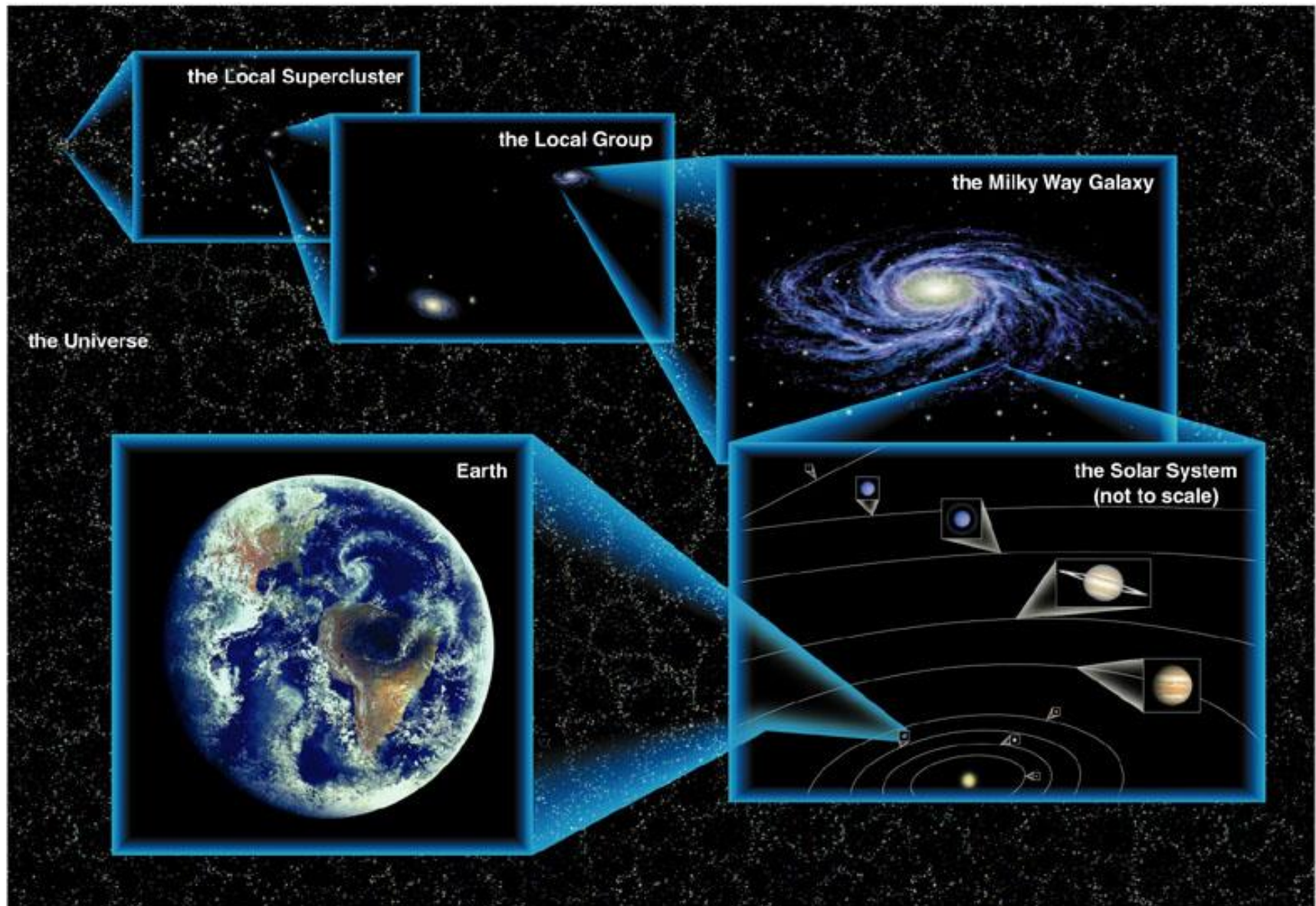


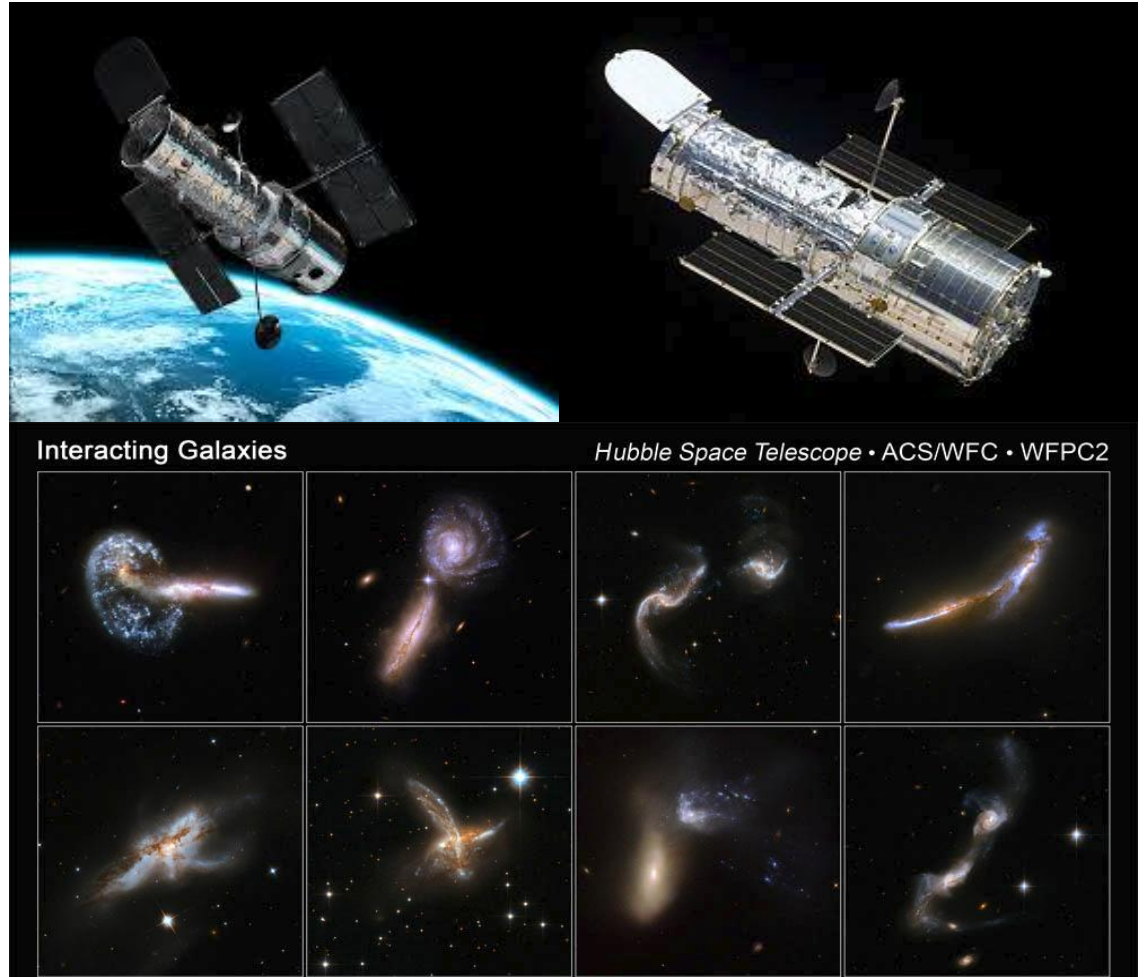
# Earth in the Universe



# 