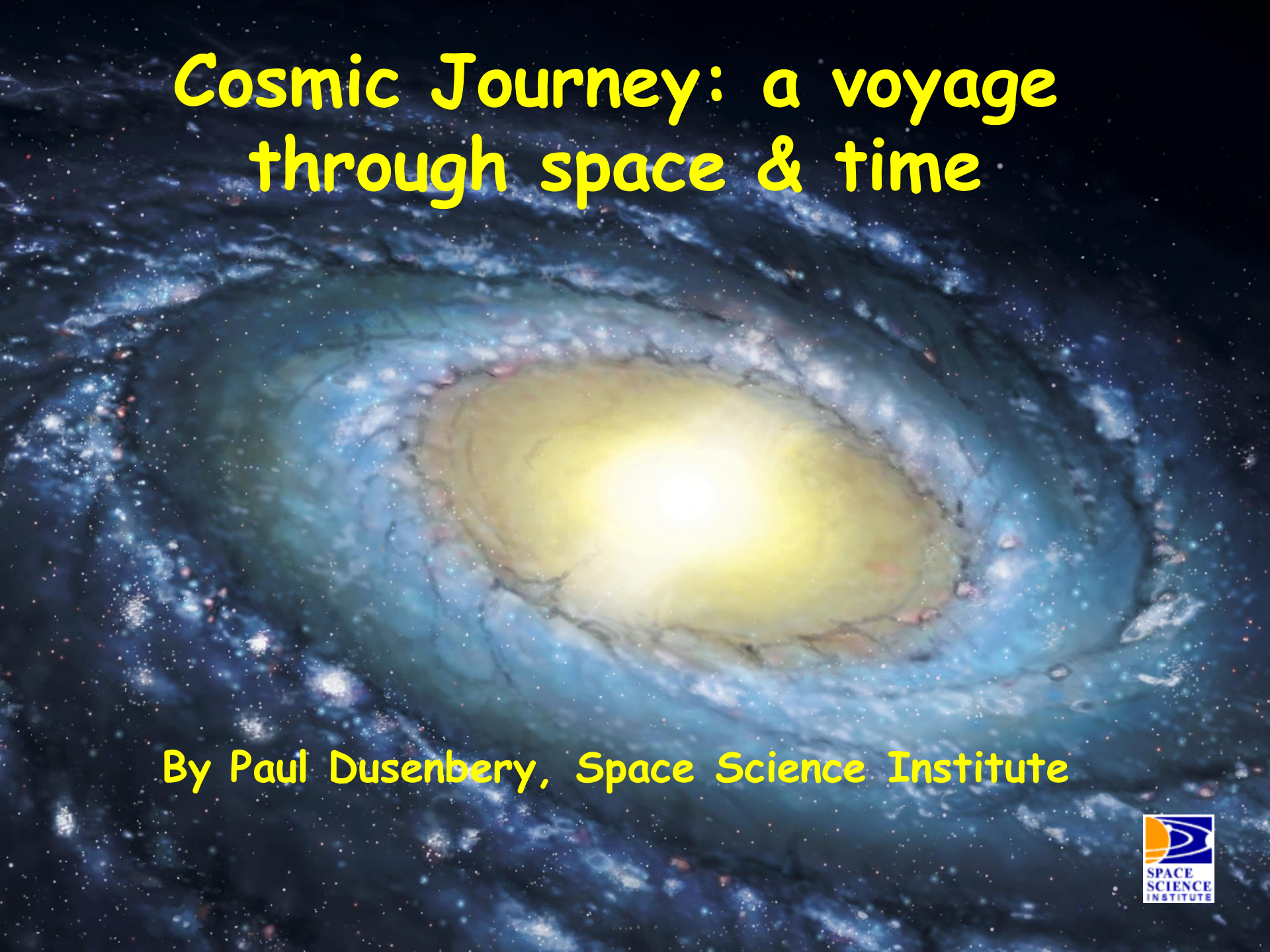
Cosmic Journey: a voyage through space & time



By Paul Dusenbery, Space Science Institute

SPACE SCIENCE INSTITUTE

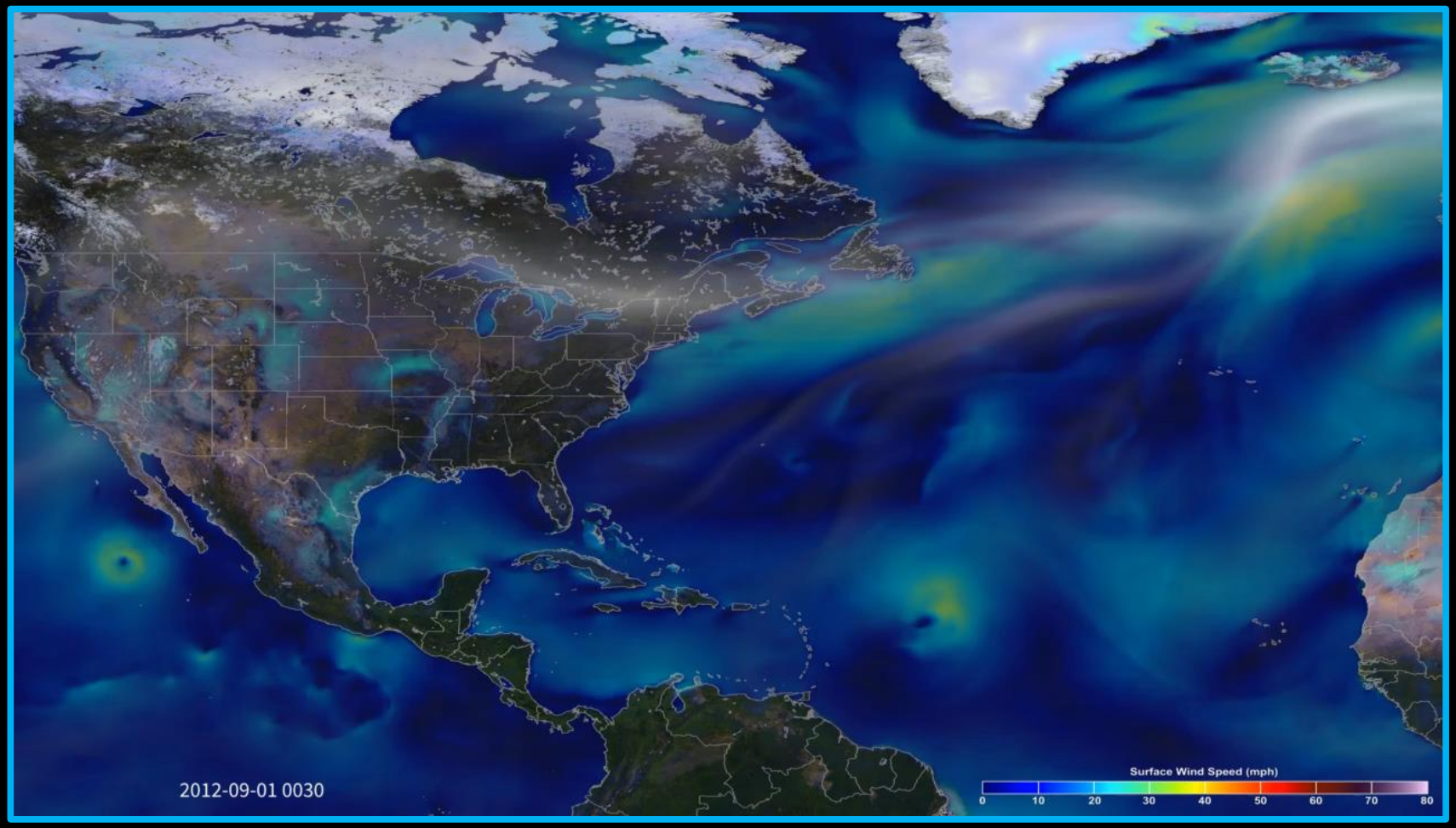
Our Place in Space

Where are we in the cosmos?

Could there be other planets like Earth out there?

Are we Alone?

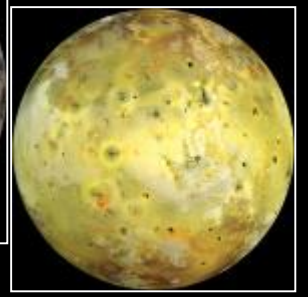
Hurricane Sandy Strikes the East Coast



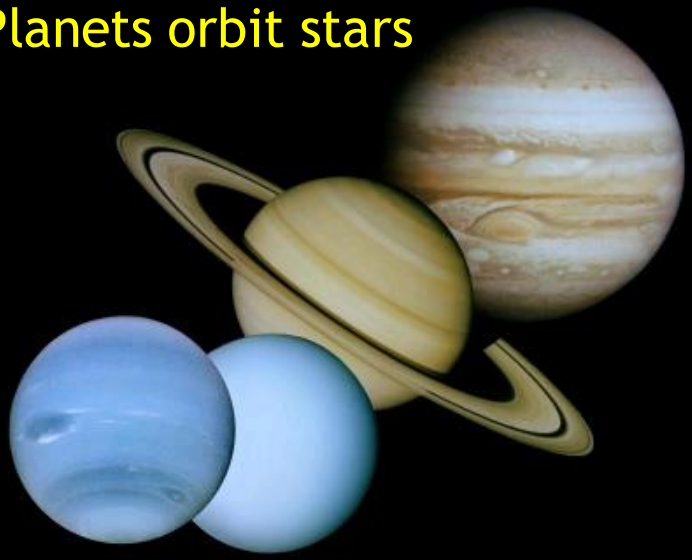
Humans for countless generations have wondered about their connection to the Sun, moon, planets, and stars that adorn the heavens.

