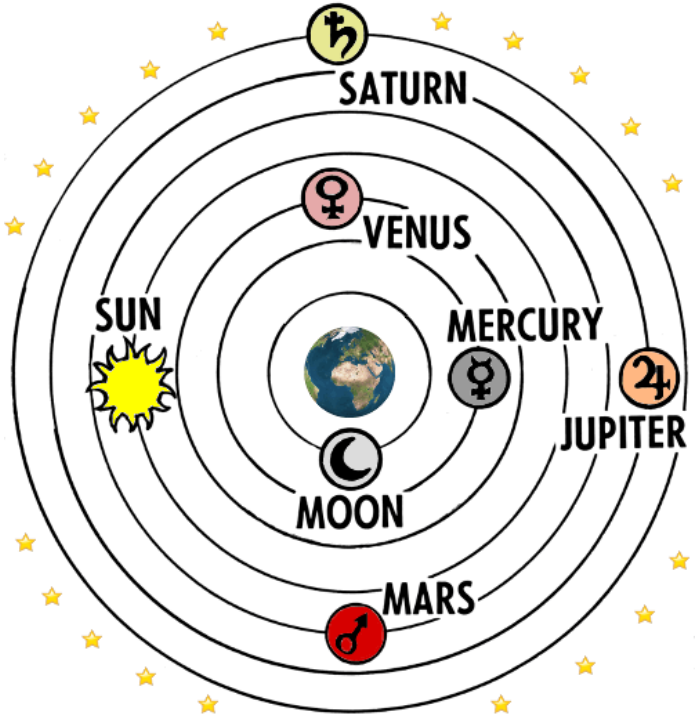
Solar System Part 1

Solar System: historical models

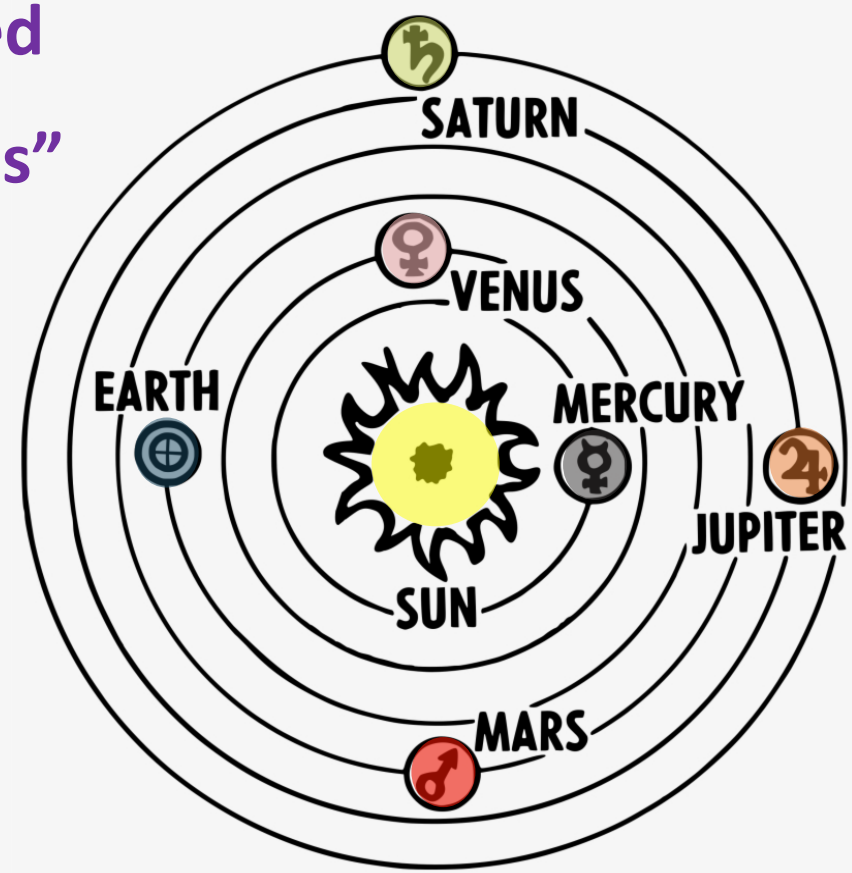


Geocentric

Aristotle (~350 BC),
Ptolemy (2nd century)