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 Local Group of Galaxies

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

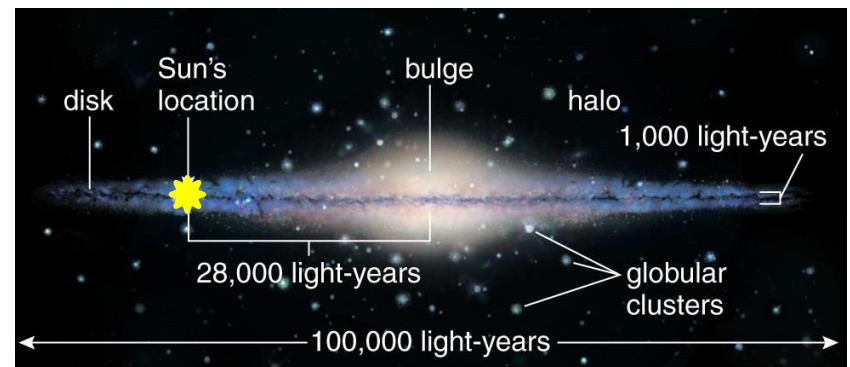
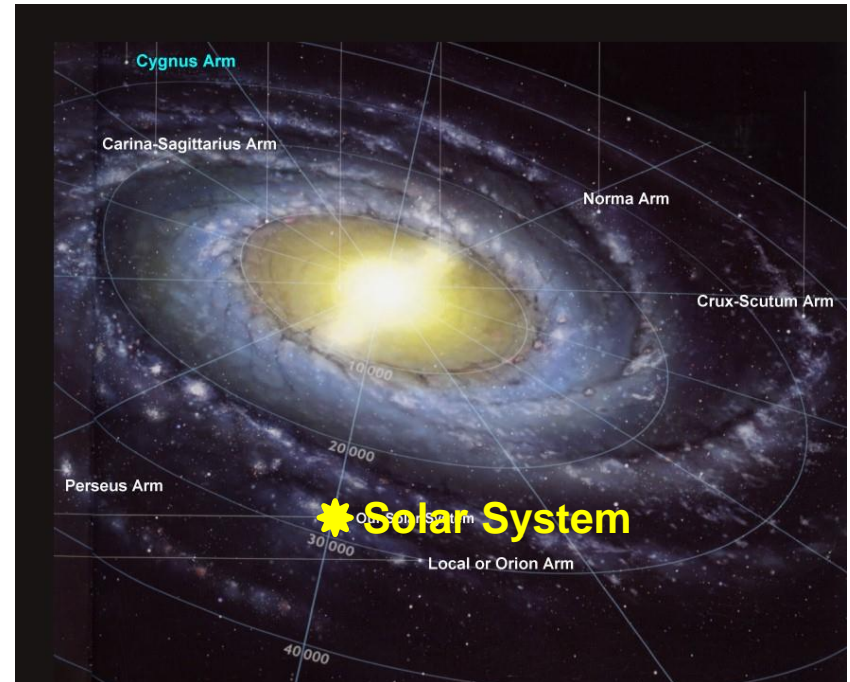


It contains **more than 50**  
(mostly *dwarf*) **galaxies**.