3. Stars and star systems orbit the centers of galaxies

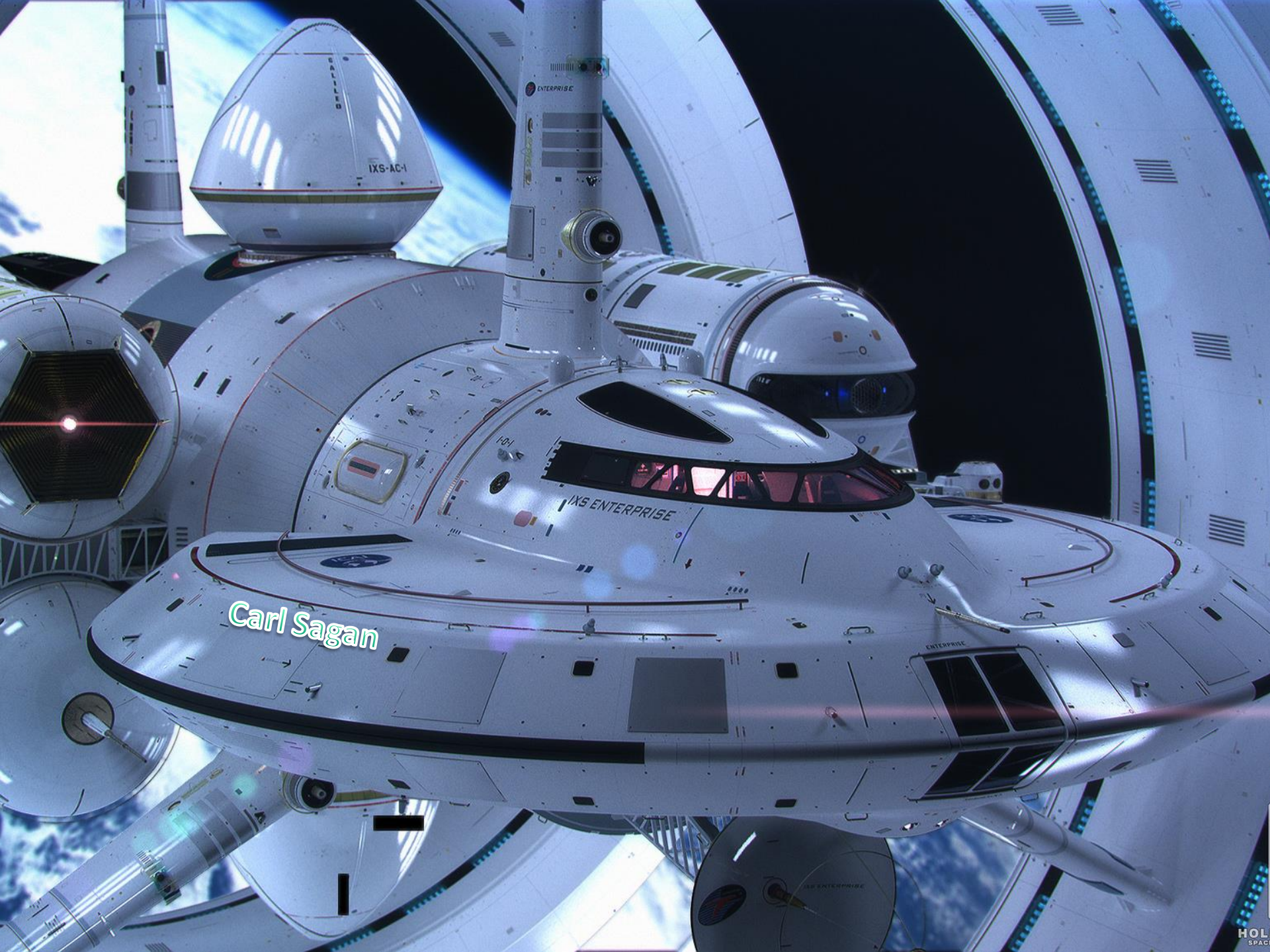
1. Moons orbit planets



2. Planets orbit stars

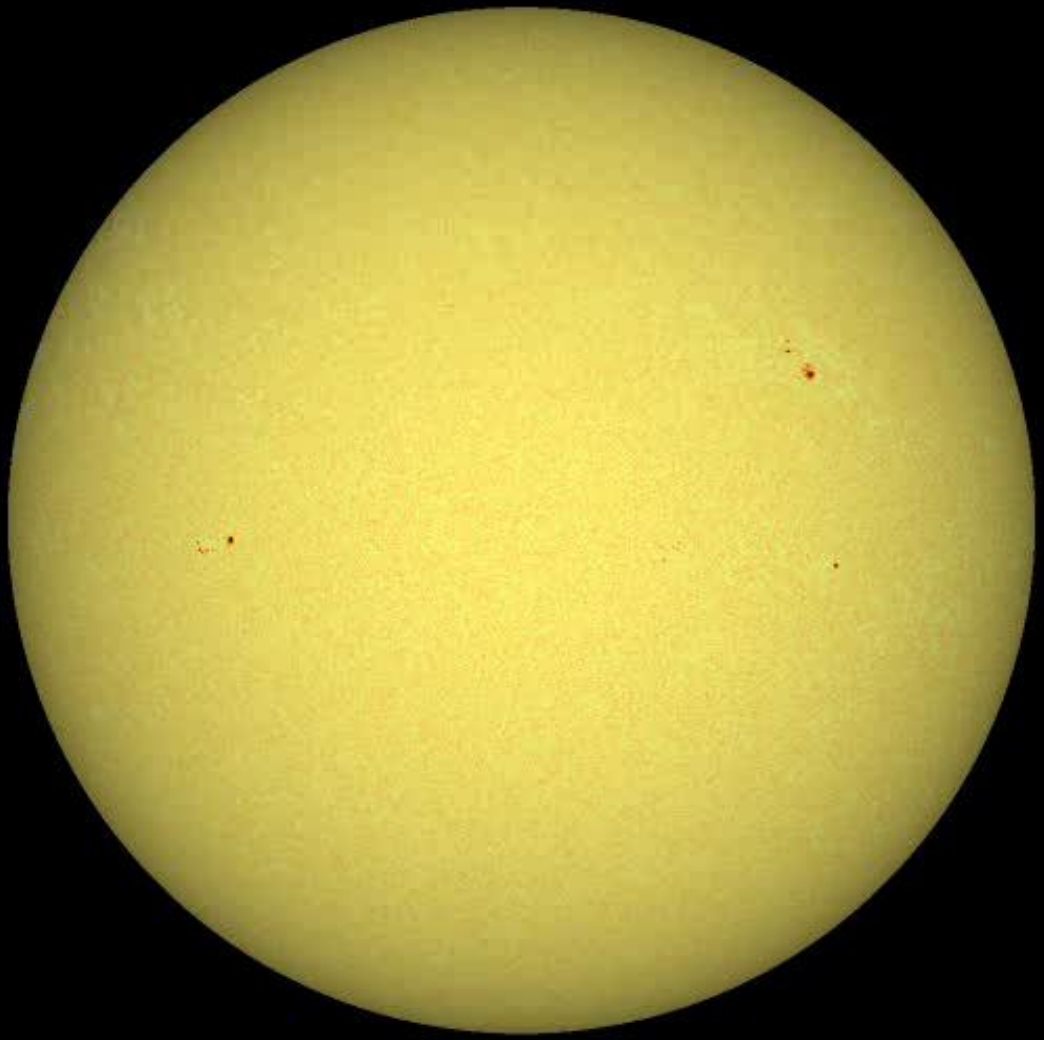


4. Galaxies orbit each other in clusters.

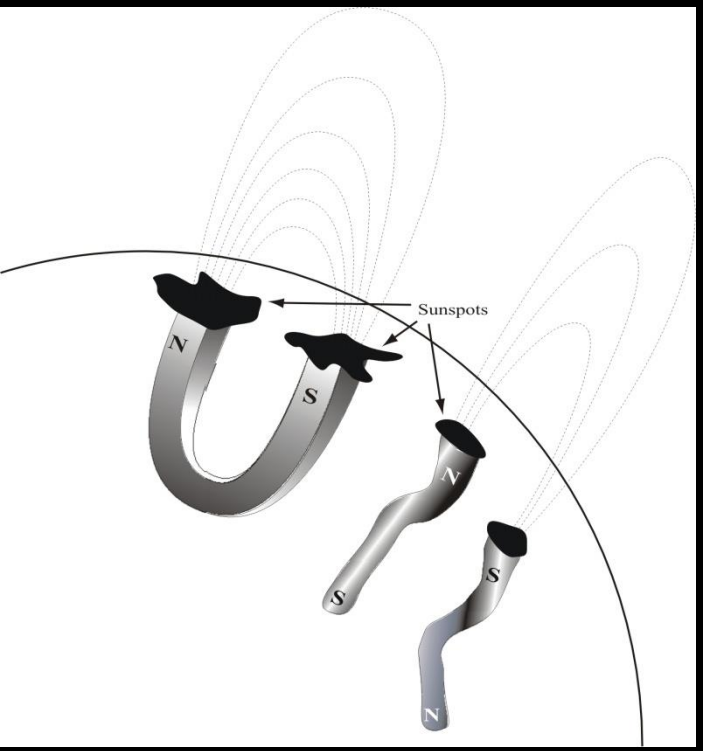

GALILEO
IXS-AC-1
ENTERPRISE
IXS ENTERPRISE
Carl Sagan

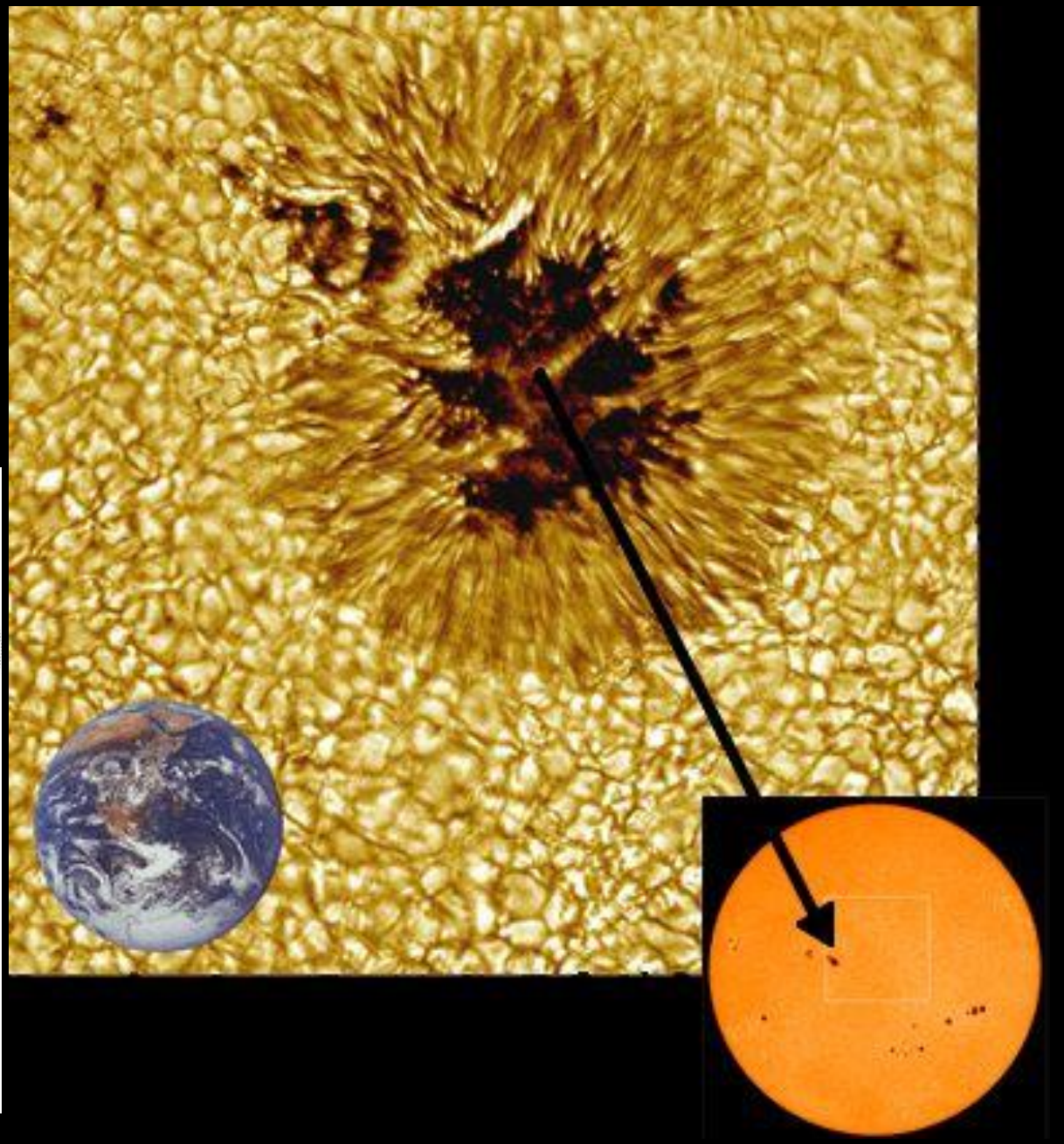
Our Star, the Sun

Seeing Spots

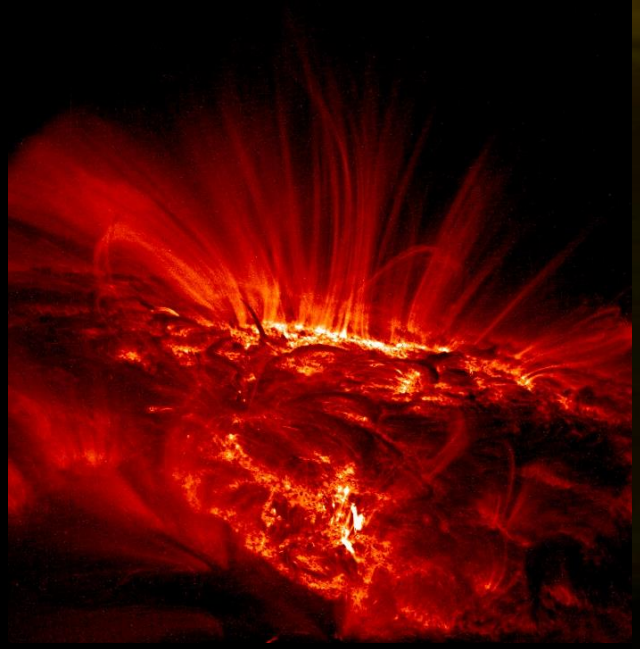


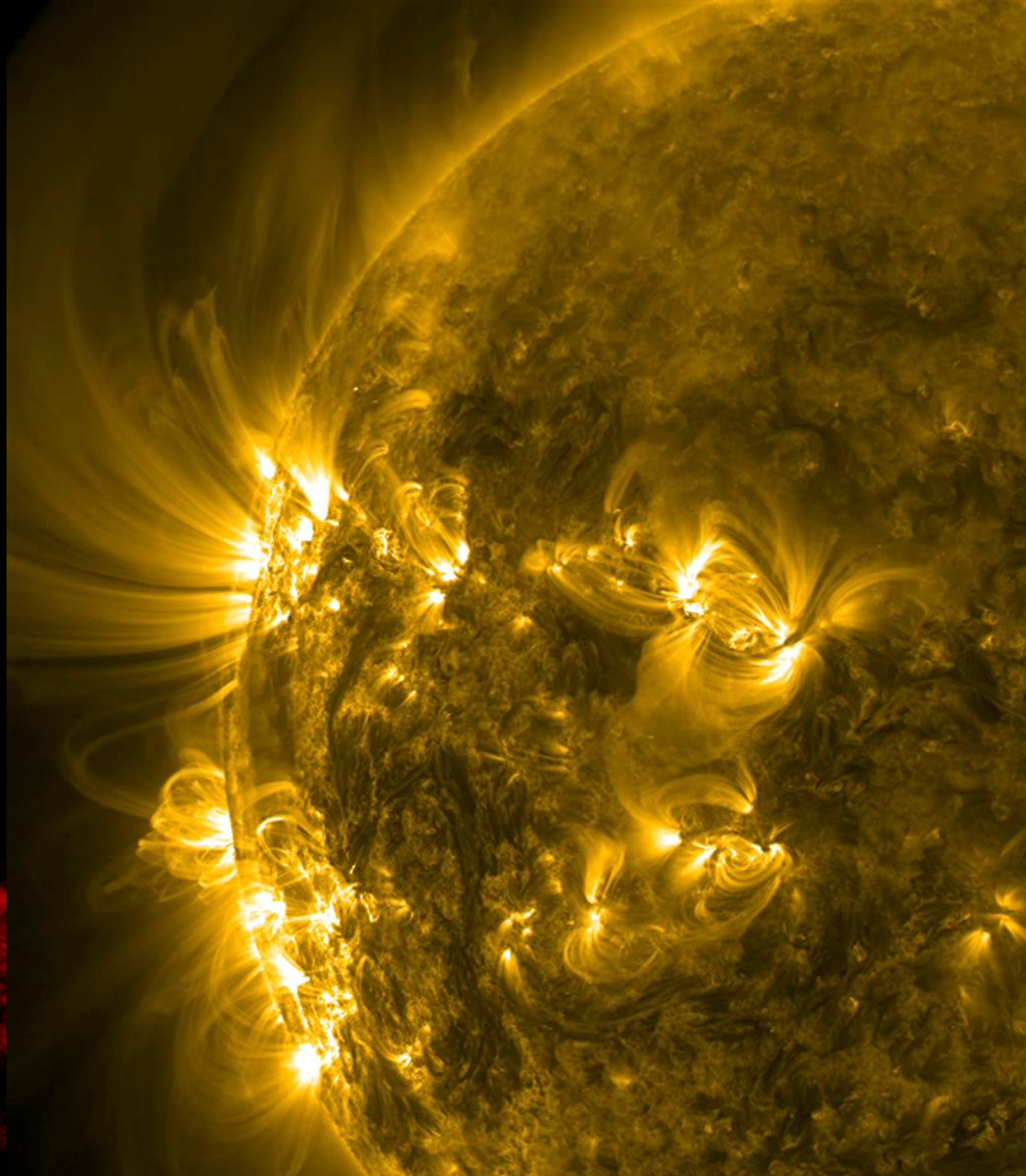
Sunspots: cool, dark, & magnetic

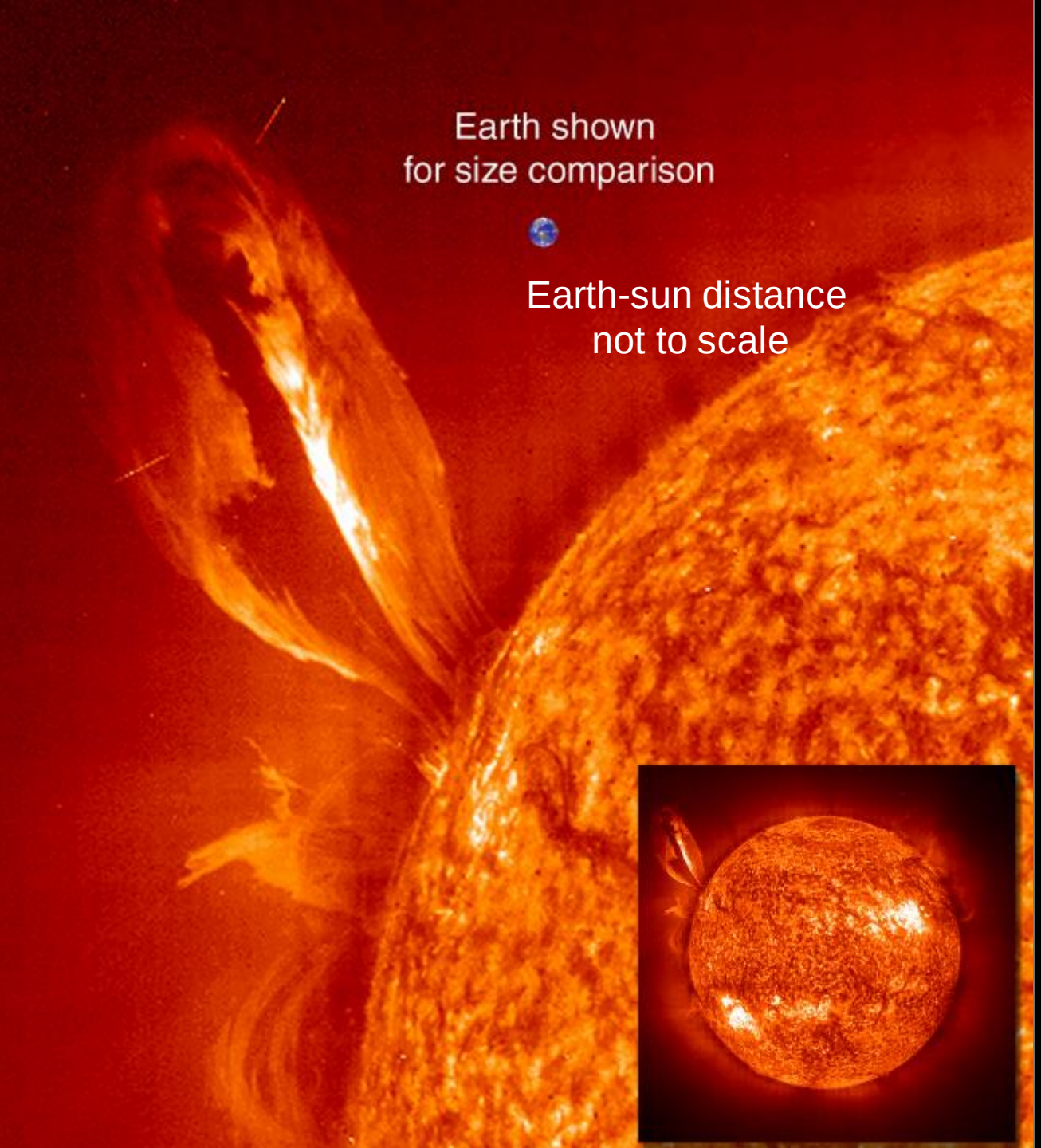




Magnetic Loops