"naked eye planets"

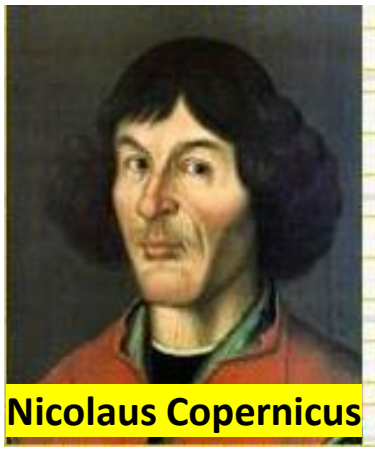
VS



Heliocentric

Aristarchus (~350 BC), Nicolaus Copernicus (15-16th century), Galileo Galilei, Johannes Kepler, Isaac Newton (16-17th century)

Solar System: Renaissance


Nicolaus Copernicus

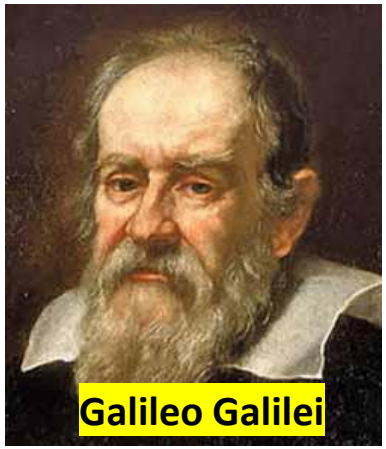

Tycho Brahe


Johannes Kepler

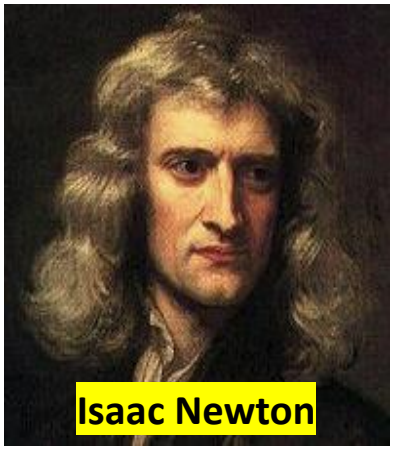
Formulated three laws of planetary motion.

Heliocentrism

Data!


Galileo Galilei

- Discovered four large moons of Jupiter (*bodies that did not orbit Earth*).
- Observed all phases of Venus (*not possible in Geocentric model*) and rotation of the Sun.


Isaac Newton

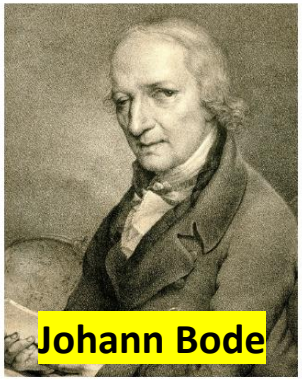
Formulated the **laws of motion and universal gravitation**.

Solar System: Modern Astronomy

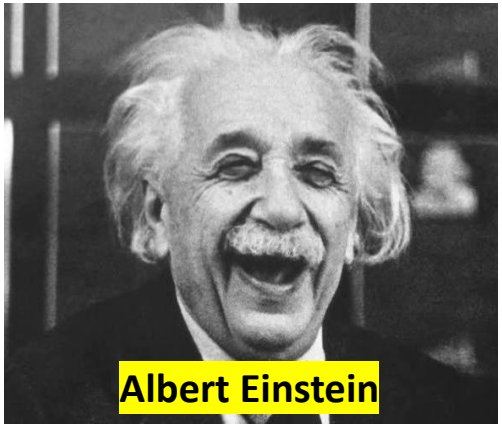

William Herschel

- Discovered *Uranus* and two of its moons.
- Created a catalog of over 2500 nebulae.
- Proposed theory of stellar evolution.
- Discovered IR light.


