

Alien Worlds



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HARDY

Alien Worlds

Curriculum Overview:

Week 1: Solar System

Week 2: Exoplanet Detection Techniques

Week 3: Exoplanet Interiors & Atmospheres

Week 4: Exoplanet Host Stars

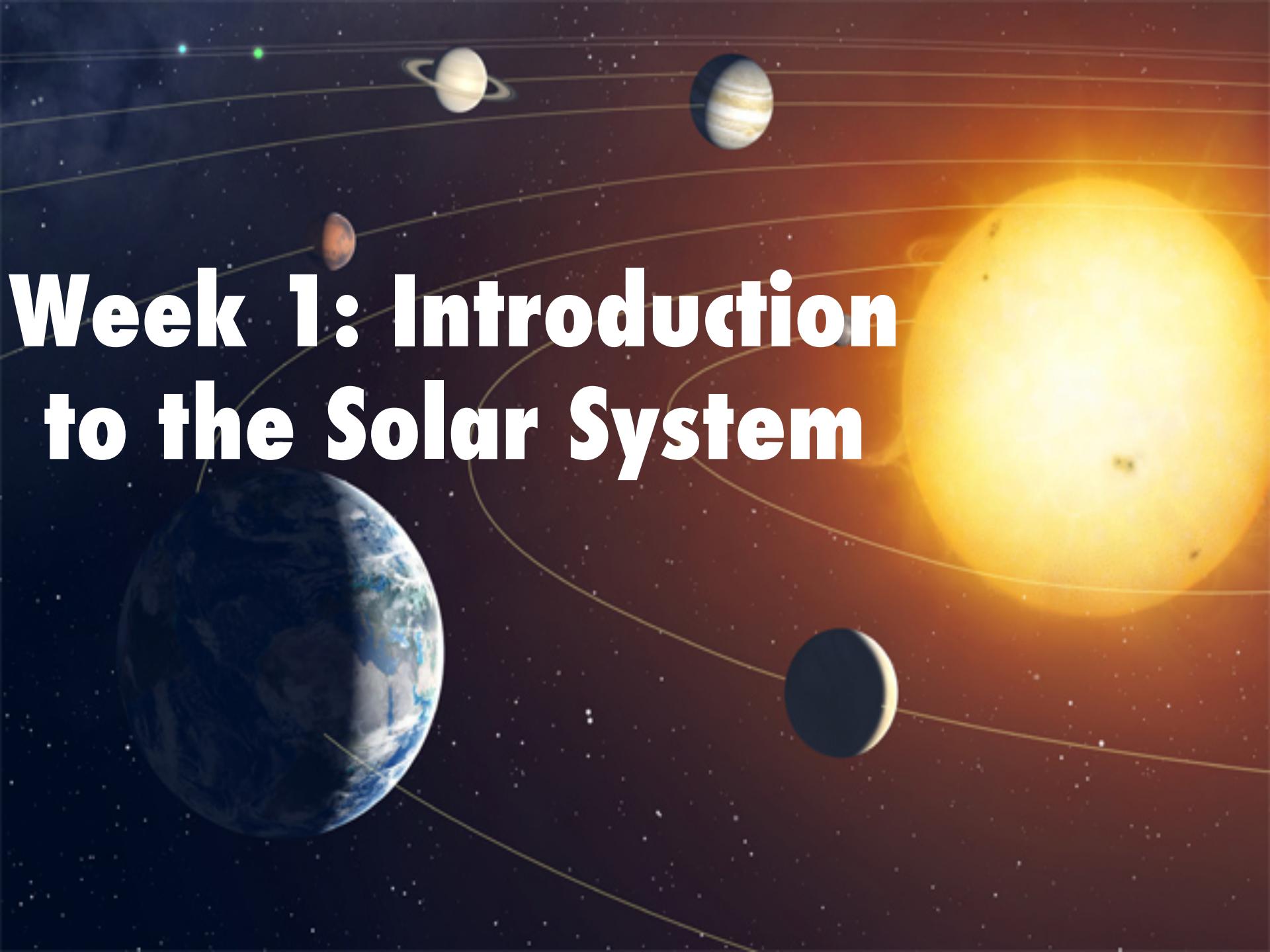
Week 5: The Habitable Zone

Week 6: Alien Worlds in Science Fiction

Week 7: Exoplanet Discoveries, Today and Beyond

Week 8: SETI (Search for Extraterrestrial Intelligence)