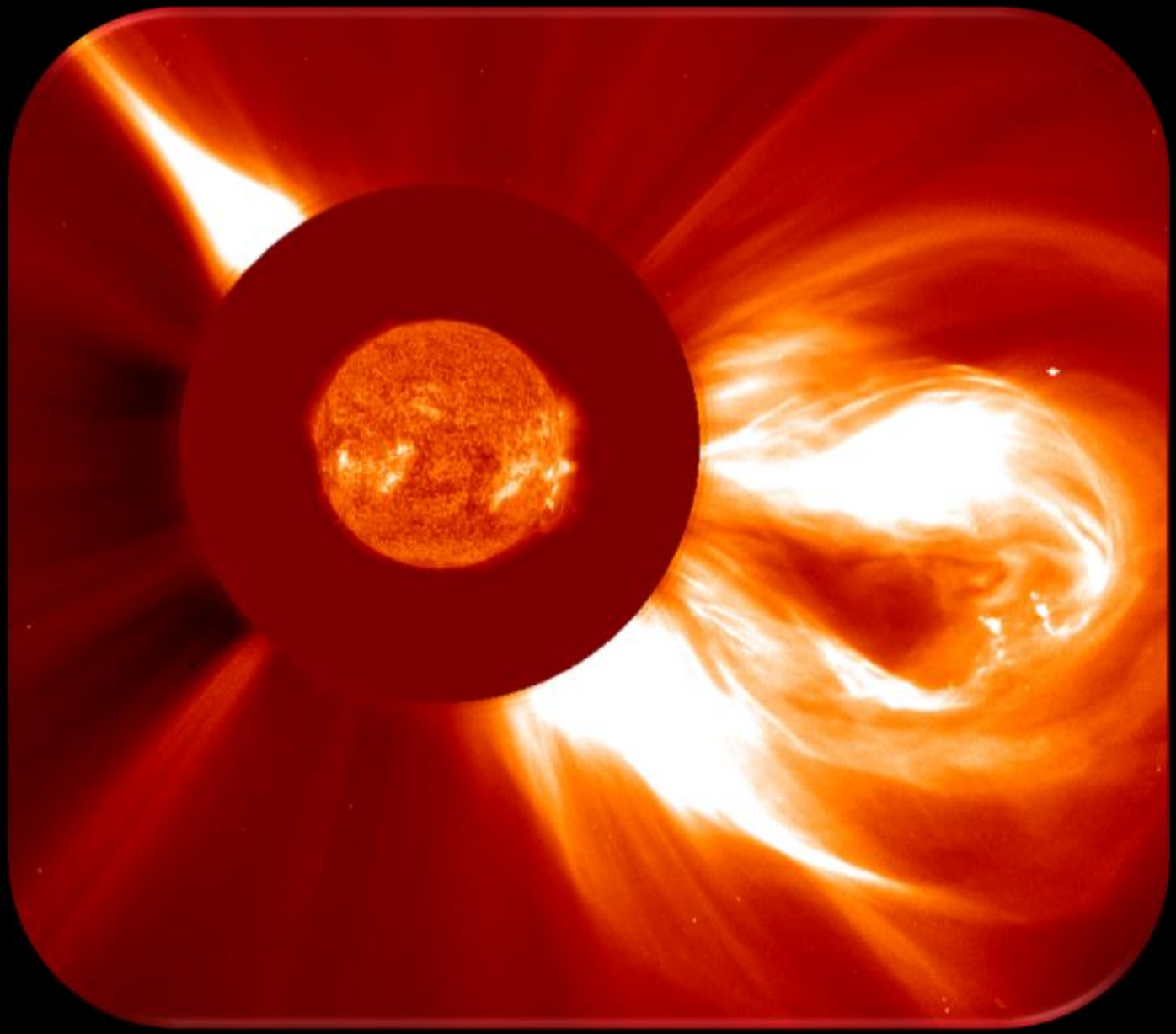


Prominences

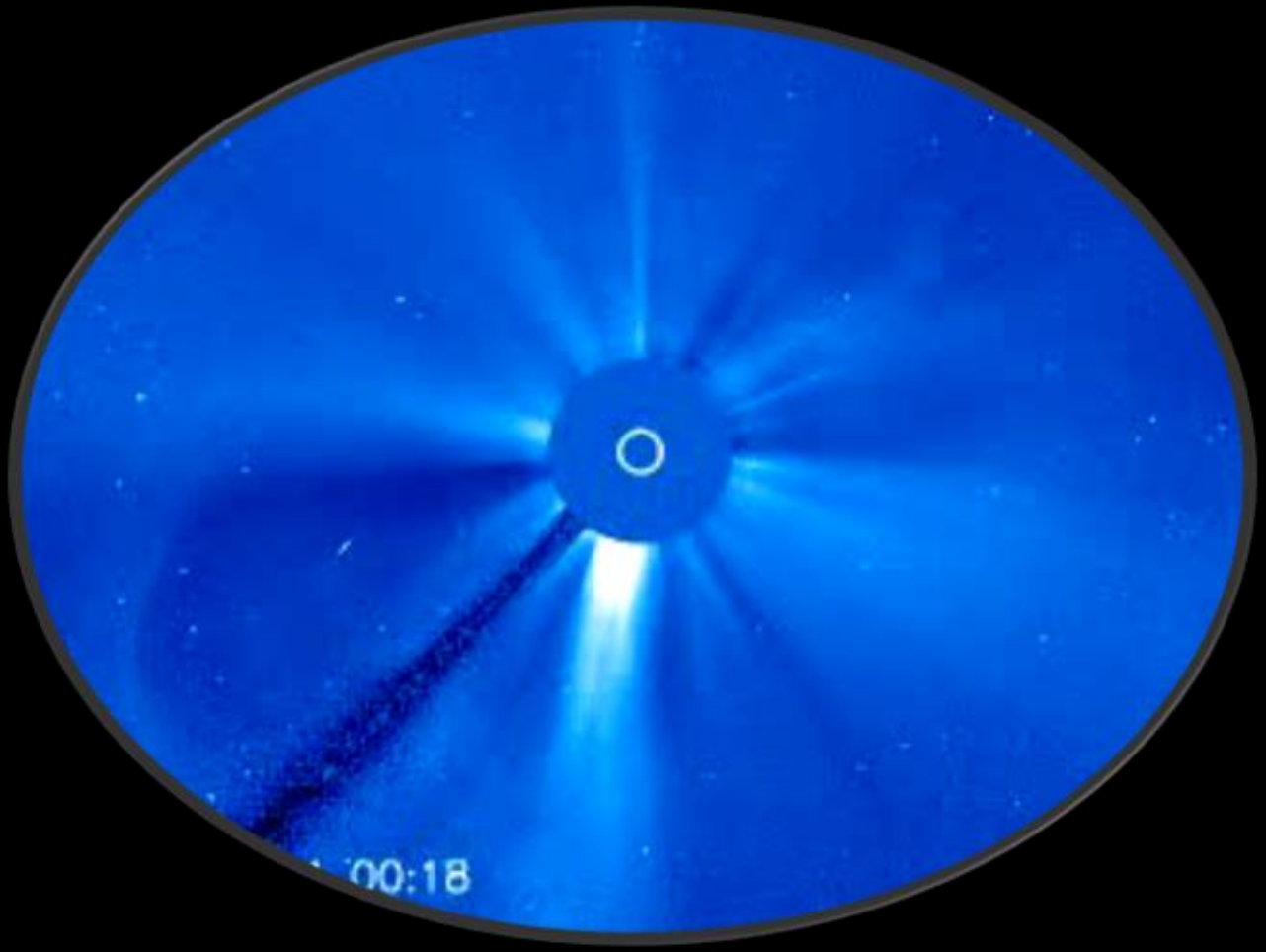
Total Solar Eclipse - 1999

Participate in the August 2017 Total Solar Eclipse!

Stormy Weather on the Sun



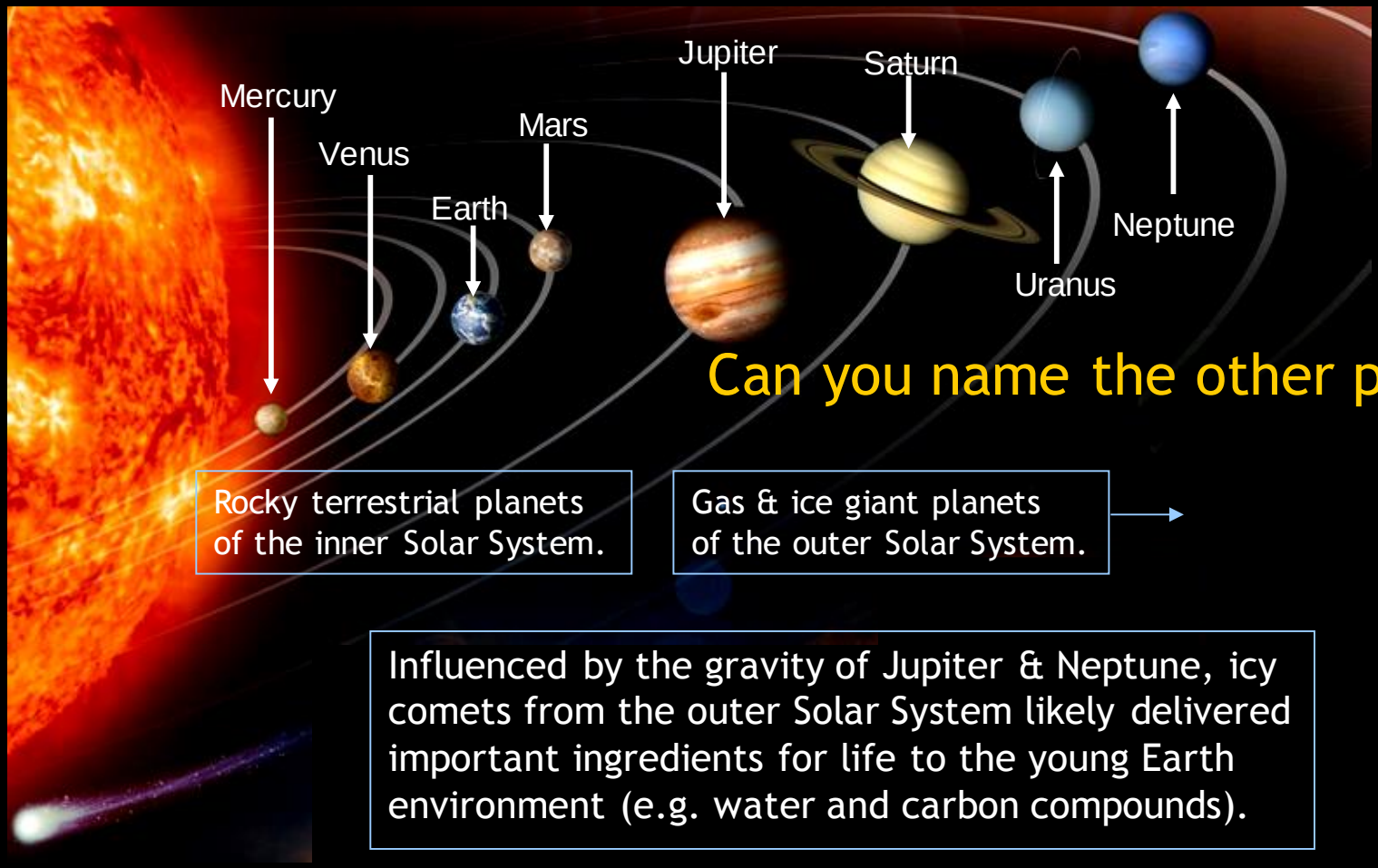
Huge blasts from the corona, known as coronal mass ejections (CMEs), are the most violent space weather events.



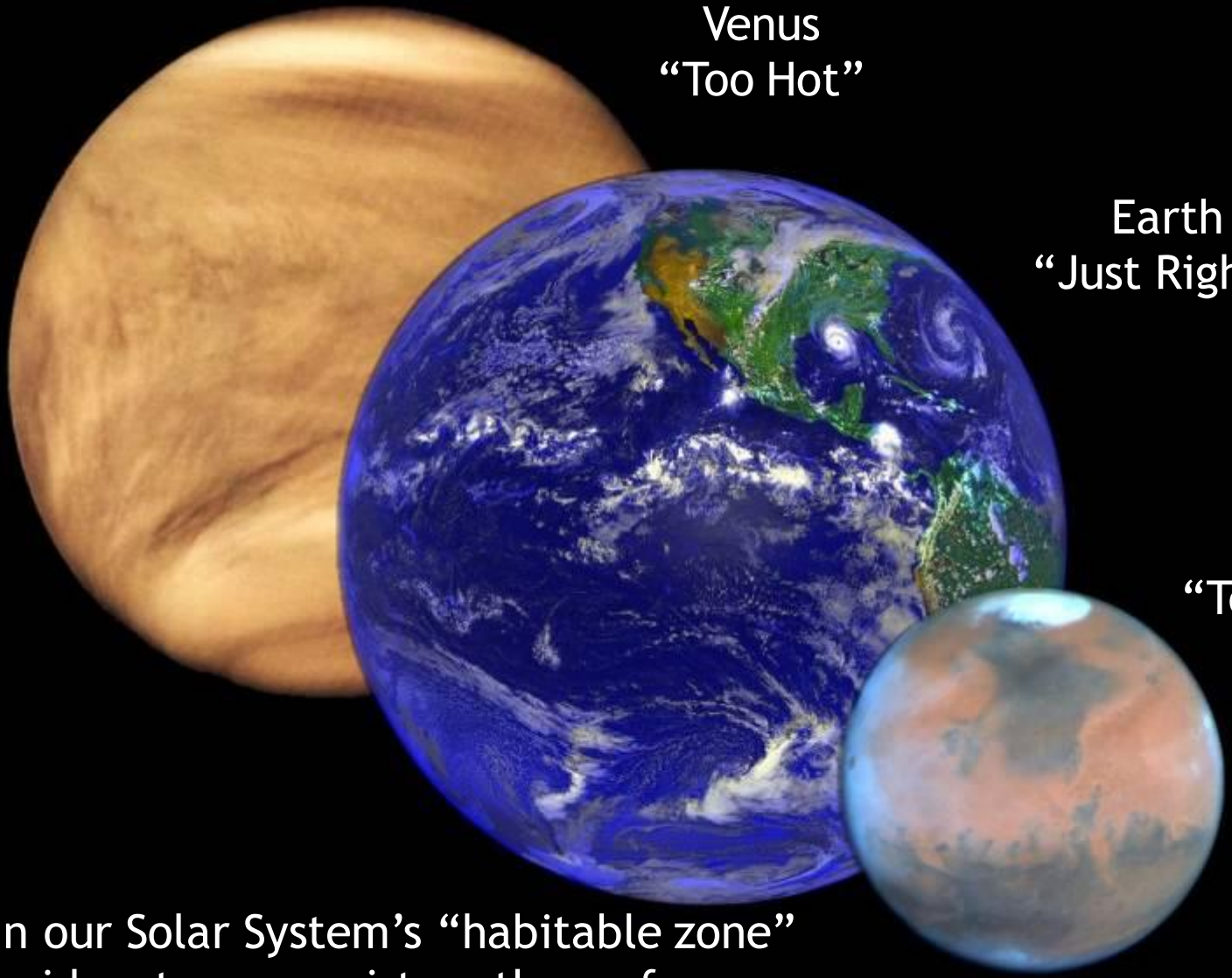
Space Weather: Sun-Earth Connections

Our Place in the Solar System

Earth is one of 8 PLANETS in our SOLAR SYSTEM.
The planets orbit a central STAR we call the SUN.

