

The Solar System

Last time

- Moon phases

The new moon rises at approximately:

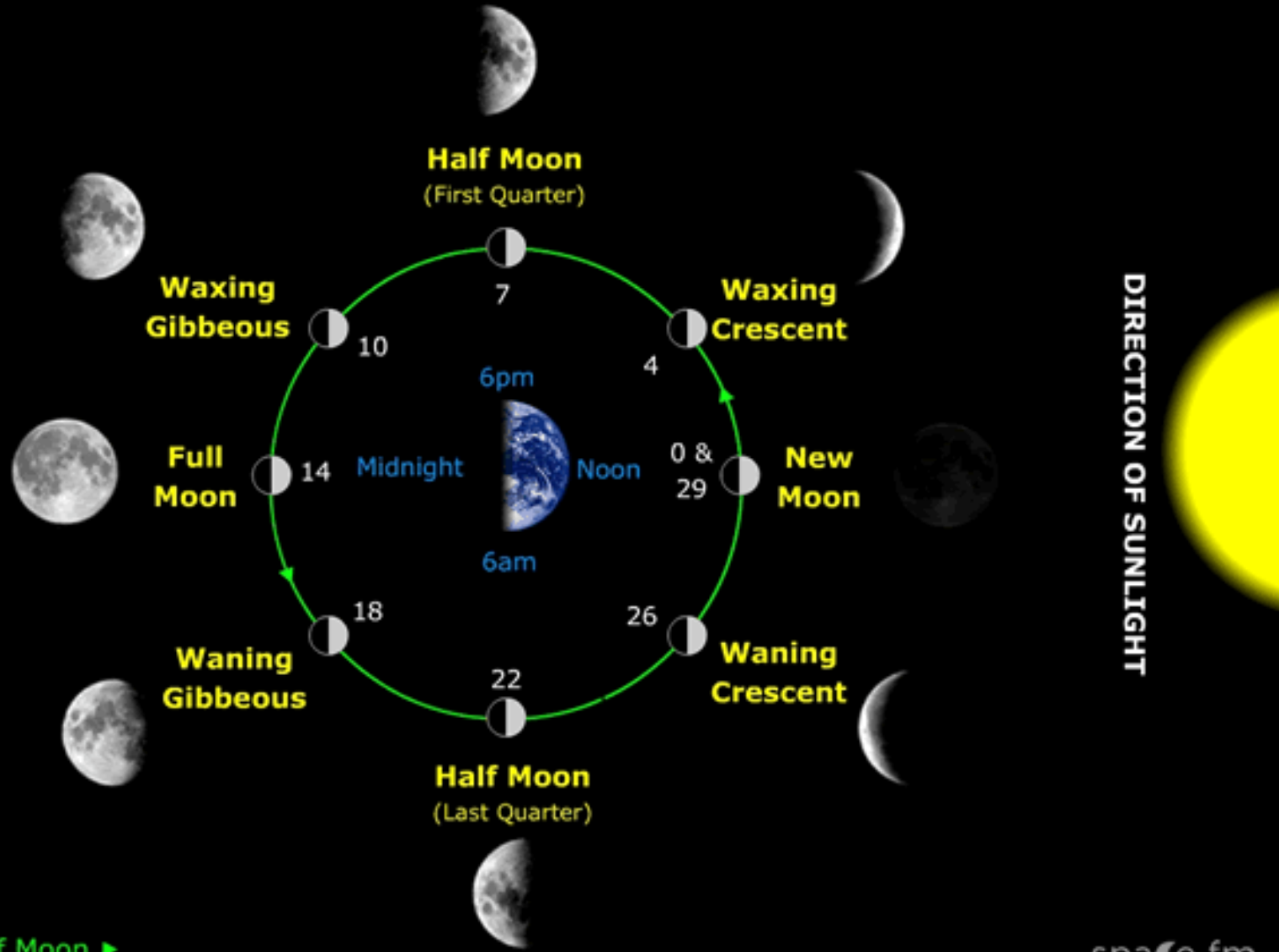
1. Midnight
2. Sunset
3. Sunrise
4. 9 or 10 p.m.
5. It rises at different times during the year

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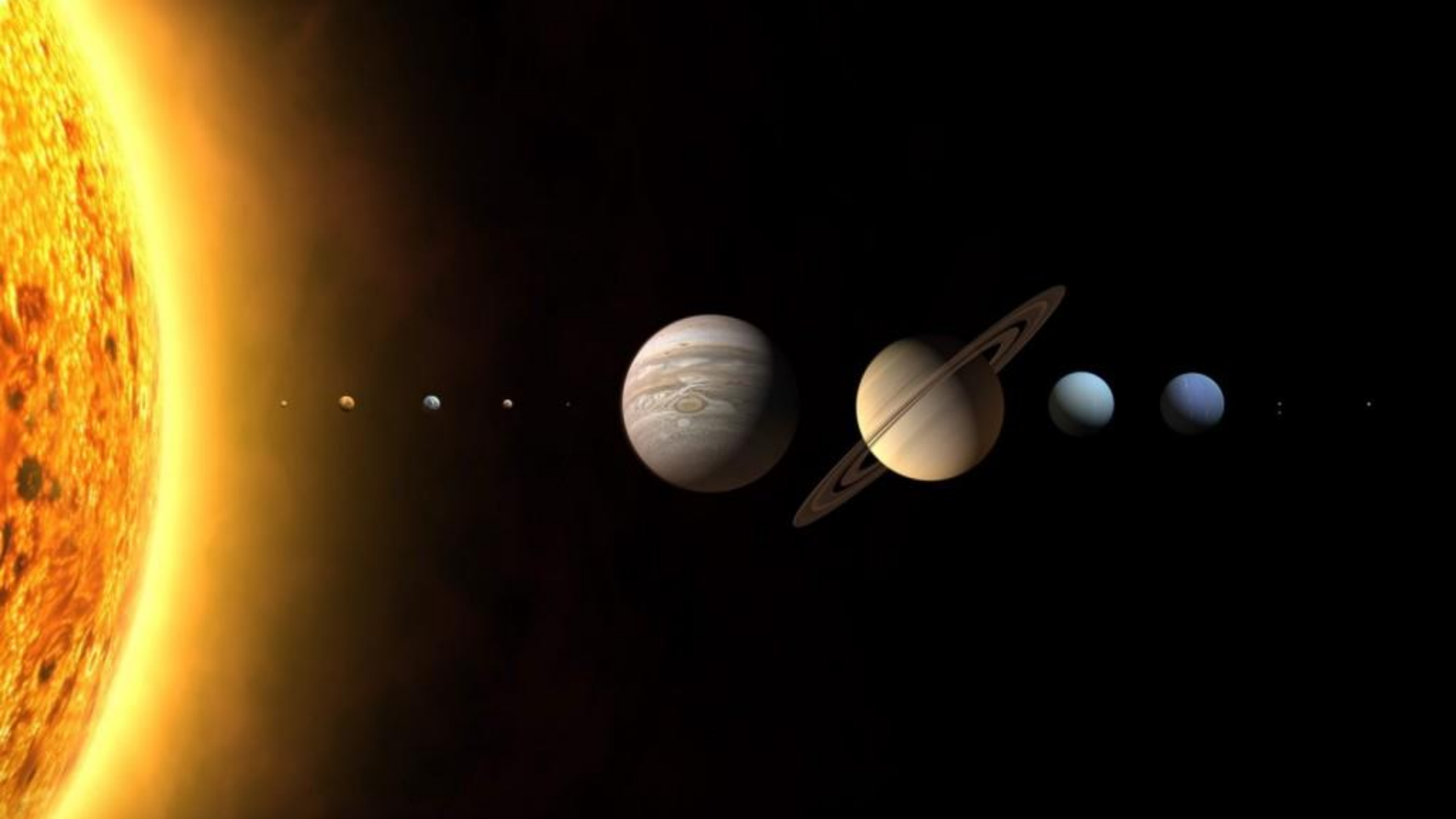
PHASES OF THE MOON

Not drawn to scale



The Solar System

Can we learn the history of the Solar System from what we see today?

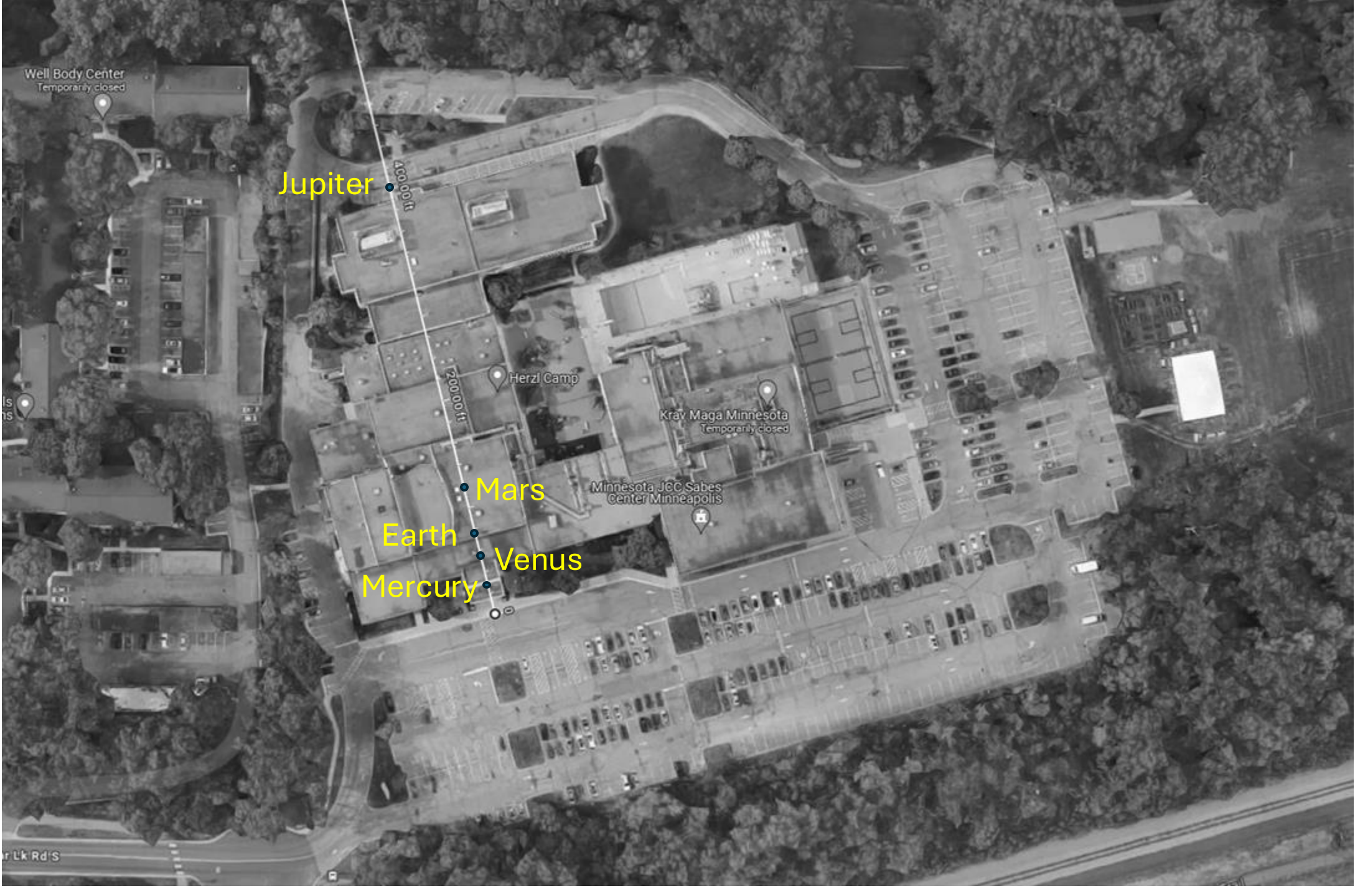




Analogies: Scales of the Solar System

- Mass
 - *What is the most massive object in the Solar system?*
- Distances
 - *How far apart are planets from each other?*
- Sizes
 - *How to the planets sizes compare to each other?*

