



SECRETS OF THE SOLAR SYSTEM

S³-01

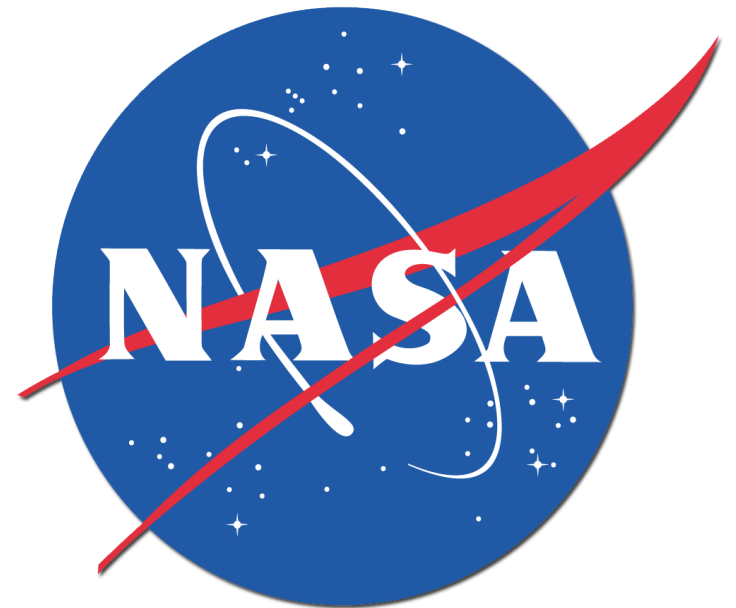
Wladimir (Wlad) Lyra
Brian Levine

AMNH After-School Program

AMERICAN
MUSEUM OF
NATURAL
HISTORY



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Quick Bio

Wladimir (Wlad) Lyra





Quick Bio

Wladimir (Wlad) Lyra

B.Sc. in Astronomy, Federal University of Rio de Janeiro (**Brazil**), 1999-2003.

Research Assistant 2003-2004

Space Telescope (Baltimore MD - **USA**).

Cerro Tololo Inter-American Observatory CTIO (La Serena - **Chile**).

European Southern Observatory ESO (Munich - **Germany**).

Lisbon Observatory (Lisbon - **Portugal**).

Ph.D. in Astronomy, Uppsala University (Uppsala - **Sweden**), 2004-2009.

Nordic Institute for Theoretical Physics (Stockholm - Sweden).

Postdoctoral Researcher

Max-Planck Institute for Astronomy (Heidelberg - Germany), 2009.

American Museum of Natural History (New York NY - USA), 2009-2011.

Stellar Astrophysics, Planetary Sciences

Solar-type stars, extrasolar planets, star and *planet formation*, hydrodynamics, plasma physics, turbulence.

Federal University of Rio de Janeiro	– Rio de Janeiro, Brazil
Cerro Tololo Interamerican Observatory	– La Serena, Chile
European Southern Observatory	– Garching-Munich, Germany
Lisbon Observatory	– Lisbon, Portugal
Space Telescope Science Institute	– Baltimore, USA
Uppsala University	– Uppsala, Sweden
Nordic Institute for Theoretical Physics	– Stockholm, Sweden
Max Planck Institute for Astronomy	– Heidelberg, Germany
American Museum of Natural History	– New York, USA



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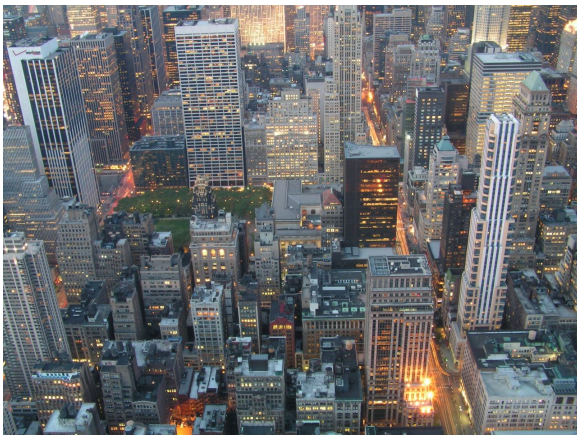
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Baltimore, USA



Lisbon, Portugal



Munich, Germany

Quick Bio

Brian Levine

Astrophysics Educator



Brooklyn



Bronx Science



Stony Brook



MS 821



AMNH

Outline

Origins

Tour of the Solar System

WHERE DO WE COME FROM?