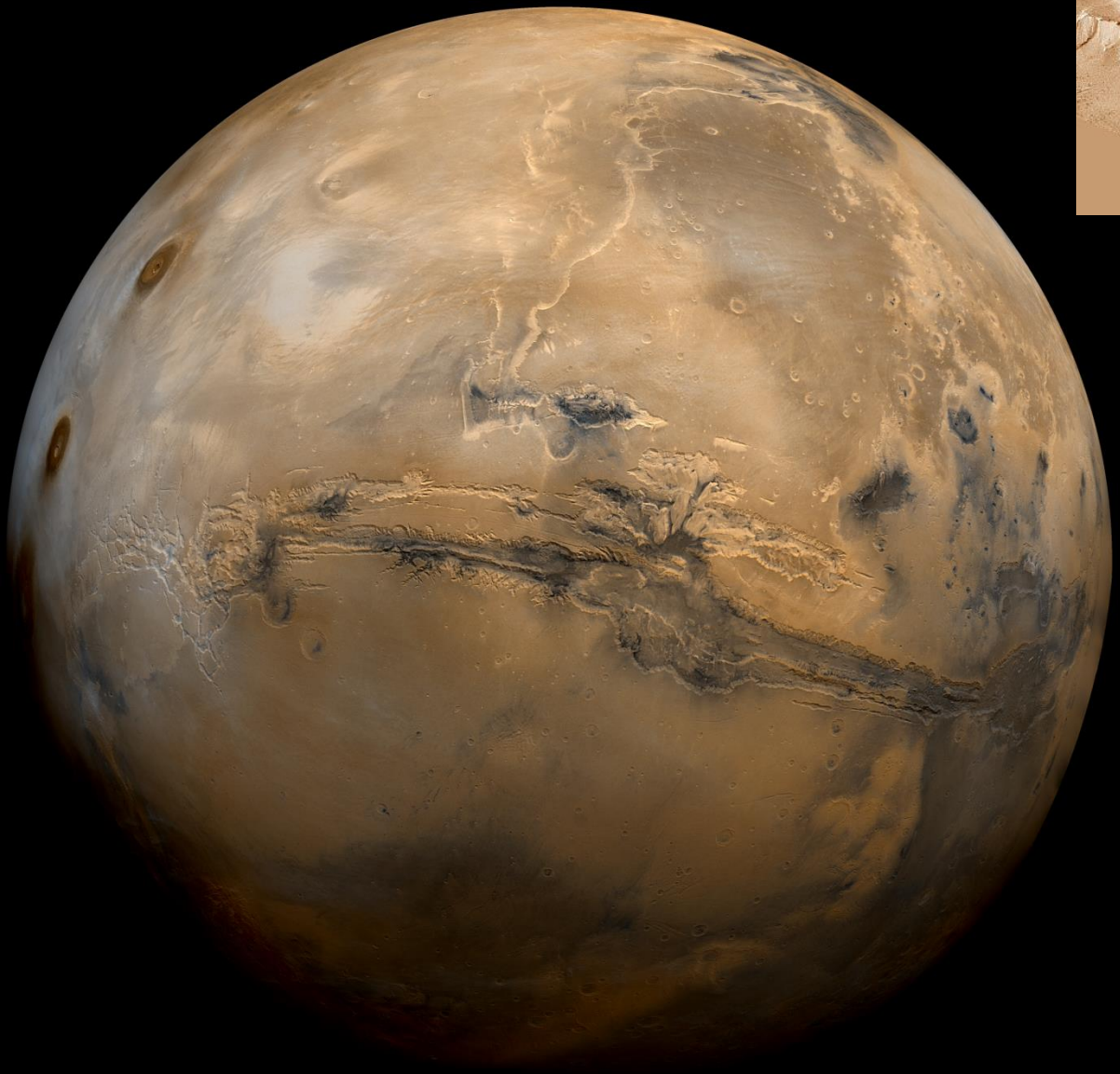


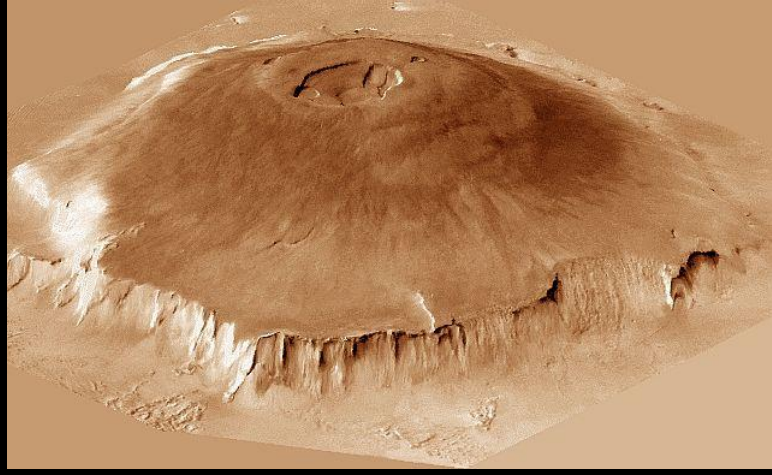
The Goldilocks Effect

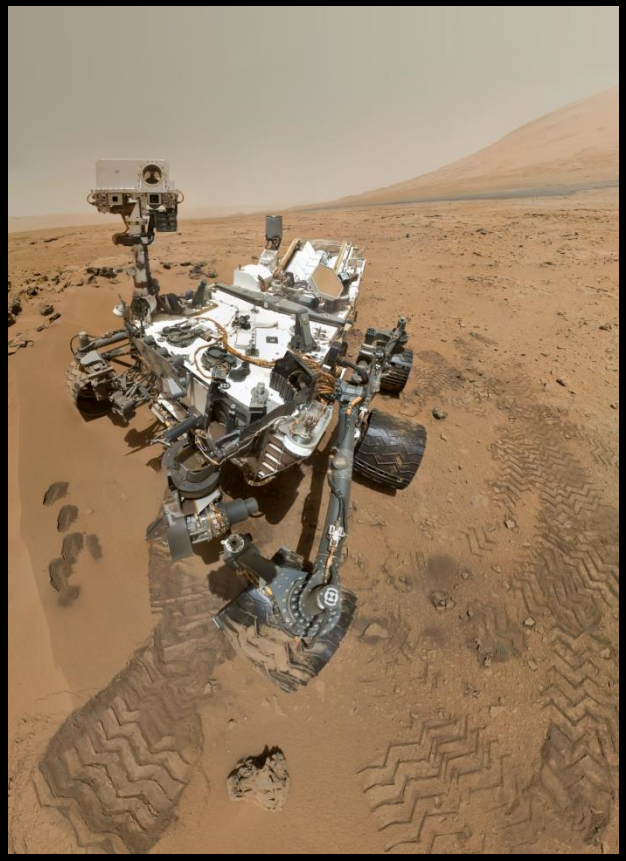


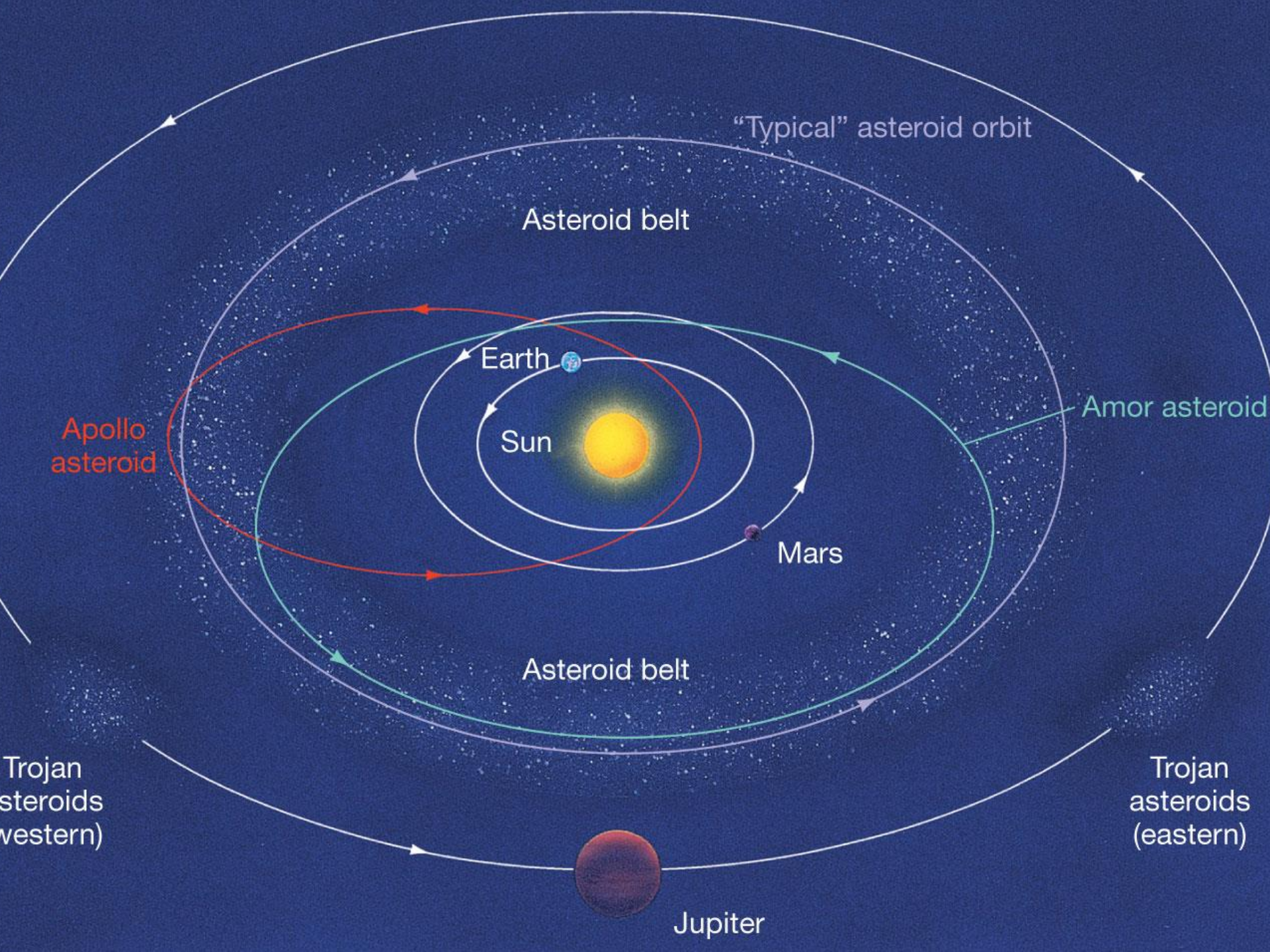
Earth is in our Solar System's "habitable zone" where liquid water can exist on the surface.