Week 1: Introduction to the Solar System



Numbers to Know

Thousand } **x1000**

Million } **x1000**

Billion }

Size Scales & Units

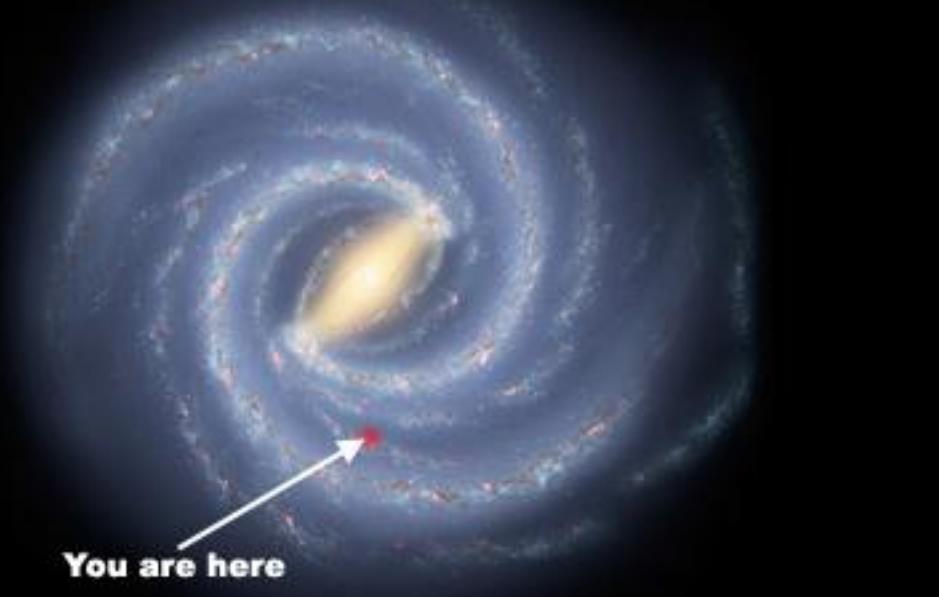


$1 \text{ AU} \approx 1.5 \times 10^8 \text{ km (150 million km)}$

- >**human scale $\approx 1 \text{ km}$**
- >**city scale $\approx 10\text{s km}$**
- >**large asteroids $\approx 100\text{s km}$**
- >**planets, large moons $\approx 1000\text{s km}$**
- >**sun $\approx 100,000\text{s km}$**
- >**size of solar system $\approx 100\text{s billions km}$**
- >**size of galaxy $\approx \text{hundred quadrillion km}$**

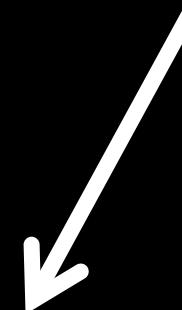
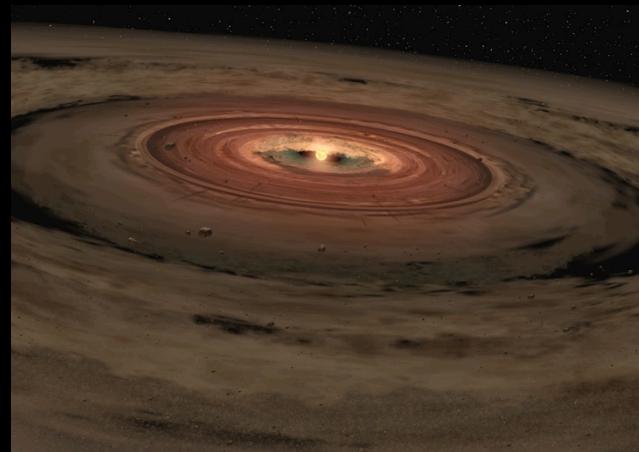
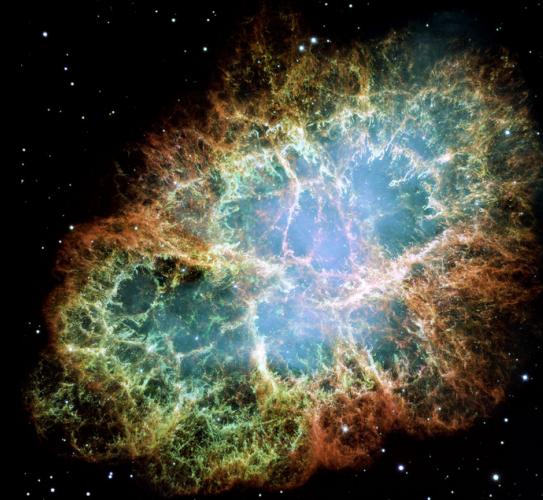
Our Cosmic Address