Star Formation

The space between stars is **NOT EMPTY**, it is just very low density

Some of it is gas (99%), some of it is dust (1%).

This matter is called **INTERSTELLAR MEDIUM (ISM)**



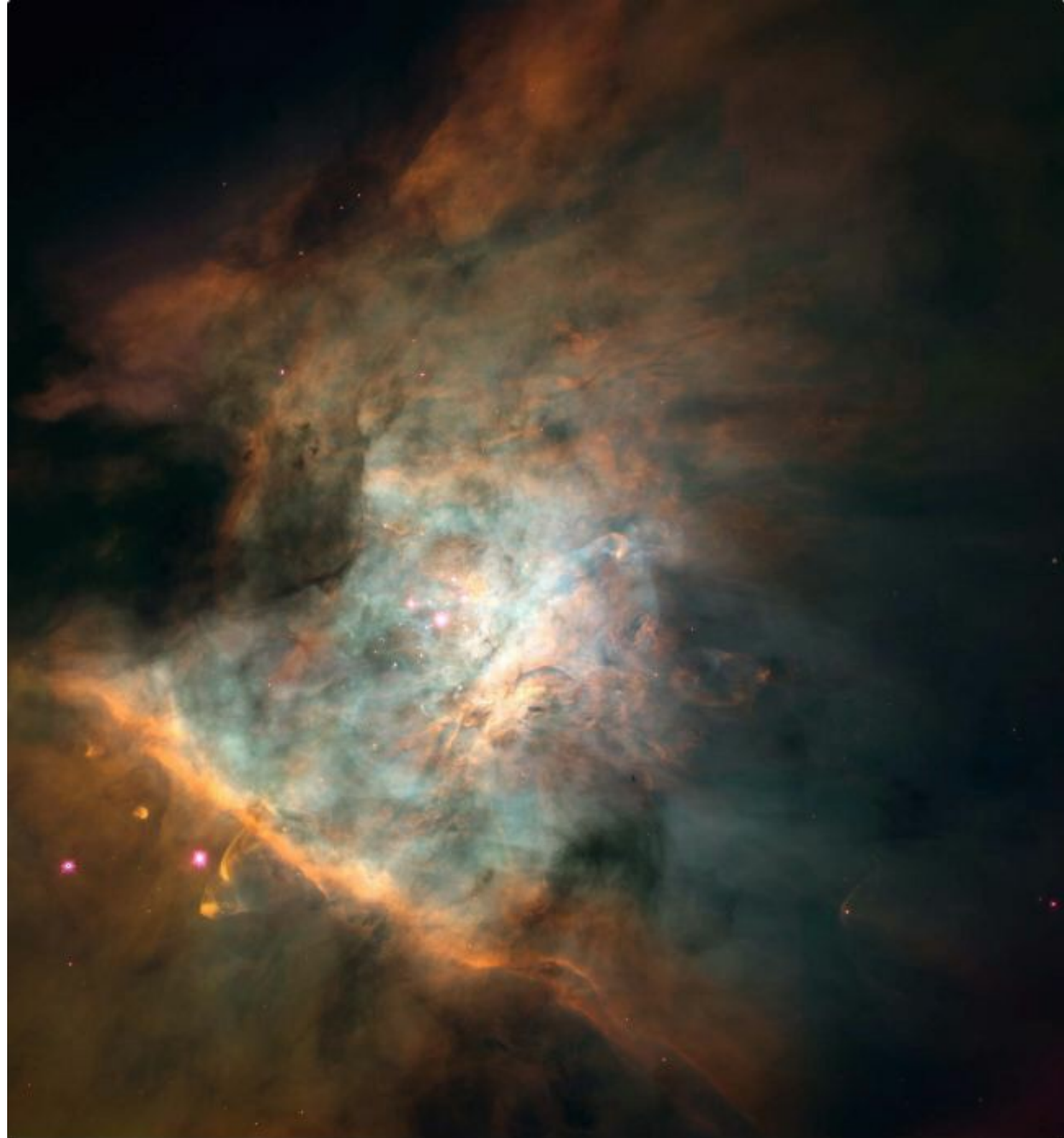
