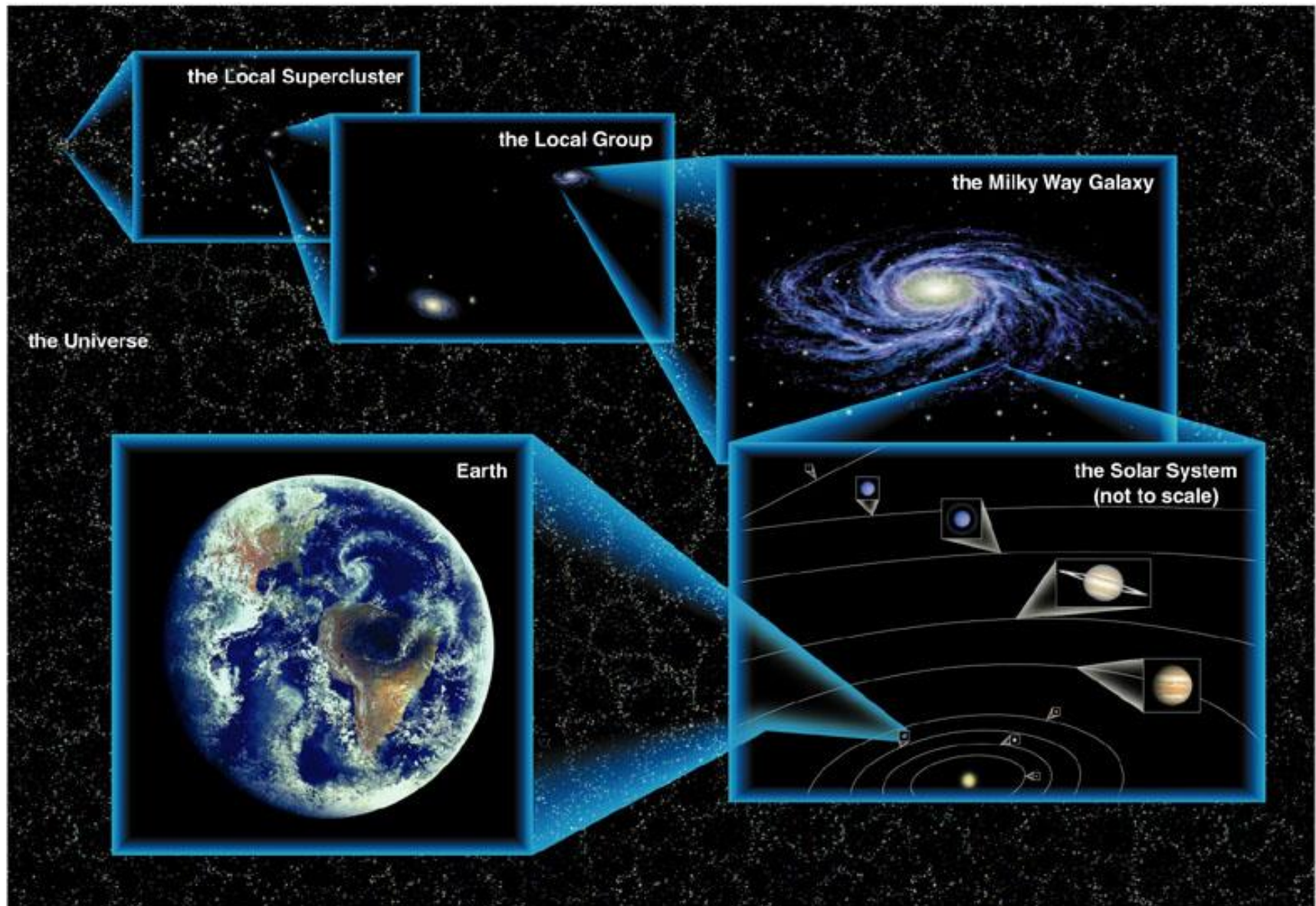


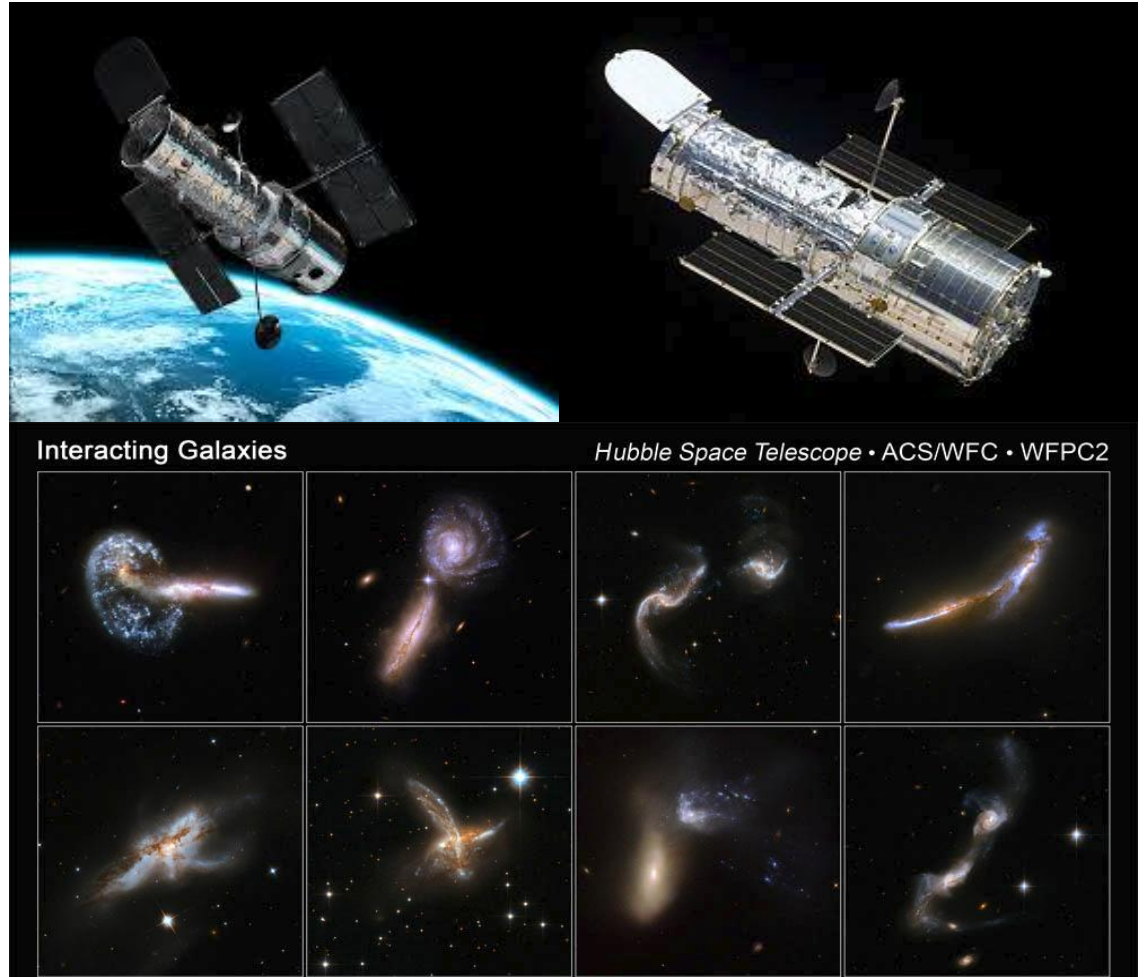
Earth in the Universe



Telescope: Past and Present



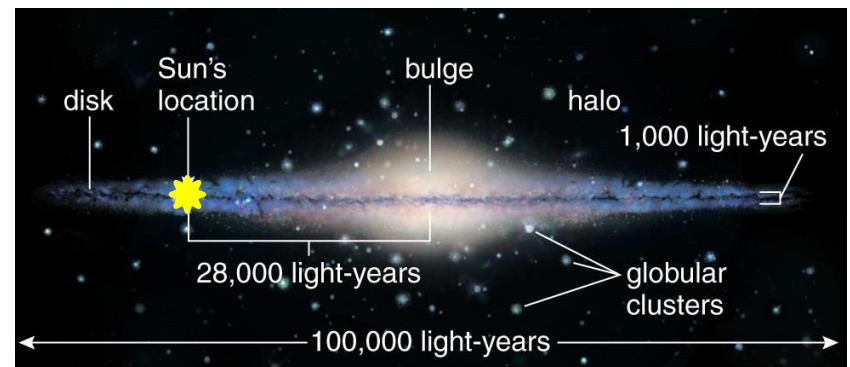
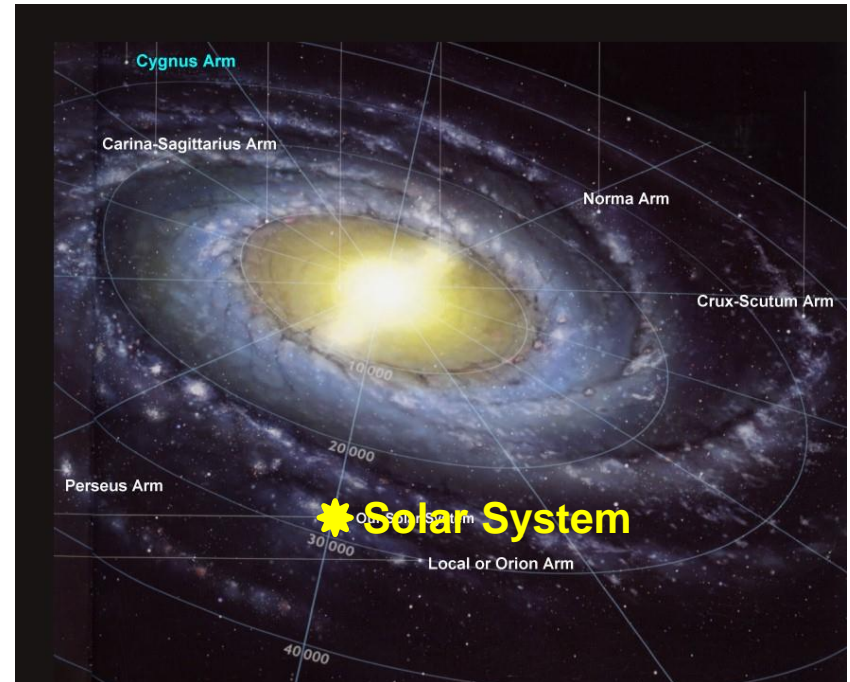
Two of **Galileo's first telescopes**, 10x and 20x and his ink rendering of the Moon.



Hubble Space Telescope (launched in 1990, expected to last until 2030-2040) allows observations in near-UV, visible, and near-IR spectra.

Our Galaxy: the Milky Way

- A galaxy is a large, massive system consisting of stars, an interstellar medium of gas and dust, stellar remnants, and dark matter, all bound together by gravity.
- Probably **~200 billion galaxies** in the observable Universe.
- The Milky Way is a **barred spiral galaxy** (we think!) some ~100,000 light-years in diameter, which contains **100–400 billion stars**. It may contain at least as many planets as well!
- Most galaxies in the Universe appear to be the size about 1/100 of the Milky Way with only a few billion stars.