The Red Planet



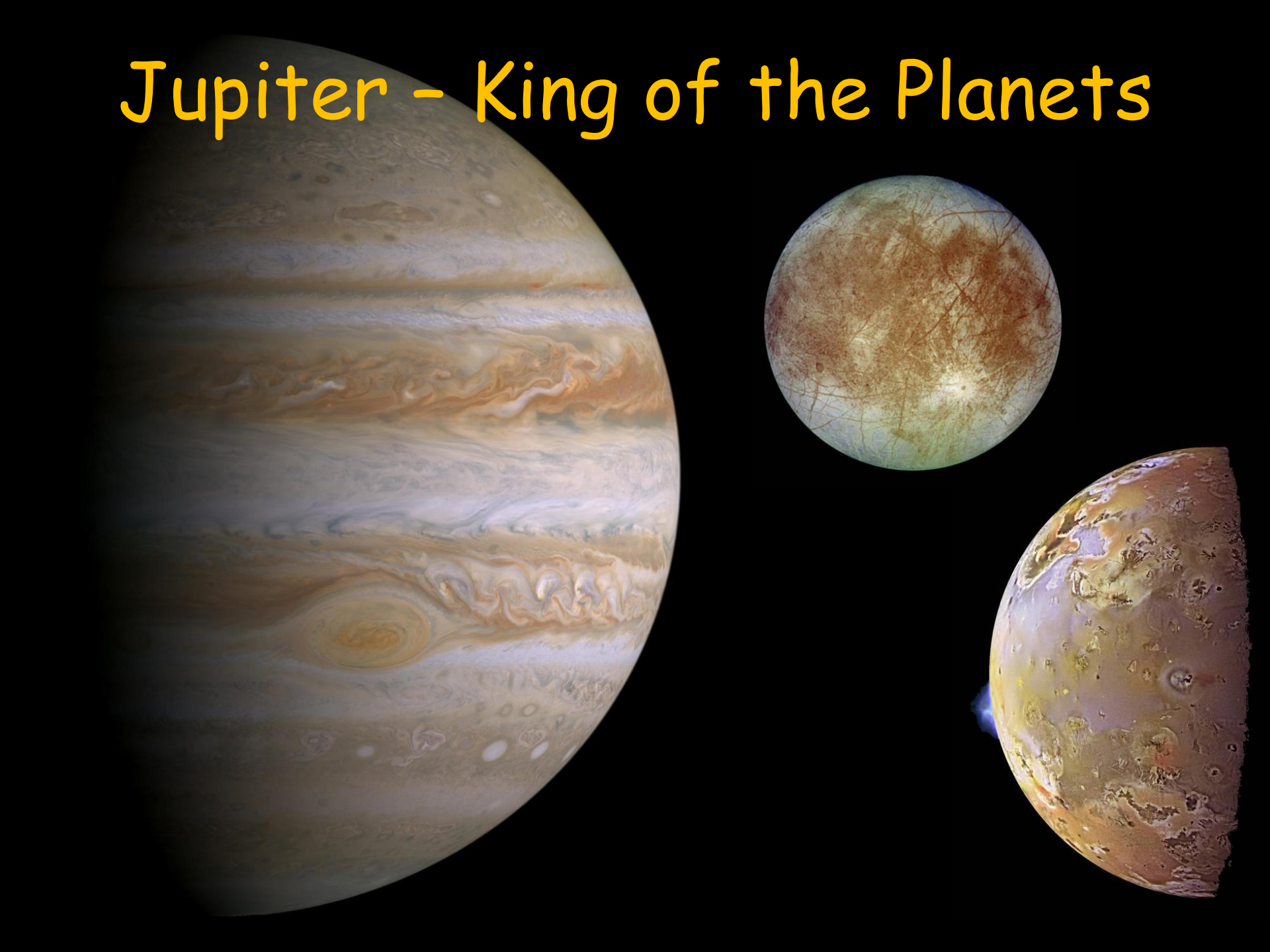


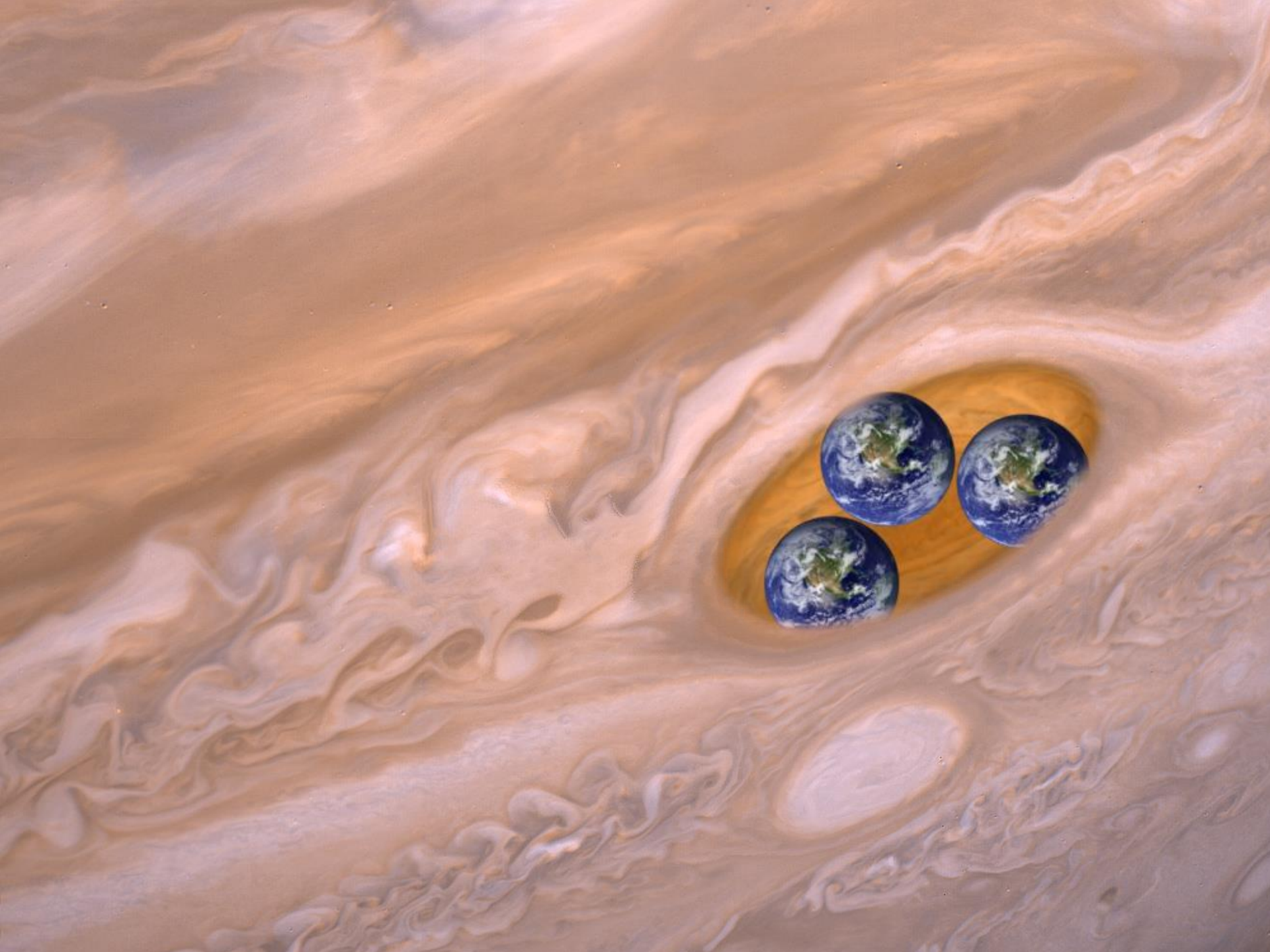



"Typical" asteroid orbit
Asteroid belt
Earth
Sun
Apollo asteroid
Amor asteroid
Mars
Asteroid belt
Trojan steroids western)
Trojan asteroids (eastern)
Jupiter

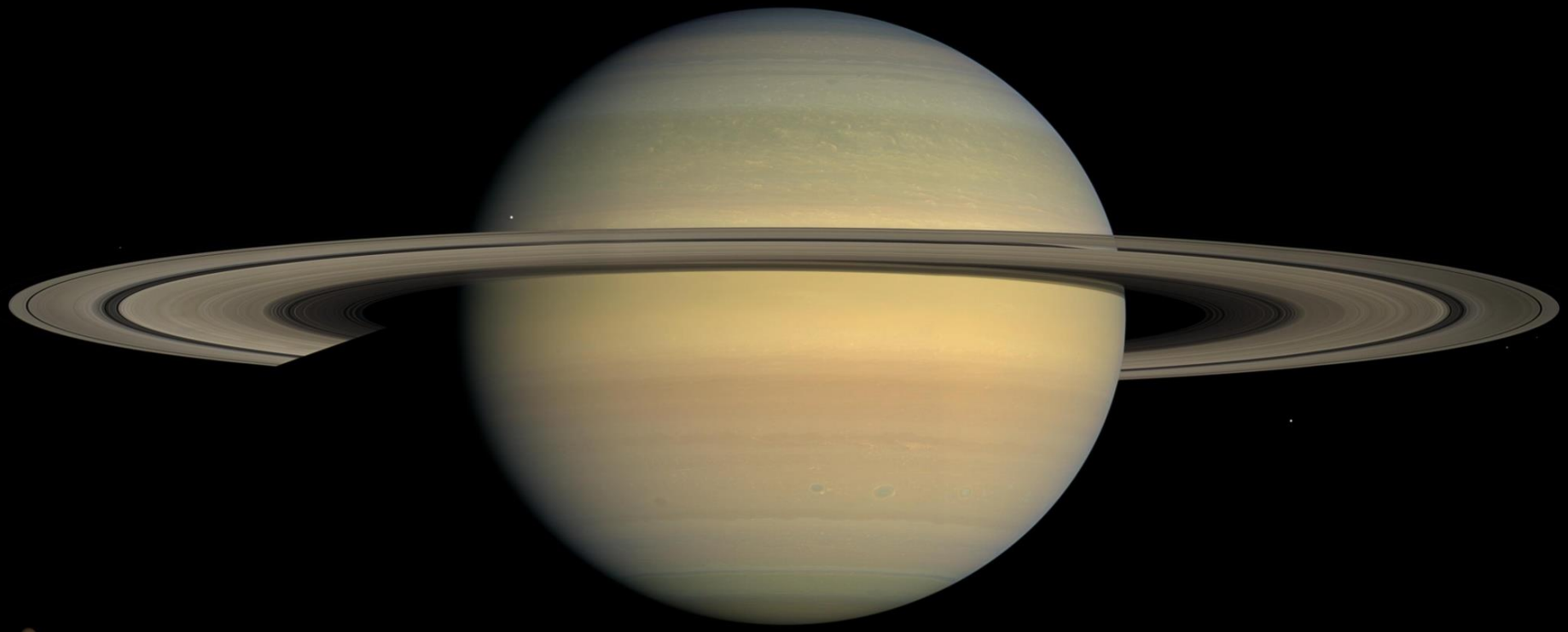
Space Rocks!

