

Doppler Effect & Solar System/Beyond

Unit 10 – Ch 23

Universe is ***EXPANDING***

■ **REVIEW:**

- **Cosmic Background Radiation** – **Low temp** waves of original waves indicating **explosion** occurred
- **Gravity** – Responsible for movement of **dust** clouds (**nebula**) to form **planets, stars, solar systems, galaxies**

Universe is **EXPANDING**

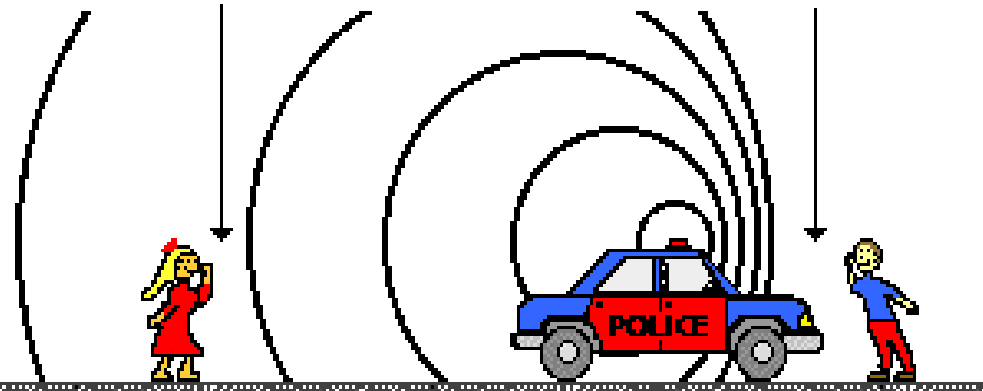
◆ **DOPPLER EFFECT (SHIFT):** Change in **frequency** of waves moving **relative** to its source

- Stars moving **AWAY** from observer = **RED** shift
- Stars moving **TOWARD** observer = **BLUE** shift
- **Greater** the shift = **Faster** the speed

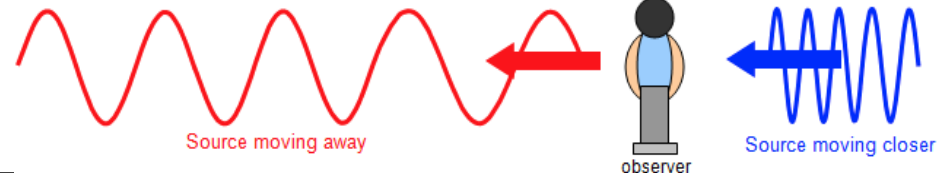
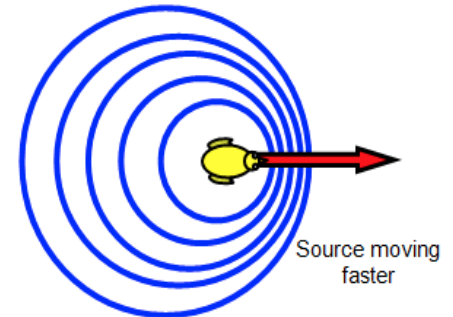
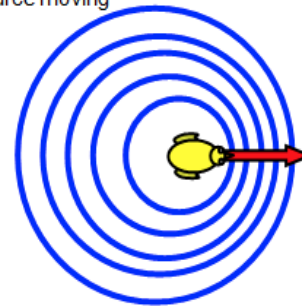
The Doppler Effect for a Moving Sound Source

