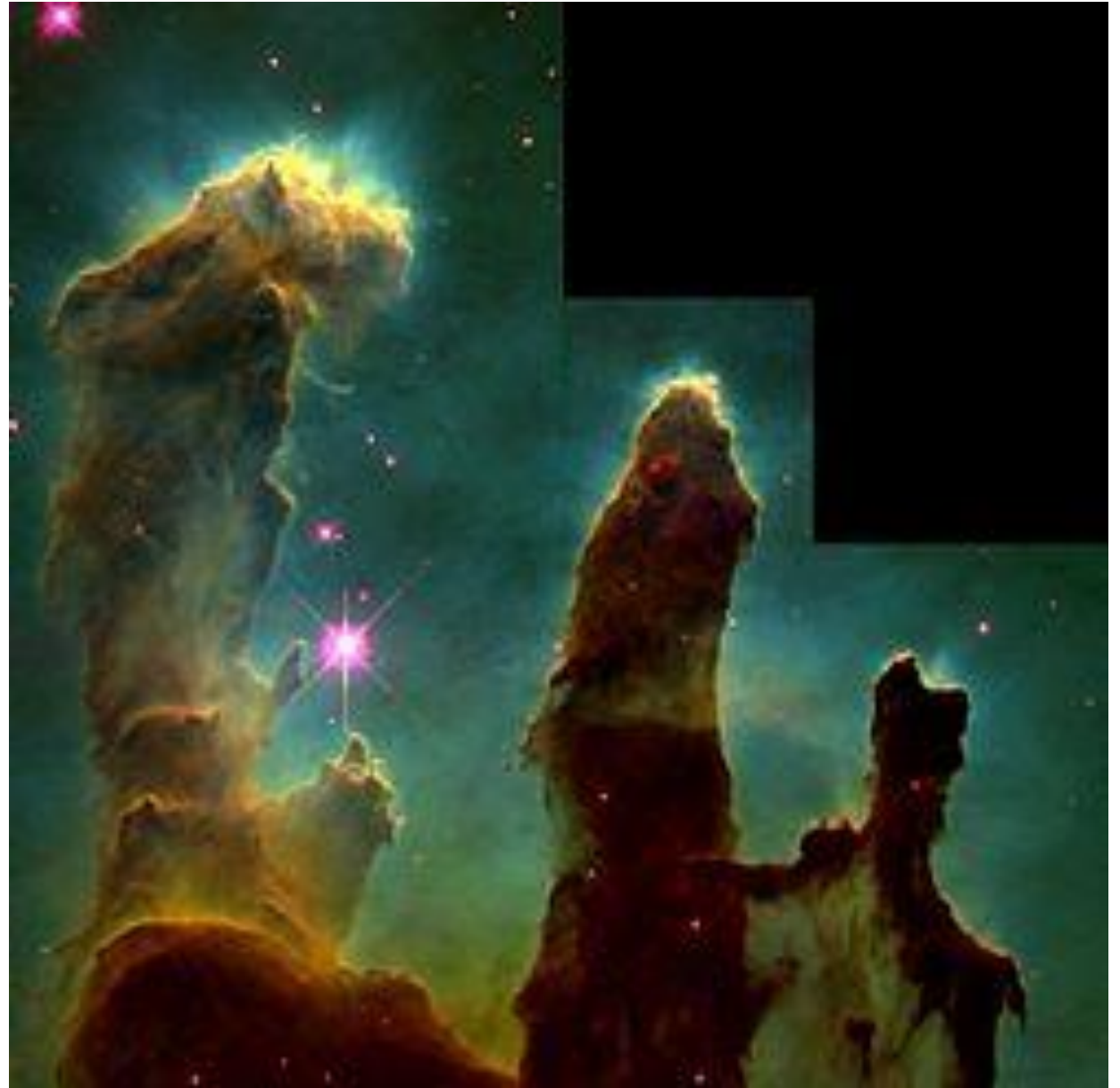


https://www.youtube.com/watch?v=PVOAClyk_xQI

https://www.youtube.com/watch?v=d57C2drB_wc

Interstellar Cloud





Protostar



Main Sequence Star

Red Giant



Low Mass Stars

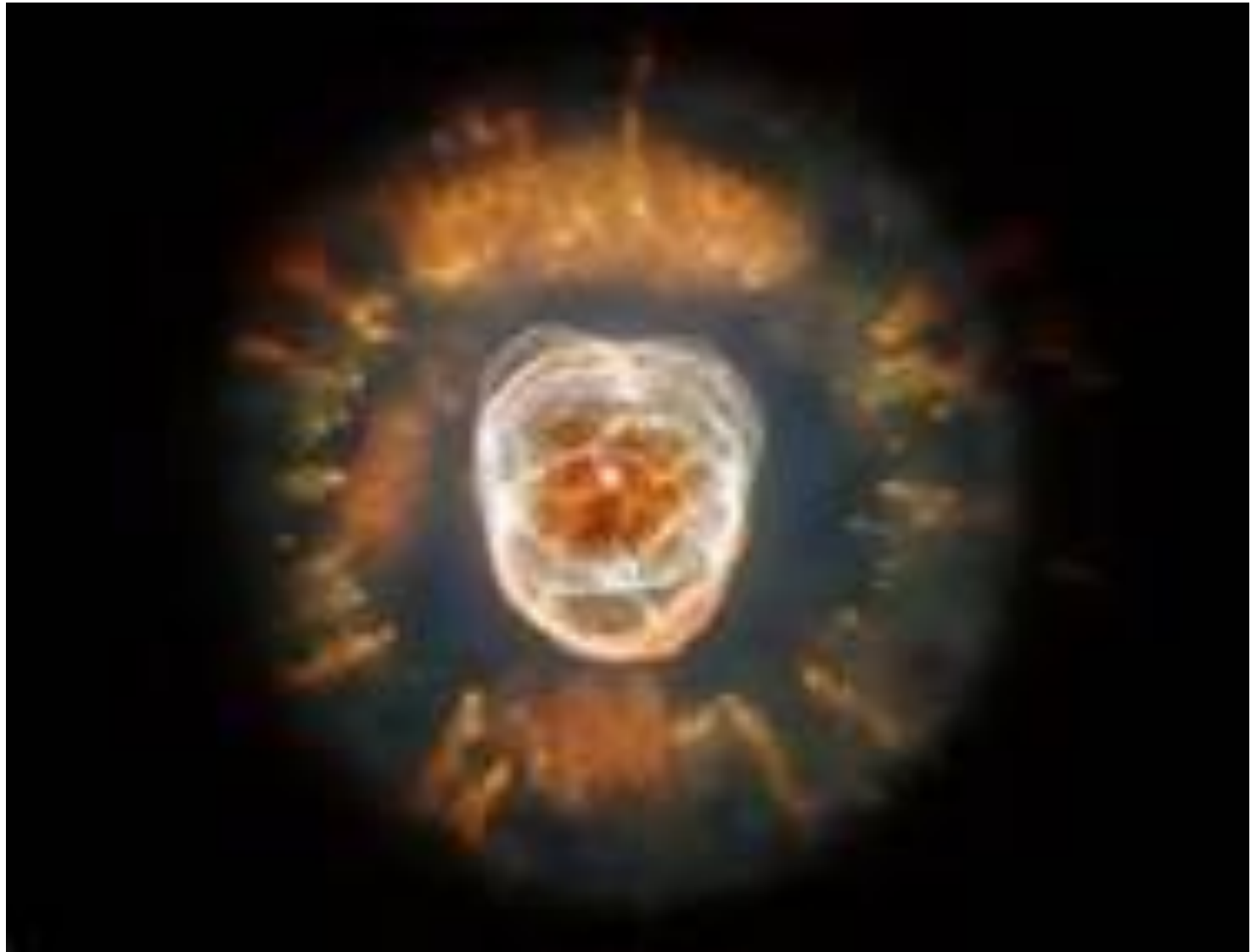




