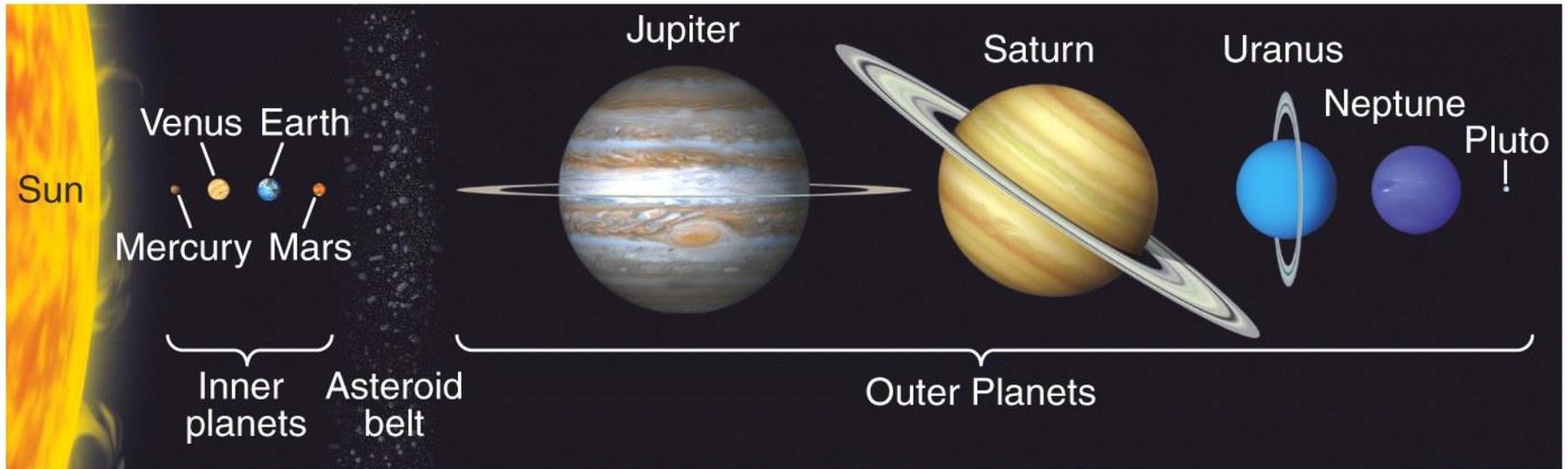






<http://astronomyonline.org/Animations/SAO/SolarSystemFormation.mov>

# Size of the Planets



# The Age of the Earth

Earth is ~ 4,570,000,000 years old

Meteorites give us access to debris left over from the formation of the solar system

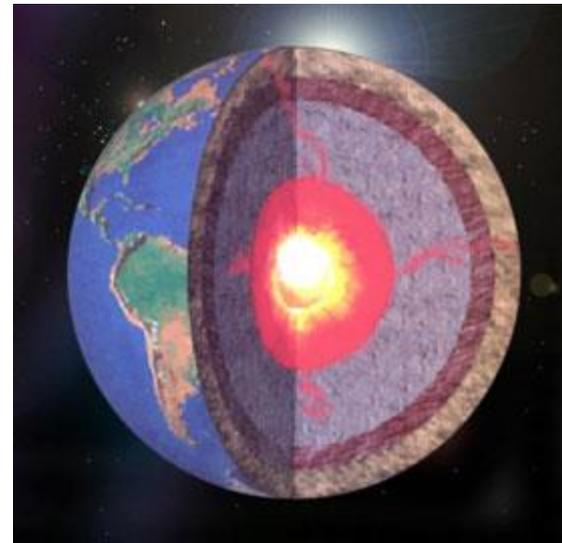
We can date meteorites using radioactive isotopes and their decay products



# The Core

About 100 million years after initial accretion, temperatures at depths of 400 to 800 km below the Earth's surface reach the melting point of iron

In a process called **global chemical differential**, the heavier elements, including the melted iron, began to sink down into the **core** of the Earth, while the lighter elements such as oxygen and silica floated up towards the surface



# Global Chemical Differentiation

This global chemical differentiation was completed by about 4.3 billion years ago, and the Earth had developed a **inner** and **outer core**, a **mantle** and **crust**