Star Formation

A process by which gas collapses gravitationally, to form stars.

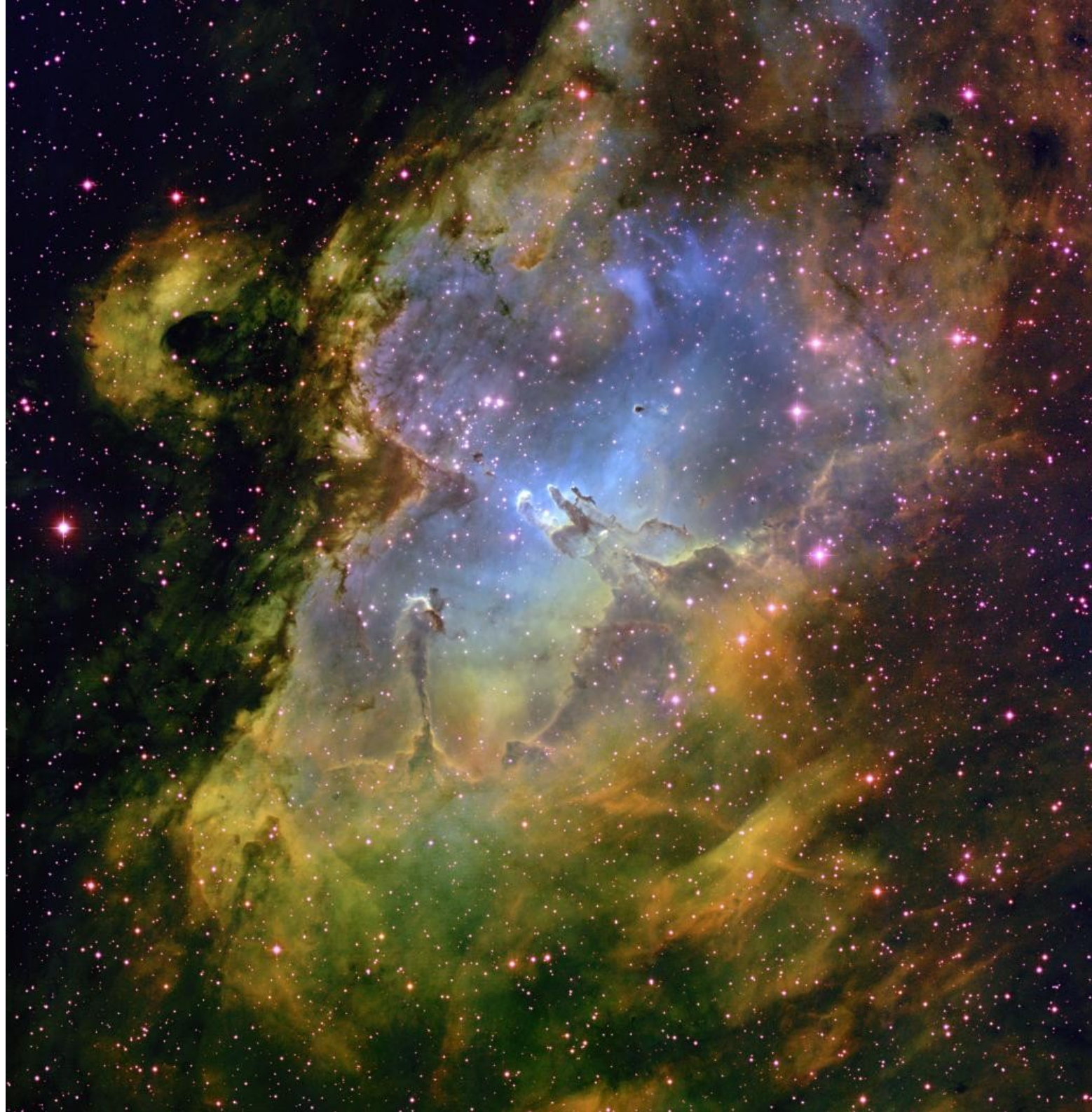
Star formation occurs in the ***densest regions of the ISM***, called ***Molecular Clouds***









