

**Immanuel Kant 1755**

**Pierre-Simon Laplace 1796**

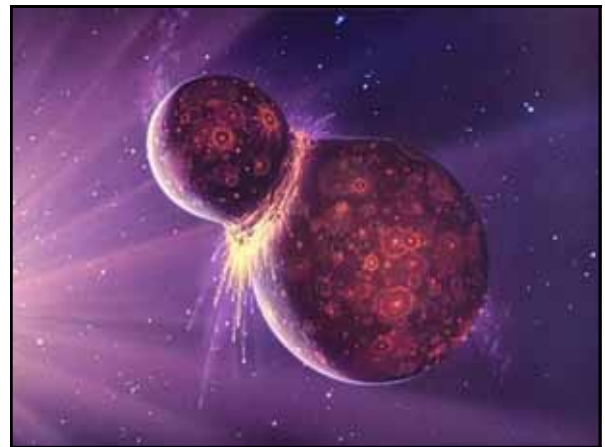
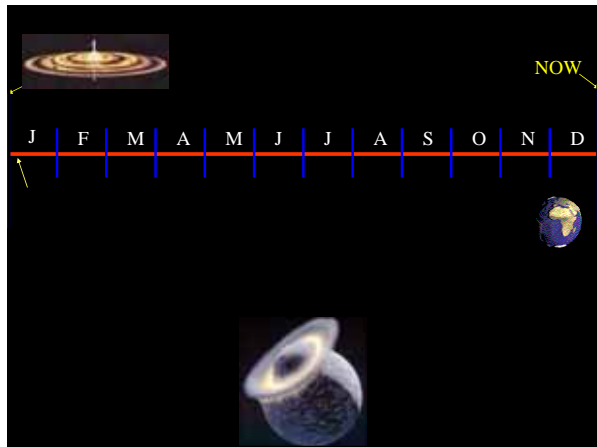
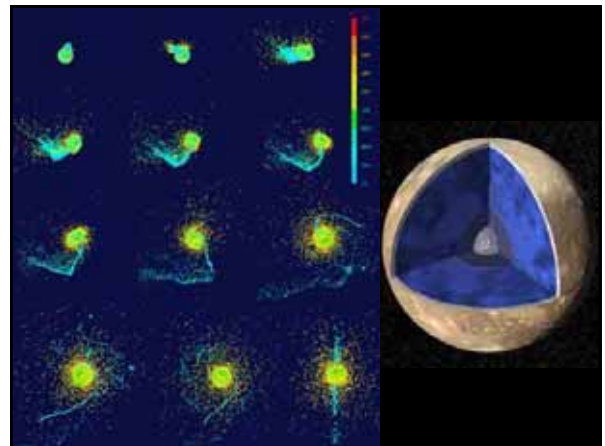
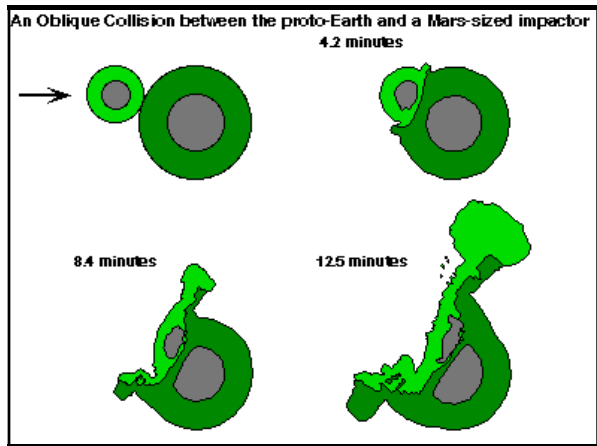
The diagram shows four stages (A, B, C, D) of the nebular hypothesis:

- A large, glowing, spherical nebula.
- The nebula flattens into a disk.
- The disk becomes more concentrated and turbulent.
- The final stage shows the Sun, planets (Mercury, Venus, Earth, Mars), and Asteroids.

Two hypothetical stages in the evolution of the early earth from (A) a large, low-density, homogeneously heterogeneous protoplanet to (B) a smaller, denser, internally differentiated planet. Note loss of light hydrogen (H) and helium (He) to space.

**A. INITIAL ACCRETION**: A large, diffuse sphere containing various elements (H, He, O, C, Si, Mg, Fe, Al, K, Na, Ca, S, Ni, Ti, Cr, Mn, Pb, Bi, Sn, Zn, Cu, Ag, Au, Pt, Pd, Rh, Ir, Os, Ru, Ni, Co, Ni, Fe, Mn, Mg, Al, Si, O, C, H, He, Ne, Ar, Kr, Xe, Rn).

**B. CONTRACTION AND DIFFERENTIATION**: A smaller, denser sphere with a central core (Fe, Ni) and an outer shell (O, Si, Mg, Al, Ca, S, K, Na, H, He, Ne, Ar, Kr, Xe, Rn). Arrows indicate the loss of H and He to space.





## Oldest Rocks Found on Earth

- Acasta Gneiss from the Canadian Shield (NW Territories near Great Slave Lake)
- 4.055 Billion years old (505 My after Earth origin)
- Previously oldest rocks from Greenland (lightly metamorphosed ss/sh) at 3.8 billion



## Oldest Mineral Found on Earth

- A zircon crystal from the Jack Hills of Western Australia has been dated at 4.4 Ga
- Gives evidence of water