White Dwarf - Low Mass Stars



Supernova – High Mass Stars

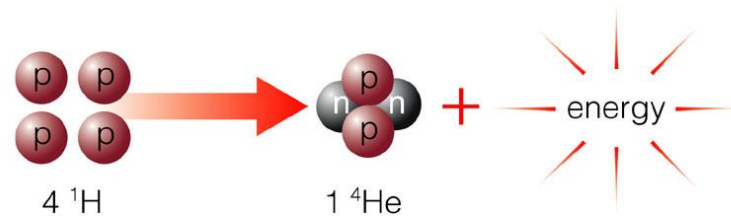
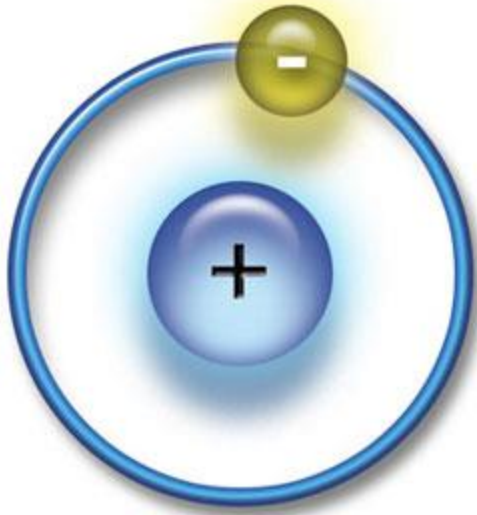


Neutron Star – High Mass Stars

Black Hole – High Mass Stars



Early Universe = a sea of atoms, mostly Hydrogen