Johann Titius

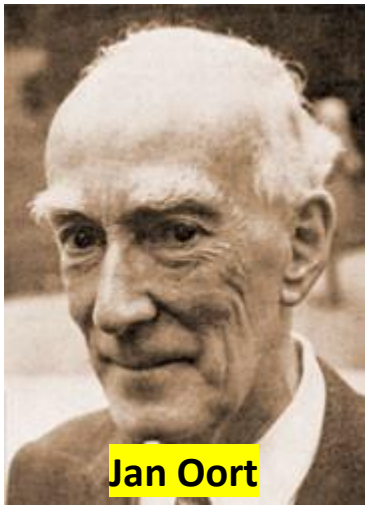

Johann Bode

Empirical Bode-Titius Law helped discover the asteroid belt.

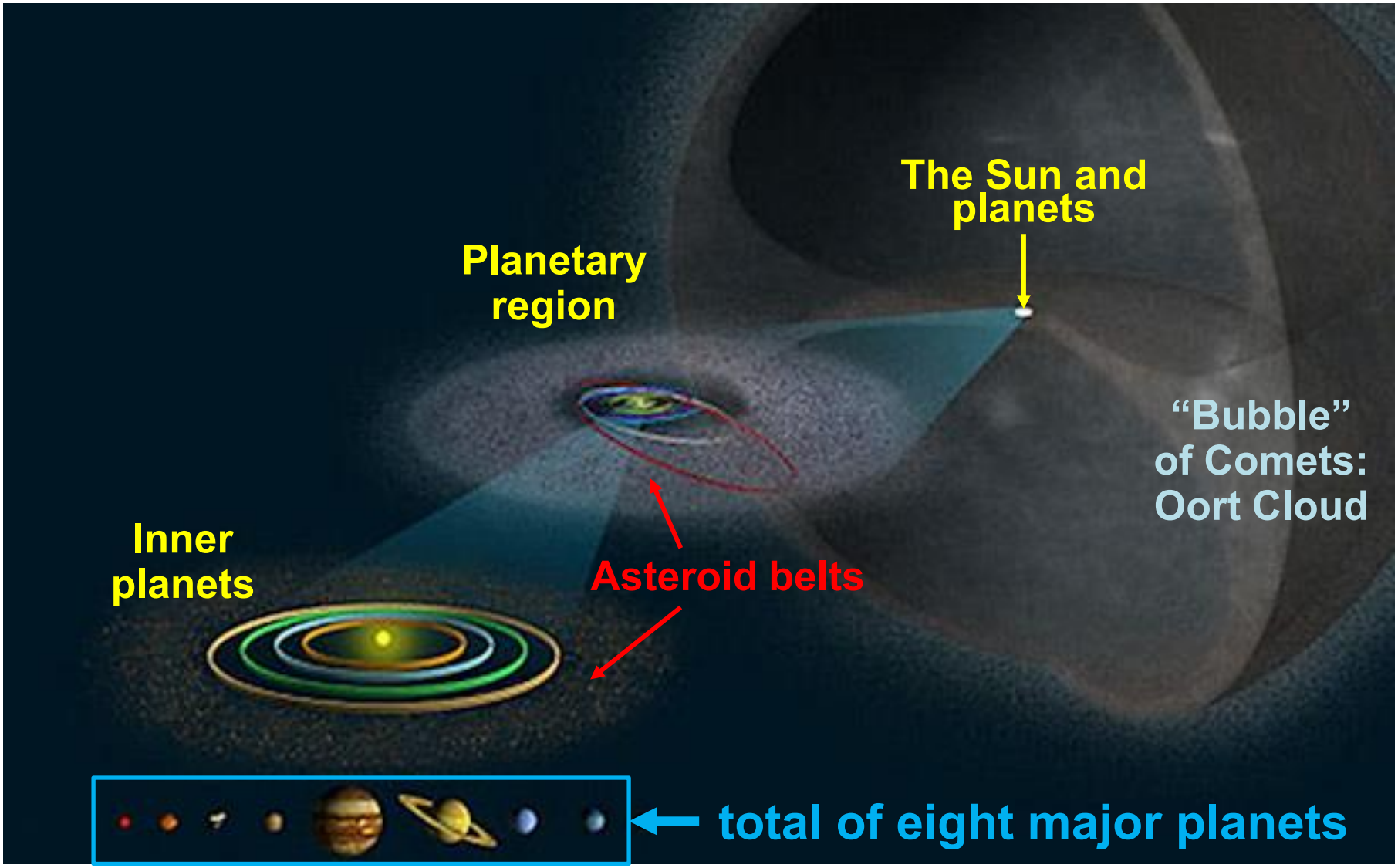

Albert Einstein

General Theory of Relativity helped explain the peculiar orbit of Mercury.

Theorized the existence of a vast *cloud of comets* at the Solar System's edge.