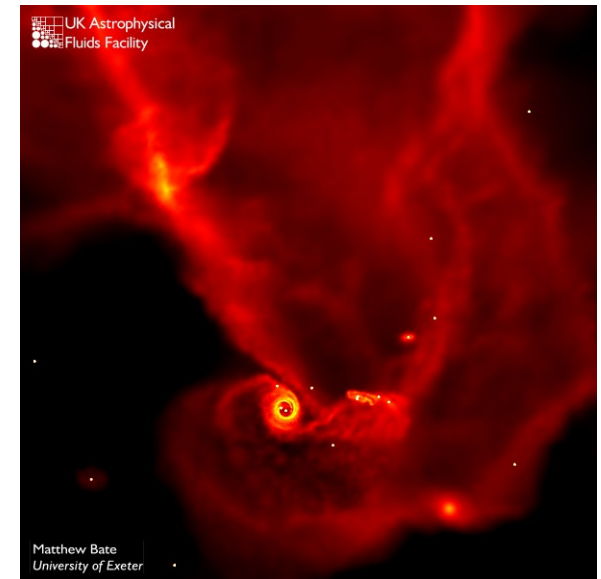
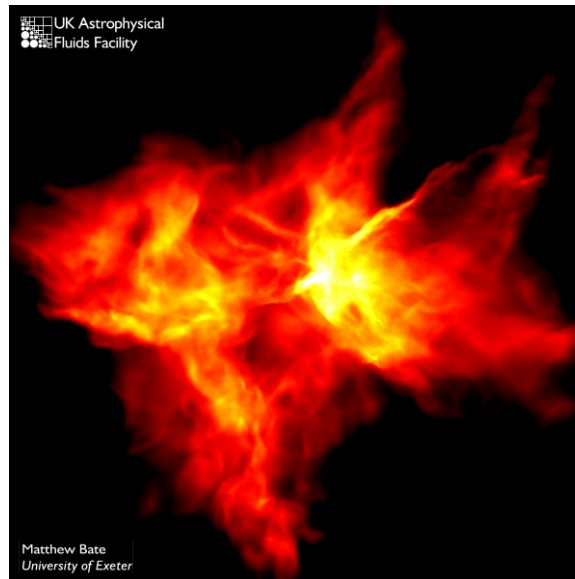
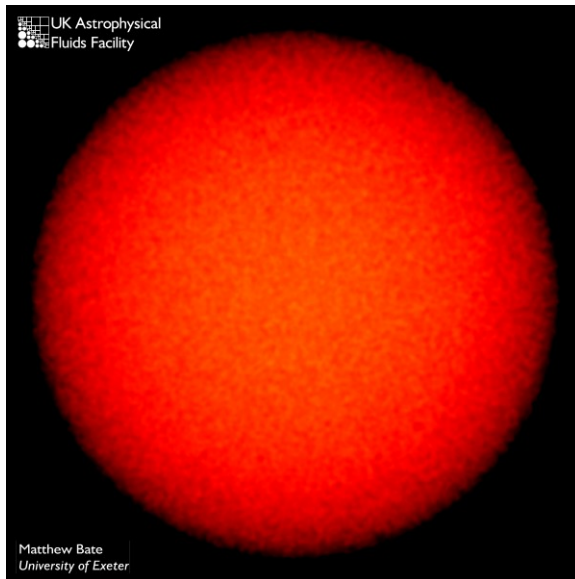