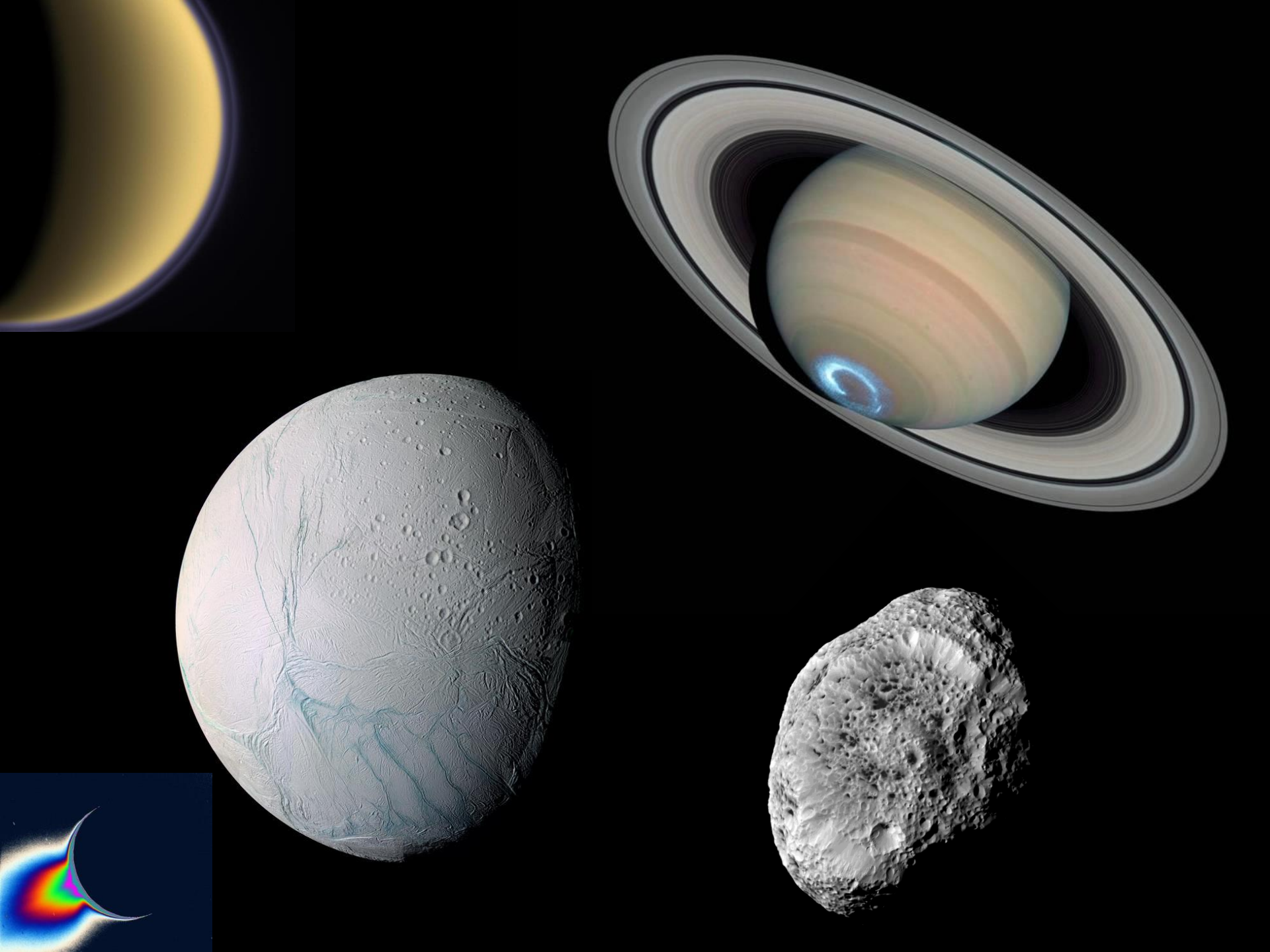
Jupiter - King of the Planets

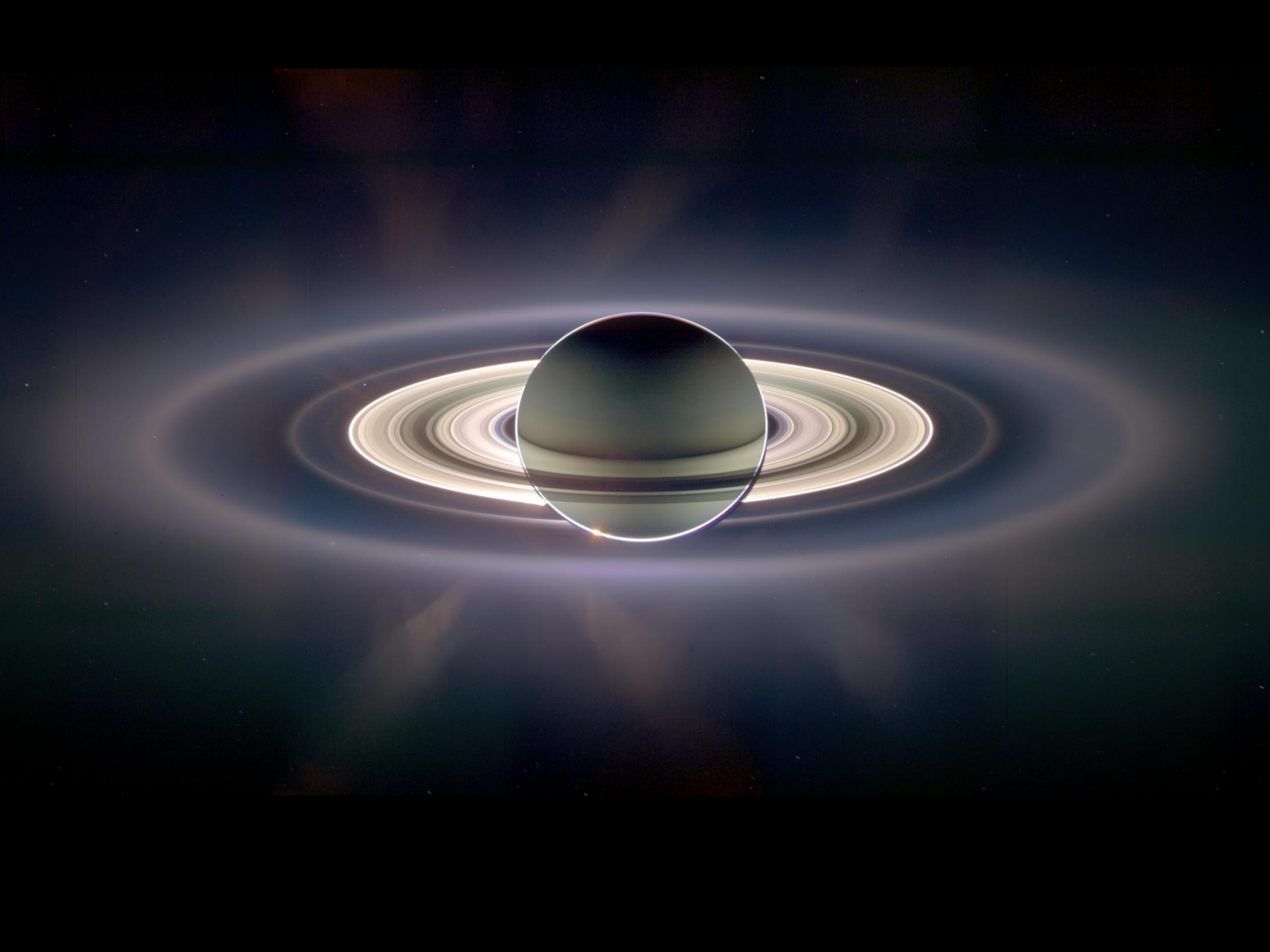




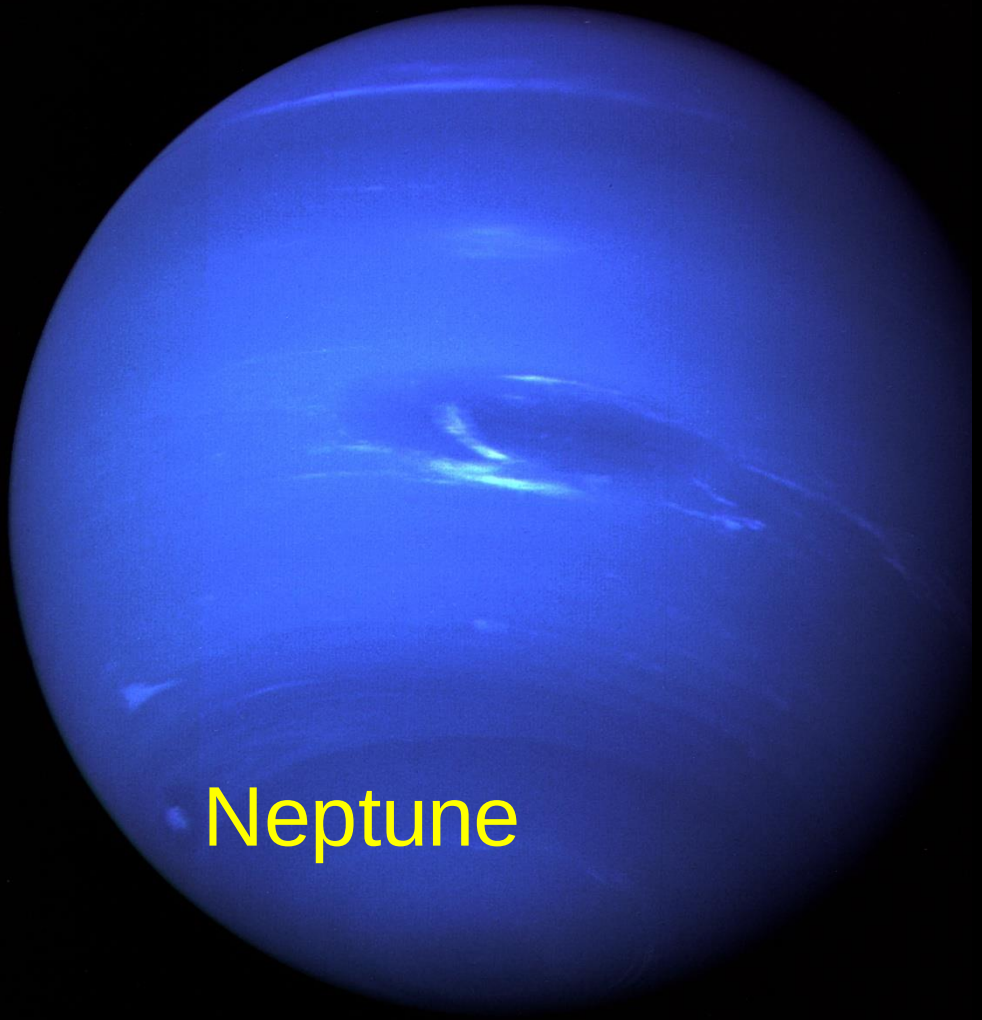
Saturn – Lord of the Rings



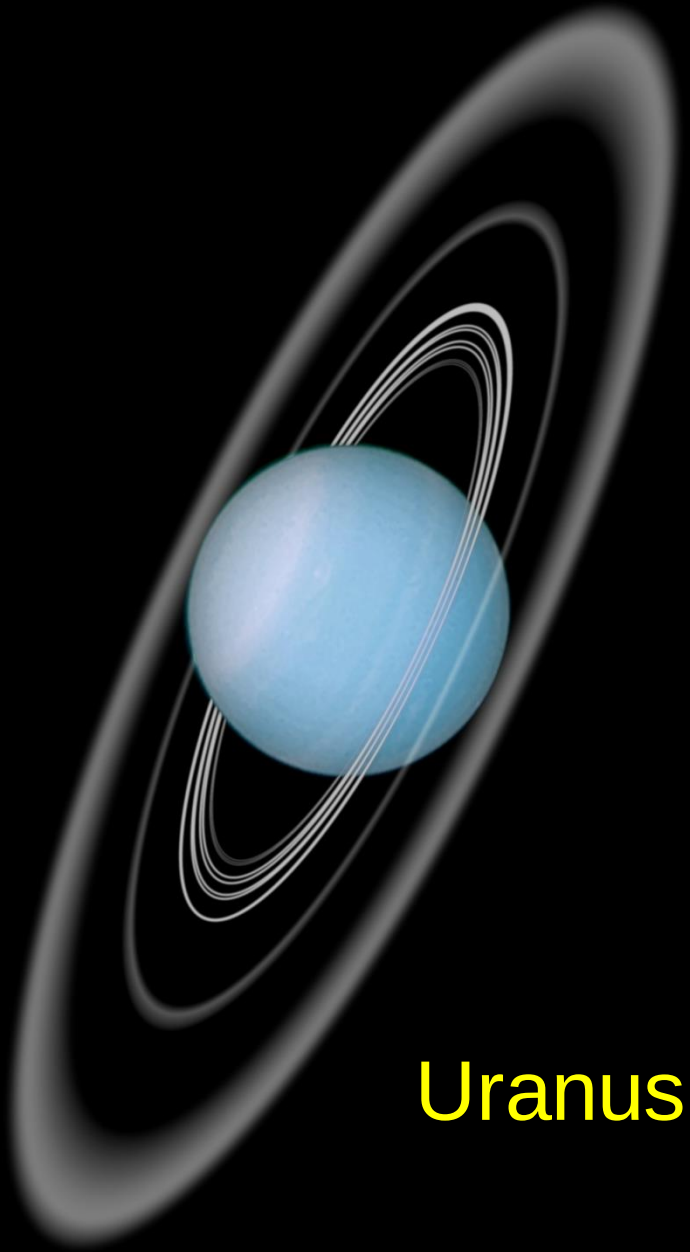




The Ice Giants



Neptune

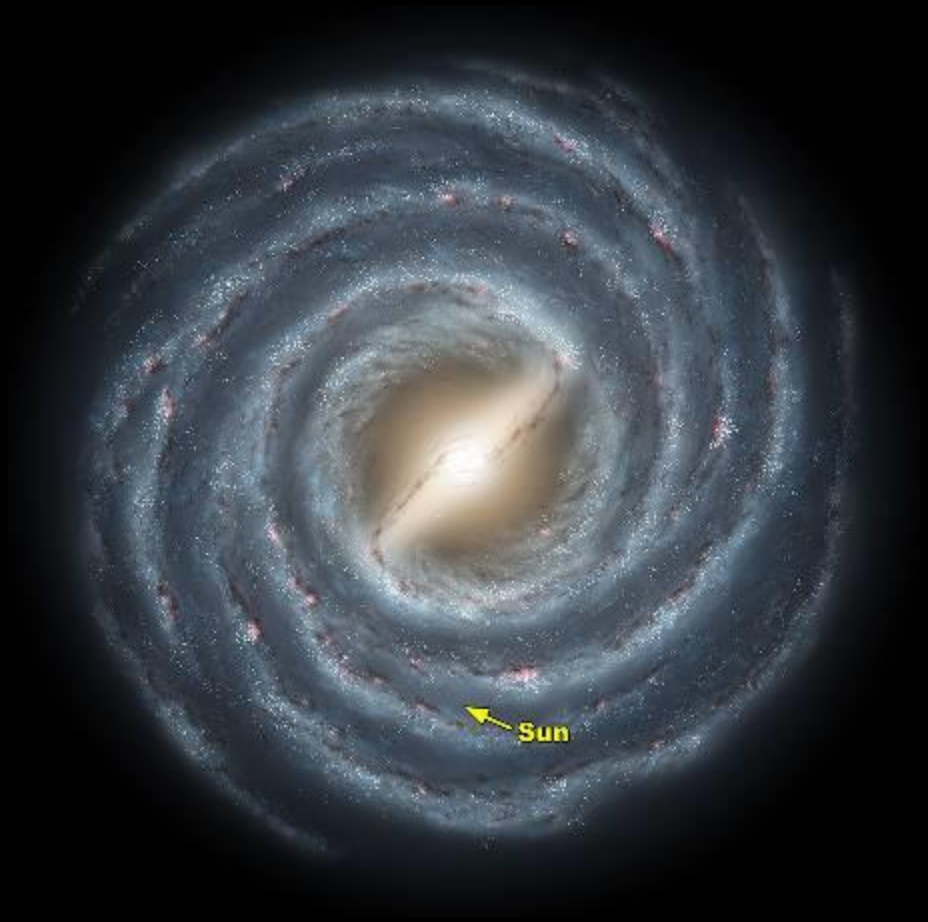


Uranus

The Sun is the ONLY star in the SOLAR SYSTEM.

Earth is the ONLY planet in our Solar System where we know for sure that life has evolved.

Our Place in the Galaxy



Artist's Concept of our Milky Way Galaxy

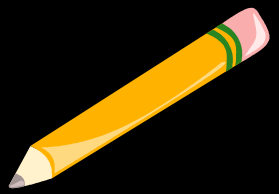
- The Sun is the only star in the SOLAR SYSTEM, but it is one of over 100 billion stars in the GALAXY we call the Milky Way.

- Our Solar System is located about 2/3 of the way out from the galaxy's center.

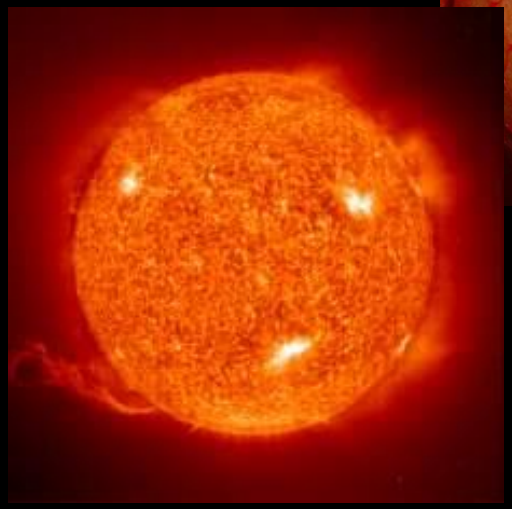
- Astronomers think that most of the stars in the Milky Way galaxy could also have planets orbiting around them. These are called "exoplanets".

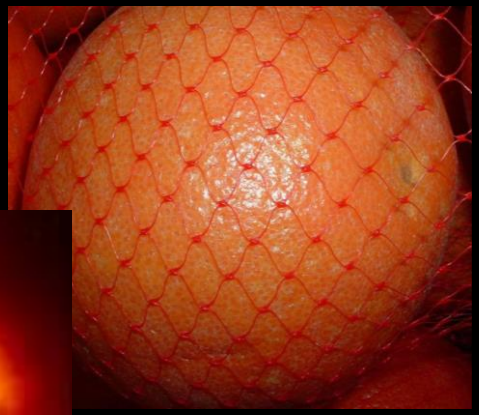
Assume the Sun is the size of a large grapefruit:

Q1. About how big would planet Earth be on this scale?



A1: About the size of a pencil tip





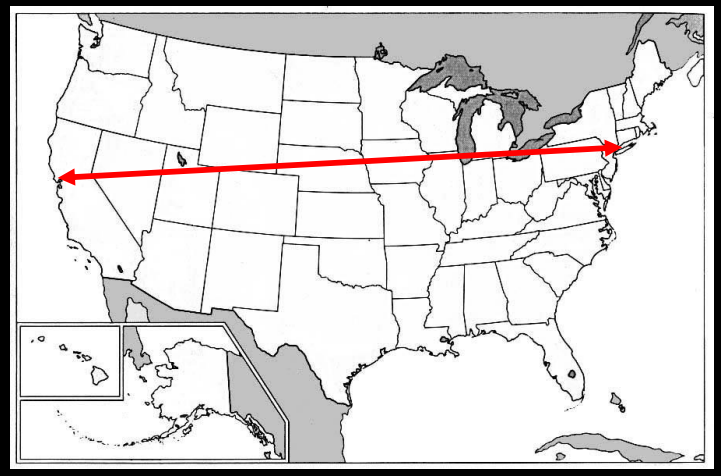
Of course, the Sun is really 10 billion times bigger than a grapefruit with a 14 cm diameter.

Q2: On this scale, how far away would pencil-tip "Earth" be from the grapefruit "Sun"?

A2: About 15 meters (50 ft) away.
Pluto would be about ½ mile away.

Q3: On this scale, how far away would the nearest star in the Milky Way galaxy be?

A3: About 5000 km (3000 miles).
The East-West distance across the US!