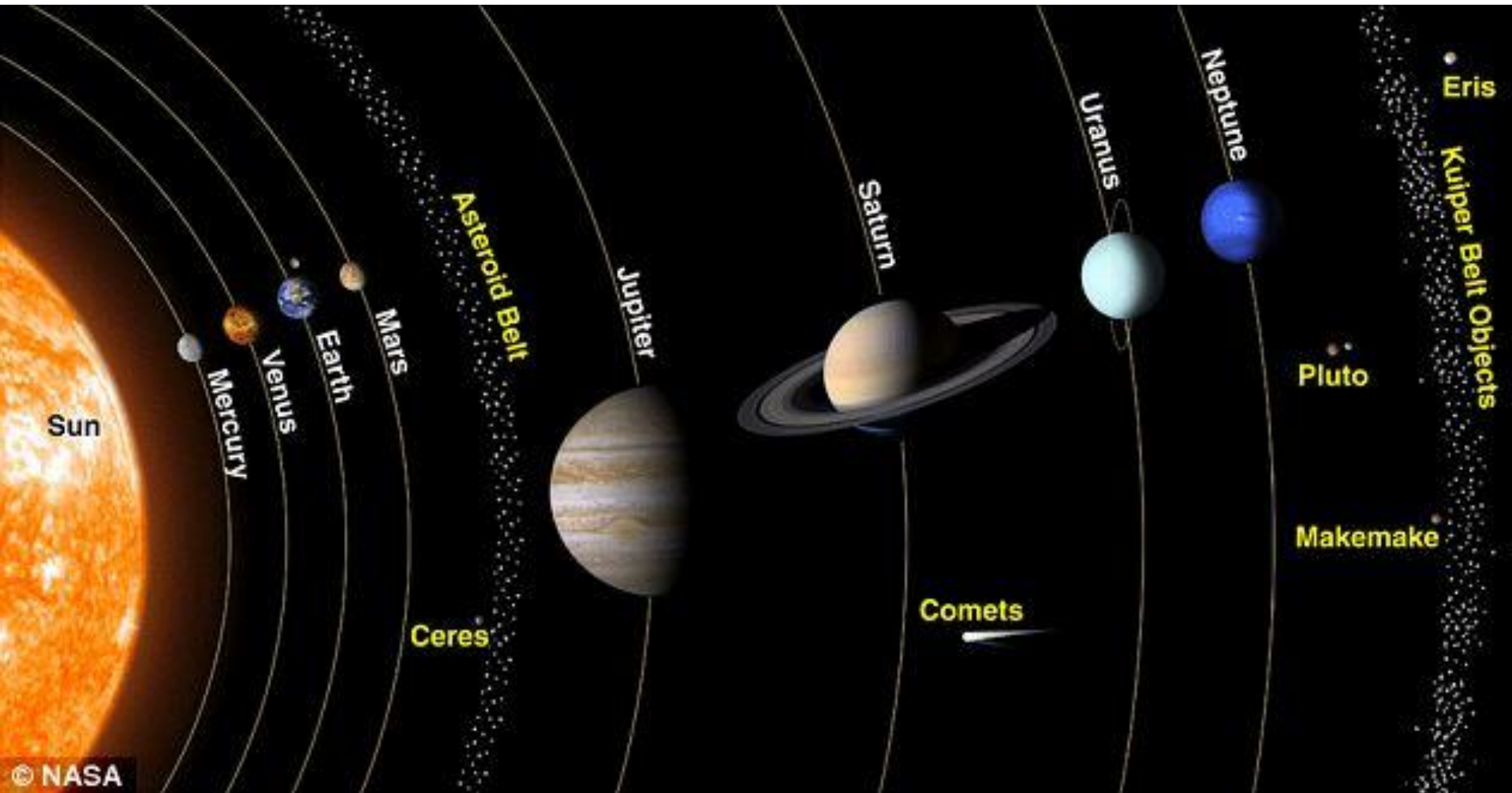
# Our Galaxy: the Milky Way

- 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.