Jan Oort

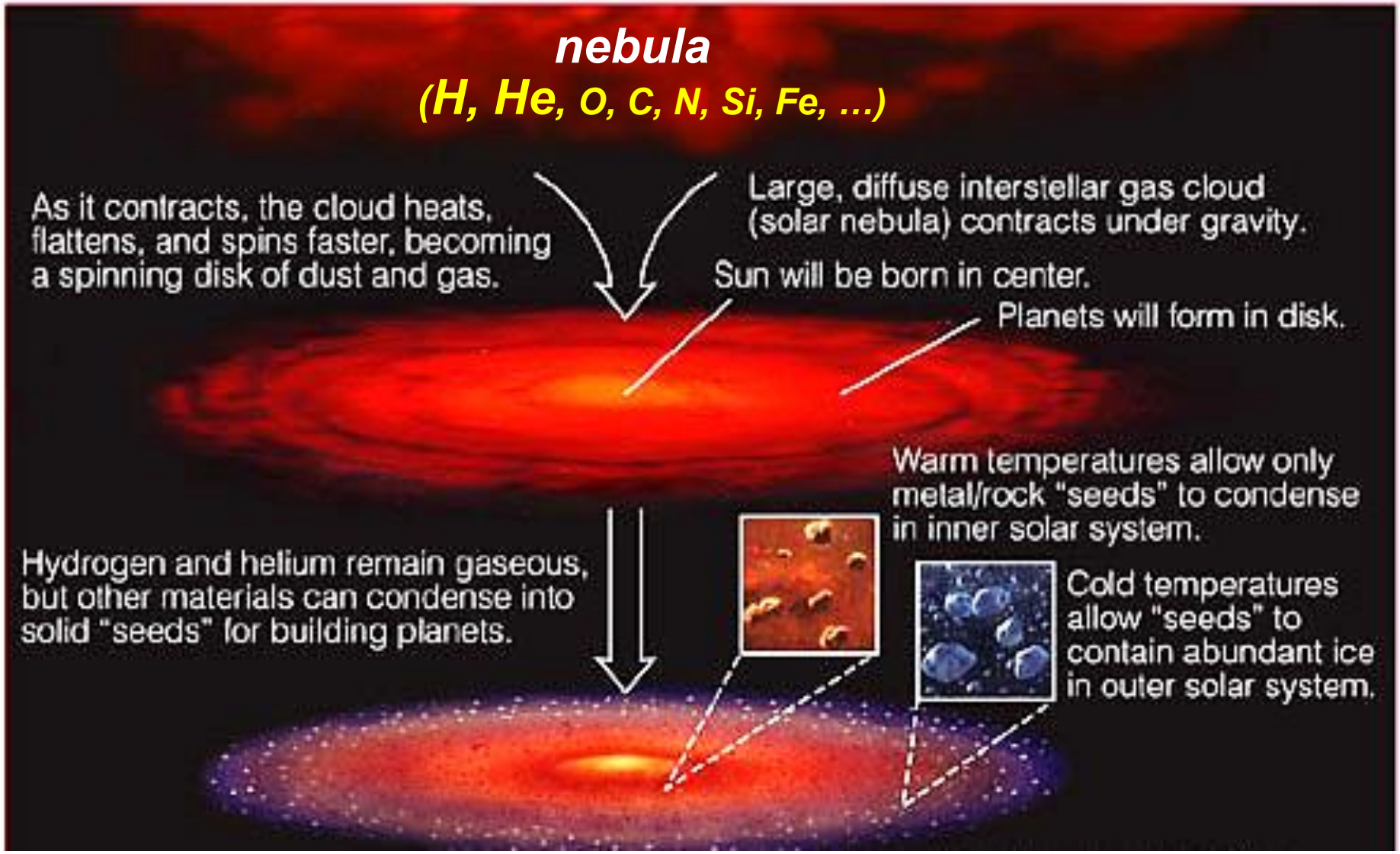
Solar System: architecture