Size scale



Well Body Center
Temporarily closed

Jupiter

Herzl Camp

Krav Maga Minnesota
Temporarily closed

Minnesota JCC Sabes
Center Minneapolis

Mars

Earth

Venus

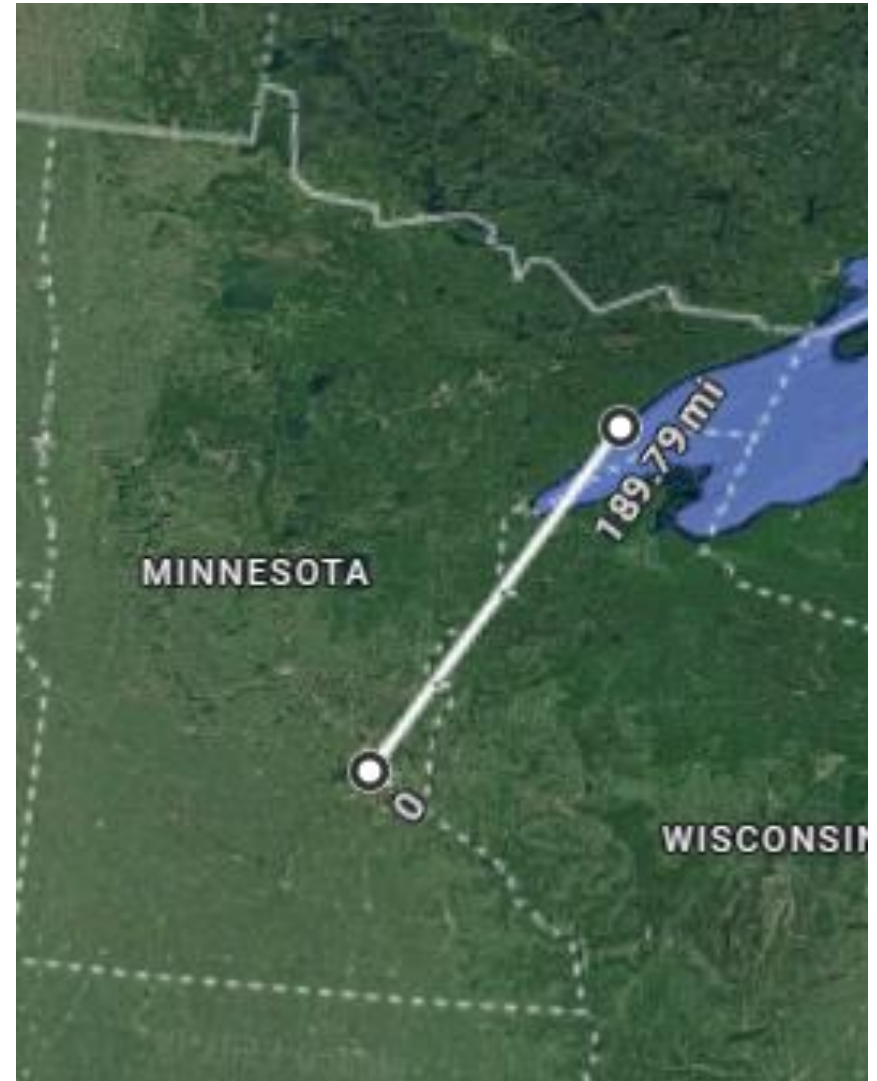
Mercury

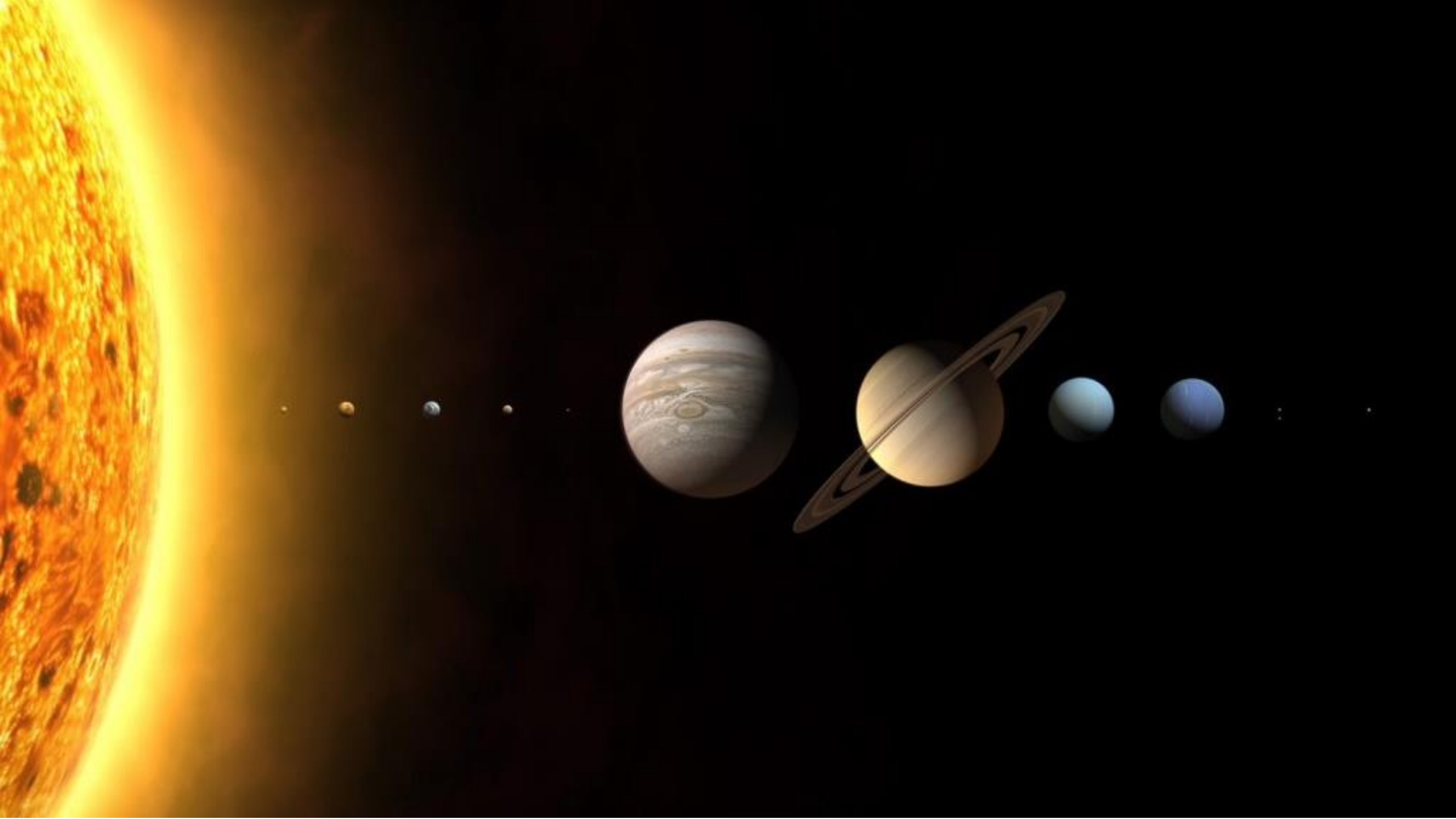
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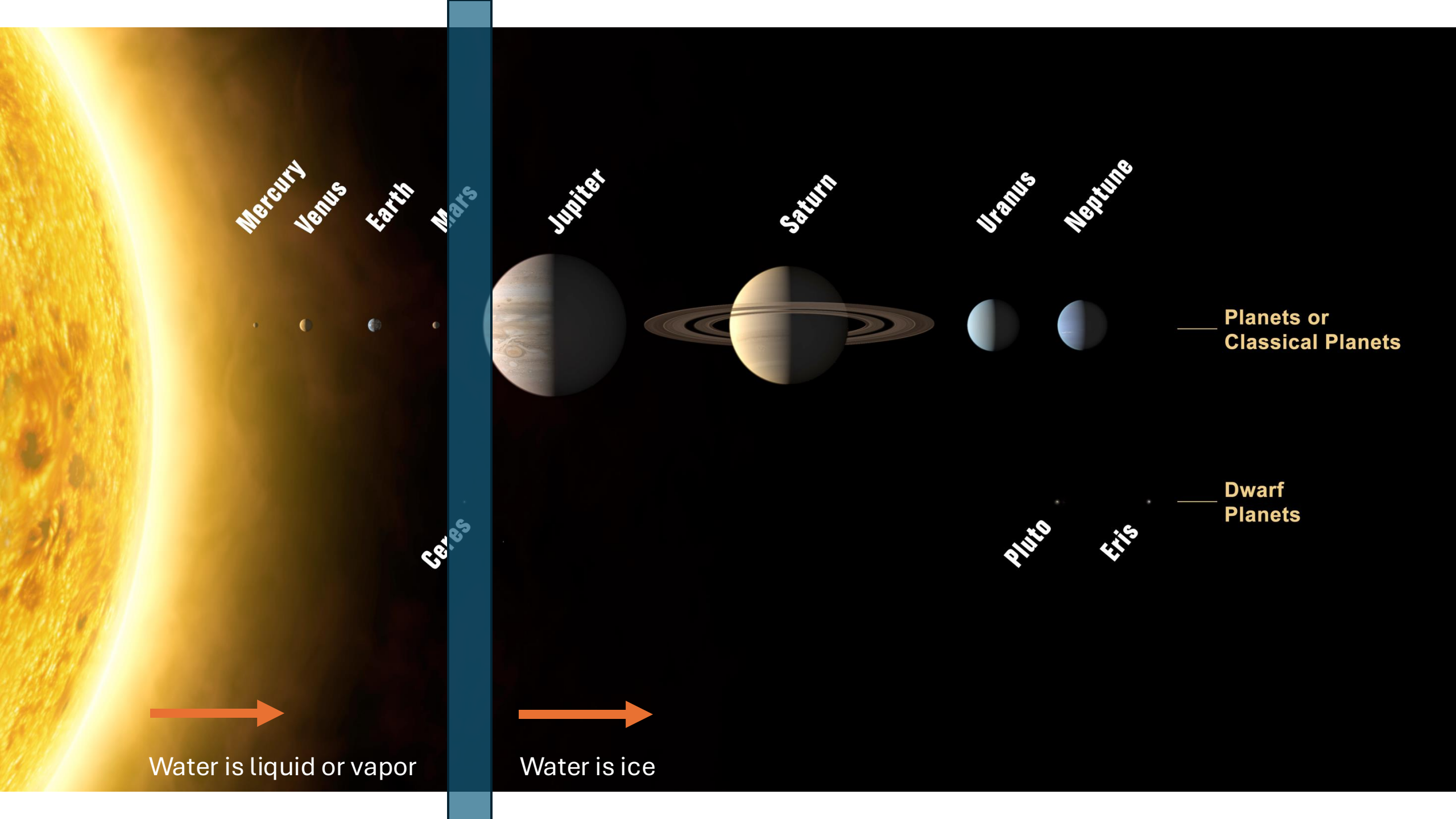


On this scale...

- Alpha Centauri = 190mi
- Andromeda galaxy ~ Neptune's orbit.







Mercury

Venus

Earth

Mars

Jupiter

Saturn

Uranus

Neptune

Planets or
Classical Planets

Ceres

Pluto

Eris

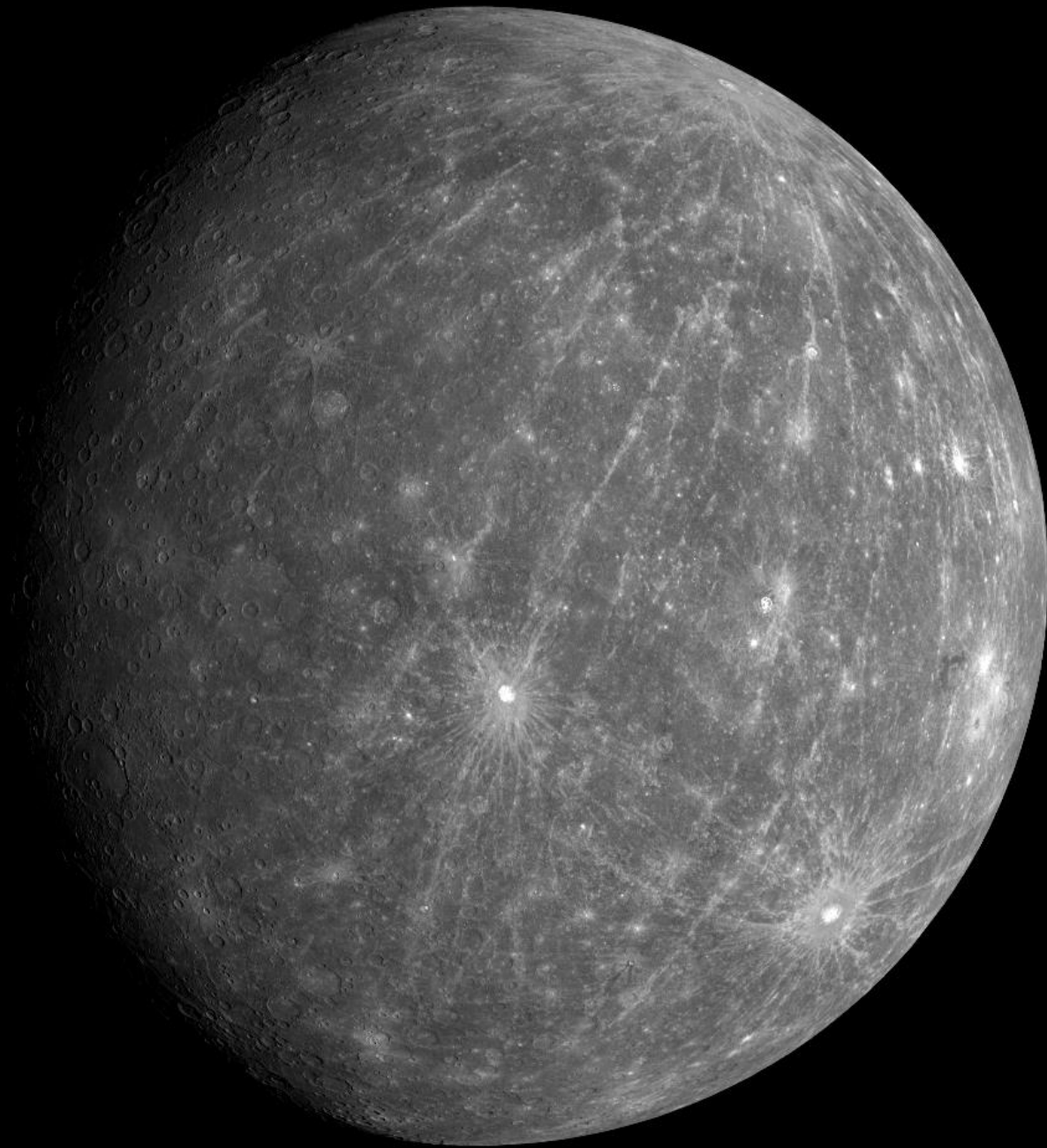
Dwarf
Planets



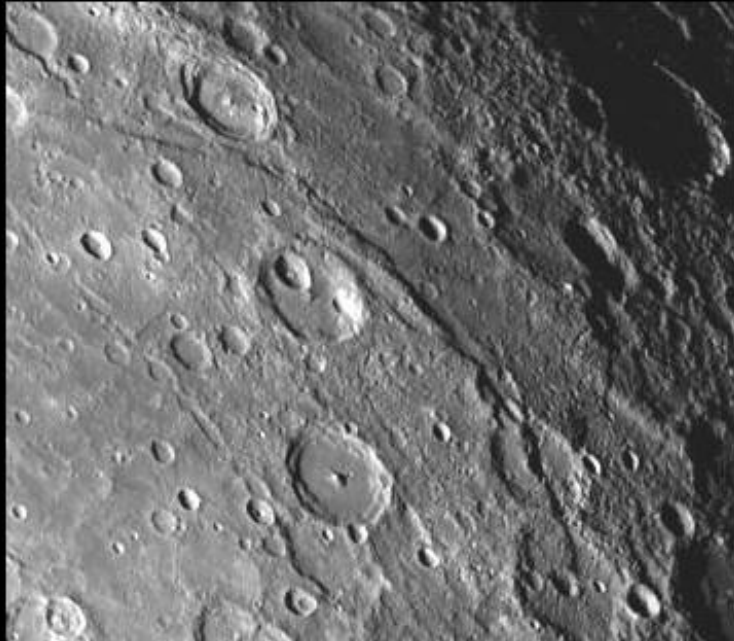
Water is liquid or vapor

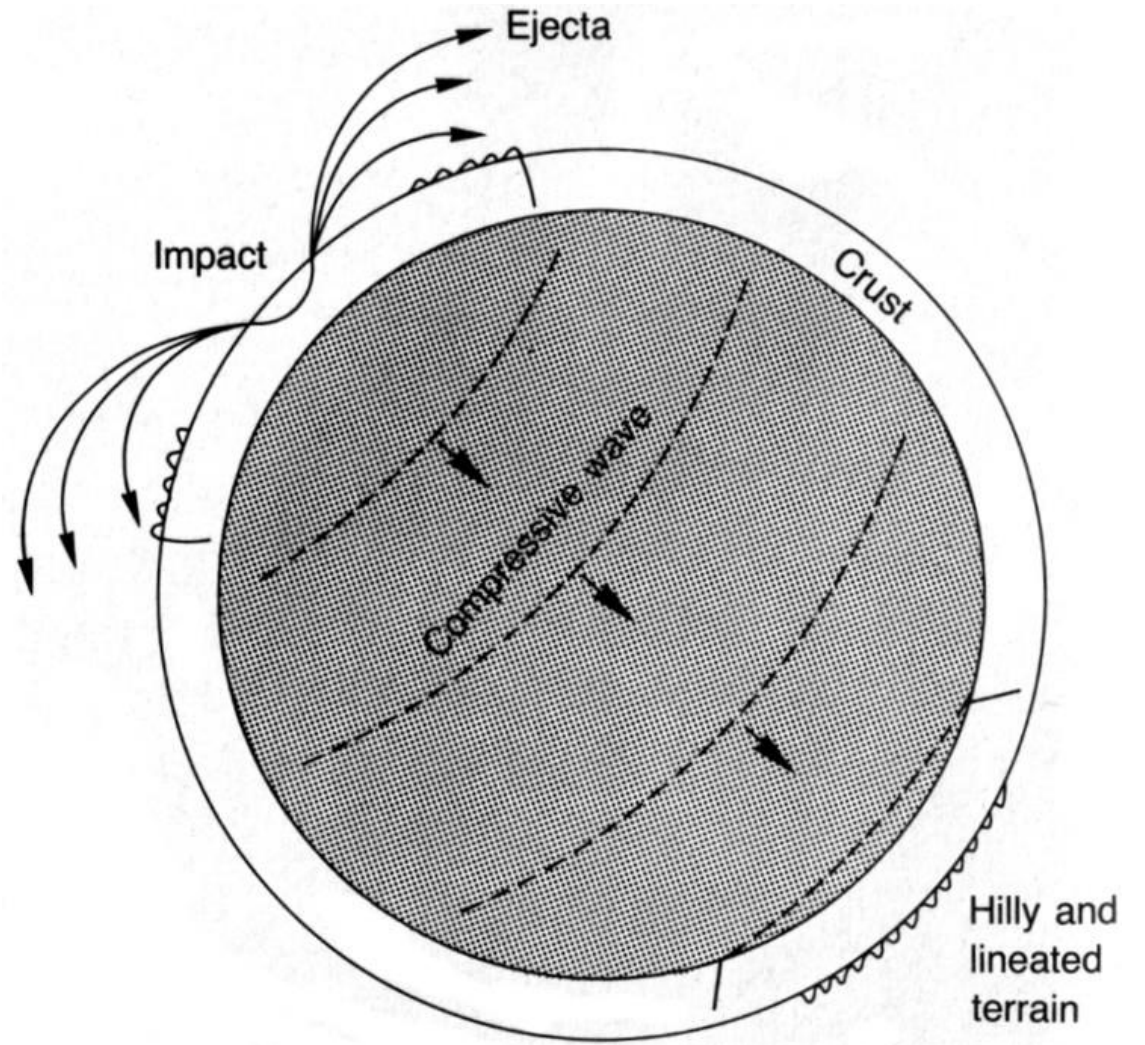
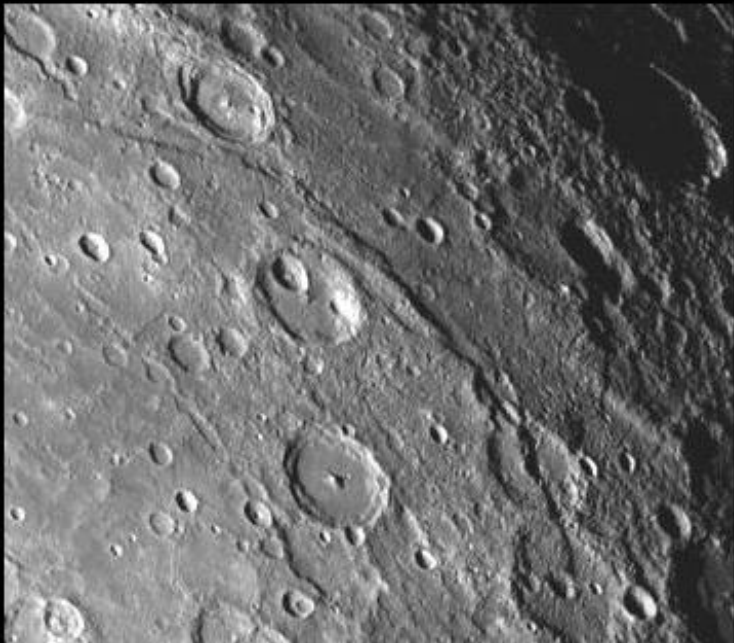