Long Wavelength
Low Frequency

Small Wavelength
High Frequency



Source moving

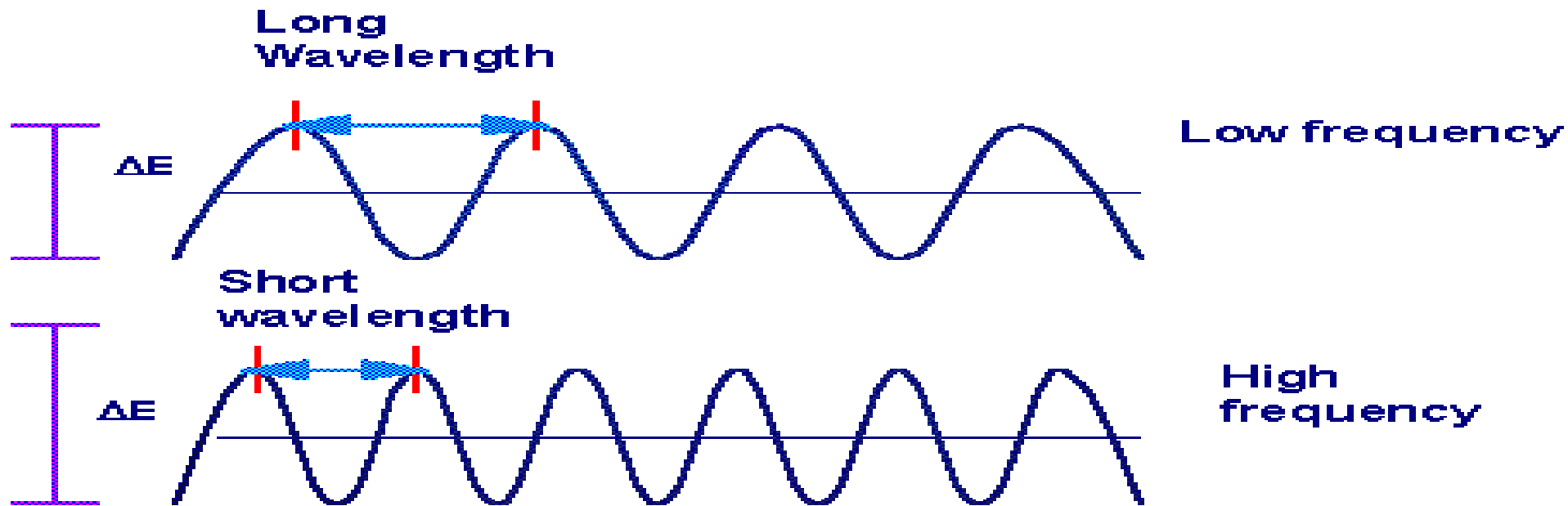


Putting it Together...

■ Inversely Proportional:

- Wavelength **increases** = Frequency **decreases**

Electromagnetic Radiation



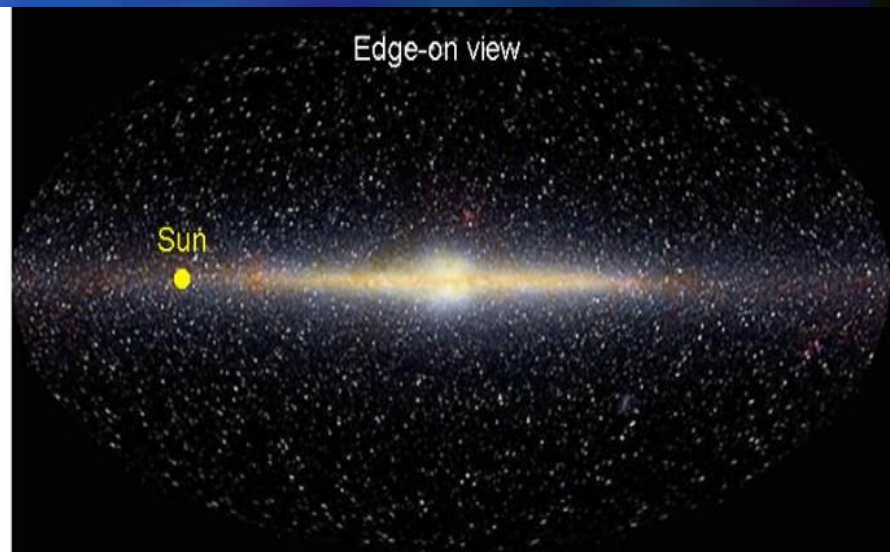
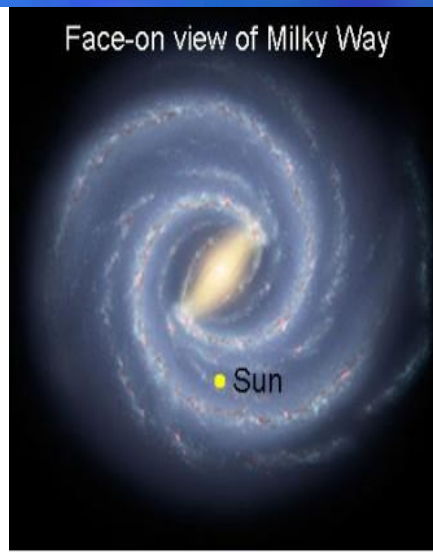
Solar System & Beyond