**The Milky Way Galaxy: 200 billion stars
(200,000,000,000 stars or
3 x 10¹¹ stars)**

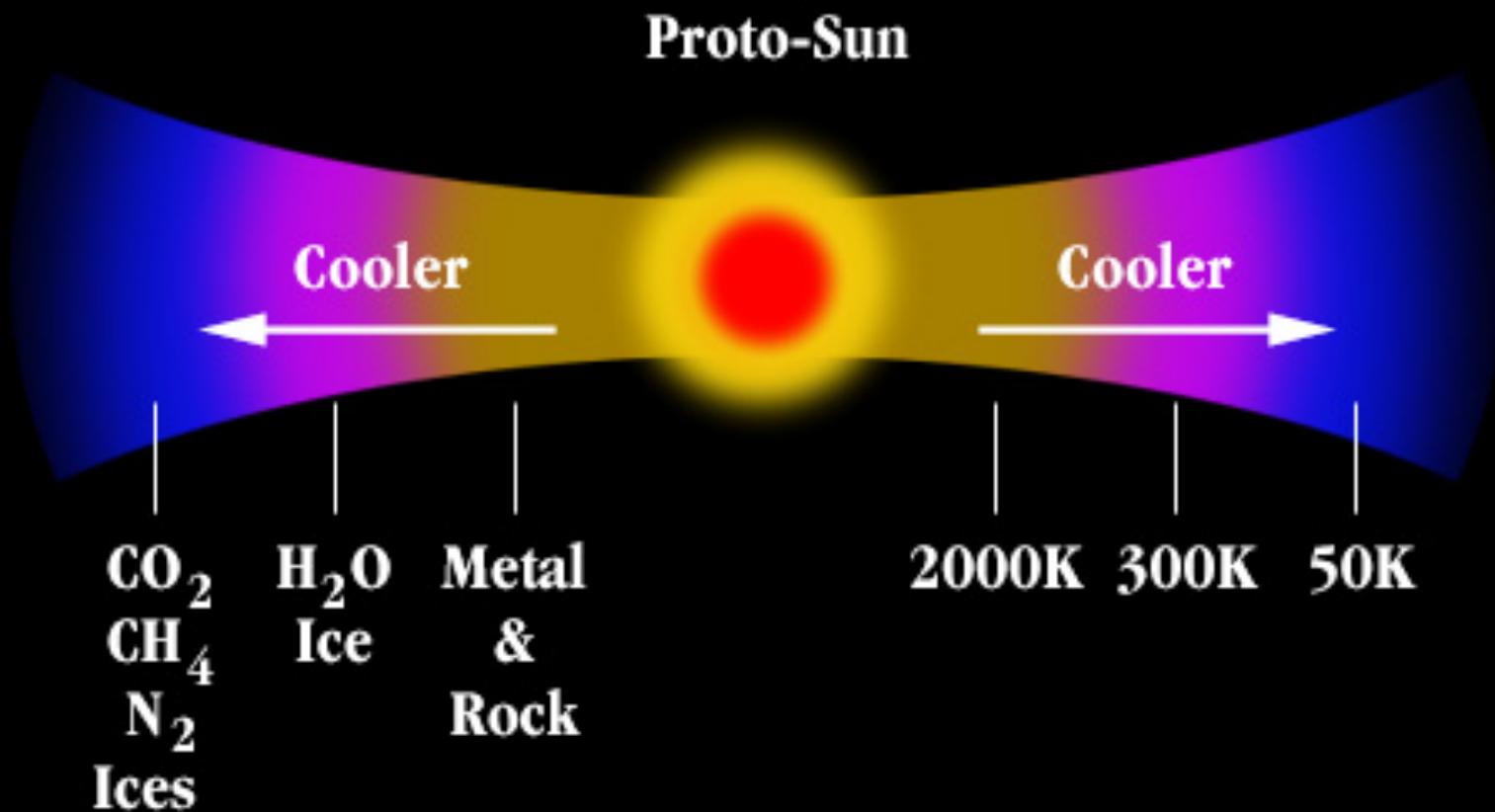


● = our solar neighborhood, where all the stars visible to the unaided eye are located

In the Beginning...