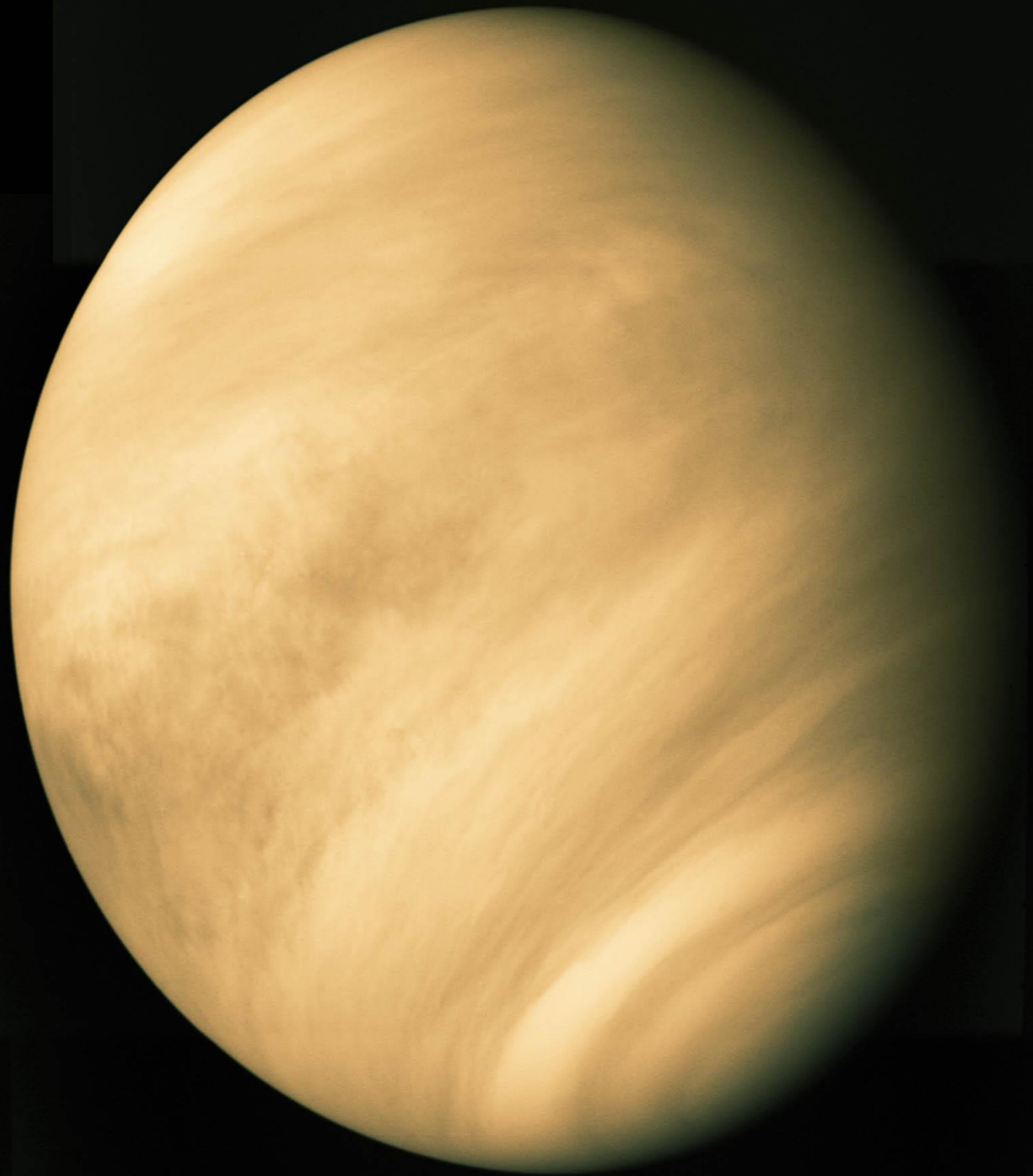
Water is ice

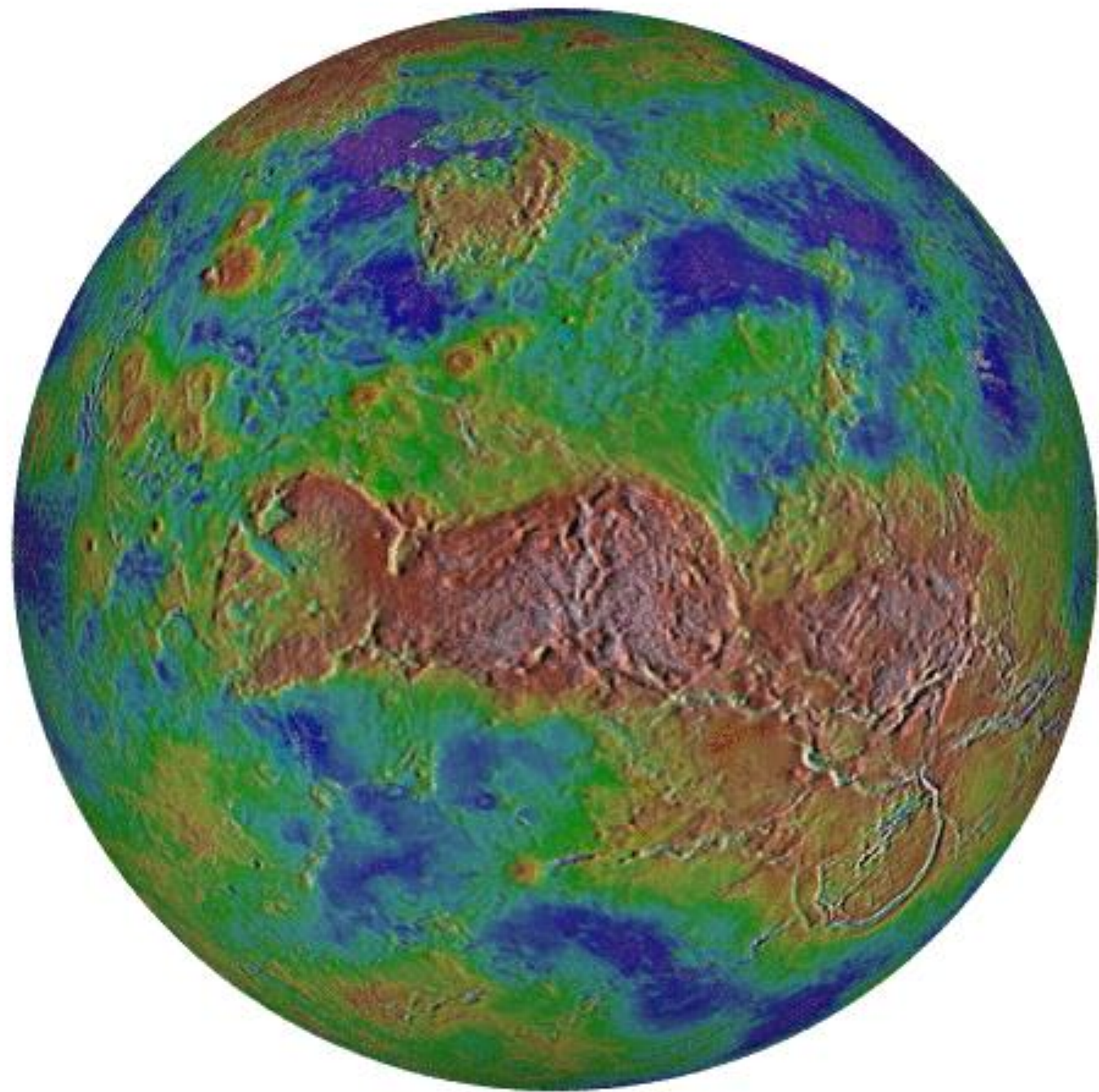


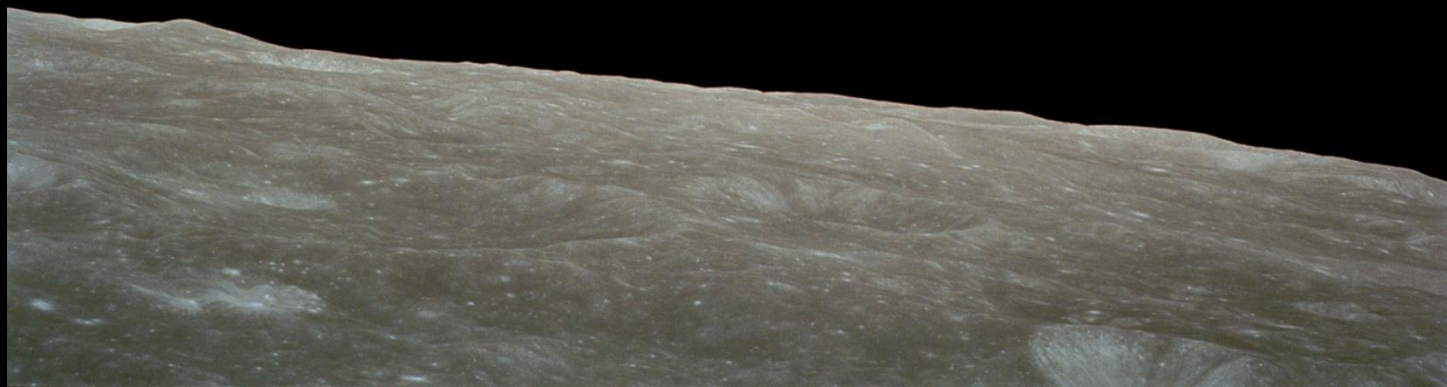
Scarps

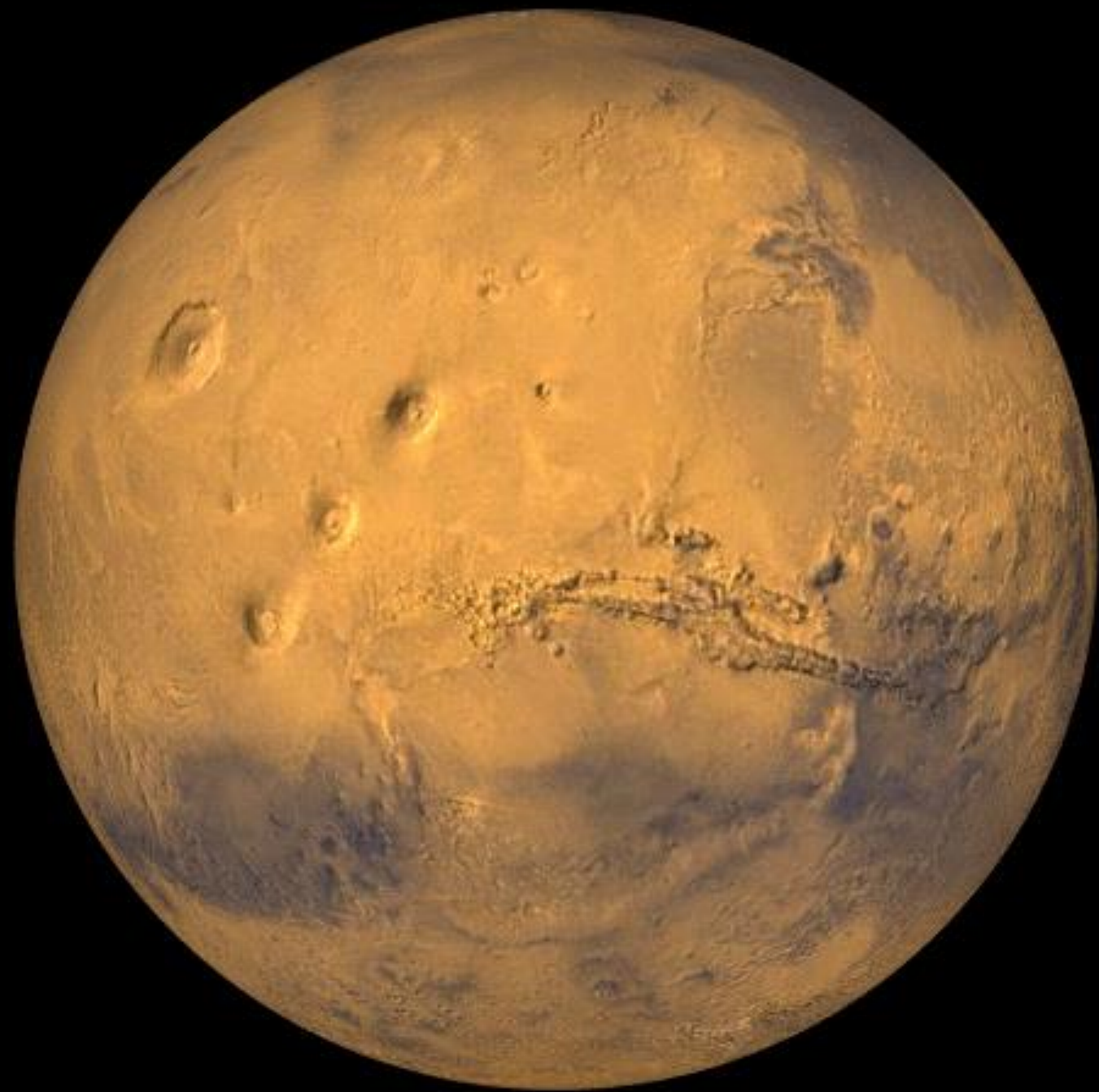


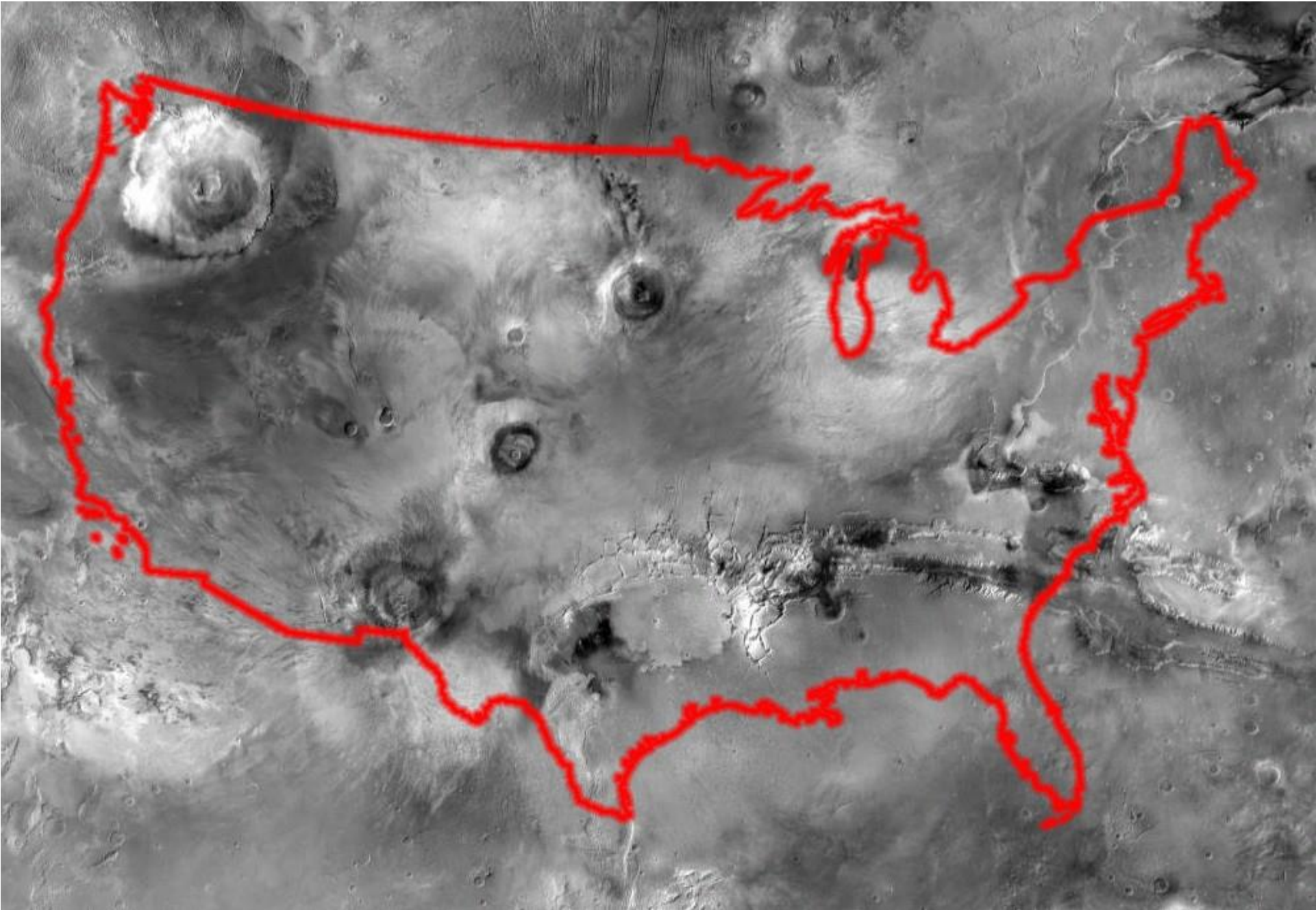




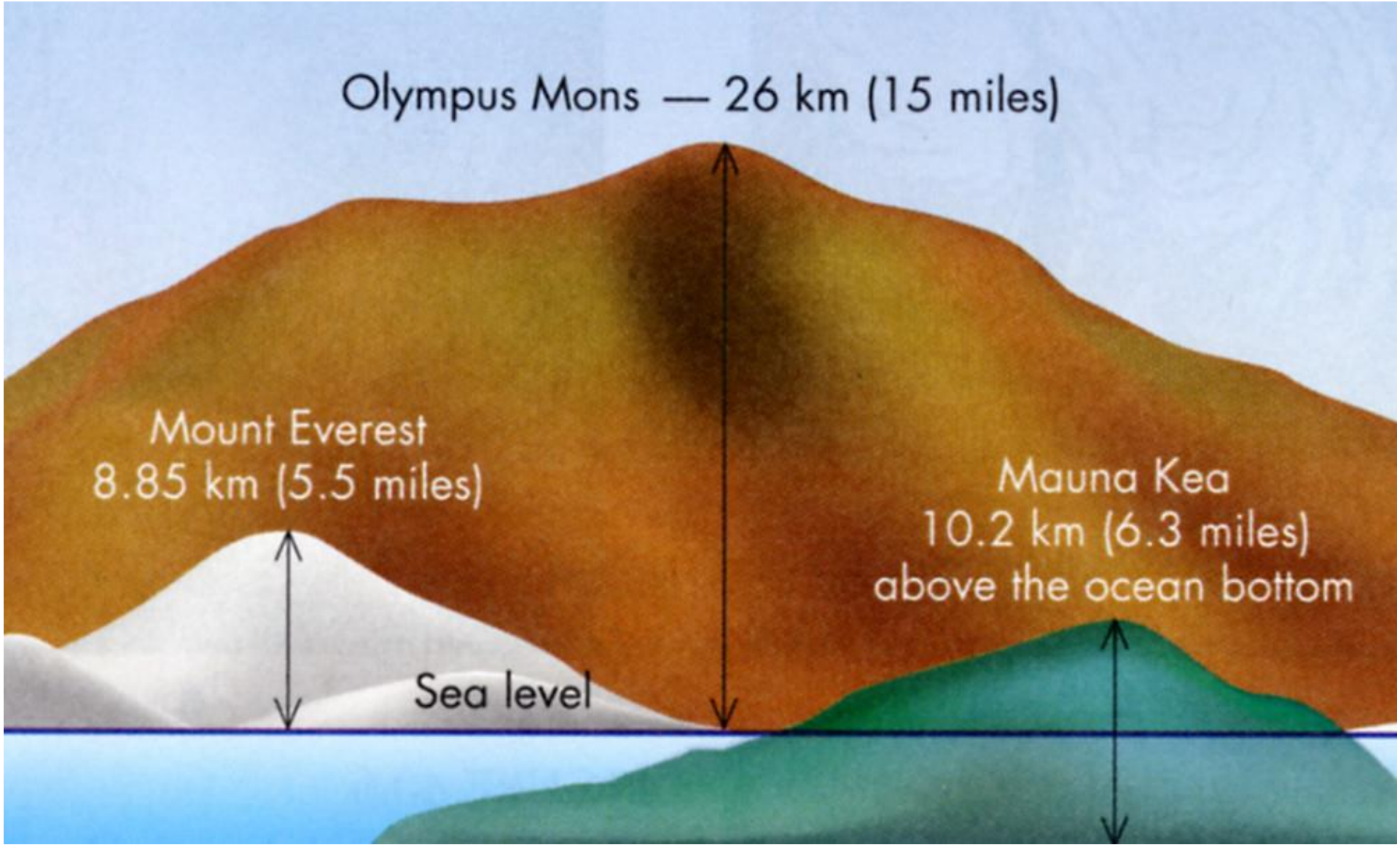










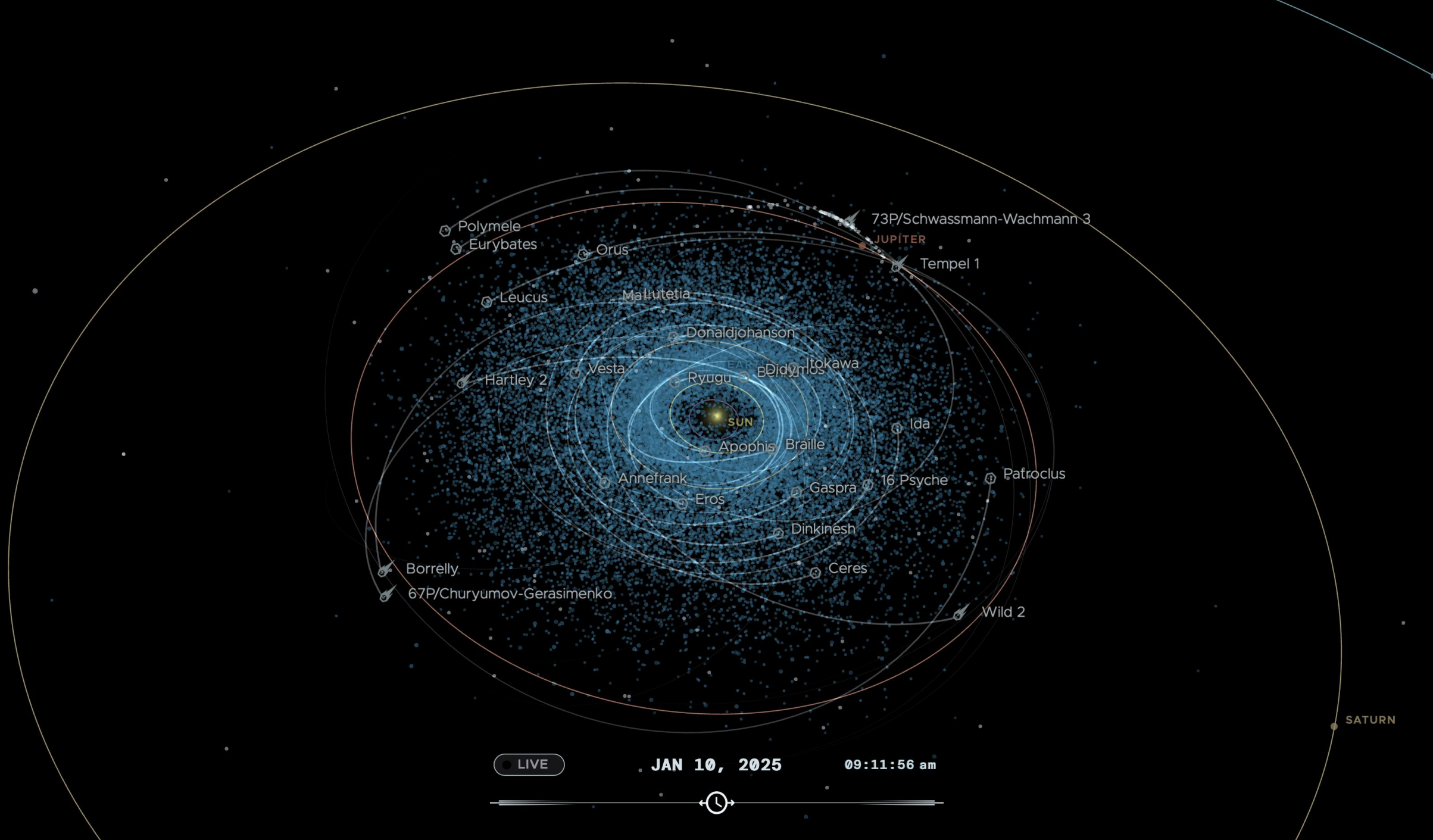


M0151295144F4

December 3 2000 23:08:30 21° 146°







URAN

Polymele
Eurybates

Orus

Leucus

Malutetia

Hartley 2

Vesta

Donaldjohanson