A Simulation of Star Formation

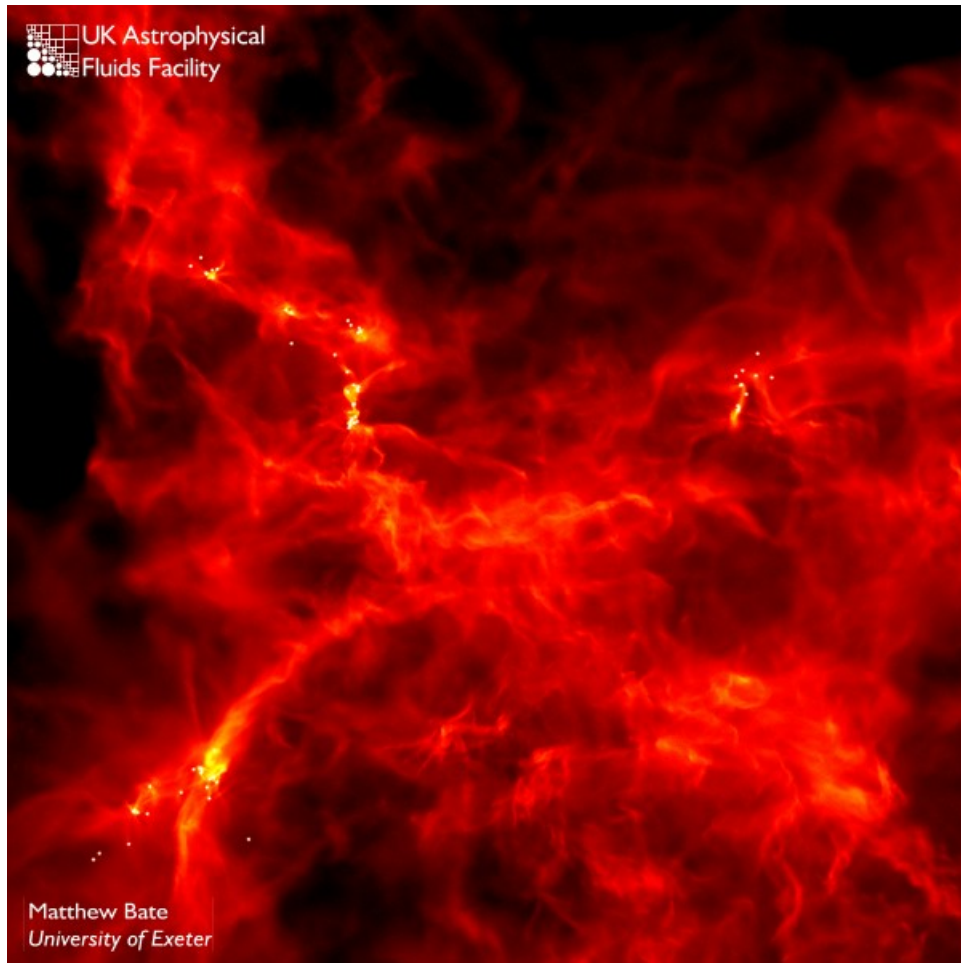


time

A Molecular cloud fragments into a clumpy structure of high and low density regions

The densest clumps are massive enough to undergo **gravitational collapse** and form stars