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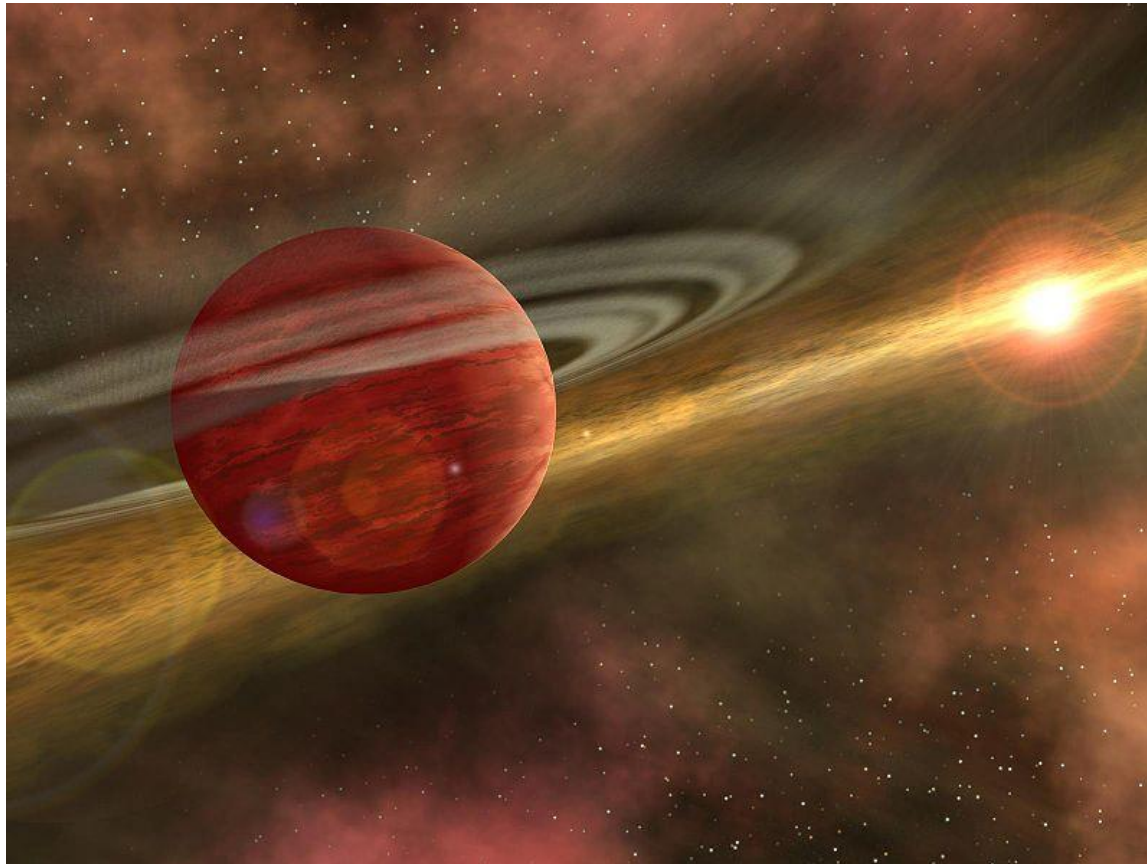
- 2 Hydrogen atoms combine to form H_2 molecules
 - 4 Hydrogen nuclei combine to make 1 nucleus of Helium
- This is Nuclear Fusion