Ryugu

Itokawa

Didymos

SUN

Apophis

Braille

Ida

Annefrank

Eros

Gaspra

16 Psyche

Patroclus

Borrelly

67P/Churyumov-Gerasimenko

Dinkinesh

Ceres

Wild 2

73P/Schwassmann-Wachmann 3

JUPITER

Tempel 1

SATURN

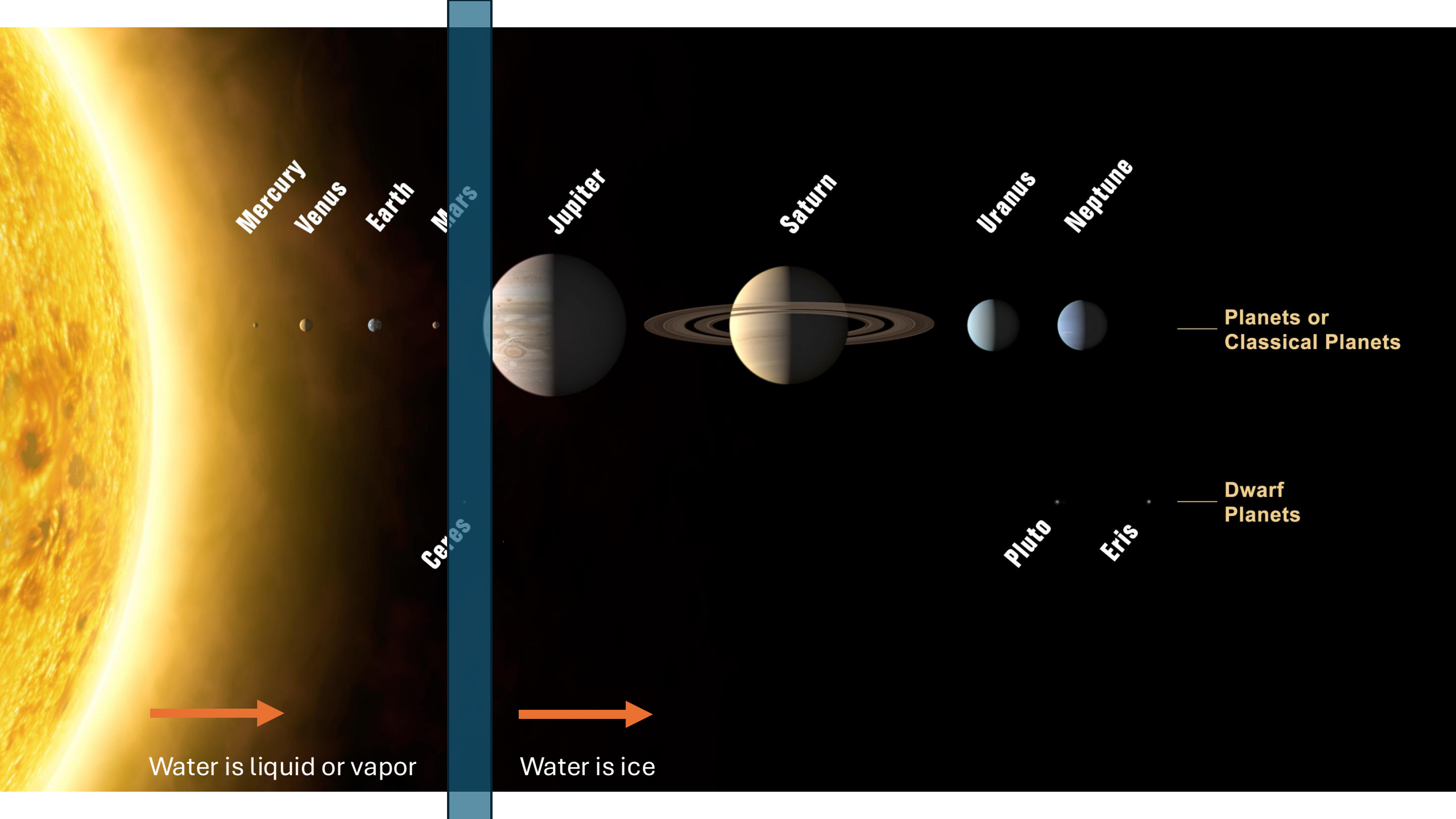
LIVE

JAN 10, 2025

09:11:56 am

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Mercury

Venus

Earth

Mars

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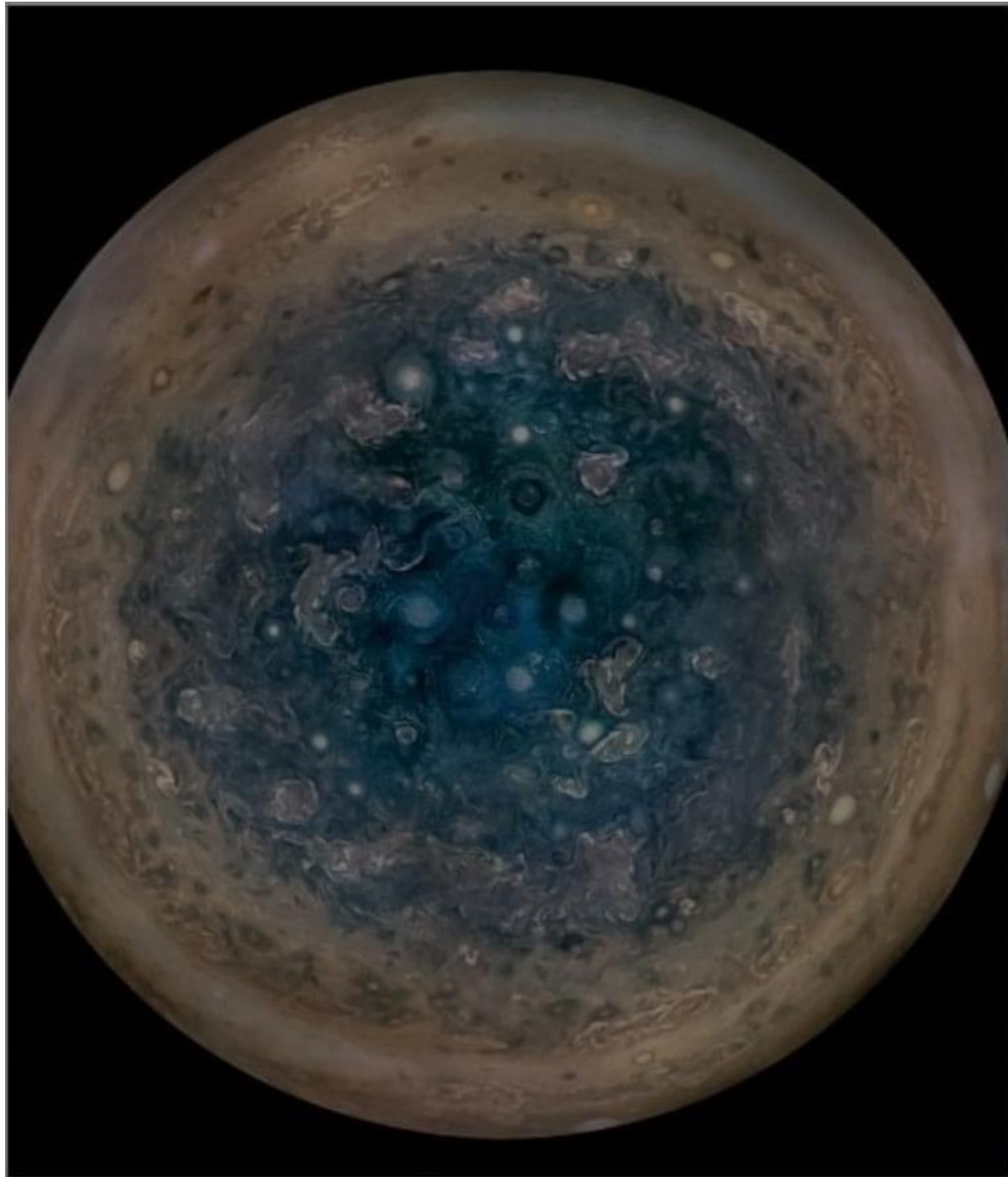
Eris