Planetesimals & the Snow Line



Planetesimals → Planets

a



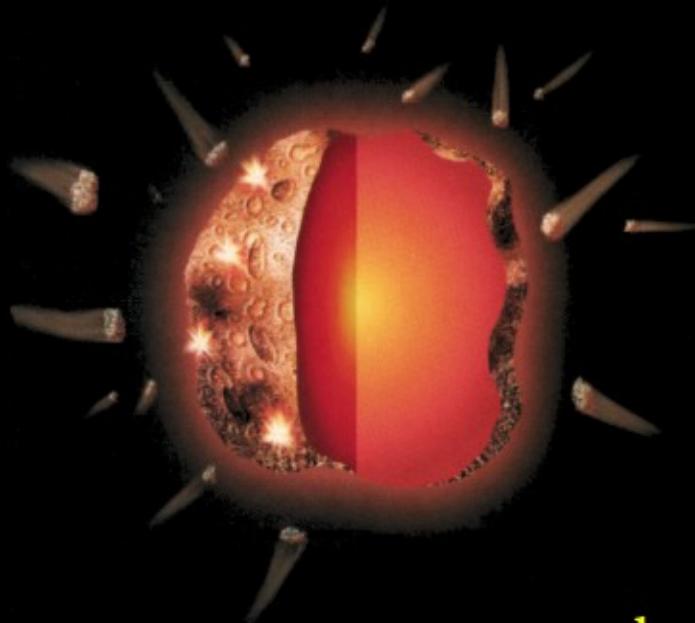
10 mm



0.1–10 m

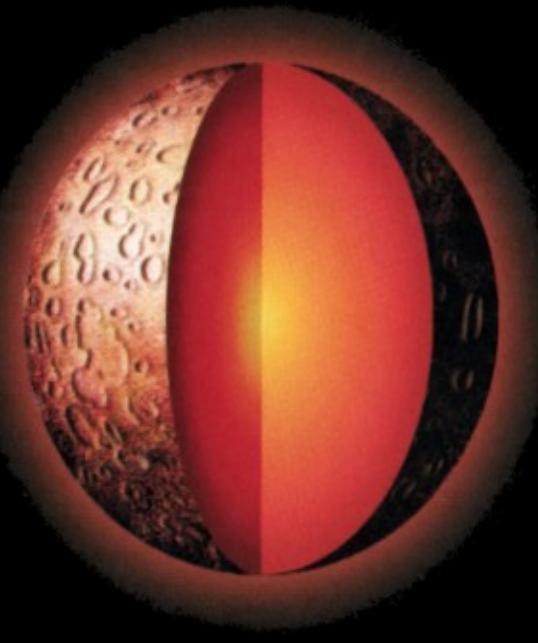


0.1–10 km



100–1000 km

d



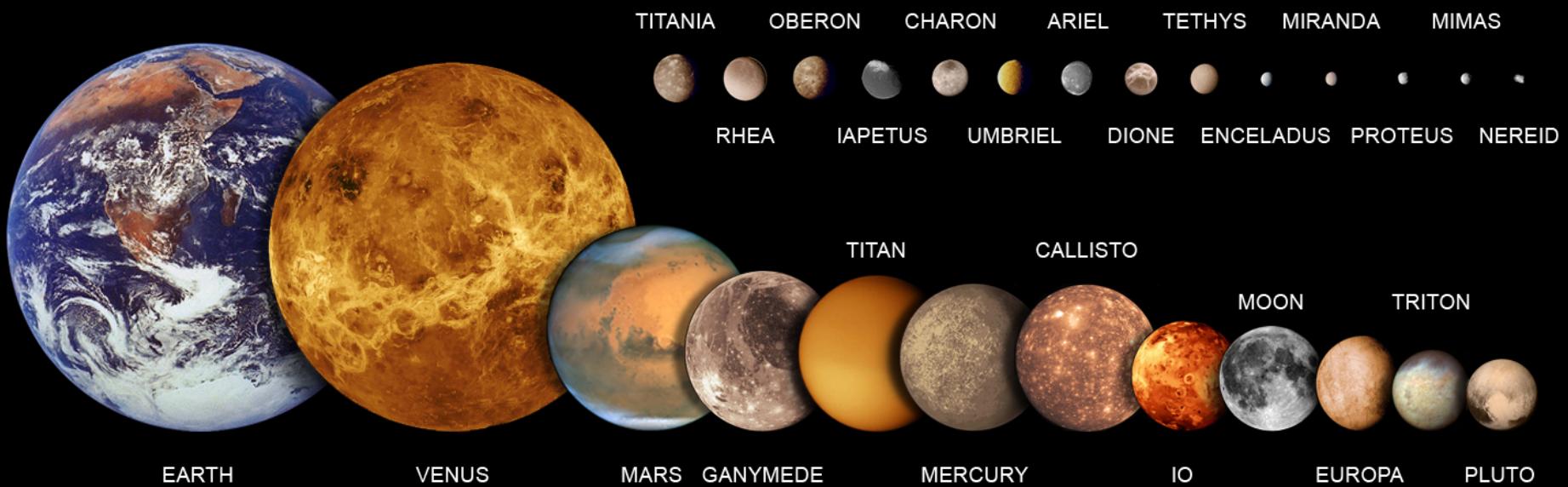
1000–5000 km

e

Early SS: Impacts

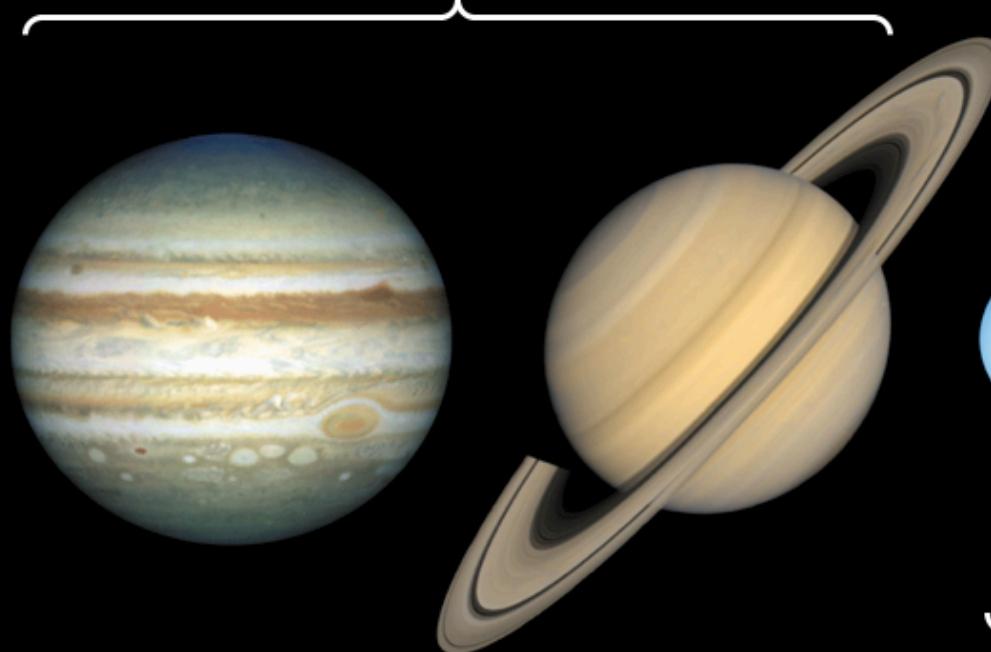


SS Today: Terrestrial Planets and Satellites



SS Today: Gas & Ice Giants

Gas giants



Ice giants

"Gas Planet Sizes"

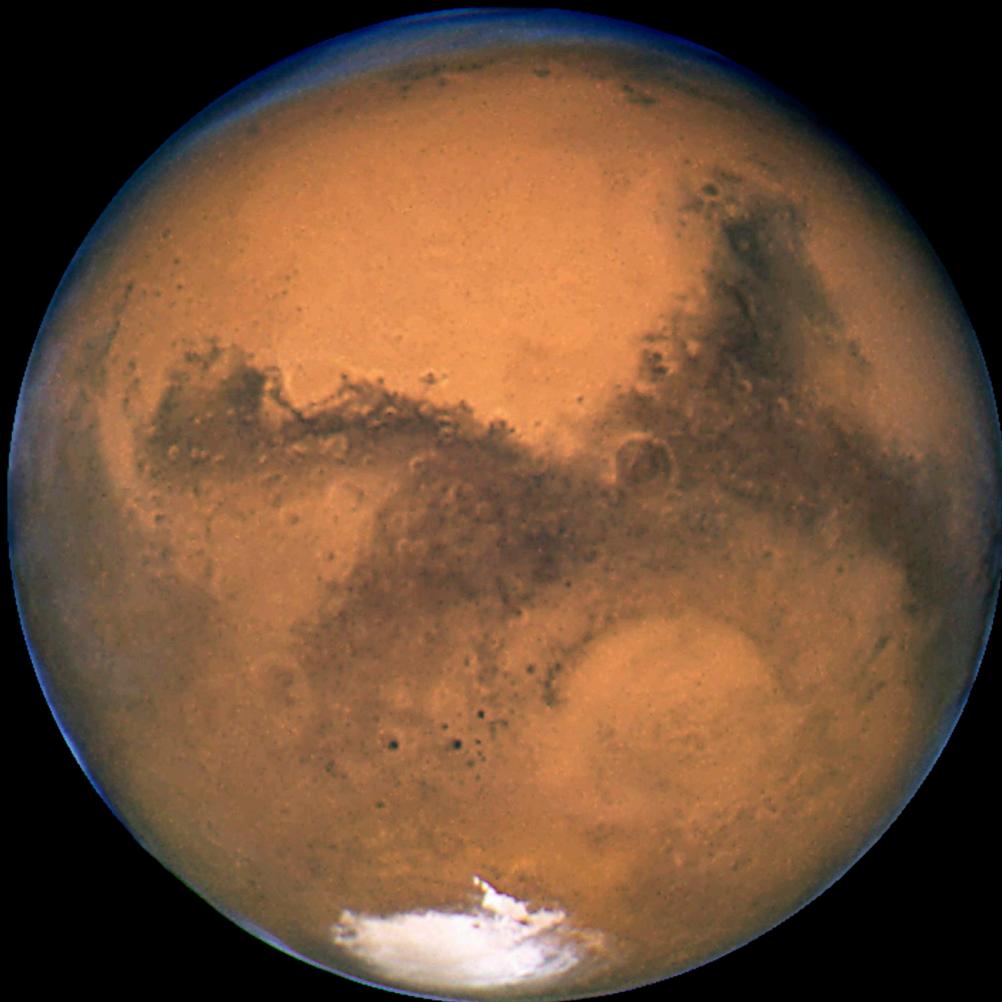
(Source: Lunar and Planetary Institute)