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

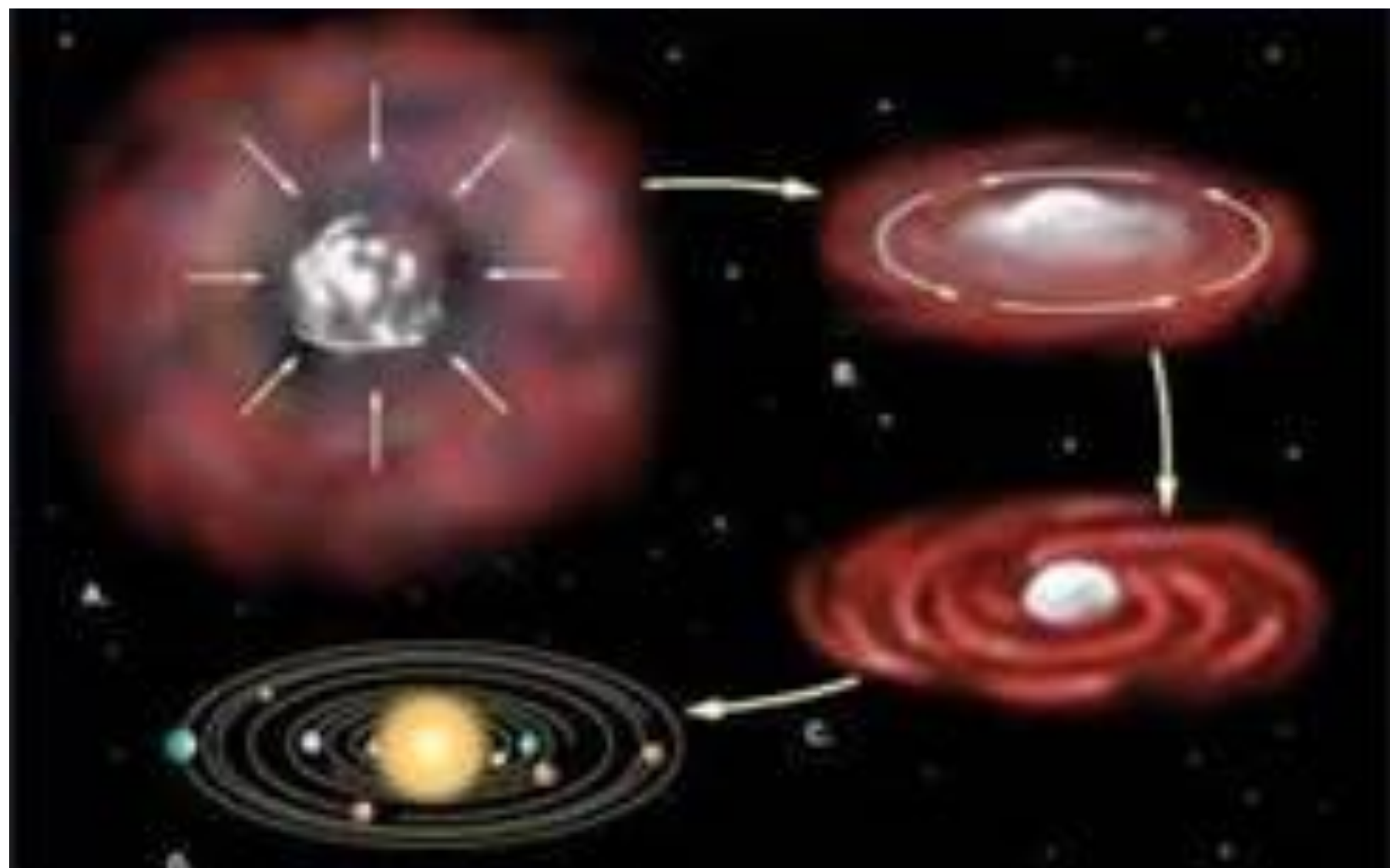
In cosmogony, the **Nebular Hypothesis** is the currently accepted argument about how a Solar System can form