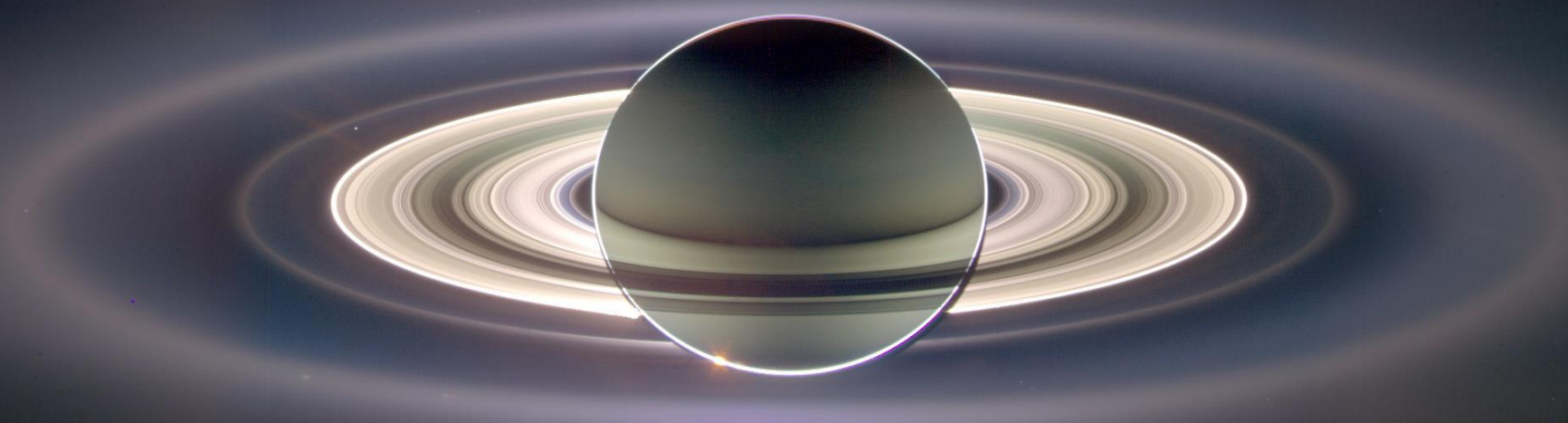
Dwarf
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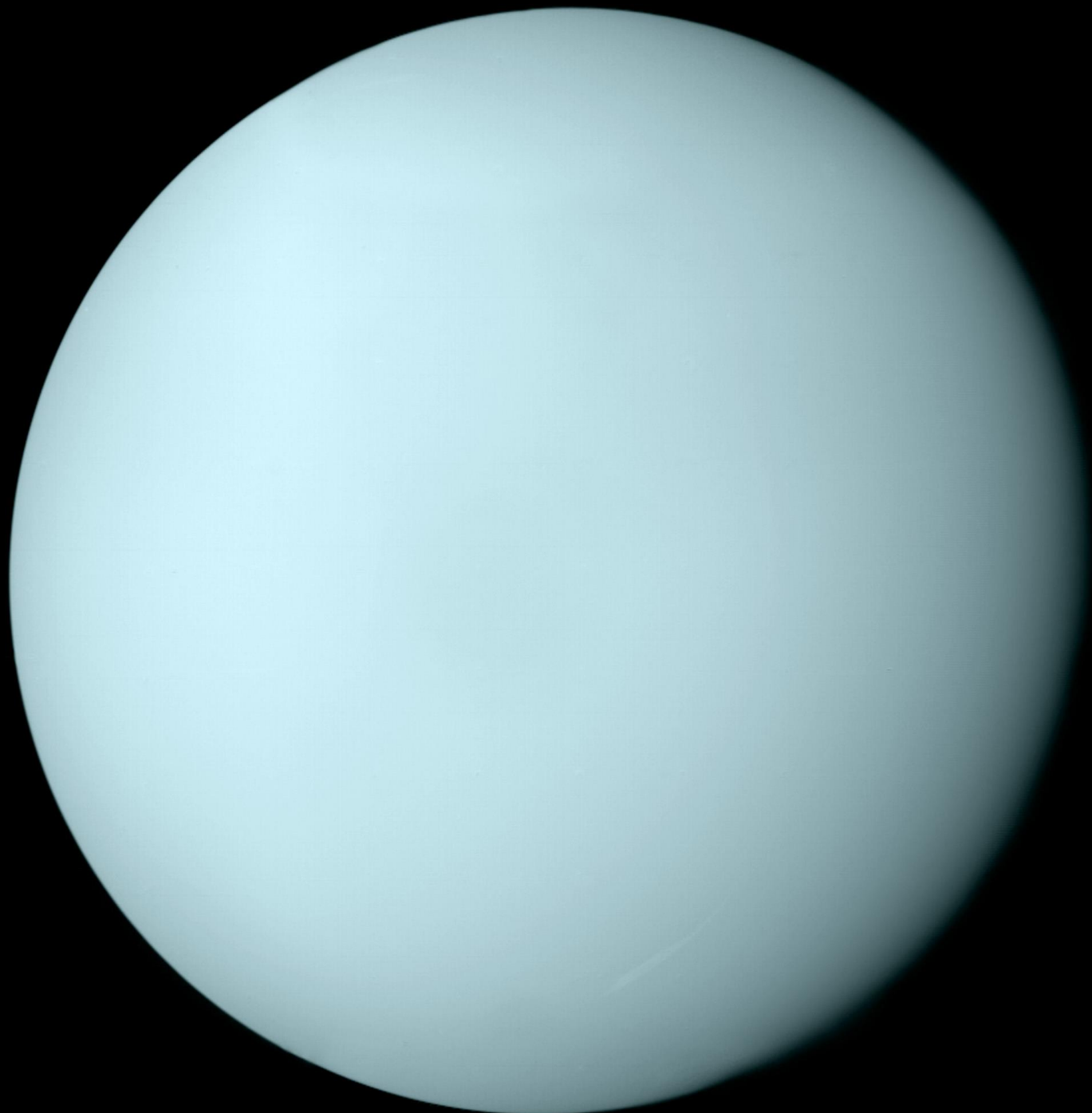
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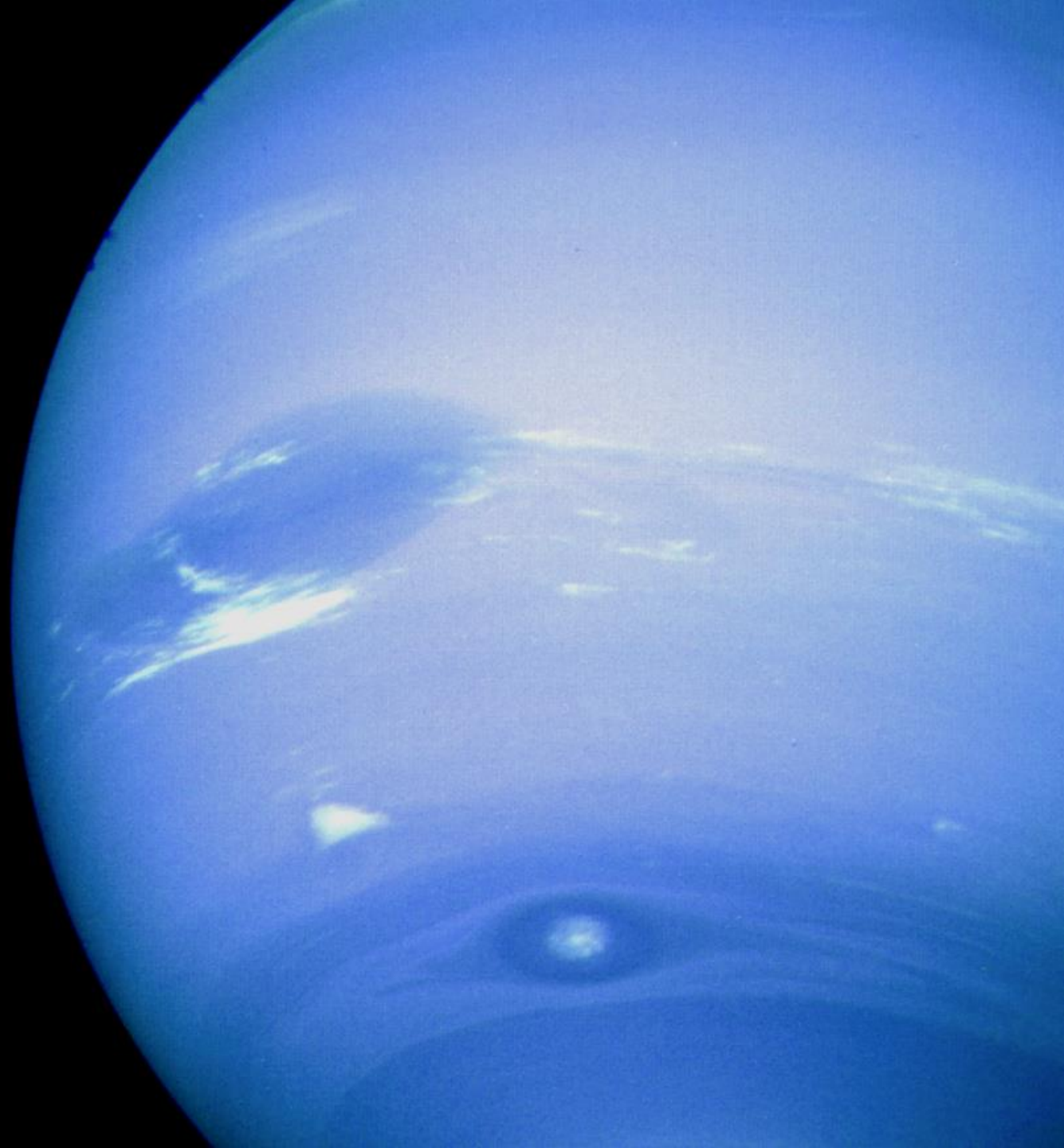
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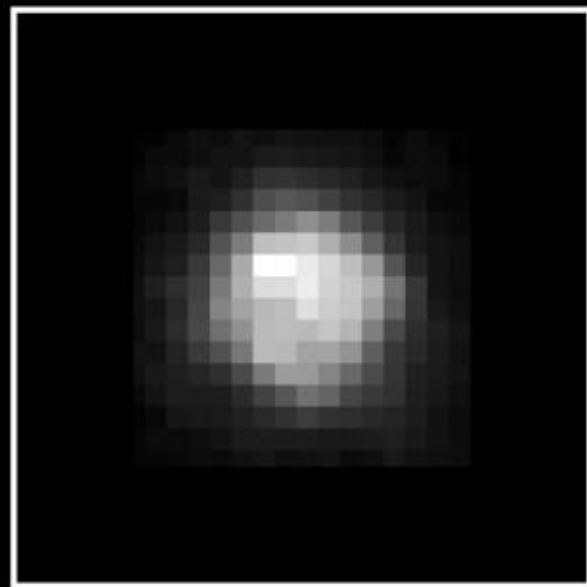
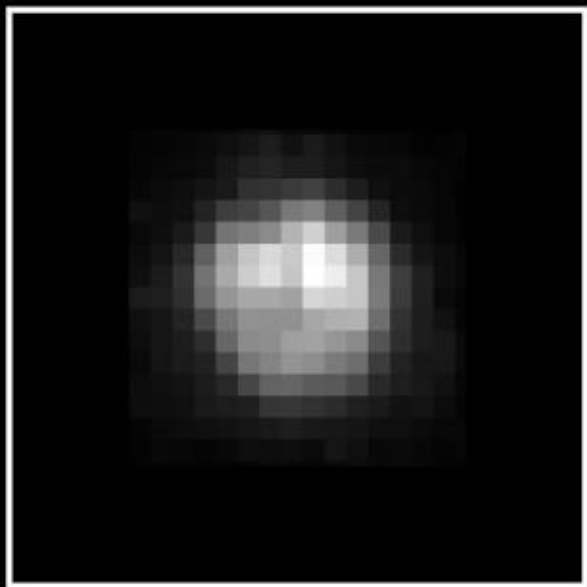








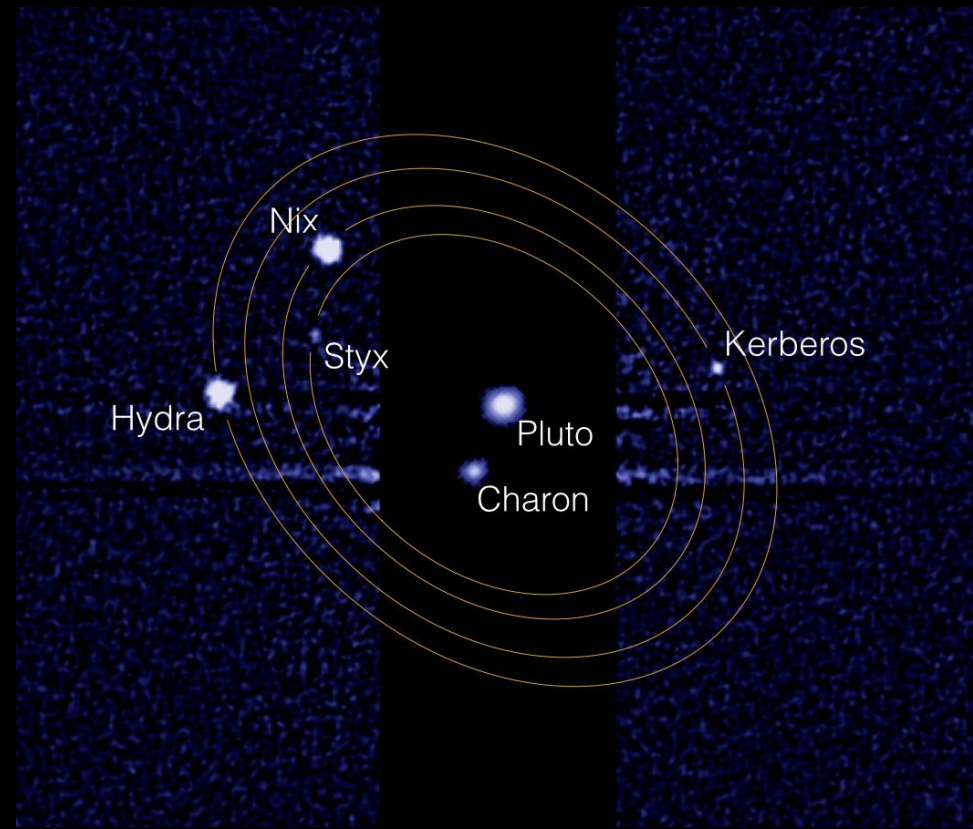
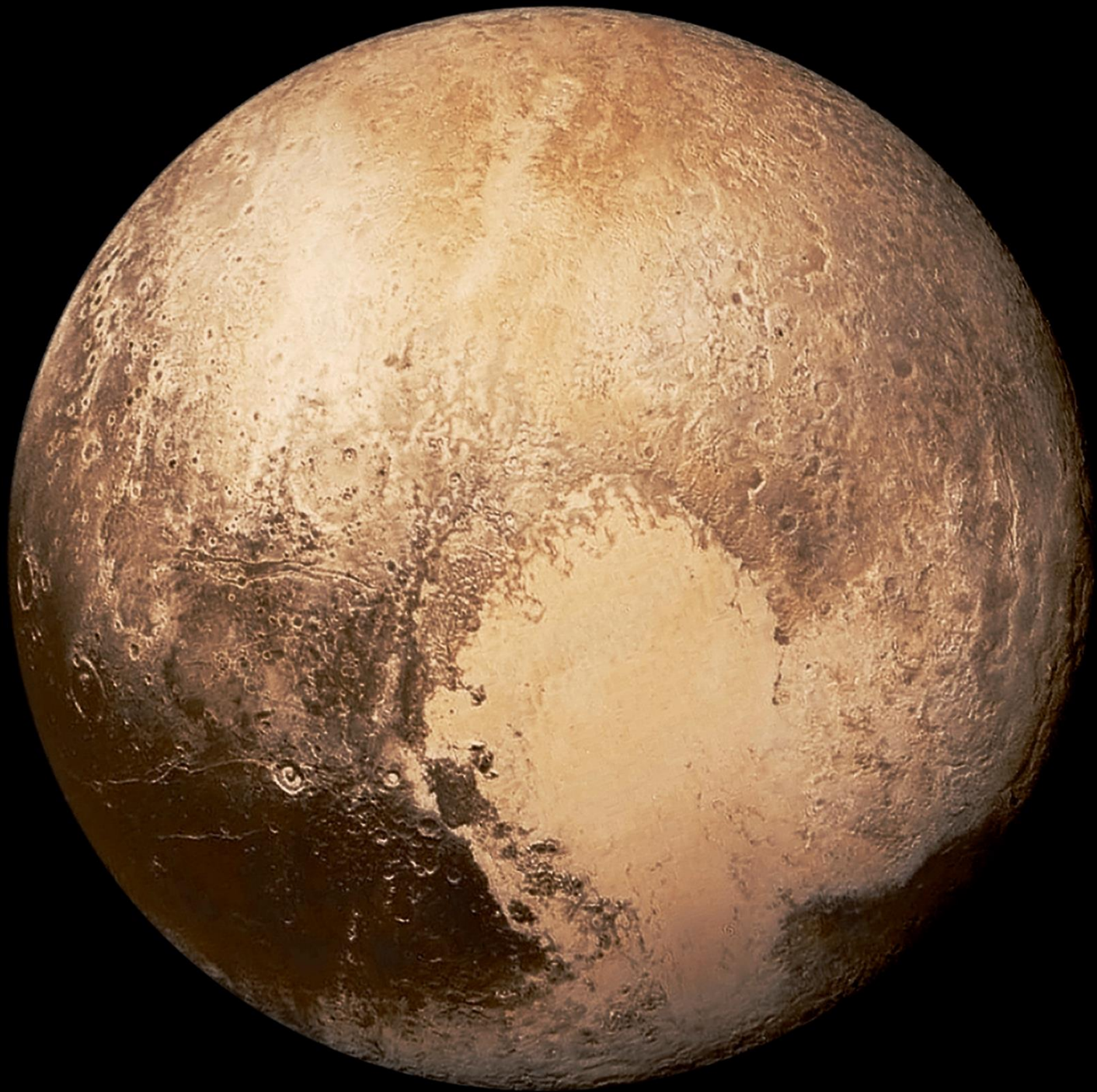




Pluto

PRC96-09a · ST ScI OPO · March 7, 1996 · A. Stern (SwRI), M. Buie (Lowell Obs.), NASA, ESA

HST · FOC



Break

Solar System Formation Theory

Any theory must be able to explain:

1. Patterns of motion among large bodies
 1. All planets orbit in the same plane (ecliptic)
 2. Most planets rotate in the same direction they orbit
2. Two major types of planets
3. Observations from outside of our Solar System

1. Planetary Motions

2. Two major types of planets

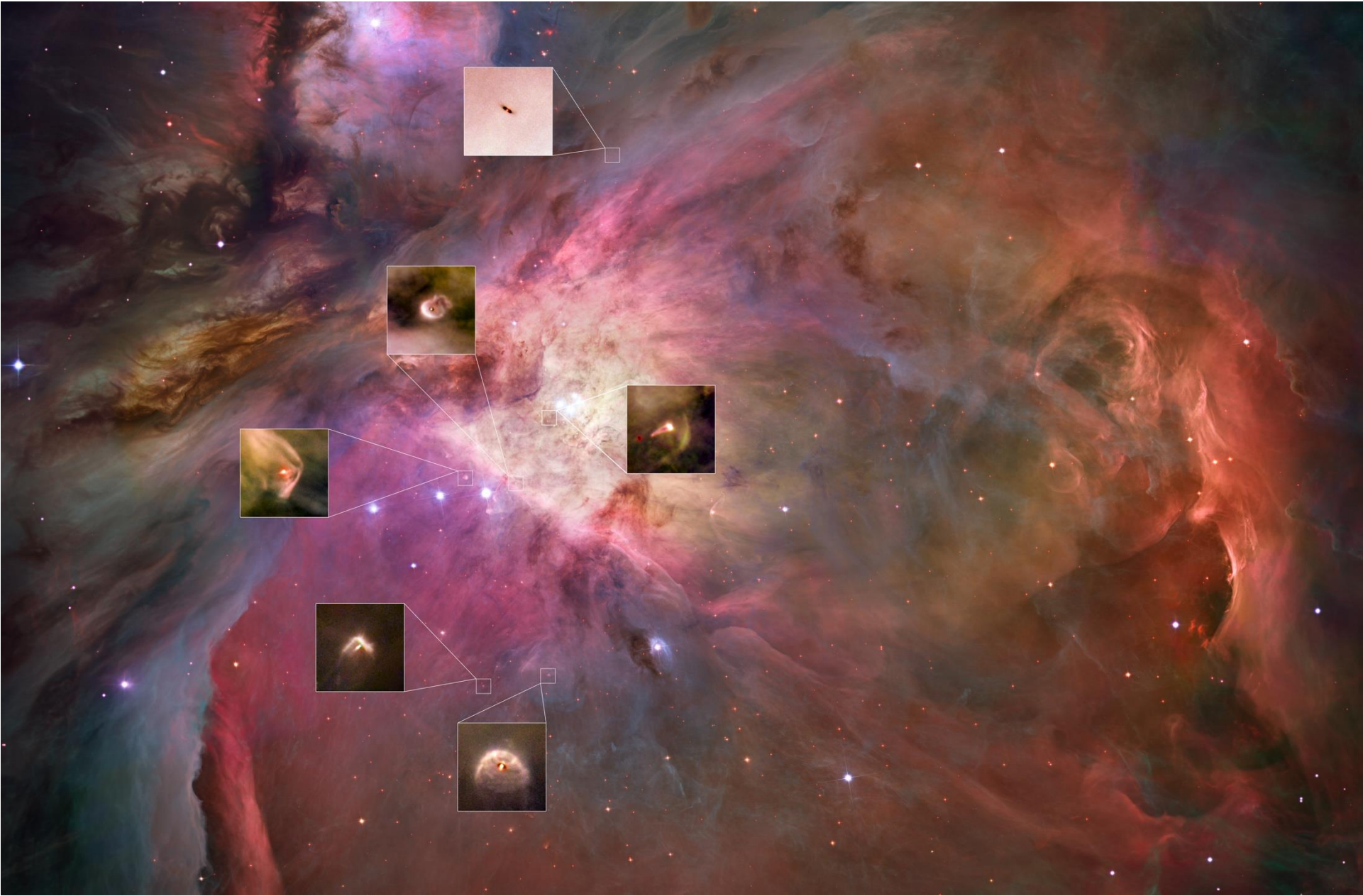
Table 7.2 Comparison of Terrestrial and Jovian Planets