1 light-year = 5.88 trillion miles

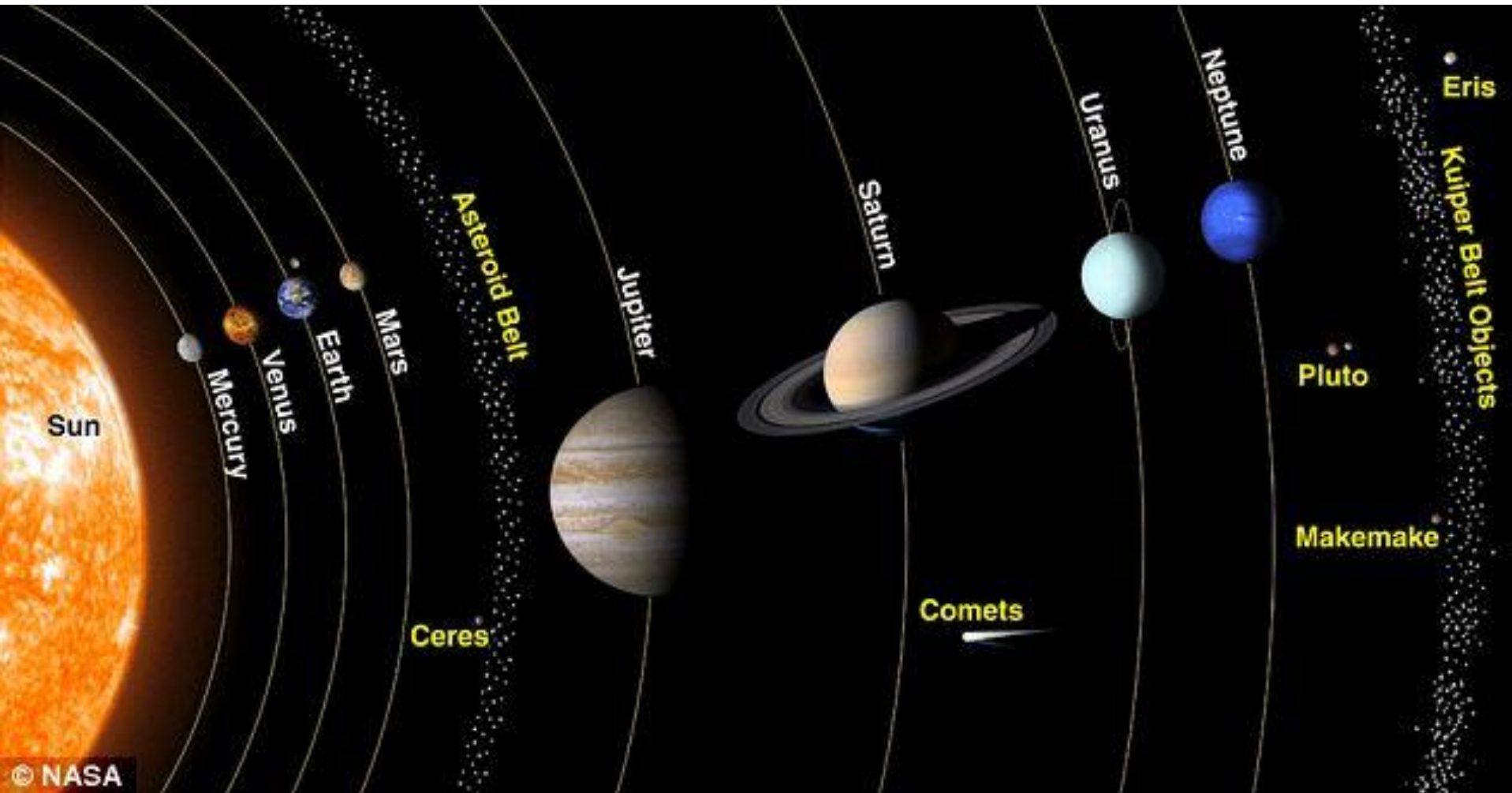
Our Local Group of Galaxies

The total size of the Local Group is **10 million light-years across**.