The Formation of the Solar System

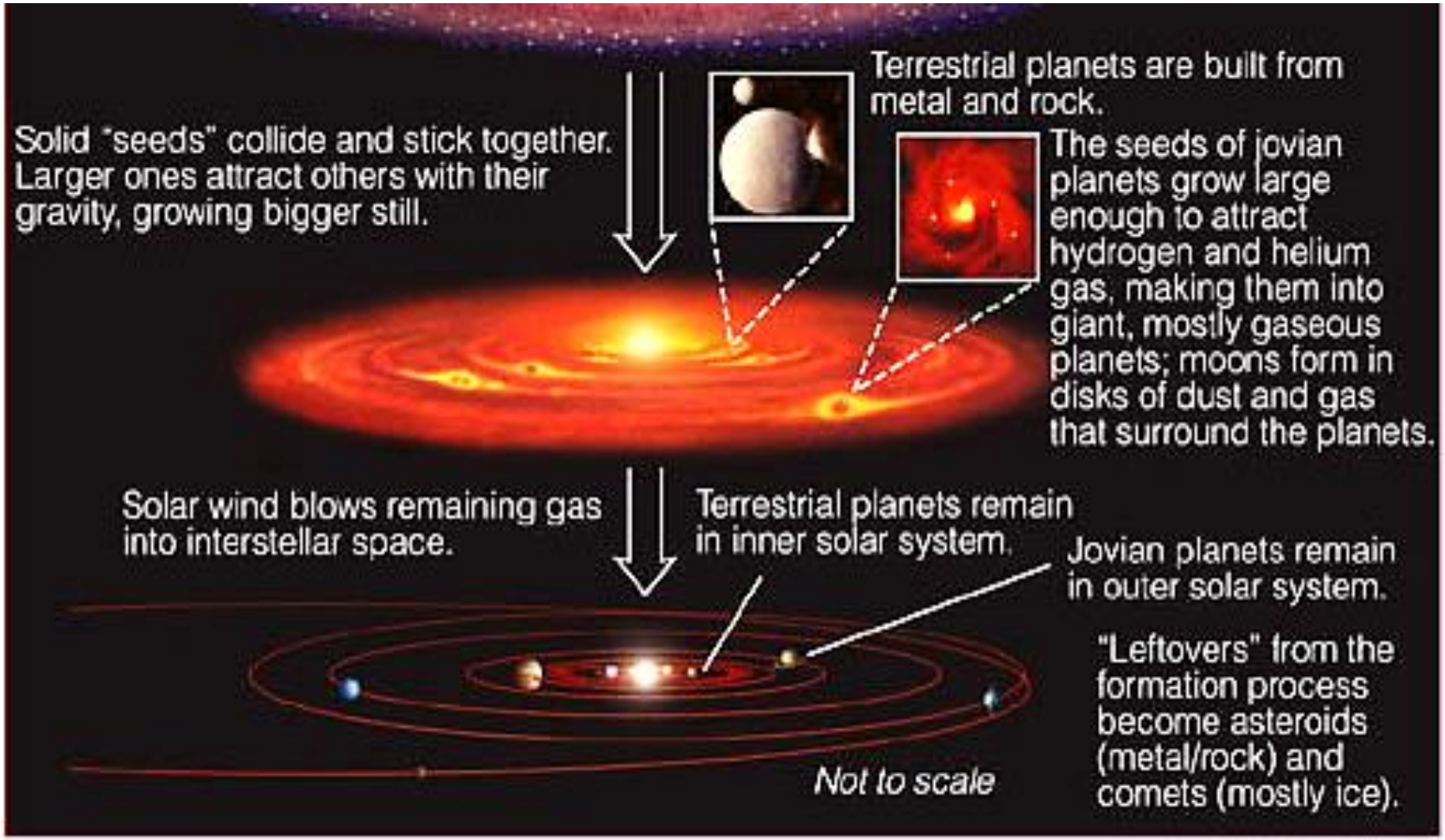
(~4.6 billion years ago)