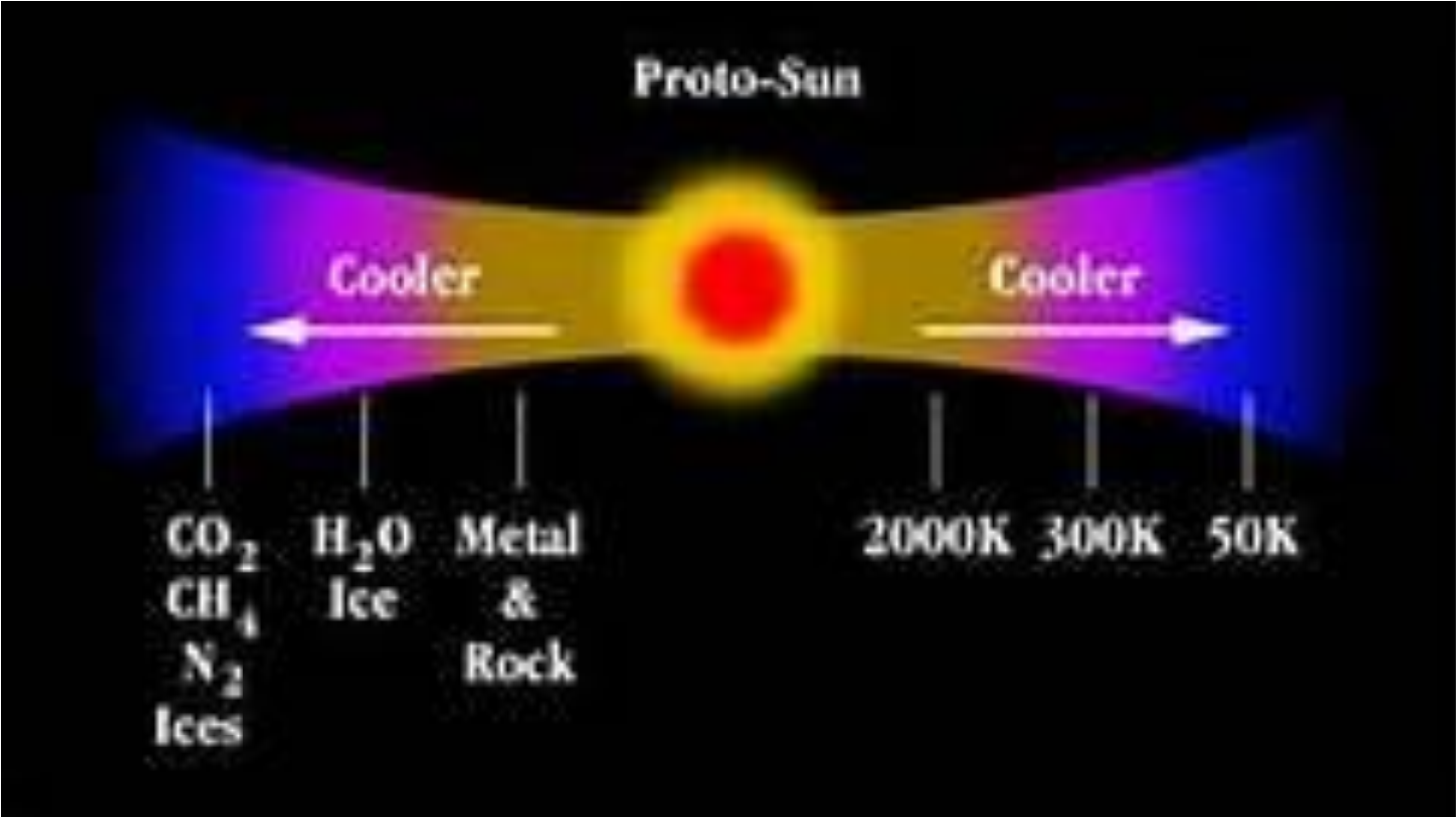


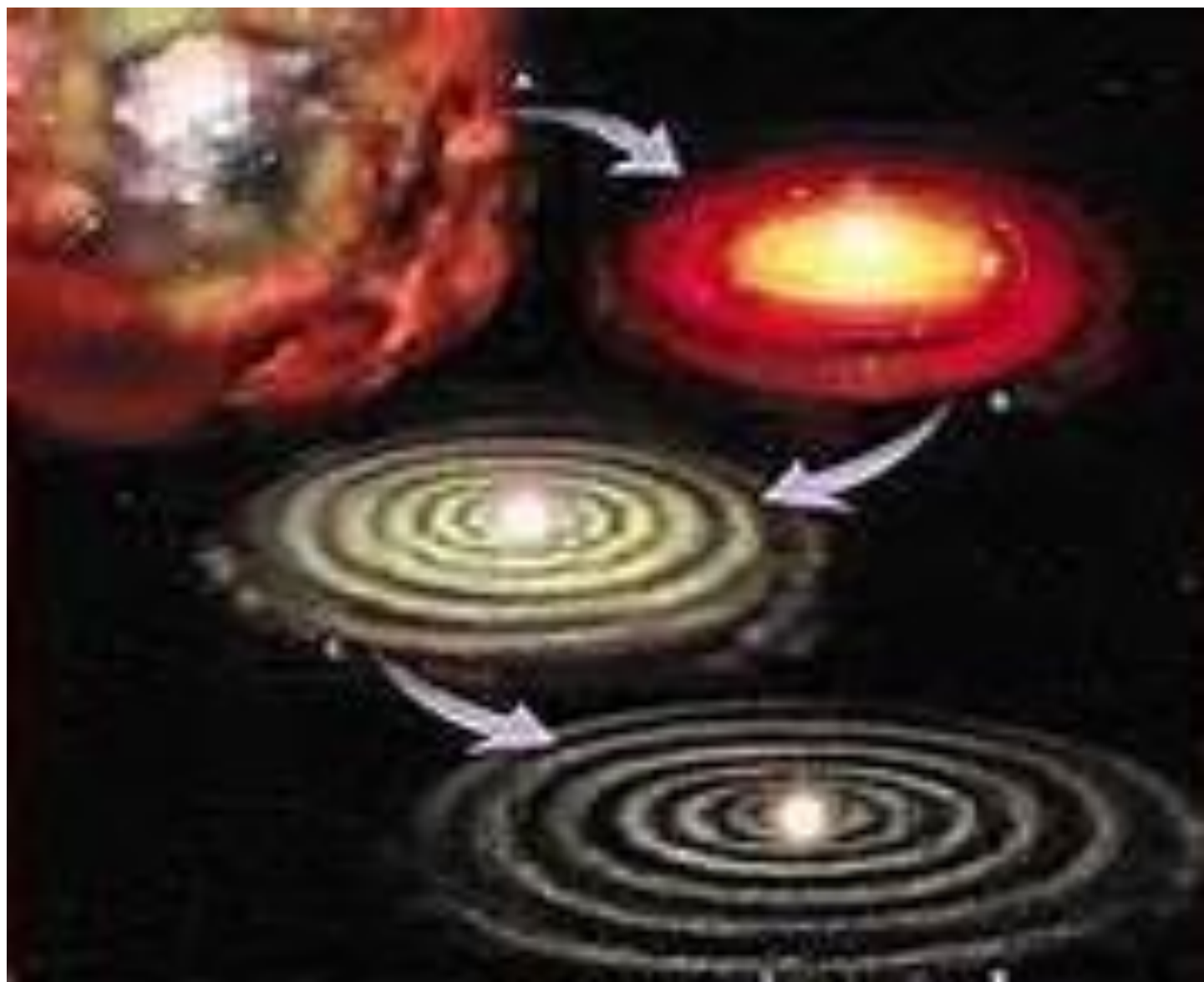
Formation of Our Solar System

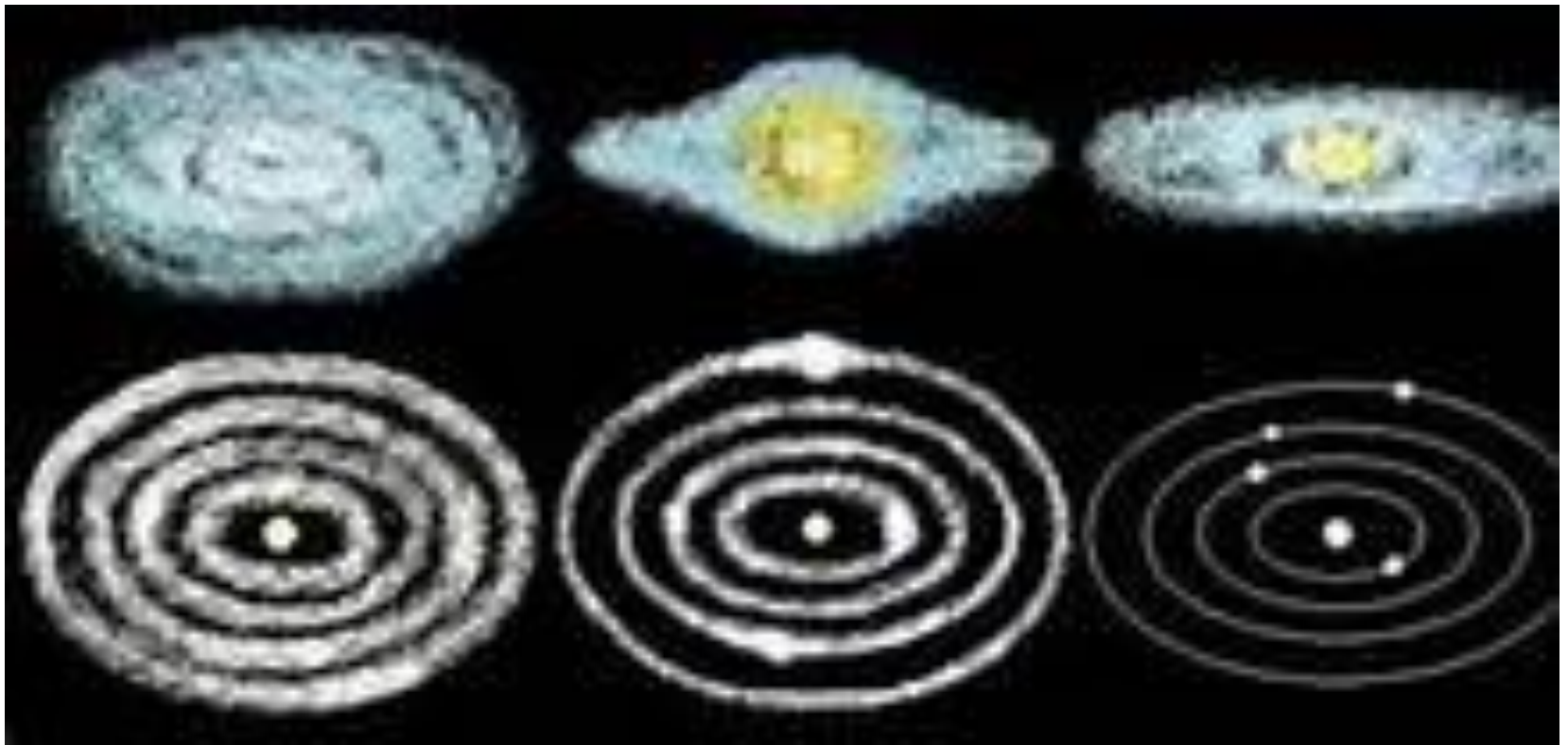
- During star formation, the interstellar cloud is pulled inward by its own gravity
- The contraction causes acceleration and the cloud flattens into a disk with a central bulge which becomes a protostar
- The dust (interstellar grains made of silicon, carbon, iron, and ice) and gas surrounding the protostar 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**