Celestial Comparisons

- SIZE of celestial object(s) is biggest distinction in space:
 - Earth = One *planet* in **Solar System**
 - Solar System = ~300 Billion stars in **Milky Way Galaxy**, but one of ~40 *billion* solar systems in galaxy
 - Milky Way Galaxy = One of ~100 *billion* in **Universe**

Earth Facts

- Distance to Sun: ~92,000,000 miles
- Age of Earth: ~4.6 Billion Years (same as solar system)
- Shape: **Oblate Spheroid** - Slight bulge at **equator** due to its gravitational **rotation**
- Location within Galaxy: **Within** one of the **spiral arms** (Orion Arm)



Terrestrial Planets

■ Inner 4 Planets:

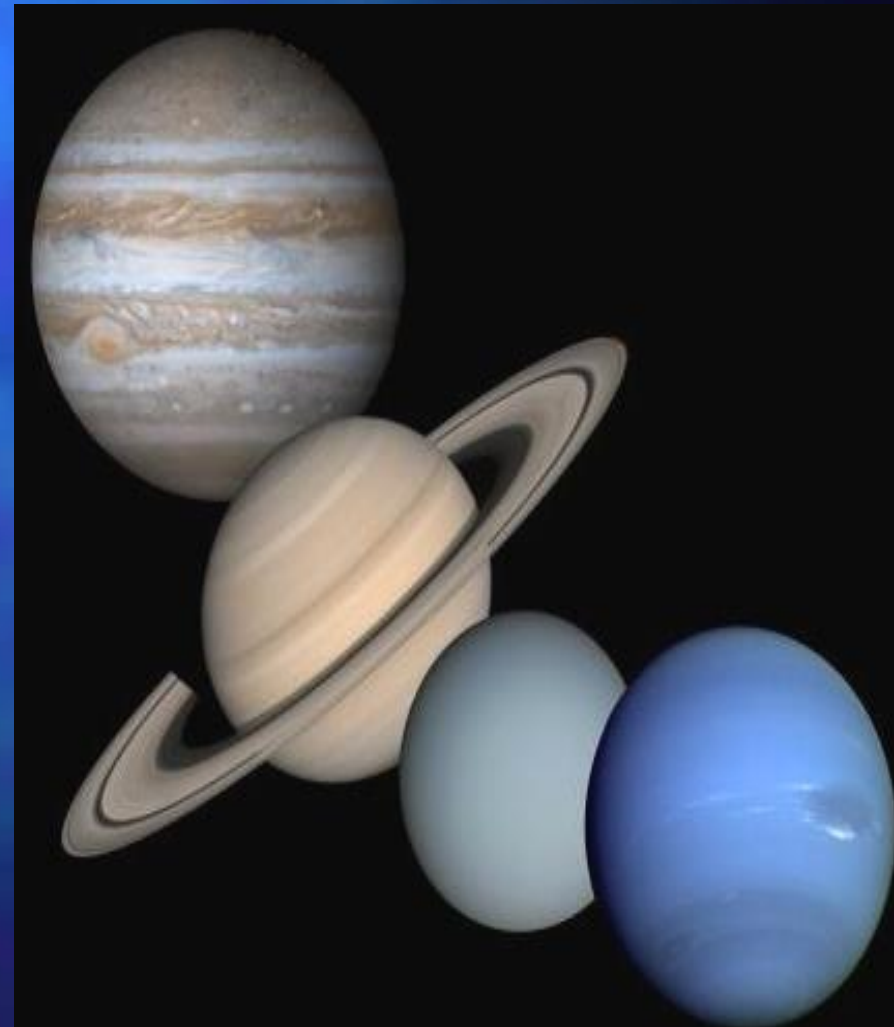
- Mercury
- Venus
- Earth
- Mars
- Small, solid, rocky surfaces