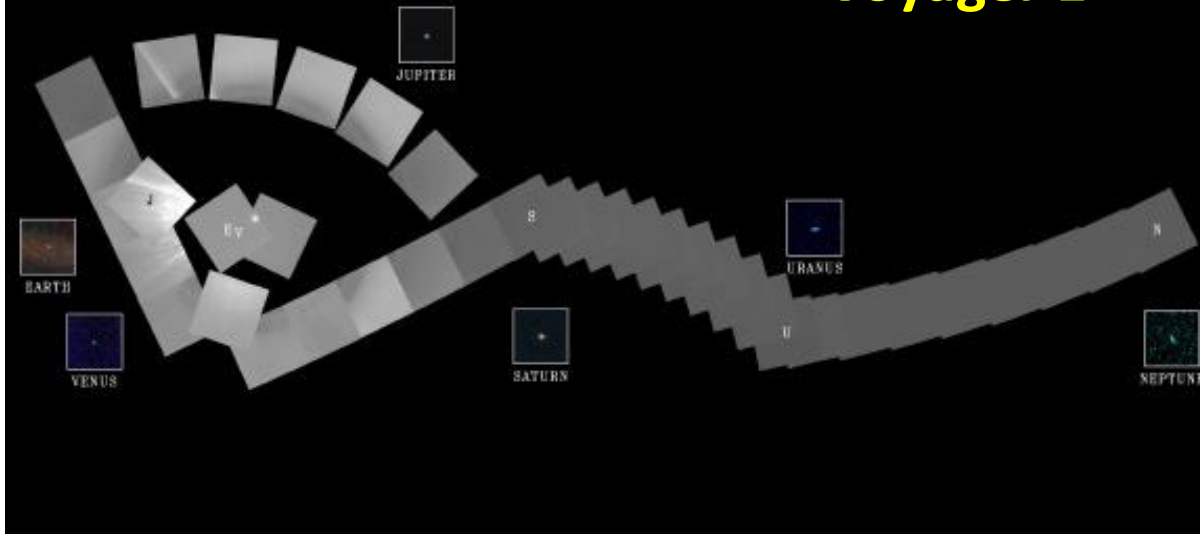


**1 light-year = 5.88 trillion miles**

# Solar System

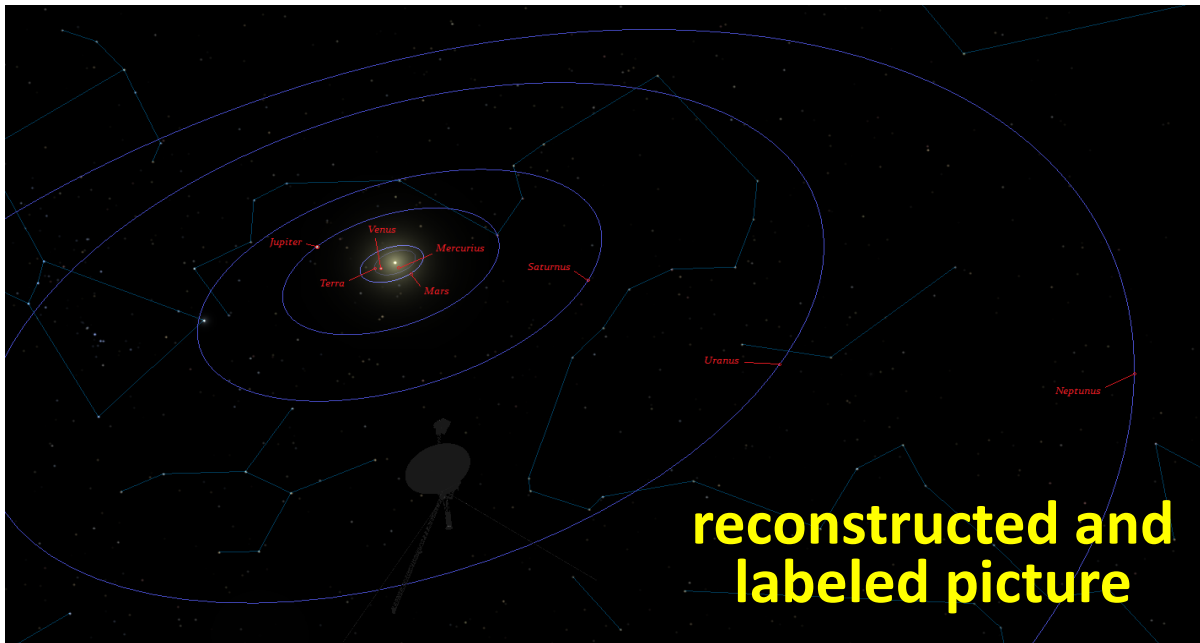


## images taken by Voyager 1



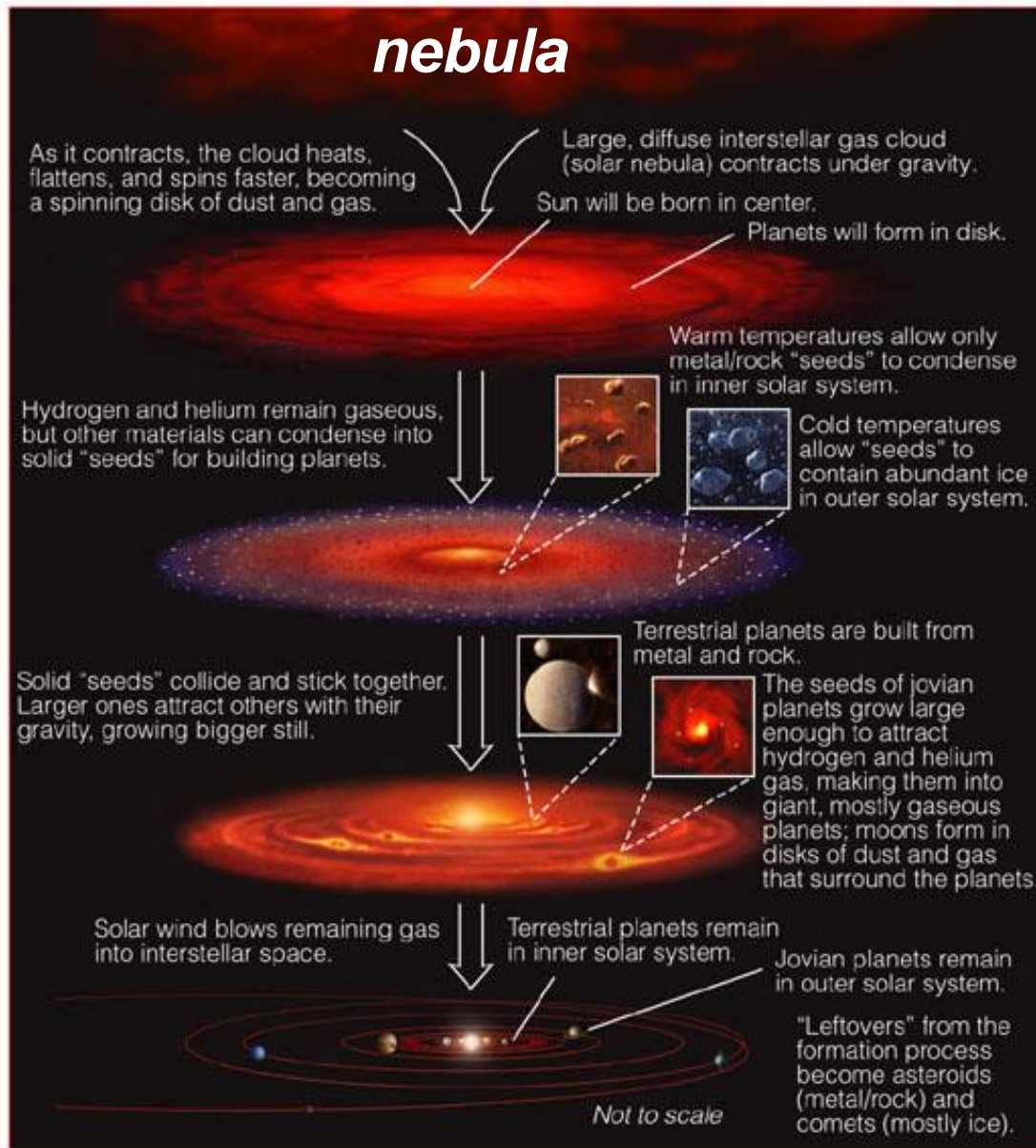
On **February 14, 1990**, the cameras of **Voyager 1** pointed back toward the Sun and took a series of pictures of the Sun, Earth and other planets, making the first ever **'family portrait'** of the **Solar System** as seen from the **outside**.