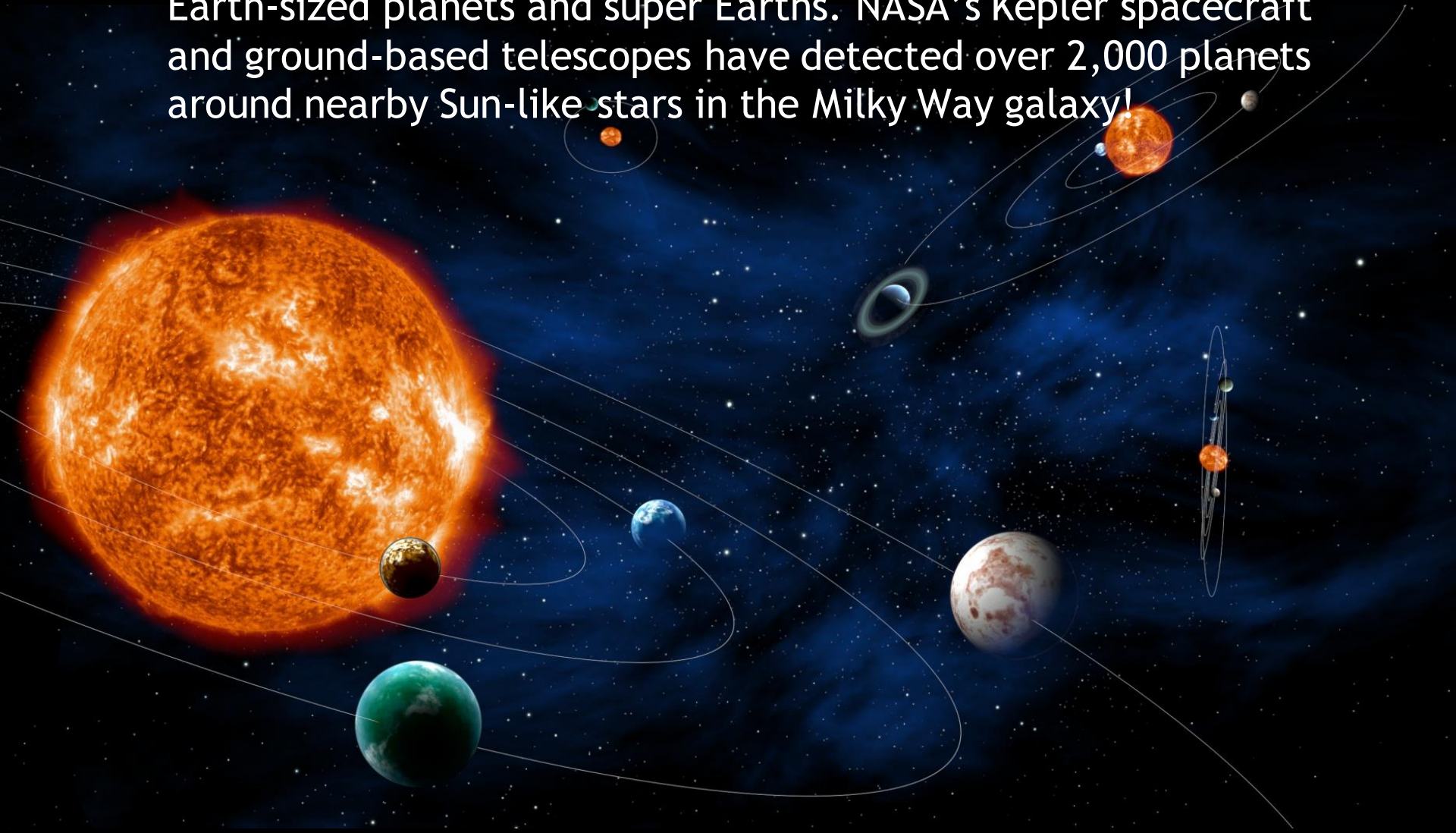


So in this scale model, the space between the Sun and the NEAREST STAR in the Milky Way galaxy is like having one grapefruit on the Golden Gate bridge in San Francisco, and another grapefruit on the Brooklyn Bridge in New York.

Images of spiral galaxies make it seem like stars are crammed closely together, but in reality there are vast distances between them.

The Search for Alien Earths

Scientists are searching for exoplanetary systems, especially Earth-sized planets and super Earths. NASA's Kepler spacecraft and ground-based telescopes have detected over 2,000 planets around nearby Sun-like stars in the Milky Way galaxy!

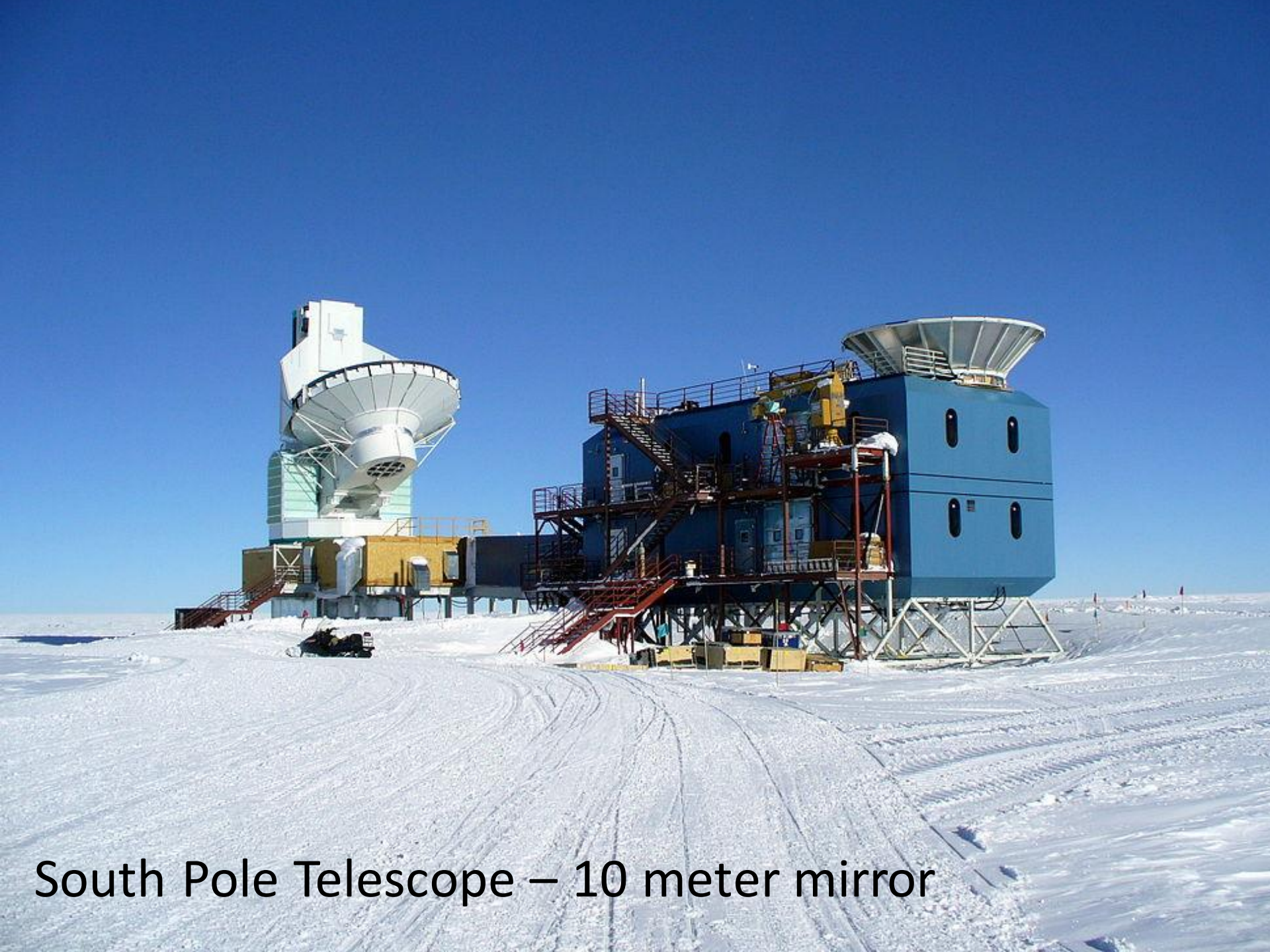


Artist's concept of a distant solar system

In the past decade, we have detected the presence of Jupiter-sized worlds in orbit around *other* stars in our Milky Way galaxy.

Tools of the Trade

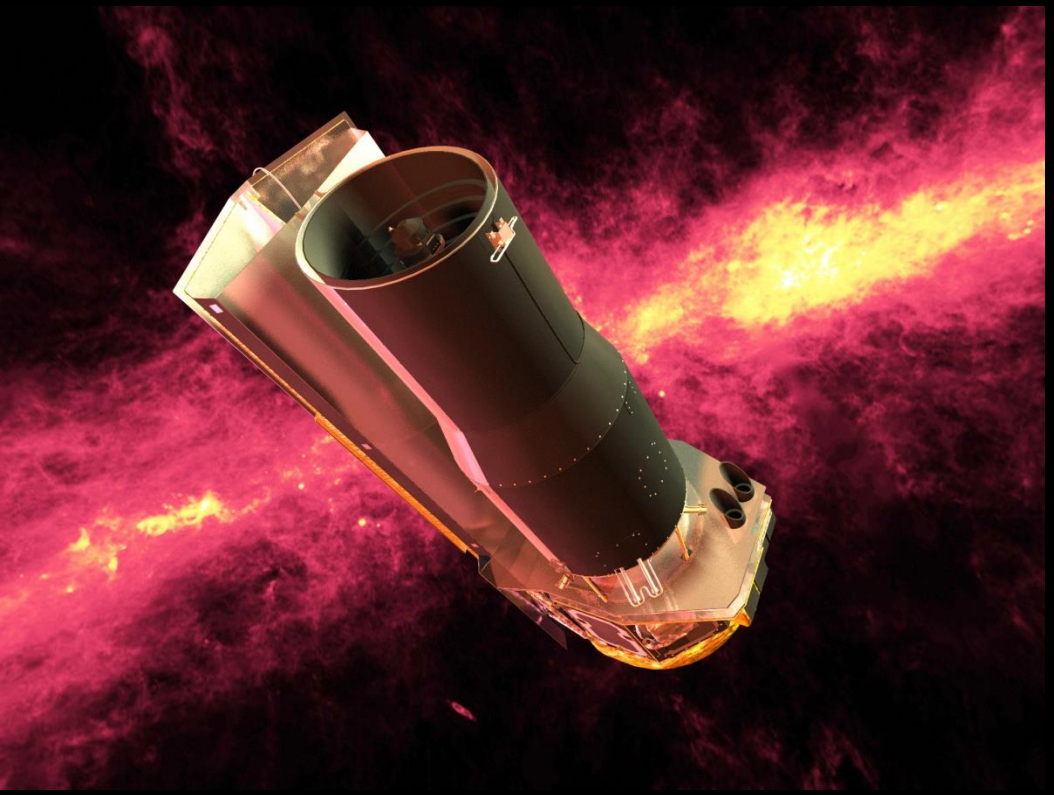
Hubble Space Telescope



South Pole Telescope – 10 meter mirror

Spitzer "Sees" through the Dust

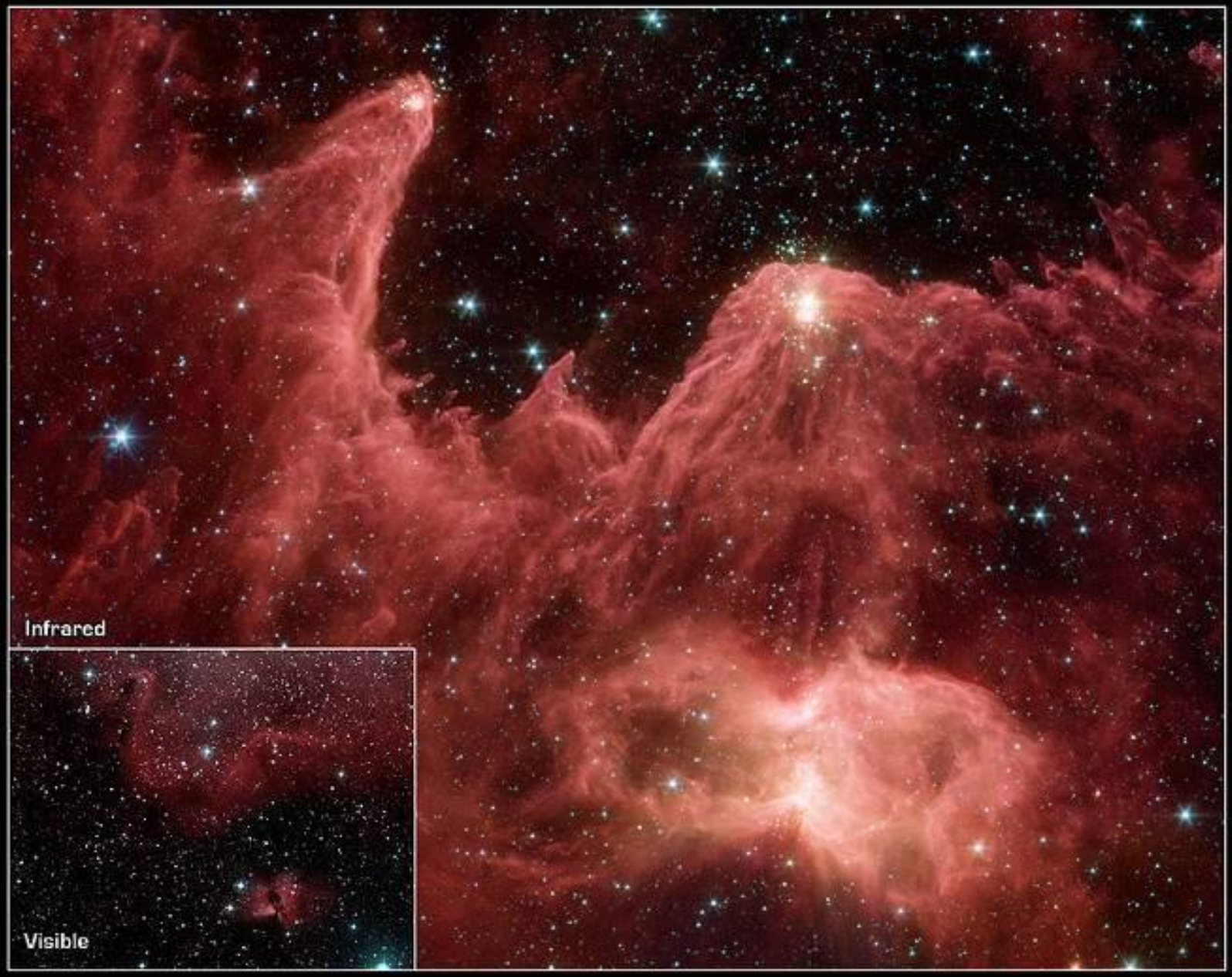
Where do stars and planets come from?