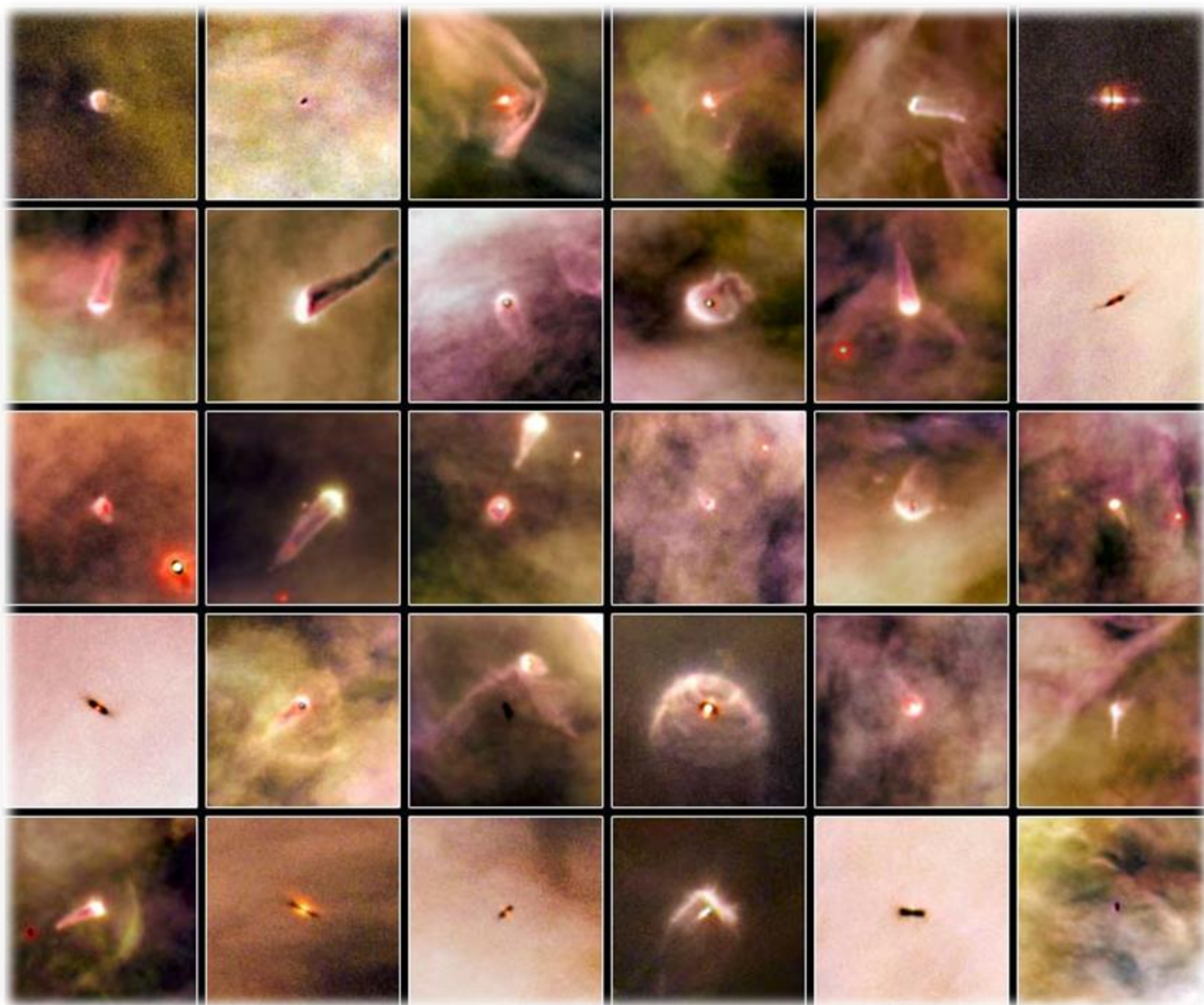
<i>Terrestrial Planets</i>	<i>Jovian Planets</i>
Smaller size and mass	Larger size and mass
Higher density	Lower density
Made mostly of rock and metal	Made mostly of hydrogen, helium, and hydrogen compounds
Solid surface	No solid surface
Few (if any) moons and no rings	Rings and many moons
Closer to the Sun (and closer together), with warmer surfaces	Farther from the Sun (and farther apart), with cool temperatures at cloud tops

3. Observations from outside of our Solar System









Solar System Formation Theory

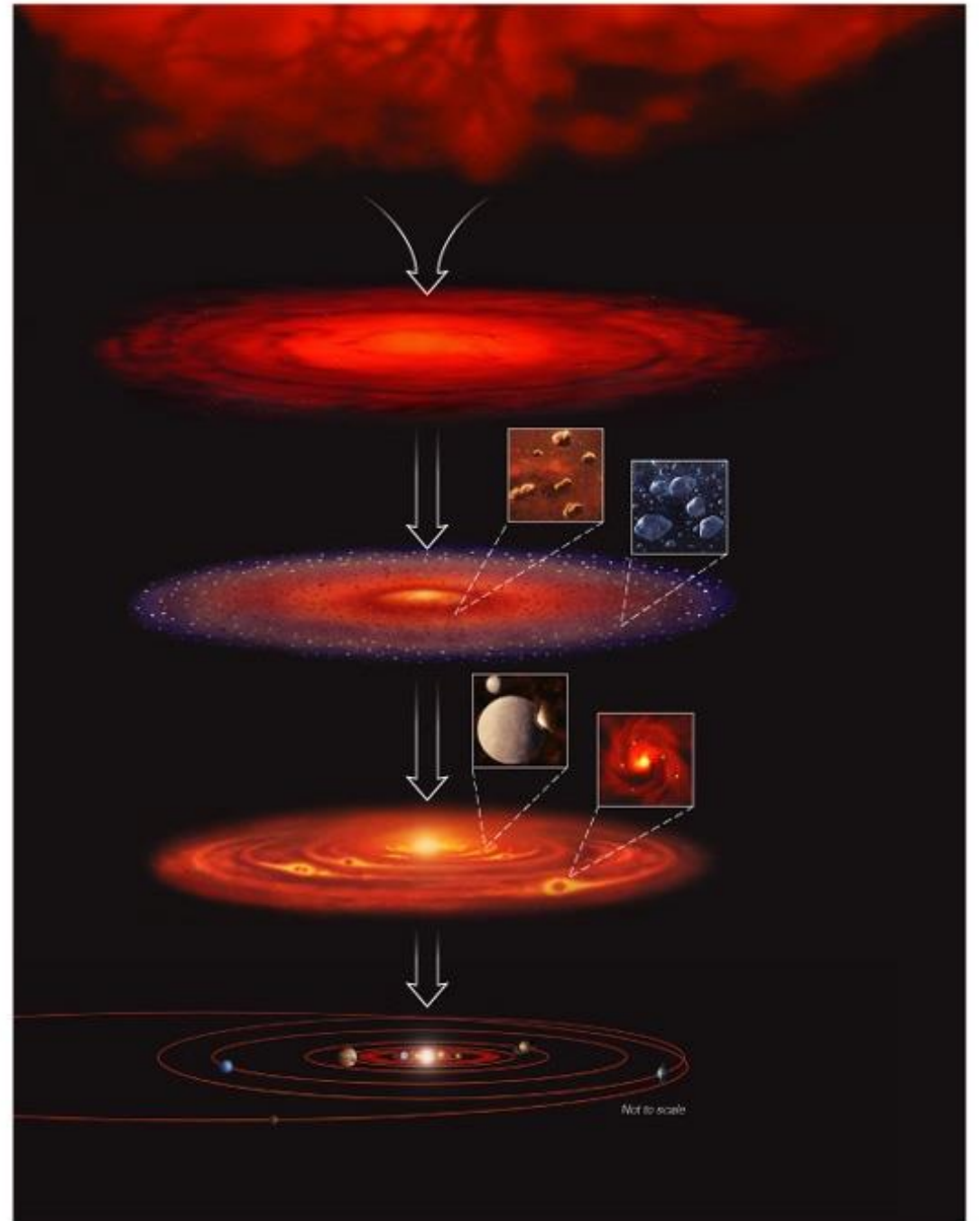
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Nebular Theory

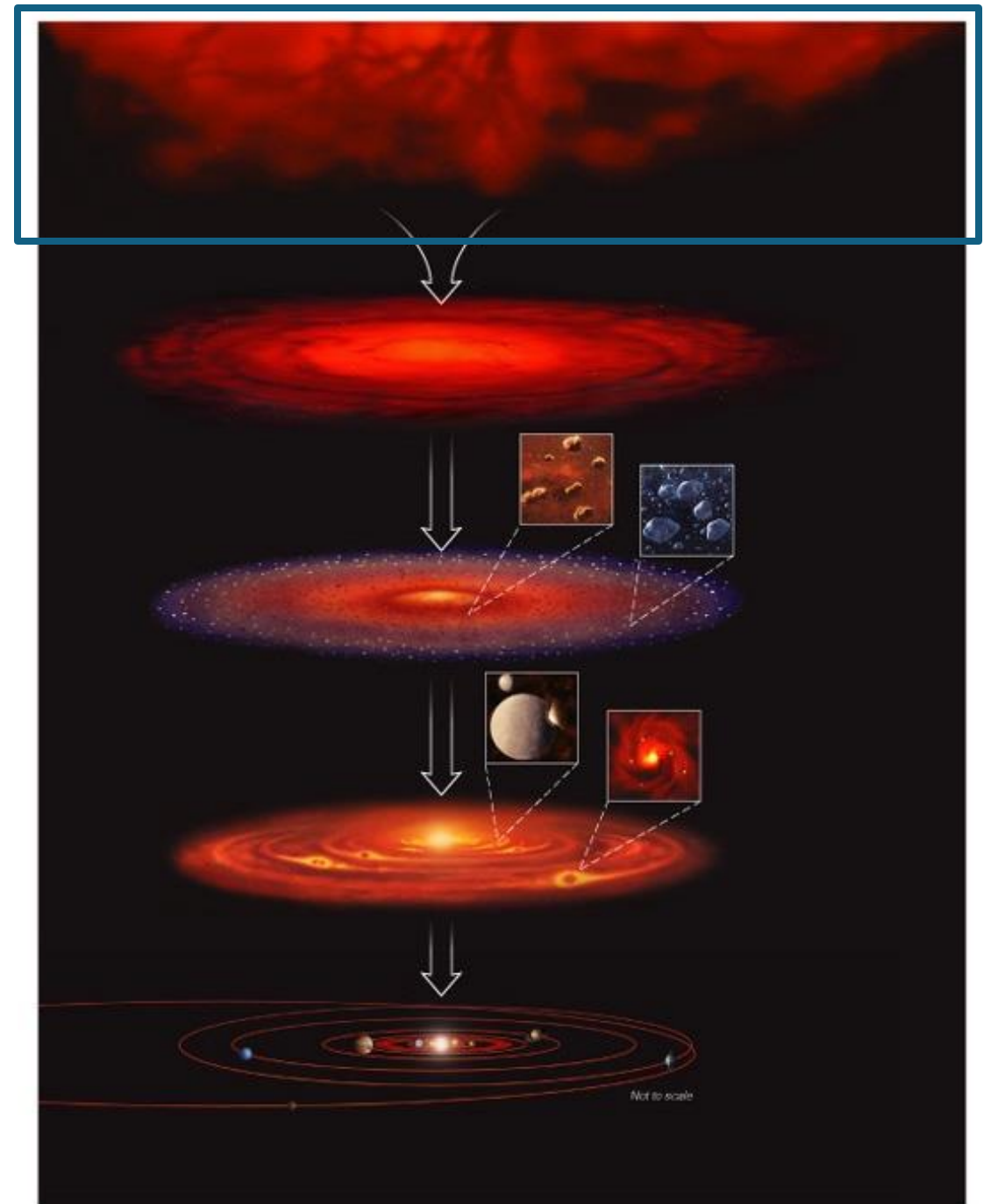
Nebular Theory

1. The Solar Nebula was made of Hydrogen and Helium from the Big Bang, and other heavier elements from the explosions of massive stars.
2. Gravity: Nebula collapses: Heats, spins and flattens
3. Chemistry takes over: Materials condense and form solids depending on the distance from the Sun
4. Accretion: Those small solids bump into each other and build up planets
5. Clearing: The Sun clears out light gases from within the nebula



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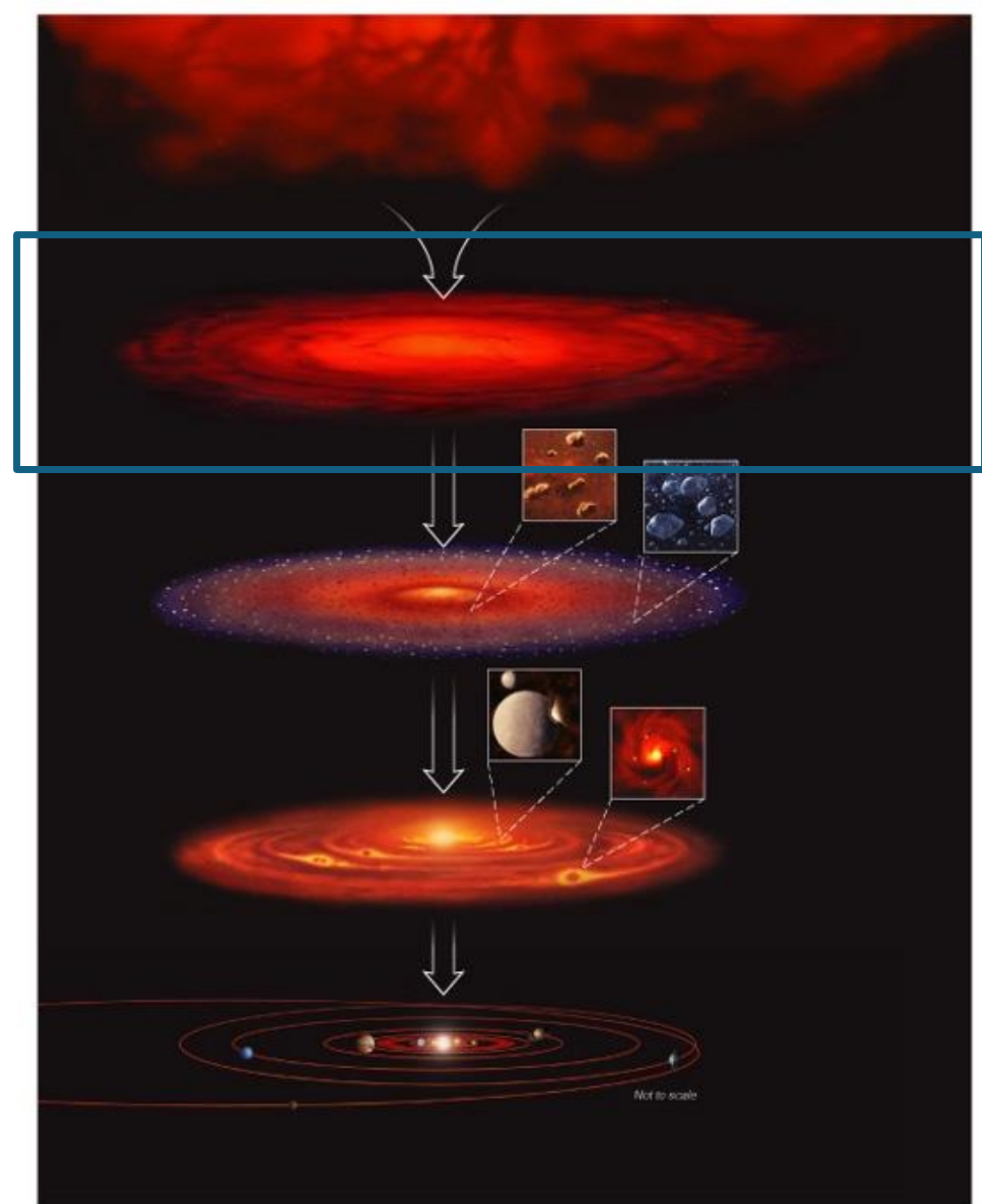