http://solarsystem.nasa.gov/multimedia/display.cfm?IM_ID=180

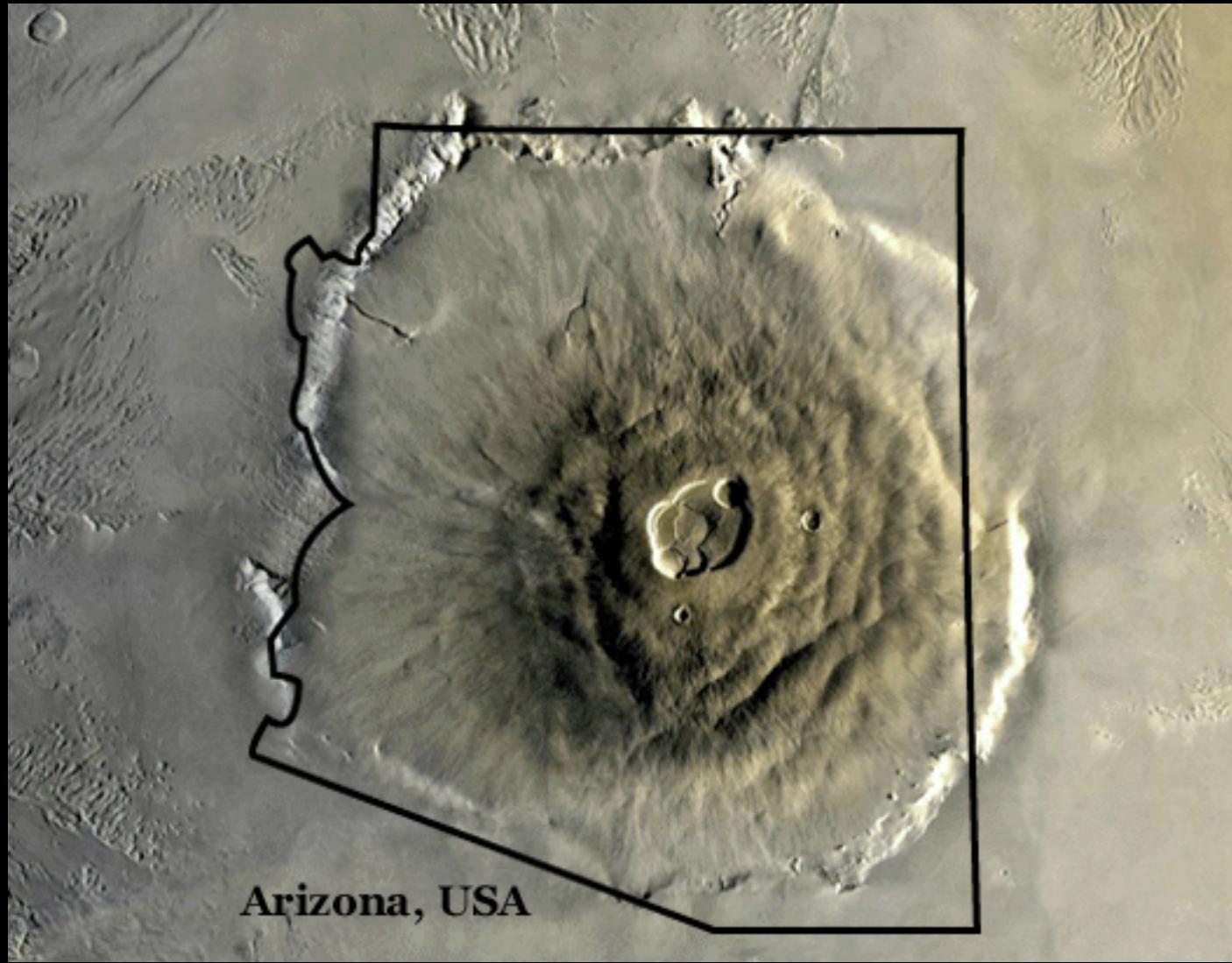
Life in the SS



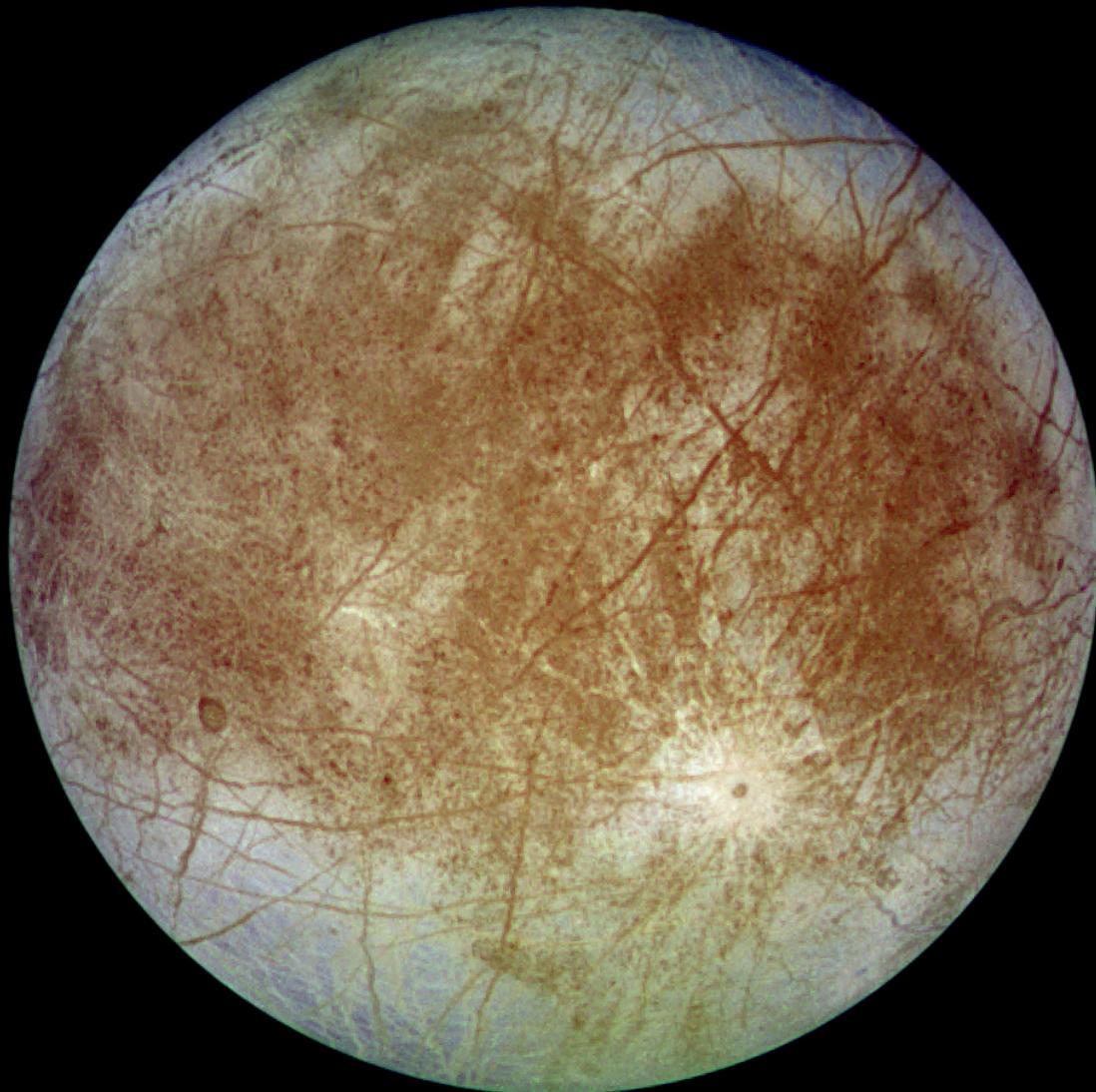
Alien Worlds in the SS: Mars