Nebular Hypothesis



The Formation of the Solar System

The Sun, planets, moons, comets, asteroids are believed to form within 50-100 million years.



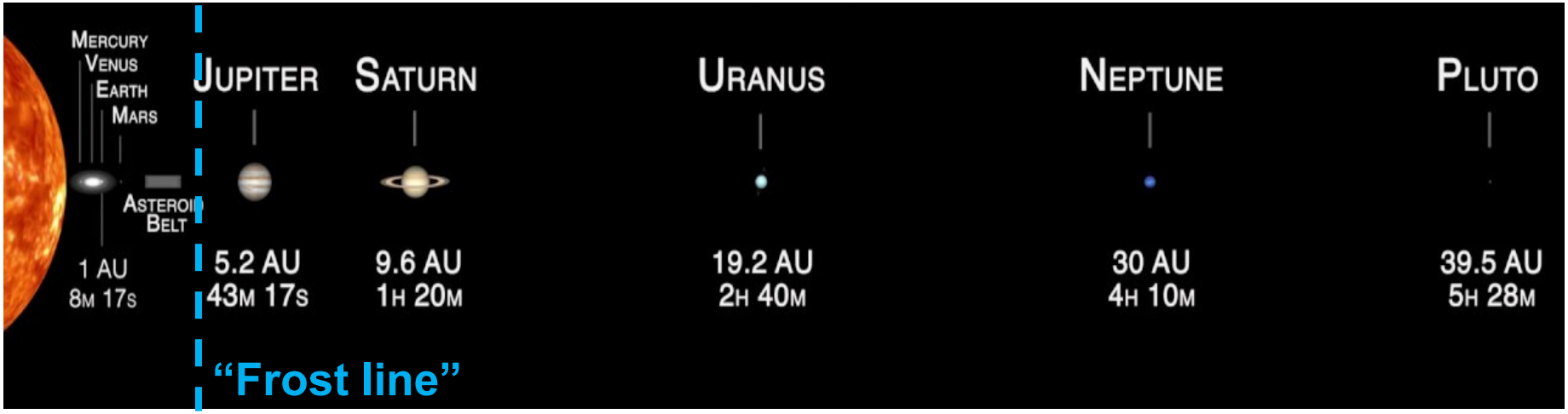
Solar System: inventory

- **Sun** **99.85% by mass**
- **Planets** **0.1 % by mass**
- **Satellites** ("moons") **and Rings** of planets
- **Asteroids** ("minor planets", small *rocky* bodies orbiting the Sun)
- **Comets** (small *icy* bodies orbiting the Sun)
- **Meteoroids** (rocky or metallic bodies smaller than 1 m)
- **Dust** (very small particles)
- **Solar Wind** (ionized gas escaping the Sun)