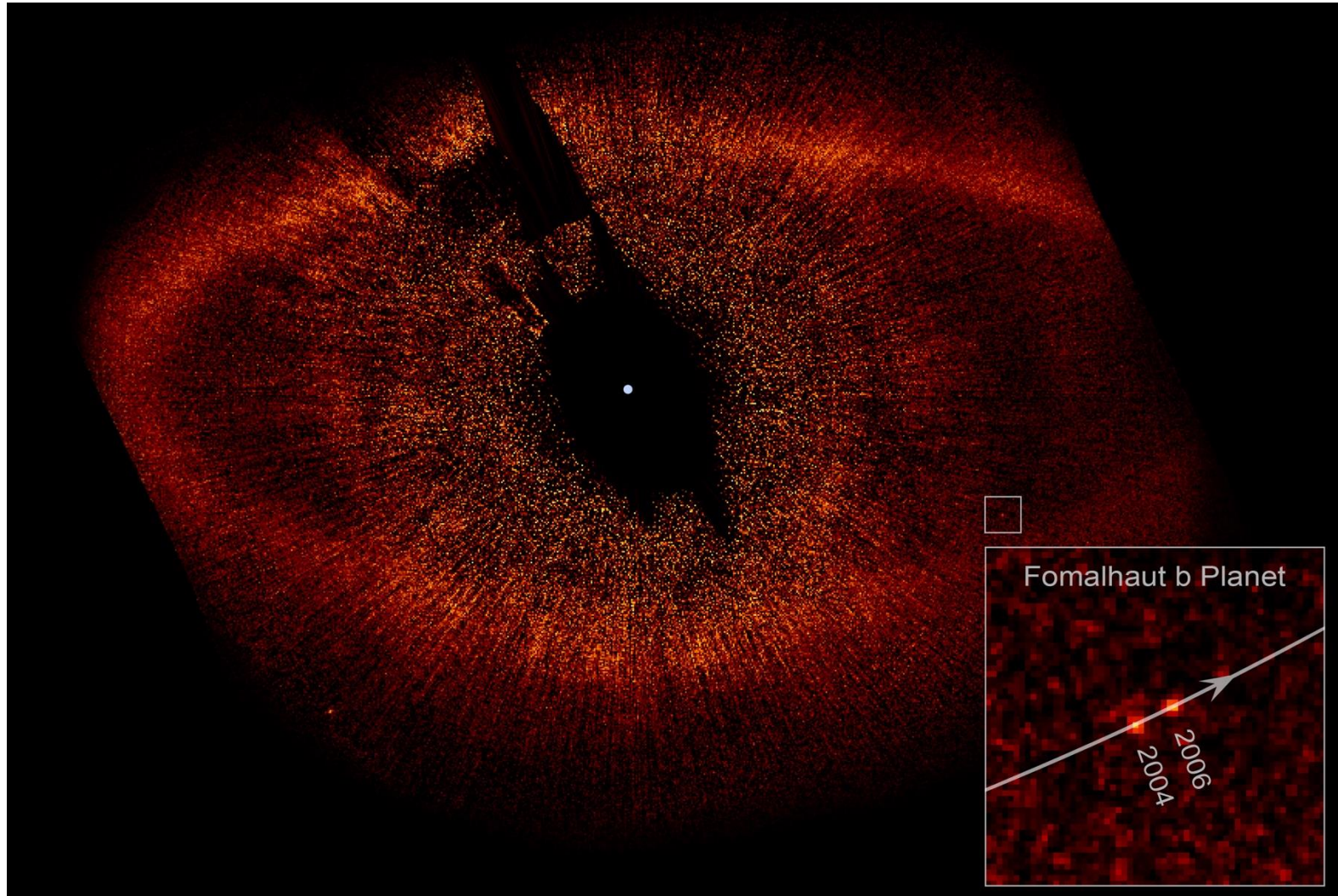


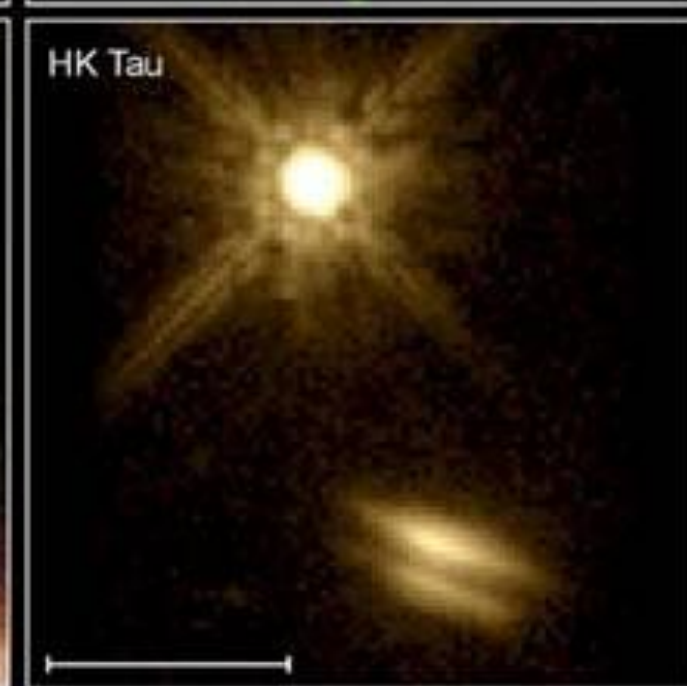
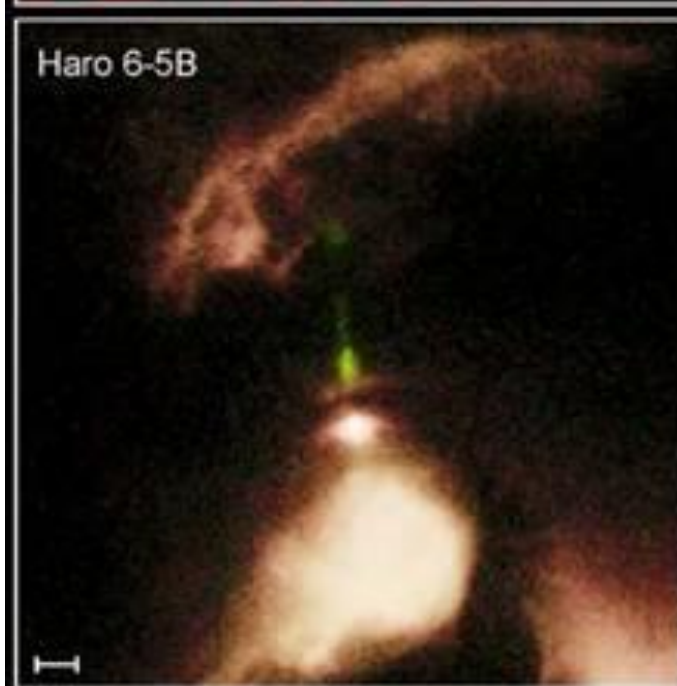
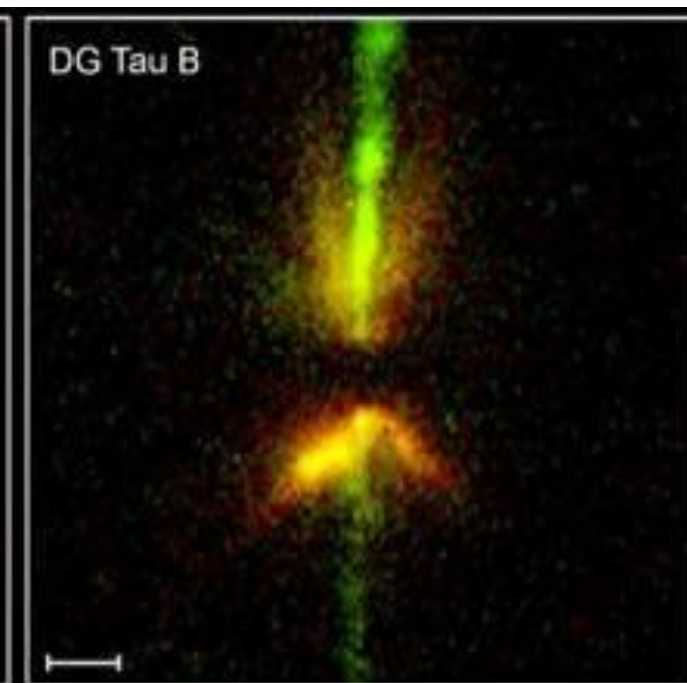
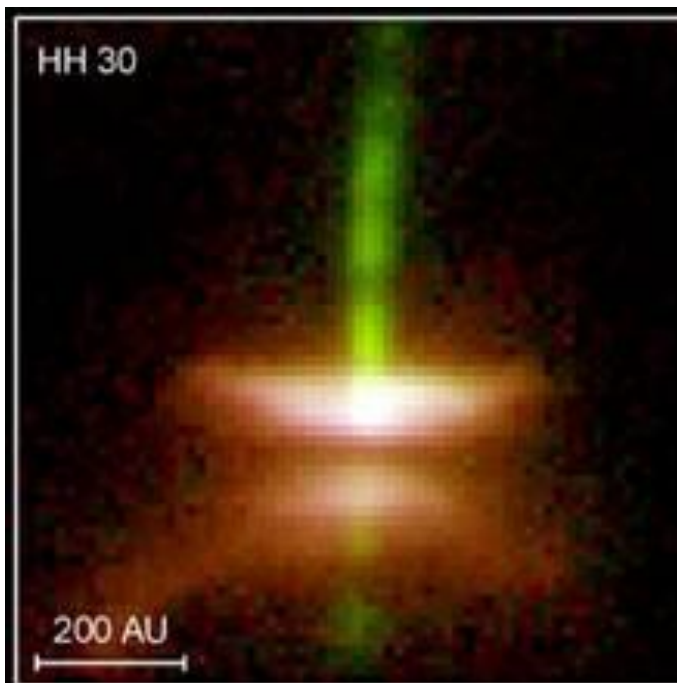
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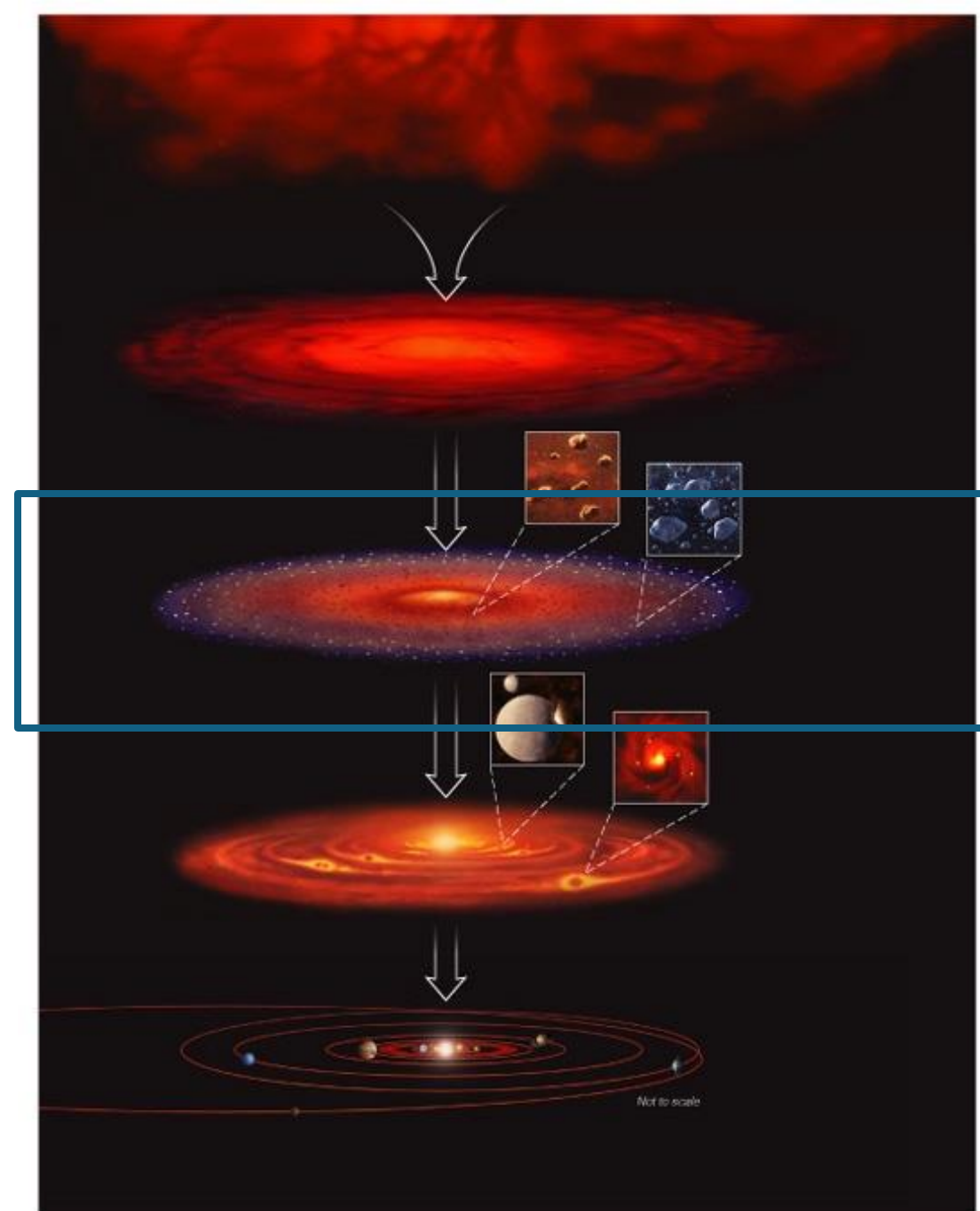
Fomalhout

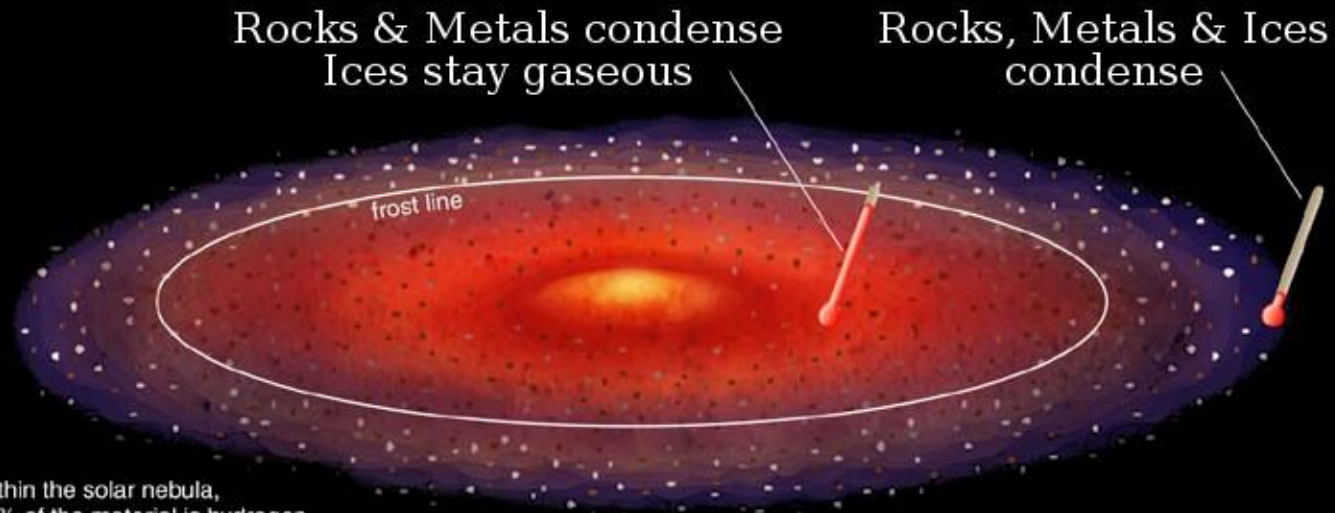




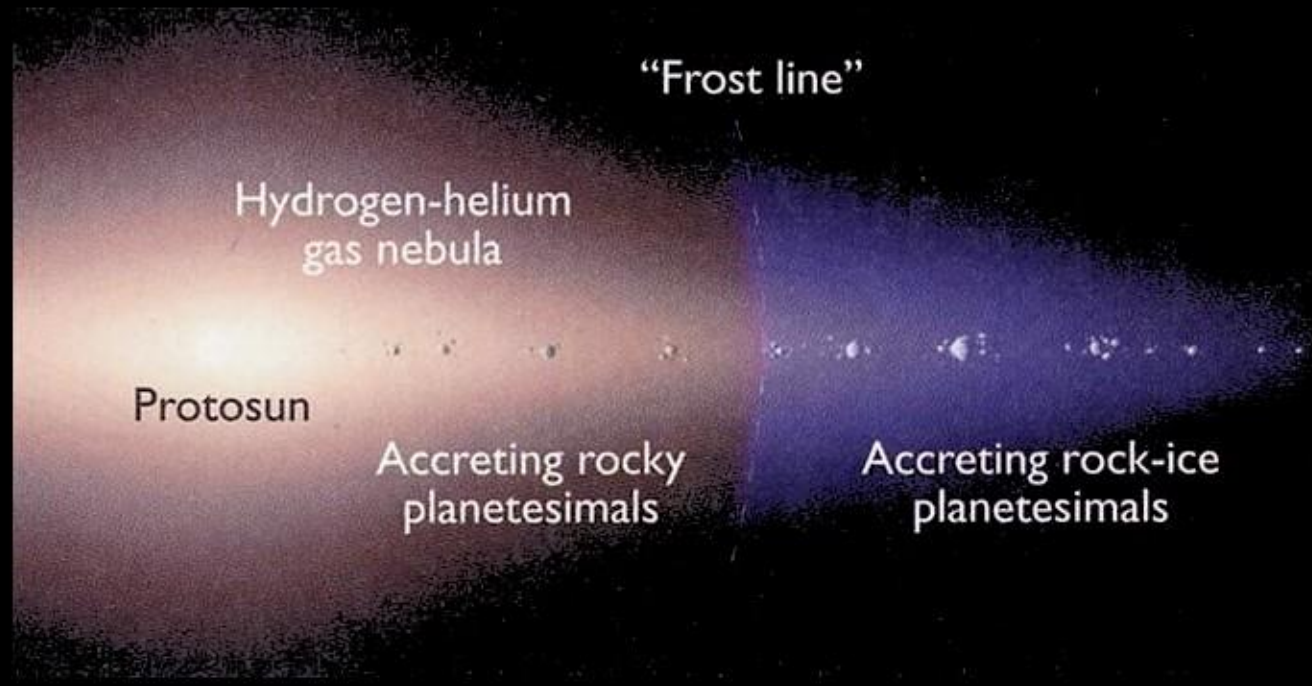
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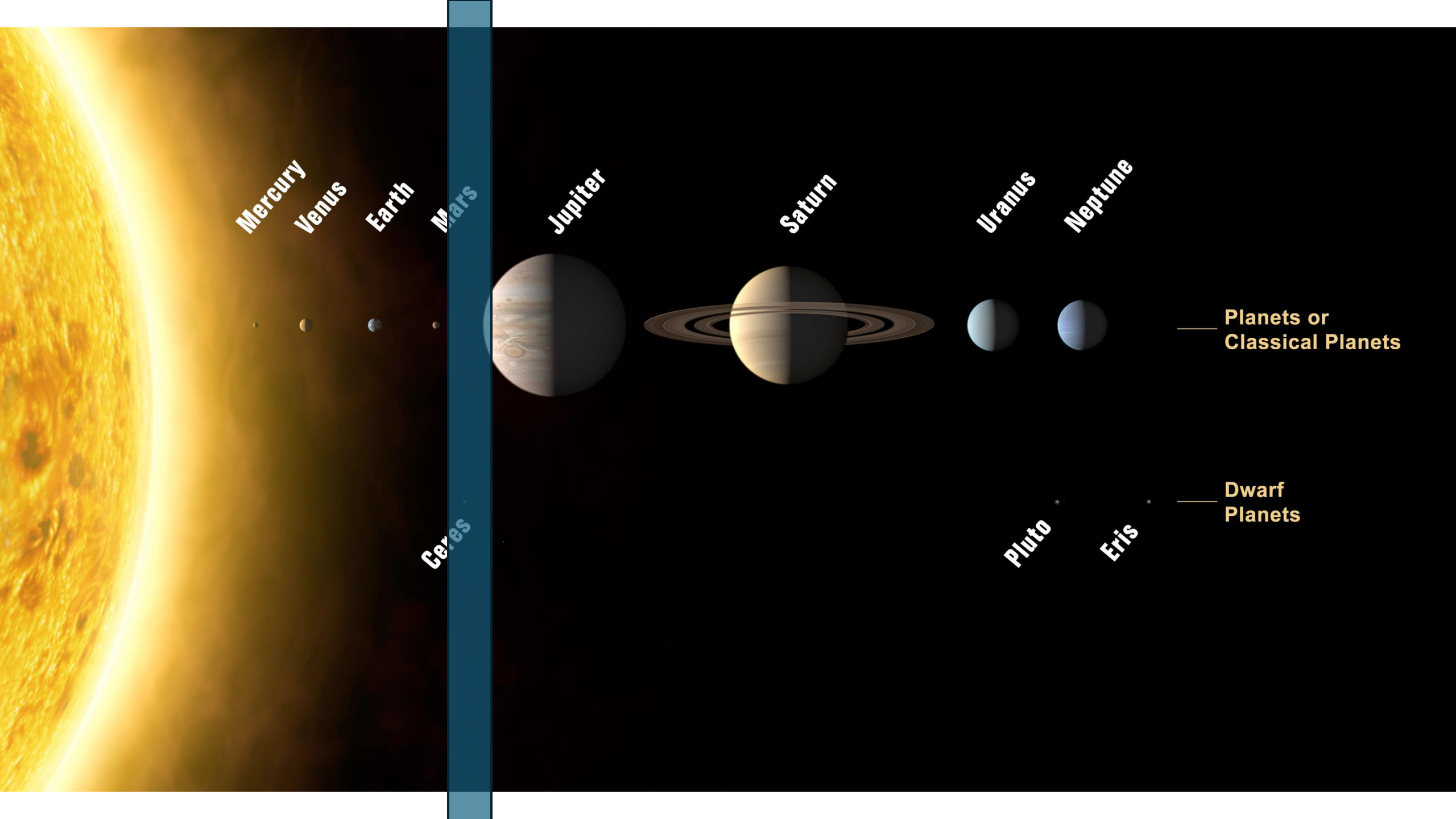
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Within the solar nebula,
98% of the material is hydrogen
and helium gas that doesn't condense anywhere.