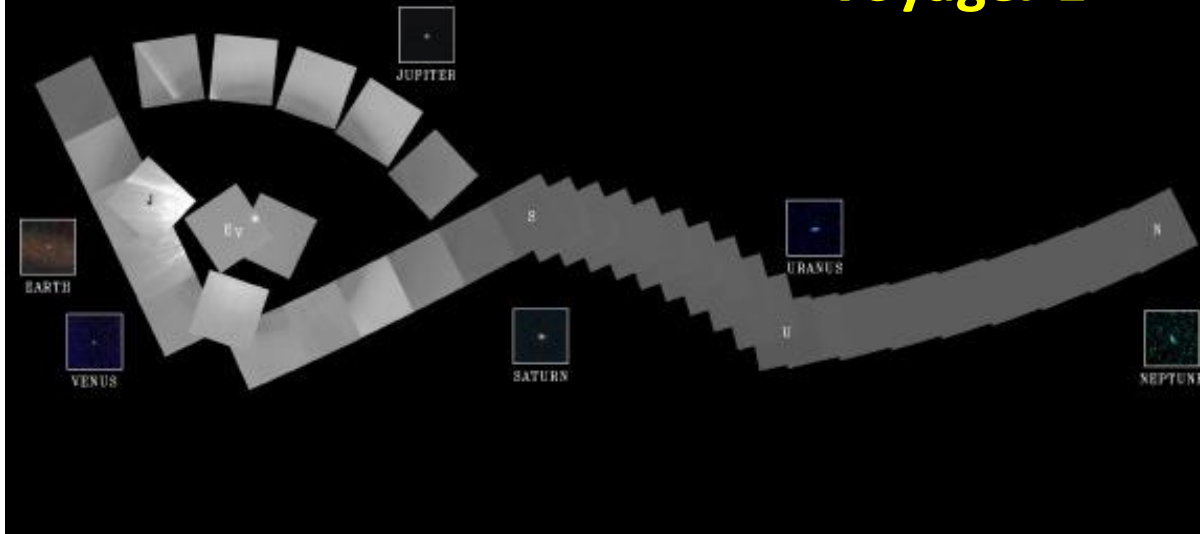


It contains **more than 50**
(mostly *dwarf*) **galaxies**.