A Simulation of Star Formation

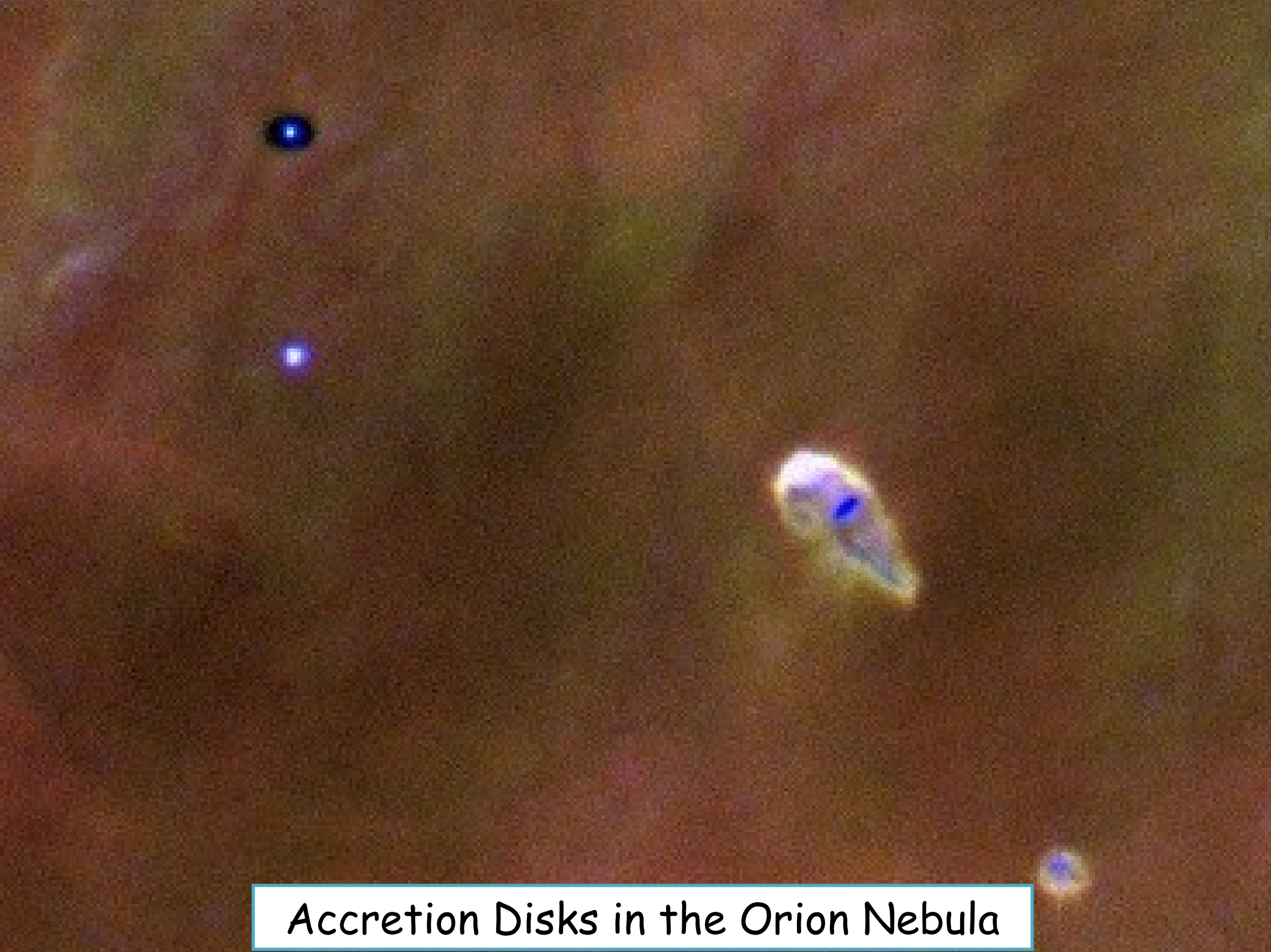


Computer simulation



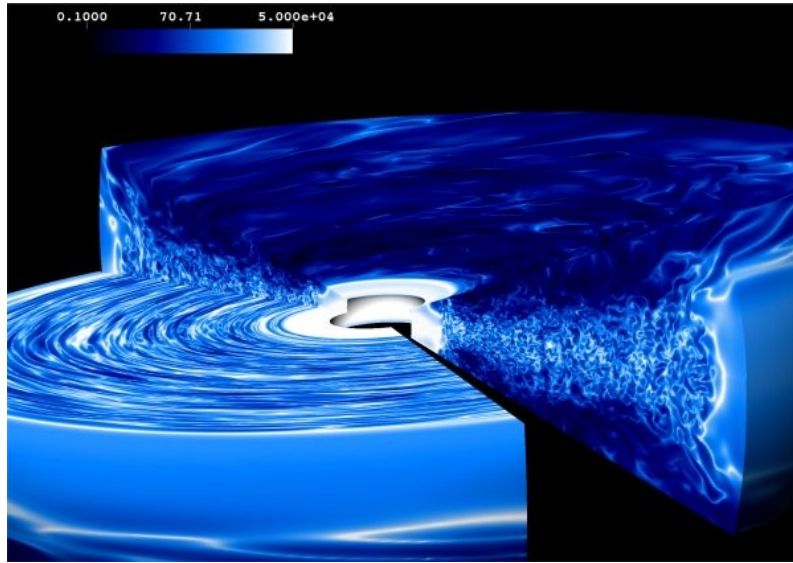
Observation