Jovian (Gas) Planets

■ Outer 4 Planets:

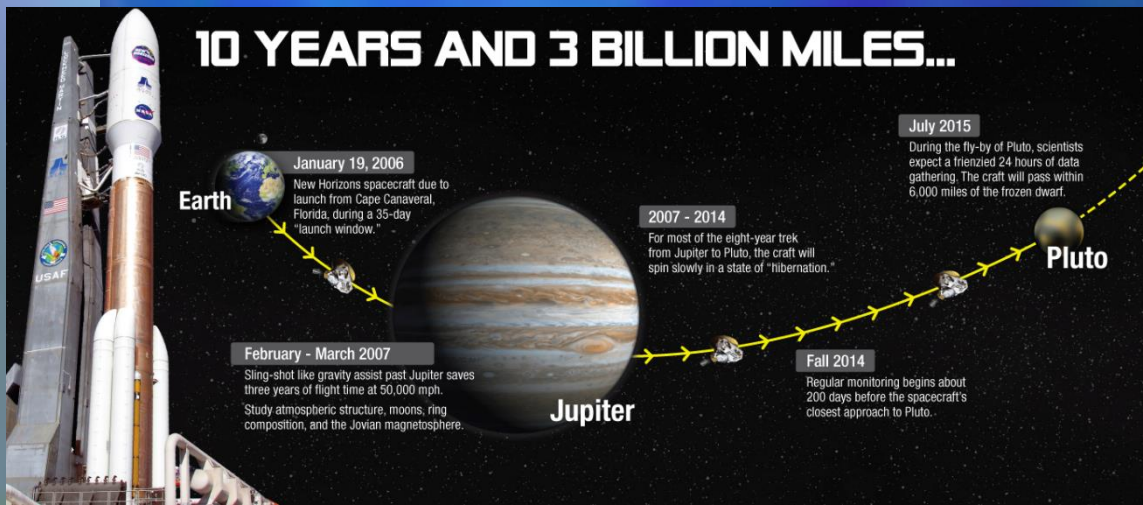
- Jupiter
- Saturn
- Uranus
- Neptune
- Larger, gaseous, and *lacks* solid surfaces



PLUTO ?