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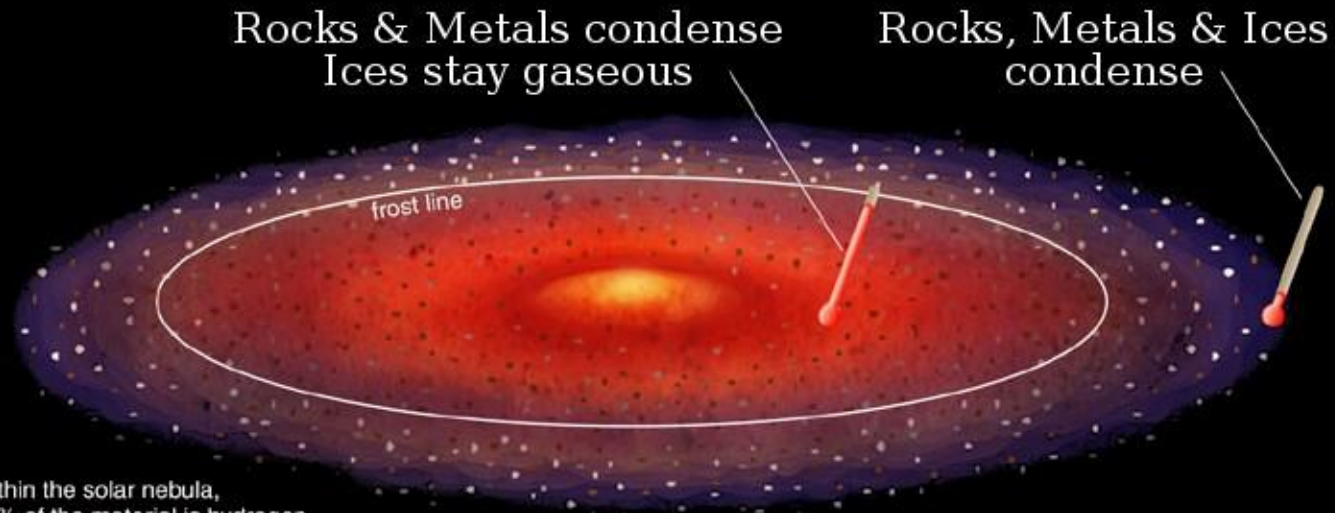
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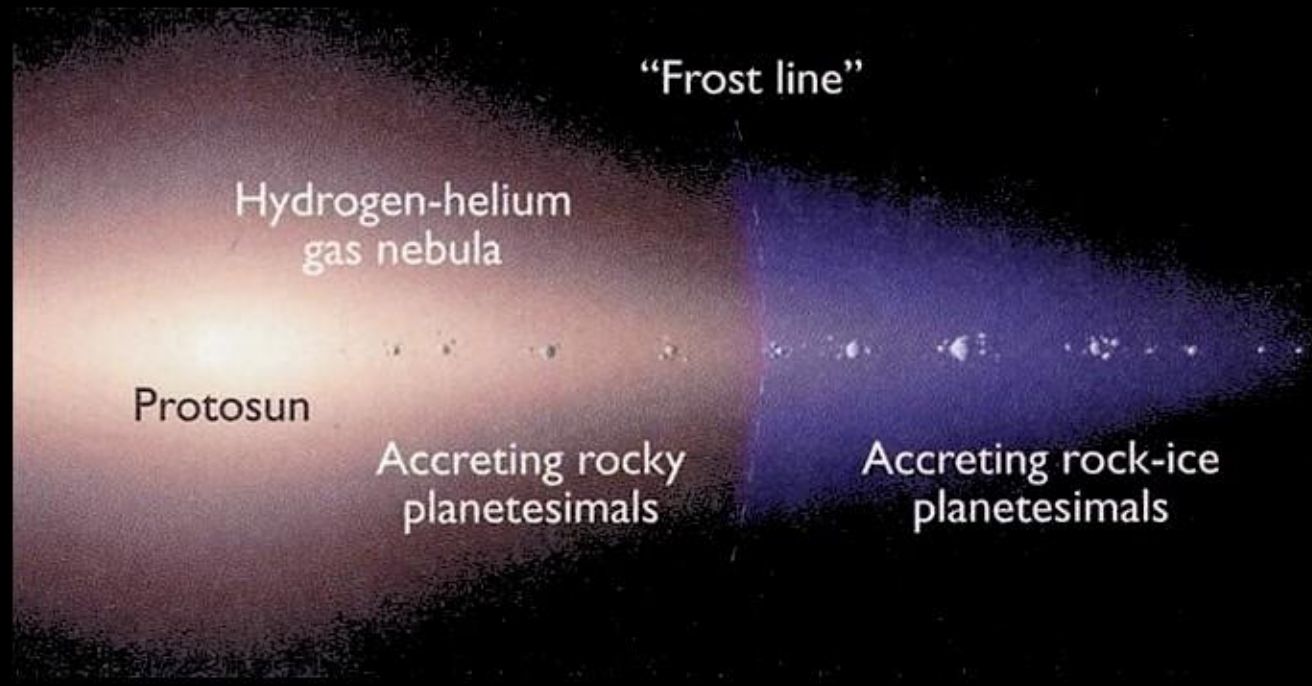
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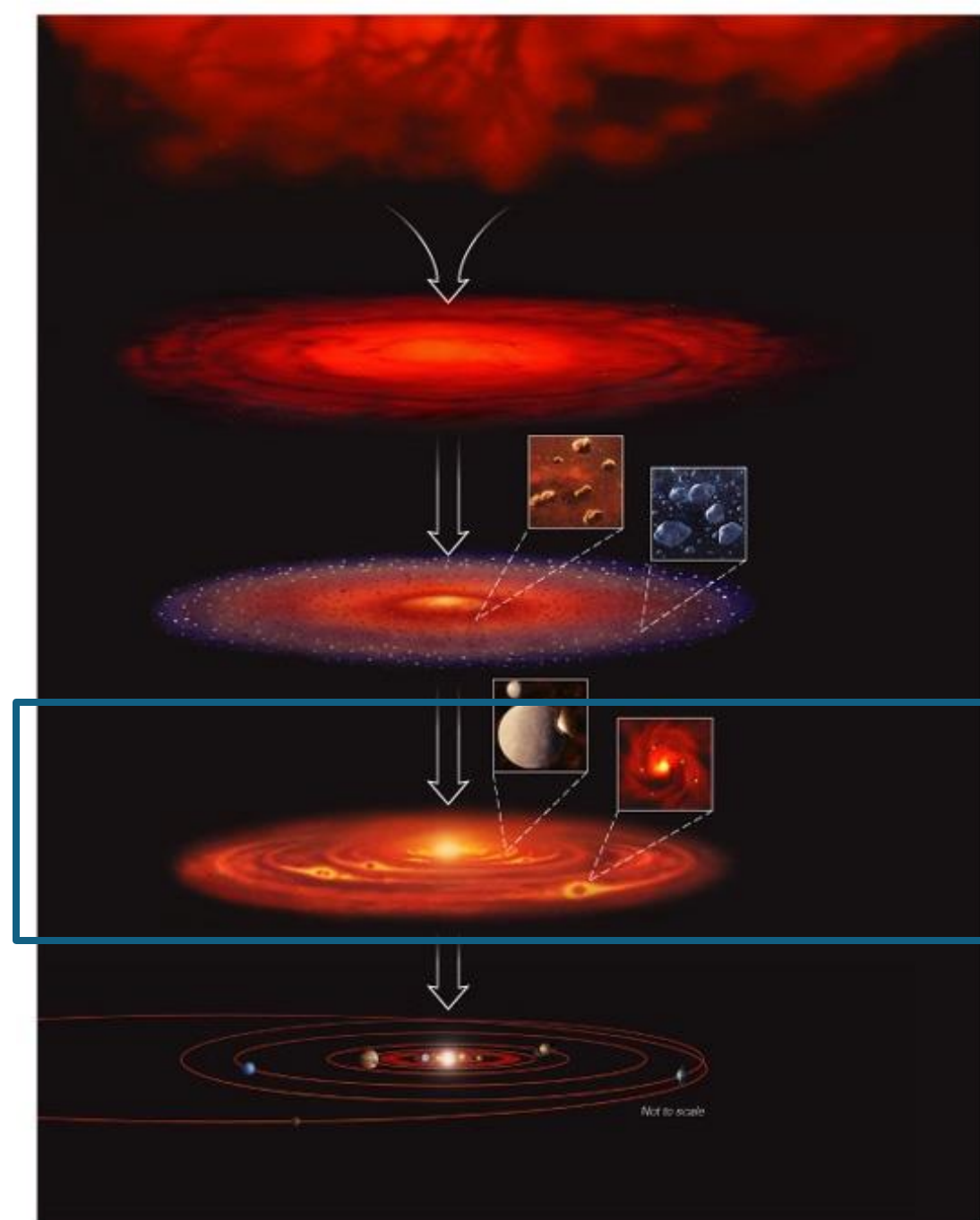


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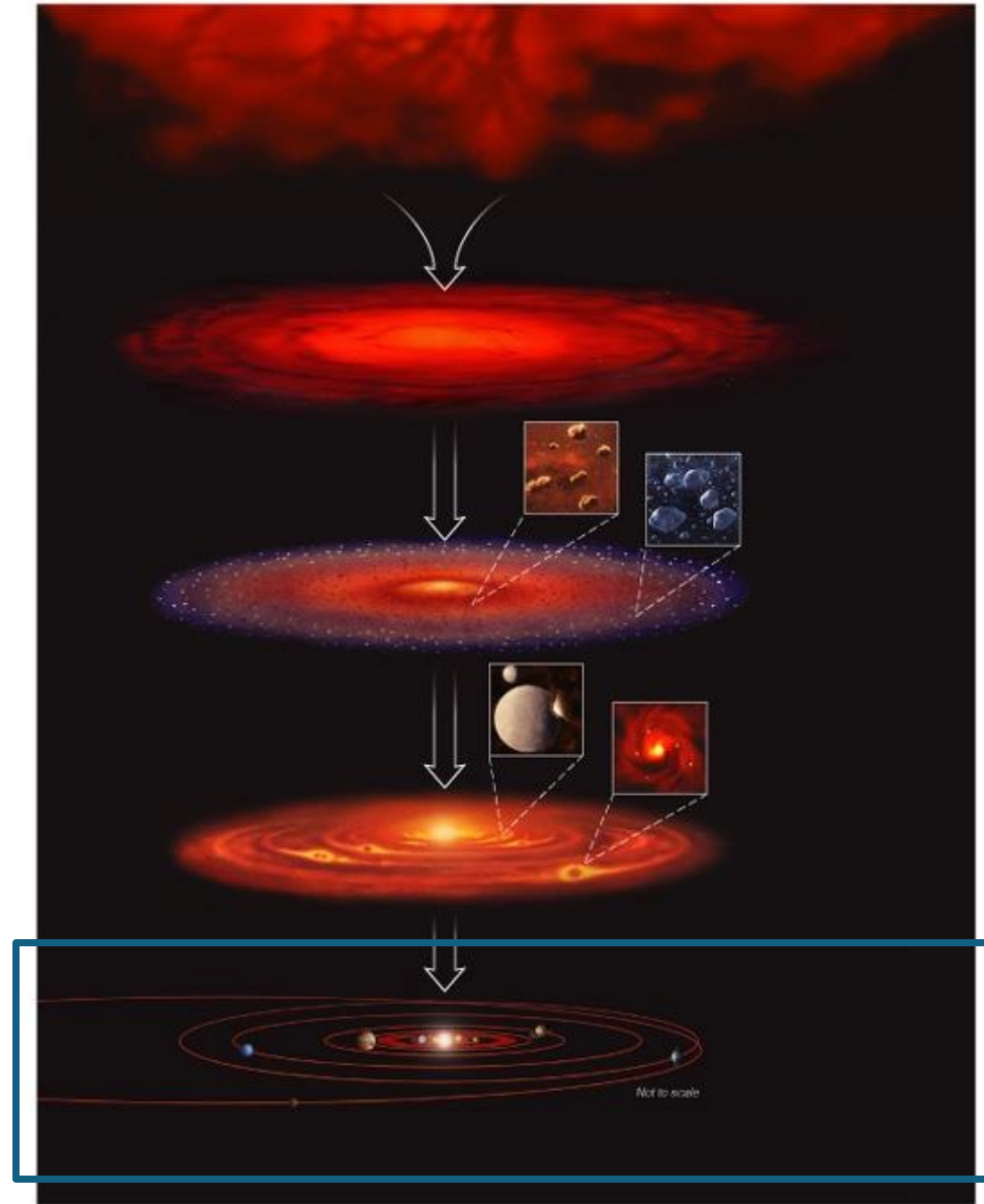
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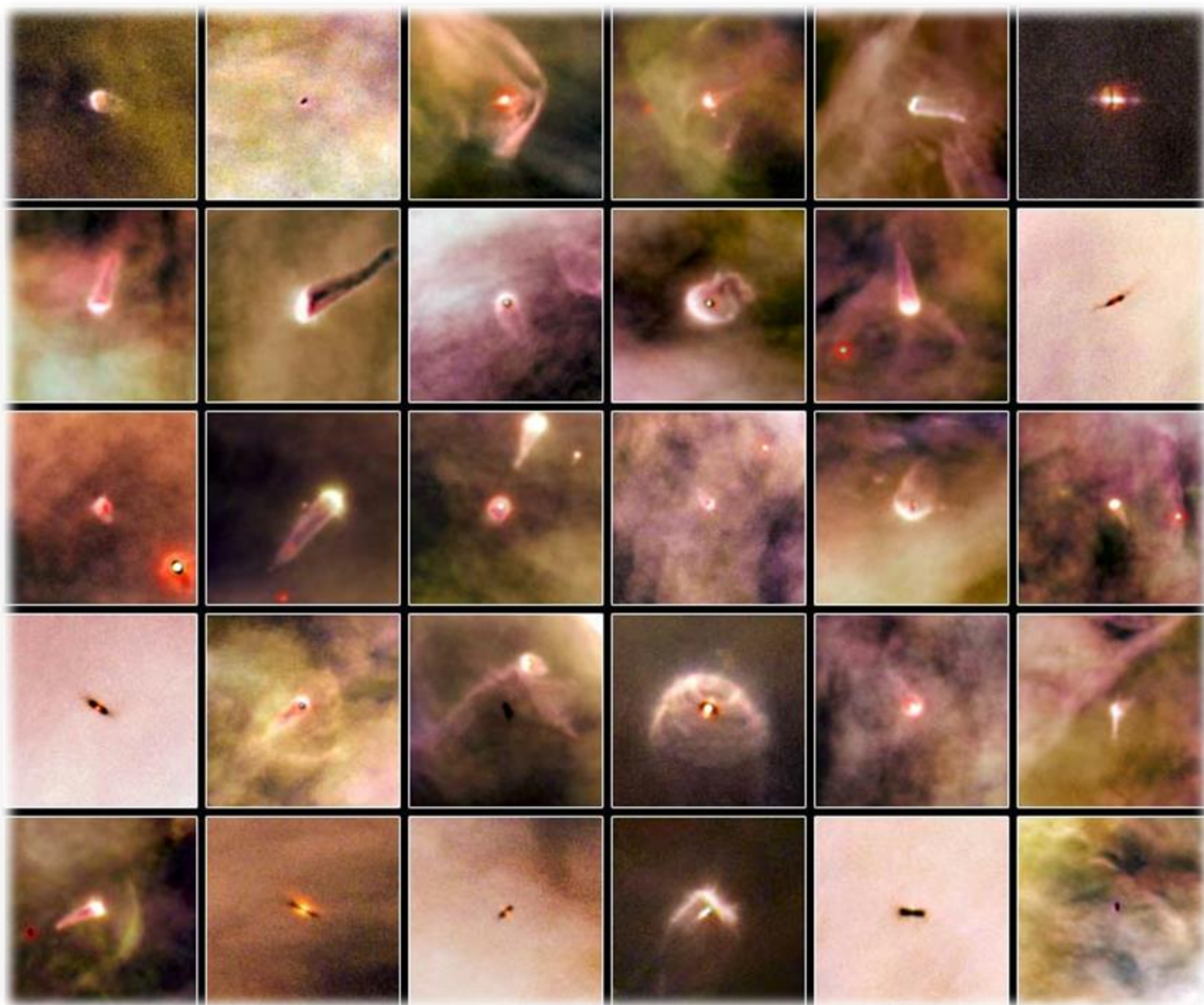
4. Accretion: Those small solids bump into each other and build up planets



Nebular Theory

5. Clearing: The Sun clears out light gases from within the nebula





Problems...

- How does Earth still have water?
- Why is Venus rotating “backwards” with a 244 day period?
- Why is Uranus’ tilt nearly aligned with it’s orbit, not with the Sun’s?