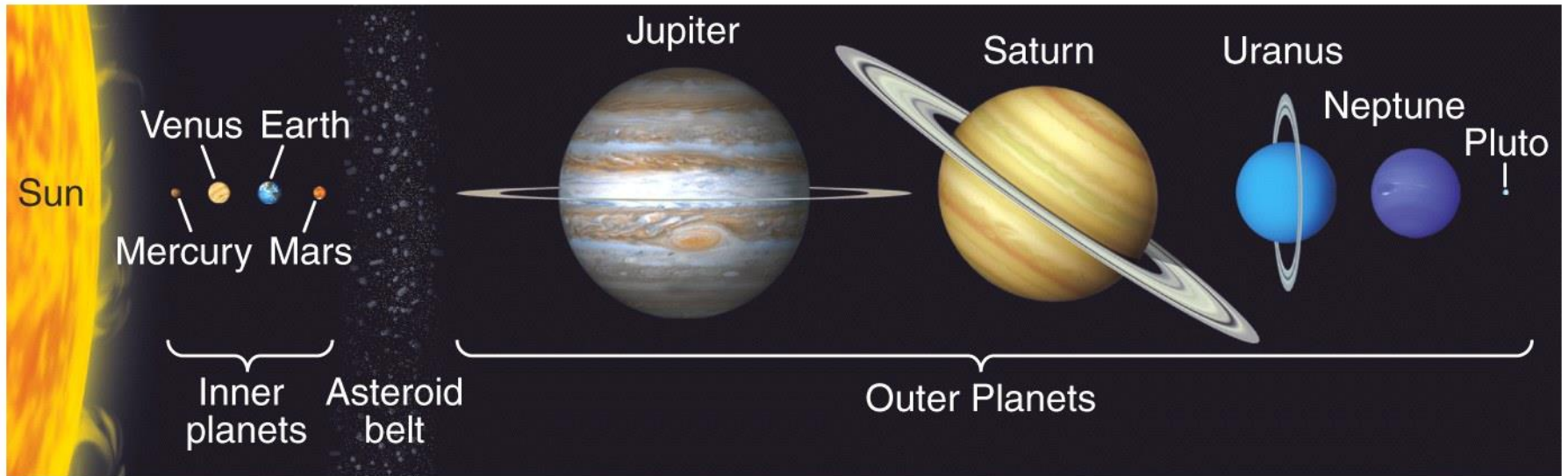






<http://astronomyonline.org/Animations/SAO/SolarSystemFormation.mov>

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

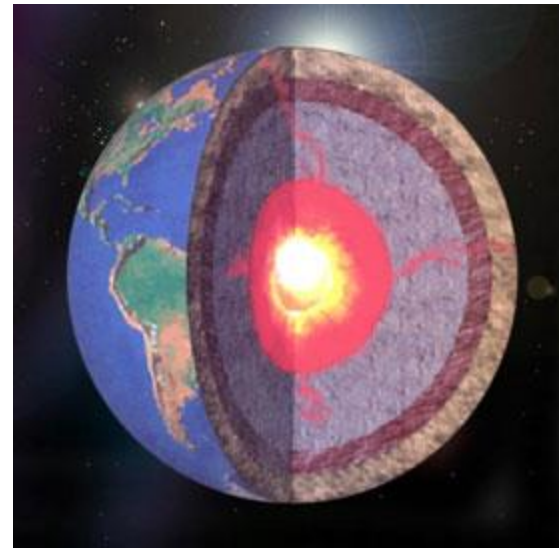
We can date meteorites using radioactive isotopes and their decay products



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**