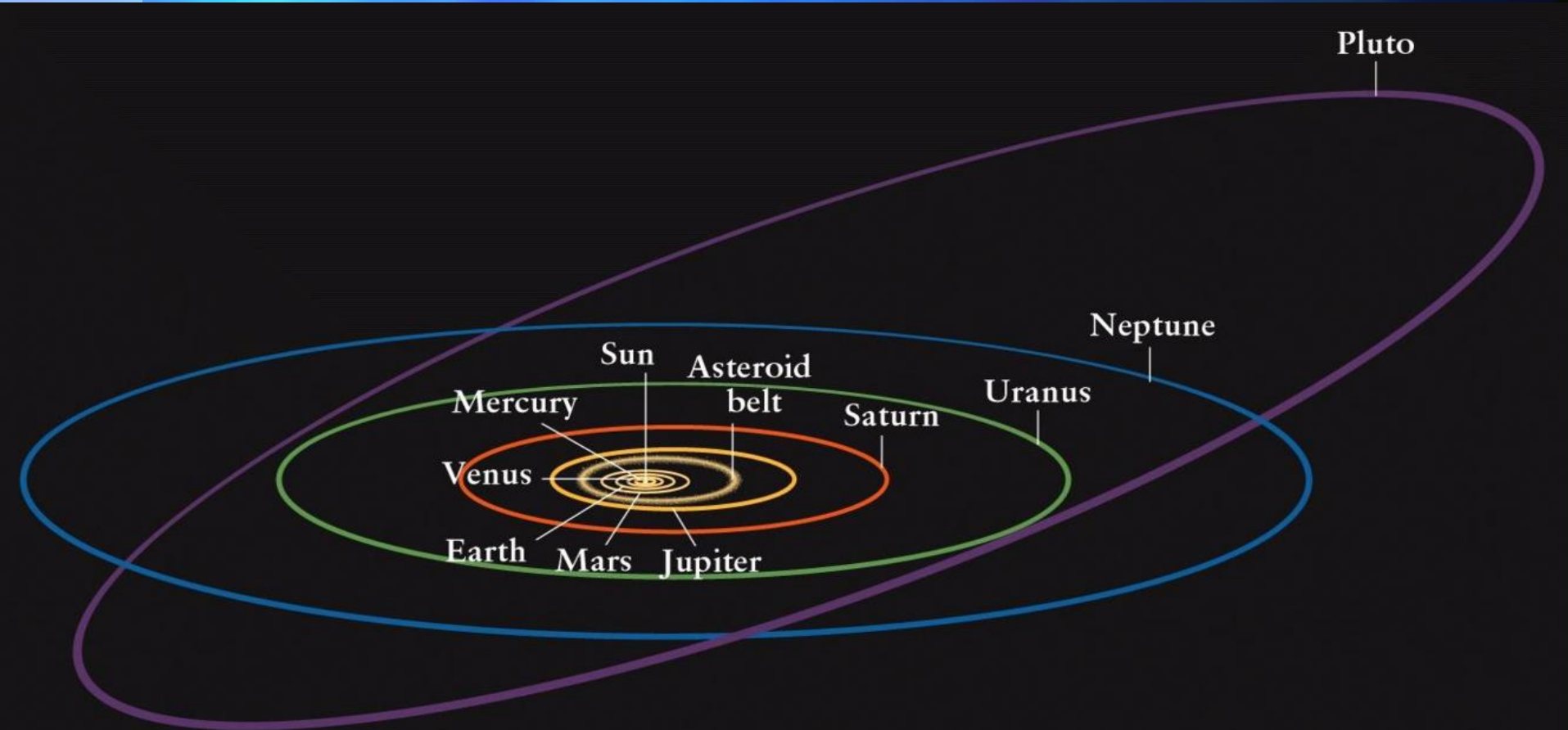
■ Not a Planet (2006):

- **DWARF PLANET**
- Orbit **NOT** in same plane as all other planets
- Orbit reaches **Kuiper Belt** – Region of *trillions* of **icy** comets and asteroids
- **Not enough mass** to clear celestial objects from its orbit
 - Pluto – 0.07 times mass of other objects in orbit
 - Earth – 1.7 million times mass