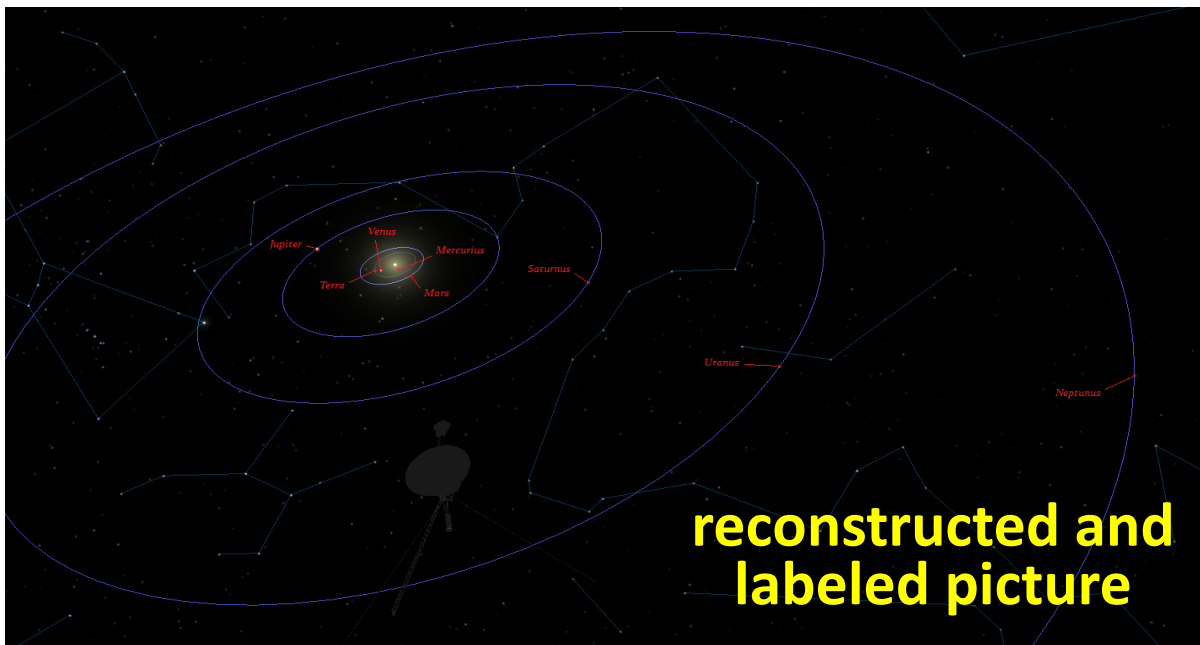
Solar System



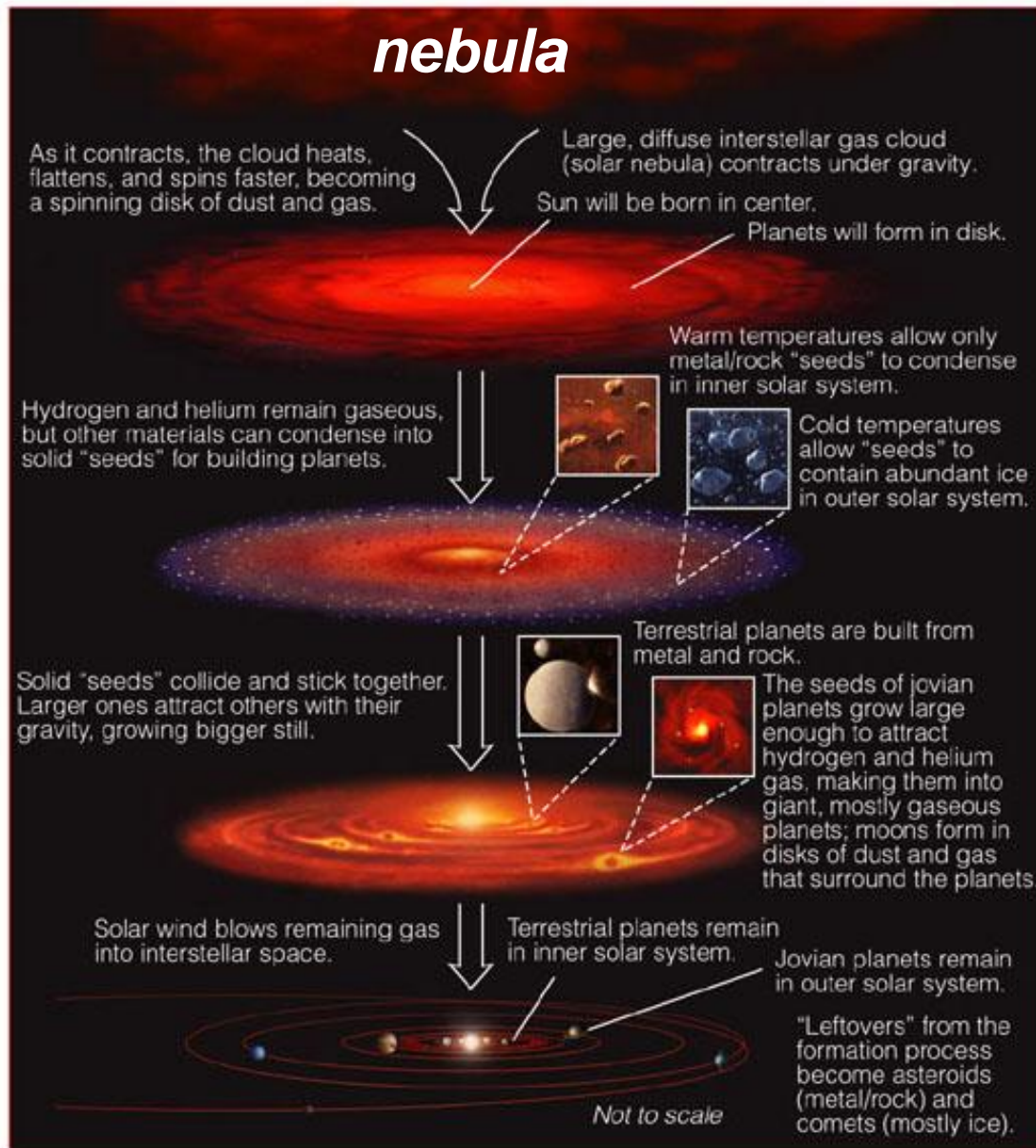
images taken by Voyager 1



On **February 14, 1990**, the cameras of **Voyager 1** pointed back toward the Sun and took a series of pictures of the Sun, Earth and other planets, making the first ever **'family portrait'** of the **Solar System** as seen from the **outside**.



The Formation of the Solar System



Solar System
formed about **4.6 billion years ago**,
when gravity pulled
together low-
density **cloud**
of interstellar gas
and dust (called
a **nebula**).

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