Solar System: distances

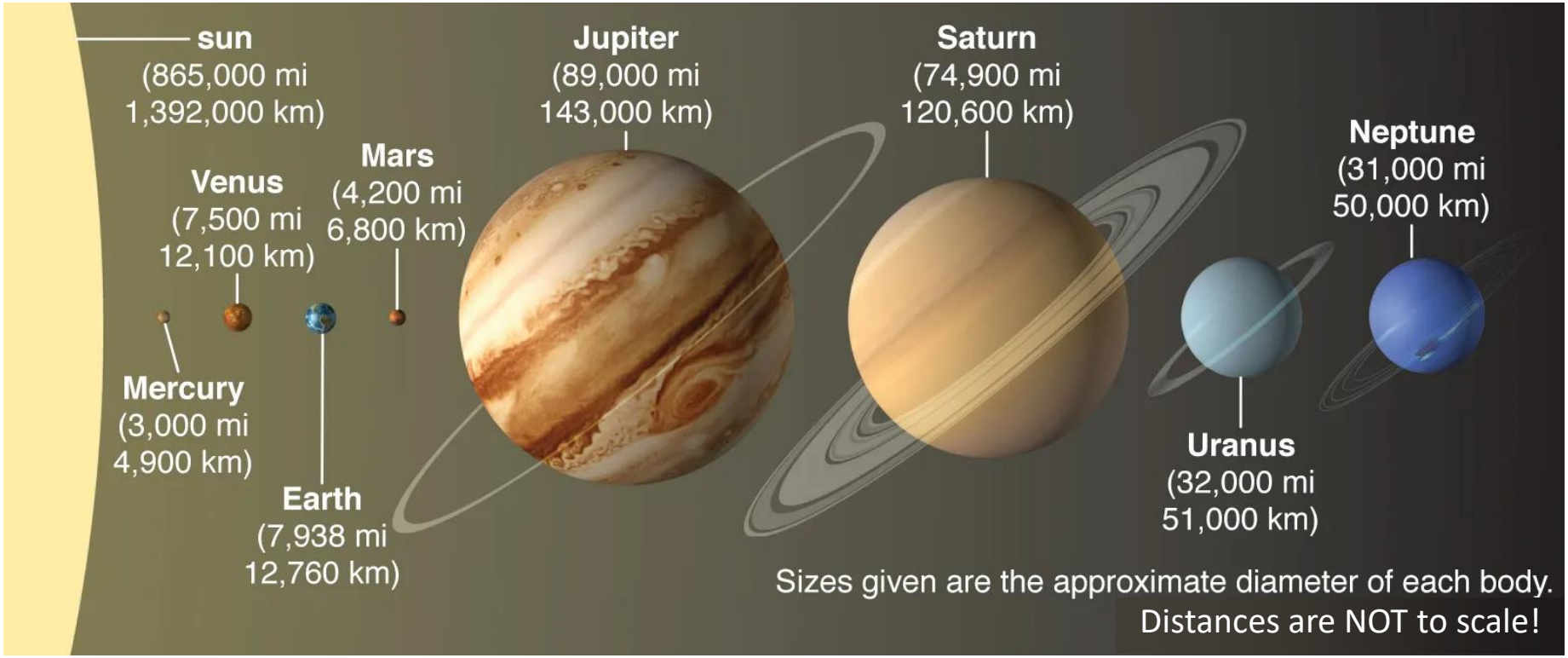
What units are used to measure distance in space?

- **1 Astronomical Unit (1 AU) = Average distance between the Earth and the Sun = 150 million km = 93 million miles**
- **1 Light Minute (Hour, Second) = Distance *light* travels in 1 minute (hour, second) = 18 million km = 11 million miles**



All distances shown to scale, all bodies x1000.

Sun and Planets: sense of scale



- **The Sun is about 100 times bigger than the Earth.**
- **Compared to the Earth by size: Mars is ~1/2, Mercury is ~1/3, Jupiter is ~11x, Uranus is ~4x.**