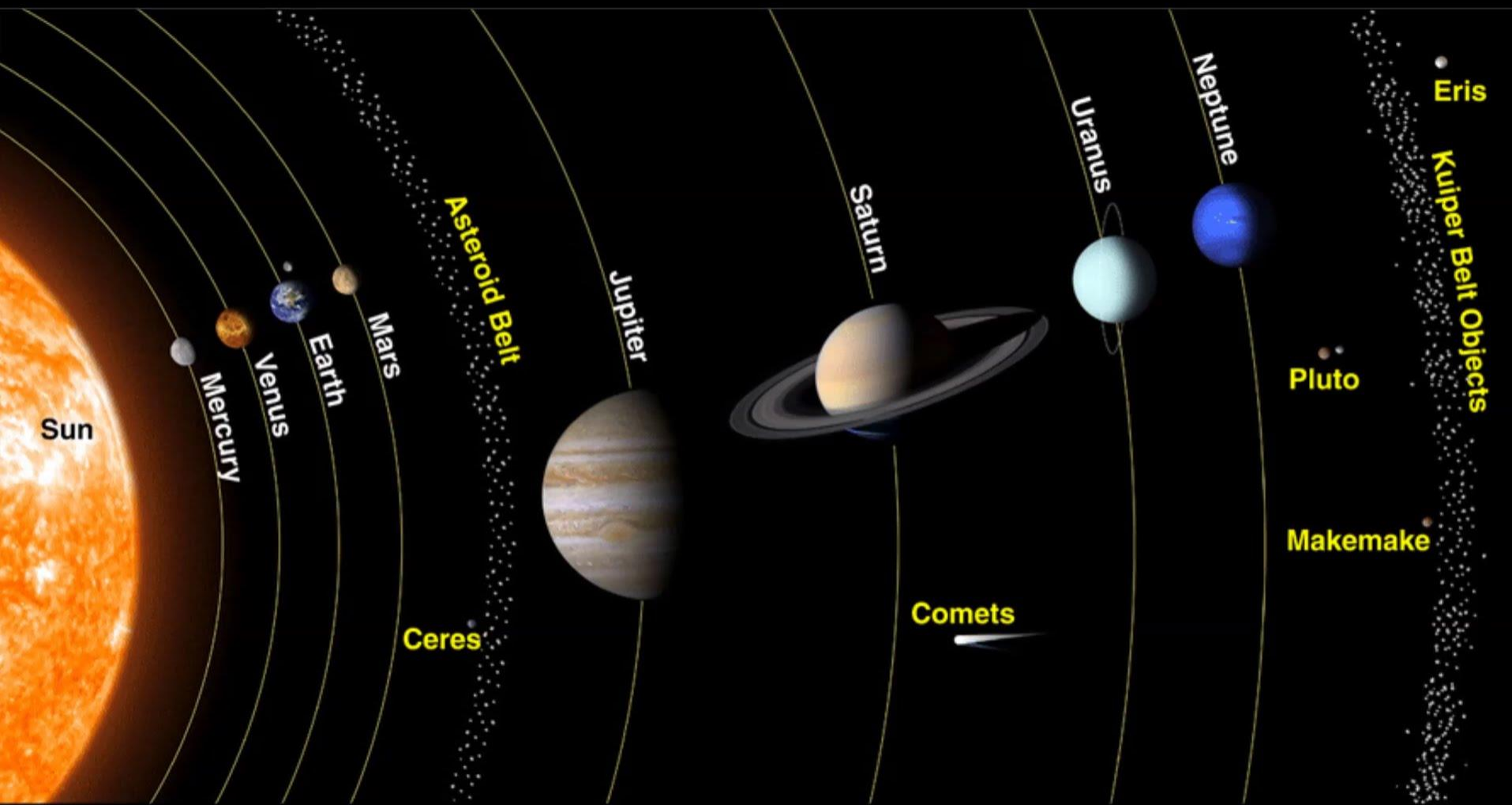


What's the Difference?