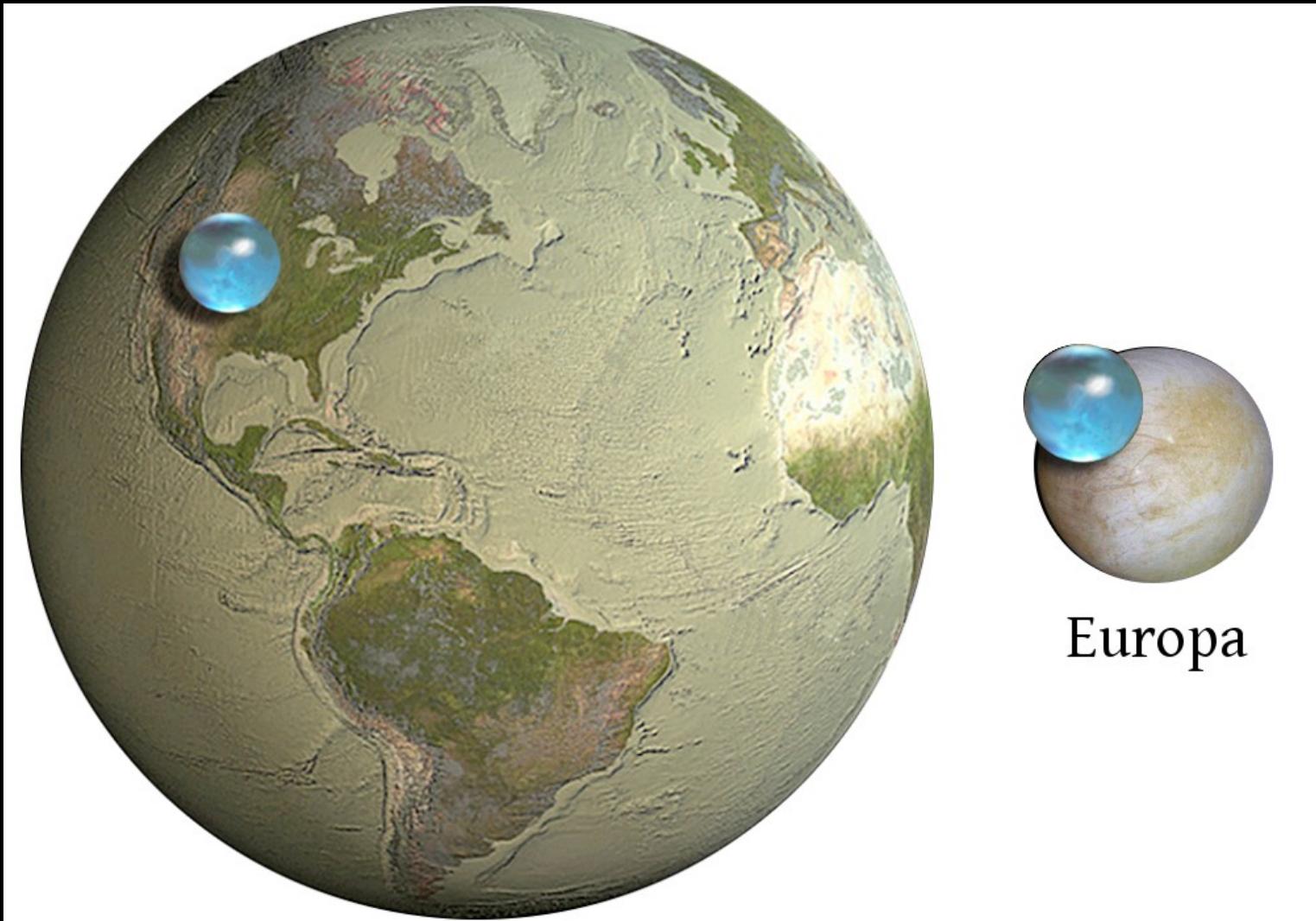
Alien Worlds in the SS: Mars



Alien Worlds in the SS: Europa

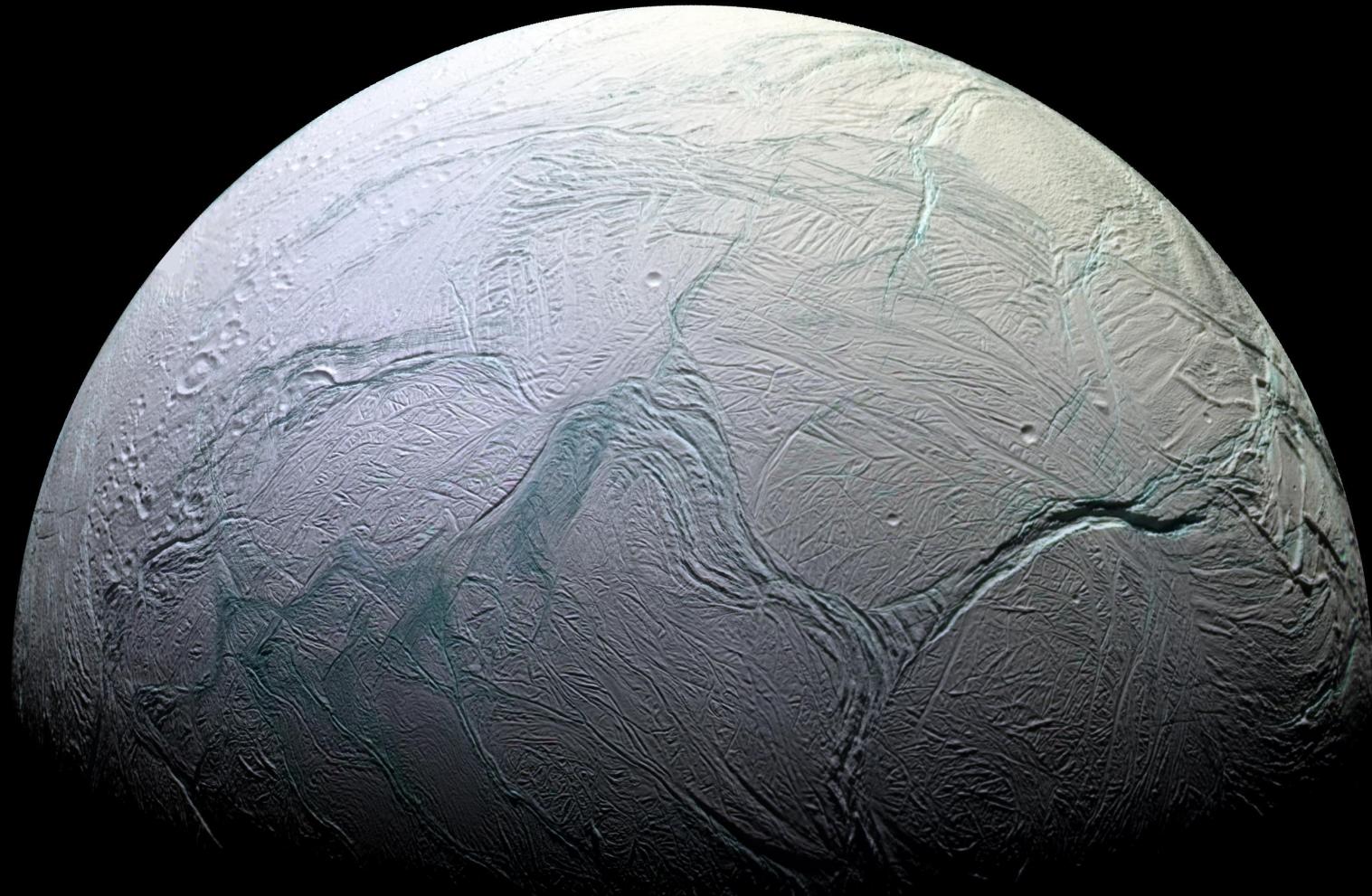


Water on Europa

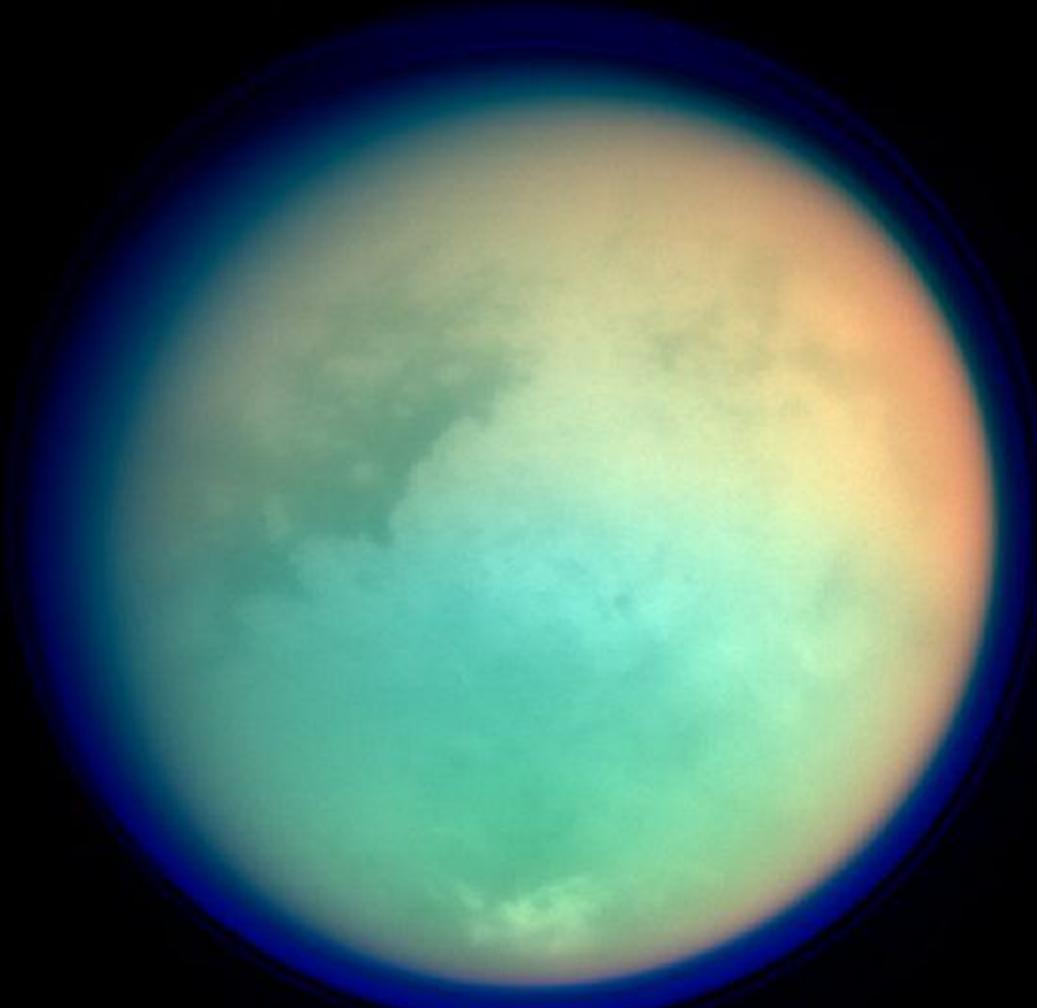