## reconstructed and labeled picture





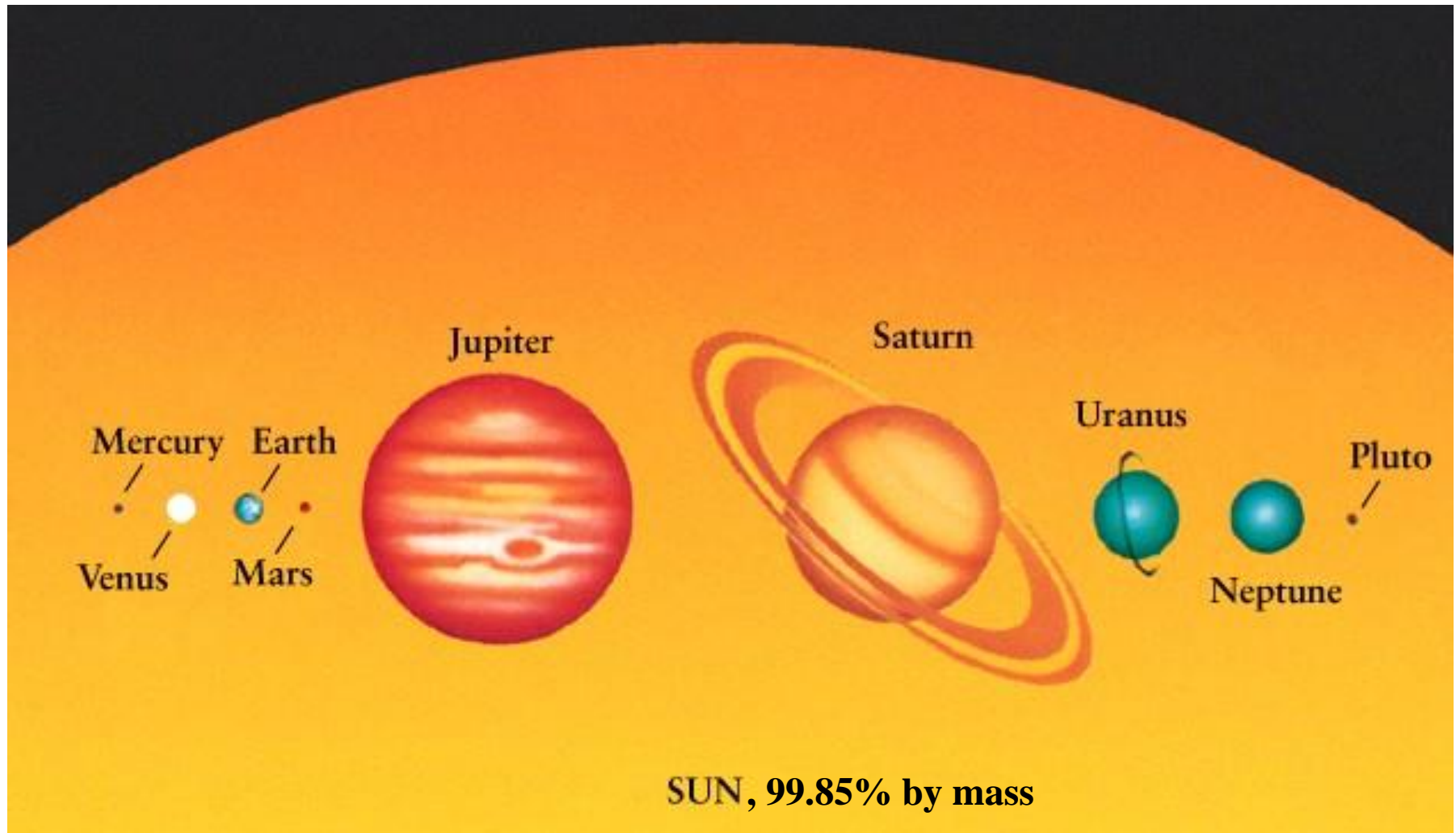
# The Formation of the Solar System



**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.**

# Sun and Planets: sense of scale





# **Additional Info**

**Solar System Animation:**

**<https://www.youtube.com/watch?v=z8aBZZnv6y8>**

**(copy the link into your browser to watch)**