■ SIZE & COMPOSITION



Our Solar System



Milky Way Galaxy

CENTRAL BLACK HOLE

MOLECULAR CLOUDS

GALACTIC BULGE

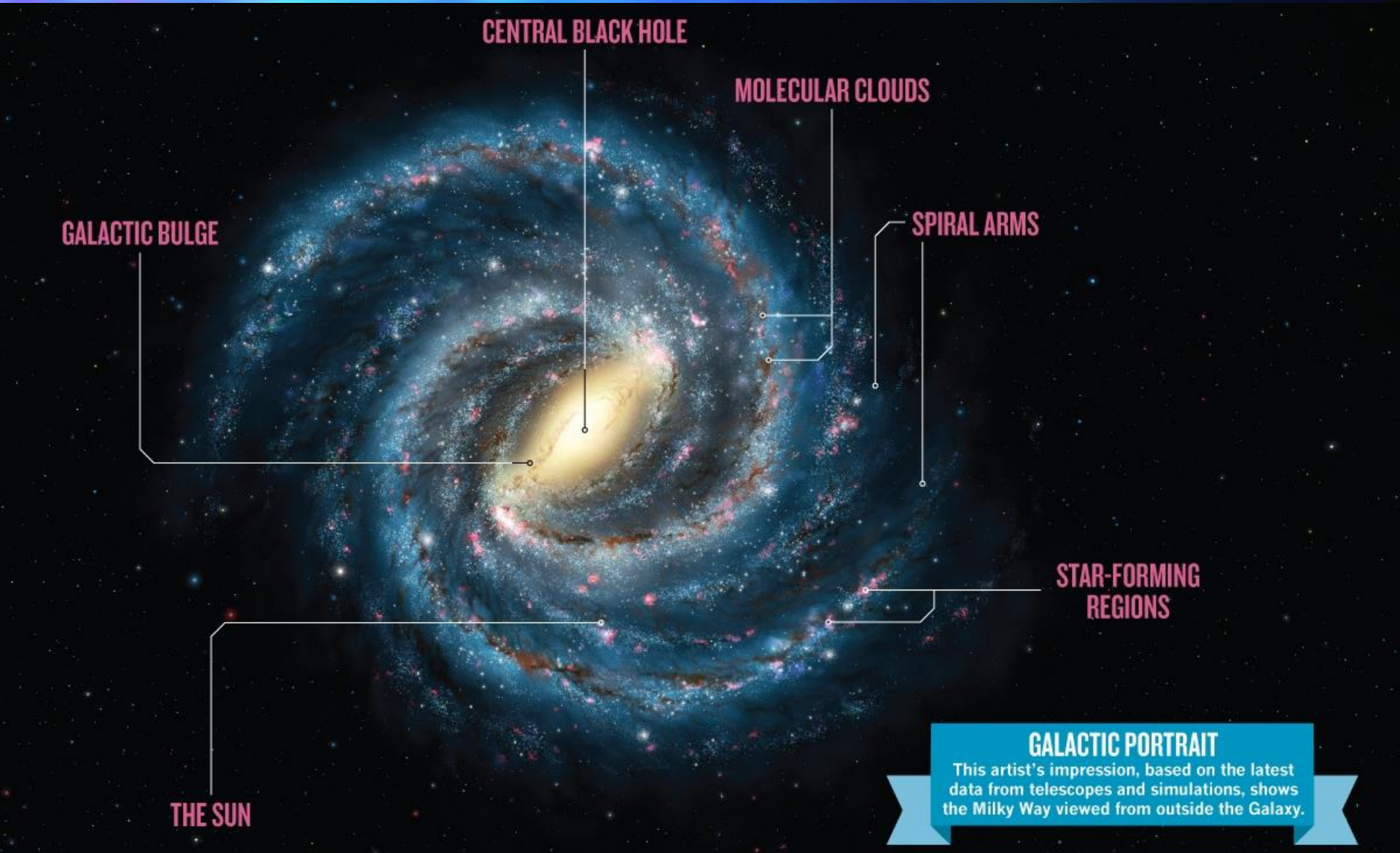
SPIRAL ARMS

STAR-FORMING
REGIONS

THE SUN

GALACTIC PORTRAIT

This artist's impression, based on the latest data from telescopes and simulations, shows the Milky Way viewed from outside the Galaxy.



Vast Universe