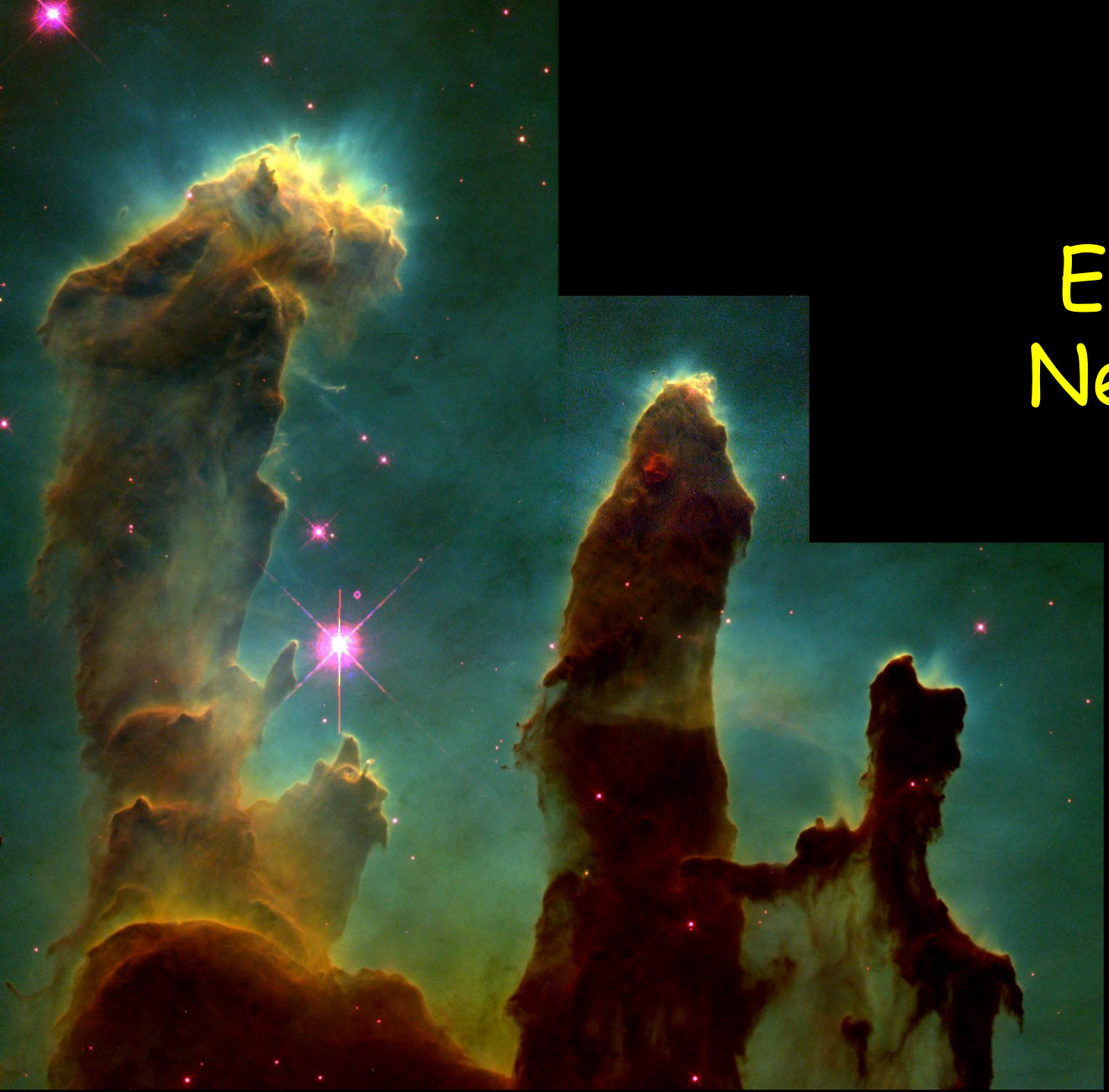


Artist Concept:
NASA's Spitzer Spacecraft

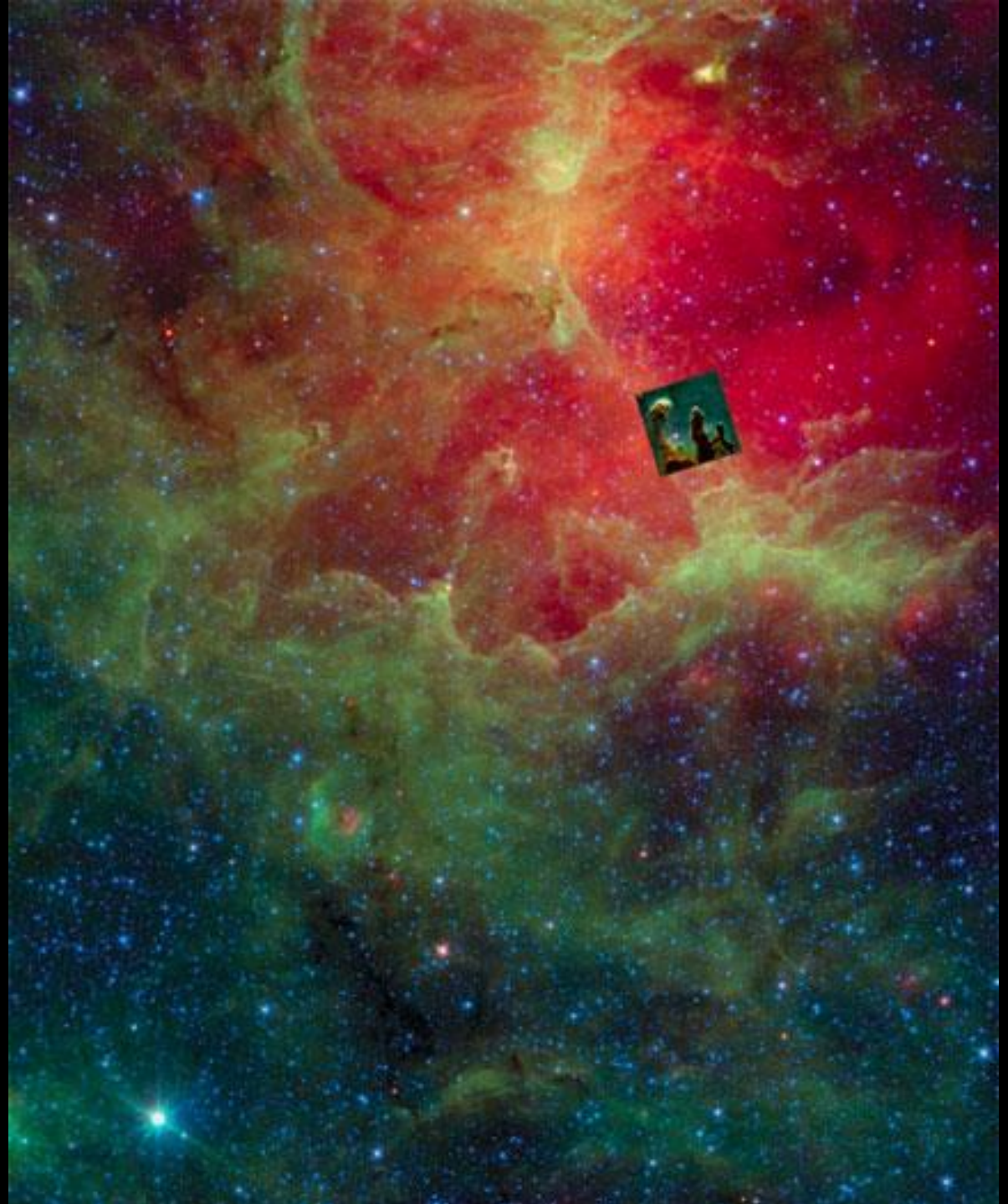
- Spitzer is the largest infrared telescope ever launched into space.
- Many areas of space are filled with vast, dense clouds of gas and dust which block our view.
- Infrared (IR) light, can penetrate these clouds, allowing us to peer into regions of star formation and into newly forming planetary systems.

A Stellar Nursery





Eagle Nebula



When Sun-Like Stars "Die"

Eskimo Nebula

Butterfly Nebula

Cat Eye Nebula

Stars have "life cycles". They are "born" and they "die" but are not alive like us.

Stars like the Sun "die" by "puffing" off their outer layers of gas and dust. This process creates a beautiful variety of NEBULAE in the Milky Way GALAXY.


Crab Nebula (6,500 L.Y. away)
SuperNova – when high mass stars "die"

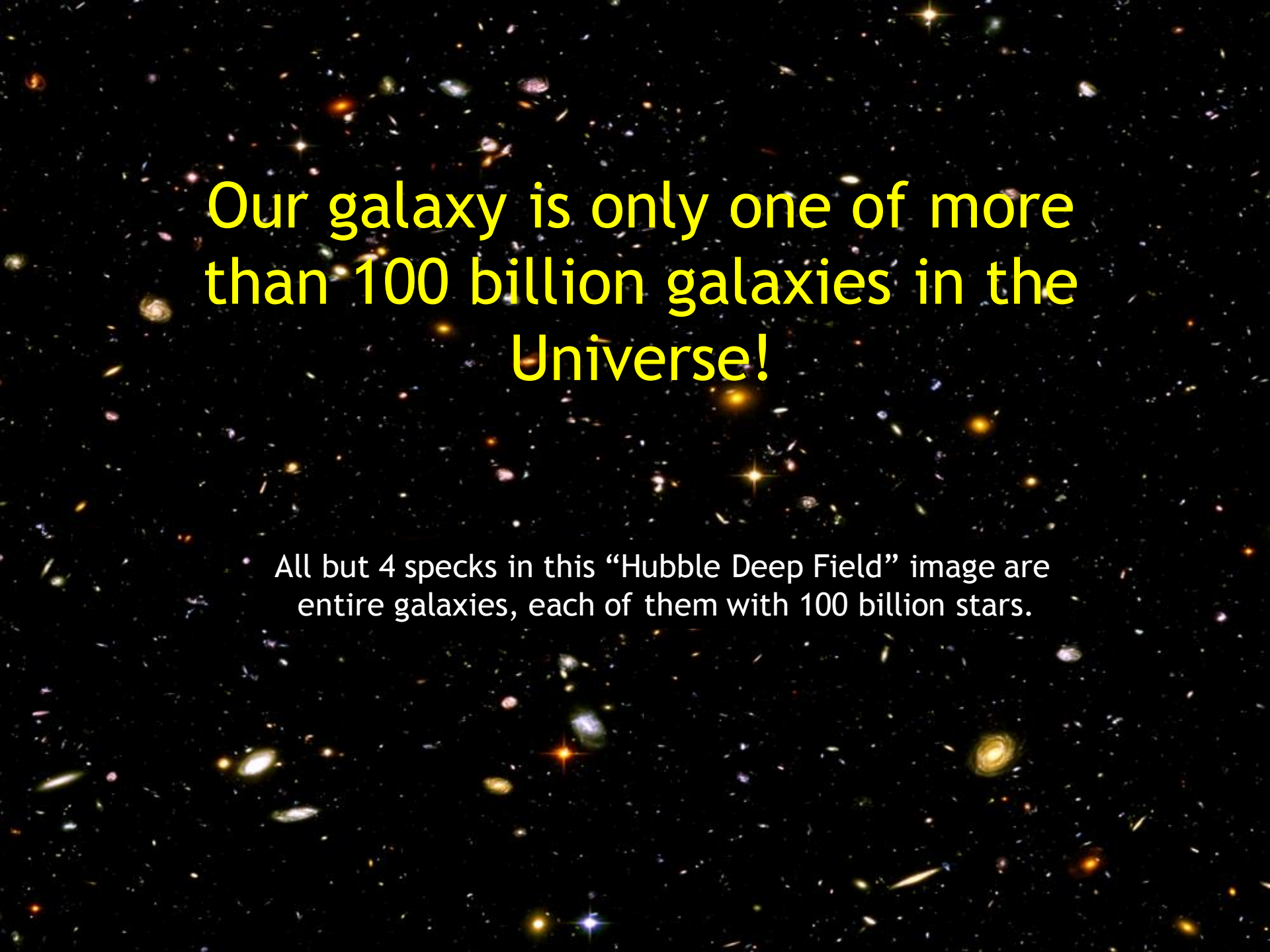

Breaking News:
There are Billions of Galaxies &
the Universe is Expanding!
Andromeda Galaxy (or M31) (2.5M L.Y. away)


Galaxy M81 (11.8M L.Y. away)

Pinwheel Galaxy (27M L.Y. away)

Sombrero Galaxy (28M L.Y. away)


Whirlpool Galaxy (31M L.Y. away)

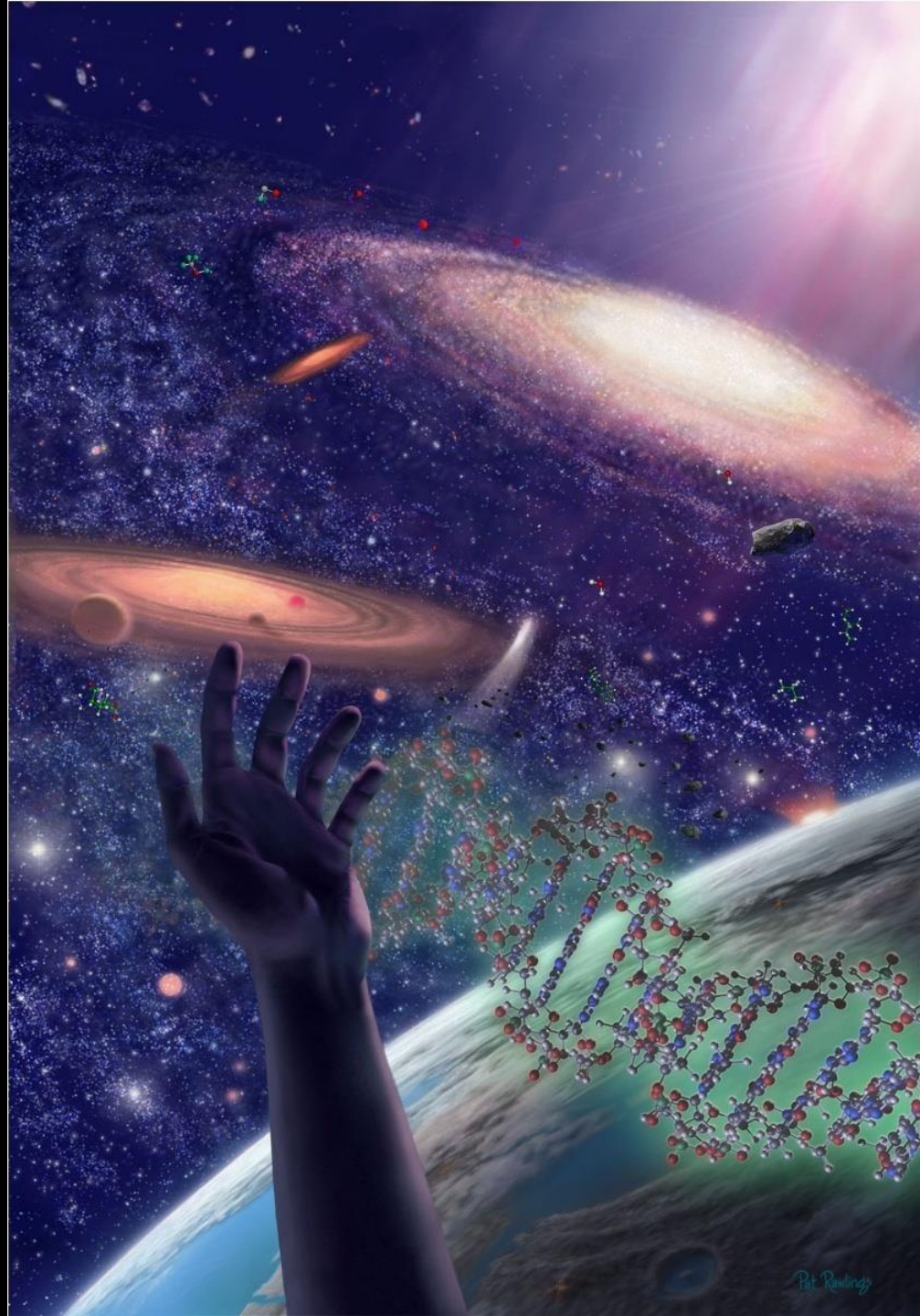

Our galaxy is only one of more than 100 billion galaxies in the Universe!
All but 4 specks in this “Hubble Deep Field” image are entire galaxies, each of them with 100 billion stars.

Are we Alone?

Maybe we are…

Maybe we're not…

Both are equally amazing…



We shall not cease from exploring,
And the end of all our exploration
Will be to arrive where we started
And to know the place for the first time.

- T.S. Eliot, Little Gidding

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