Europa

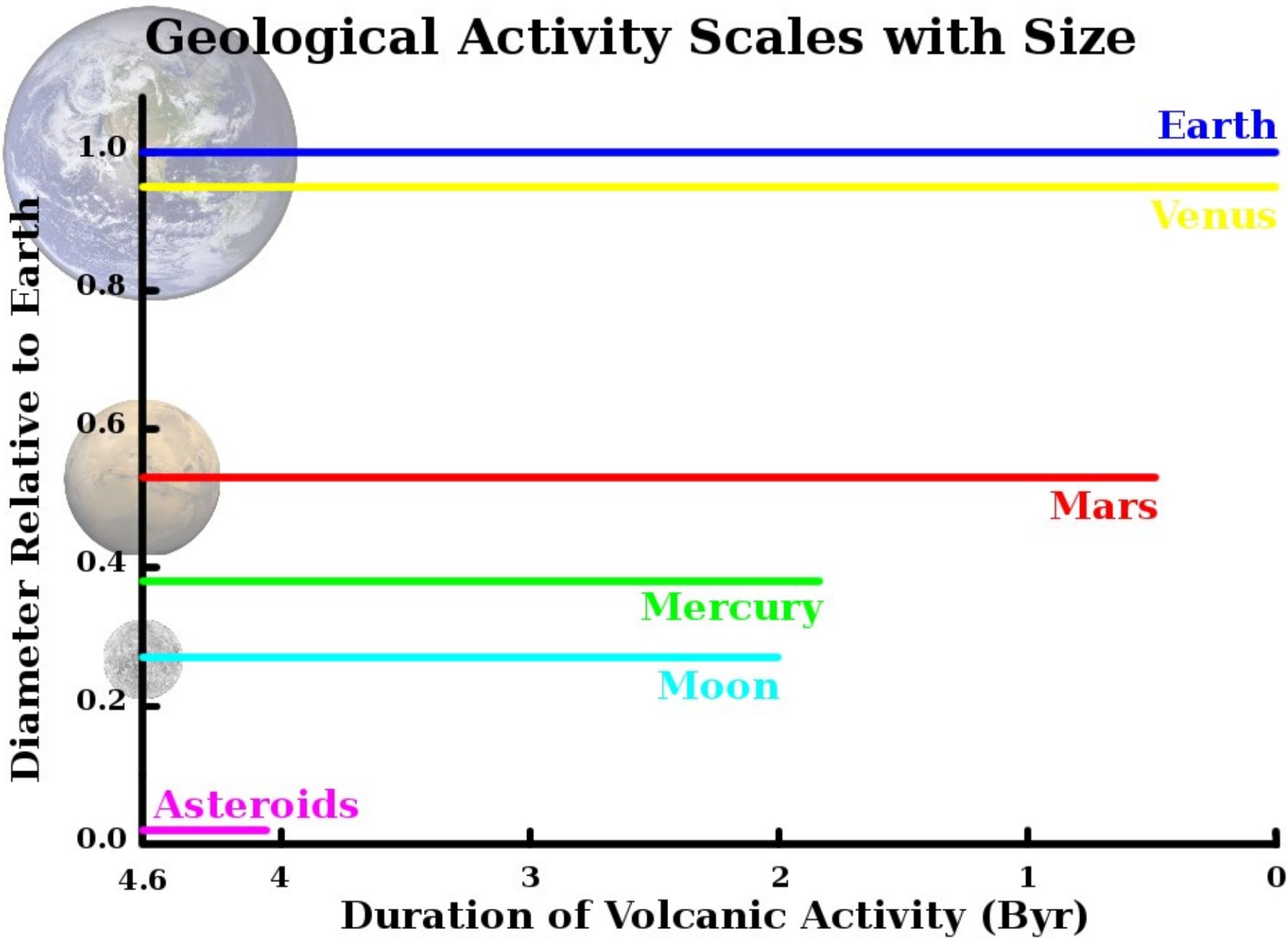
Alien Worlds in the SS: Enceladus



Alien Worlds in the SS: Titan



Geological Activity Scales with Size



Discussion: What Do You Need for Life?

- Water
- Organic molecules
- Constant energy source
 - Star
- Atmosphere
- Solid surface (rocky?)
- Geological activity
 - i.e. plate tectonics
 - Tidal heating
- Magnetic field