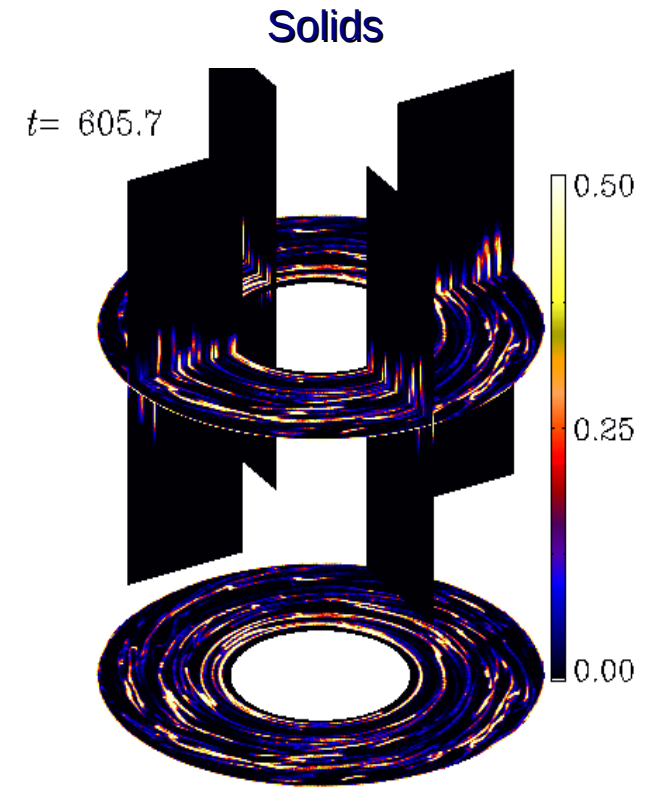


Accretion Disks in the Orion Nebula

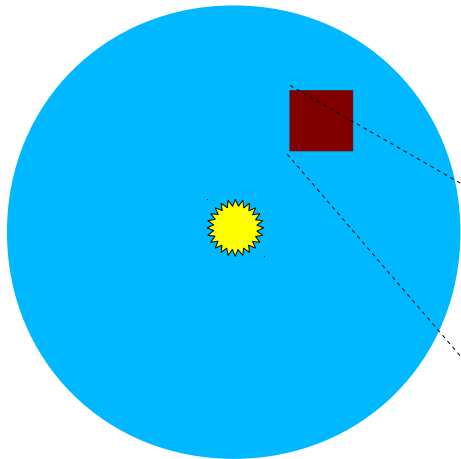
Simulations of Planet Formation



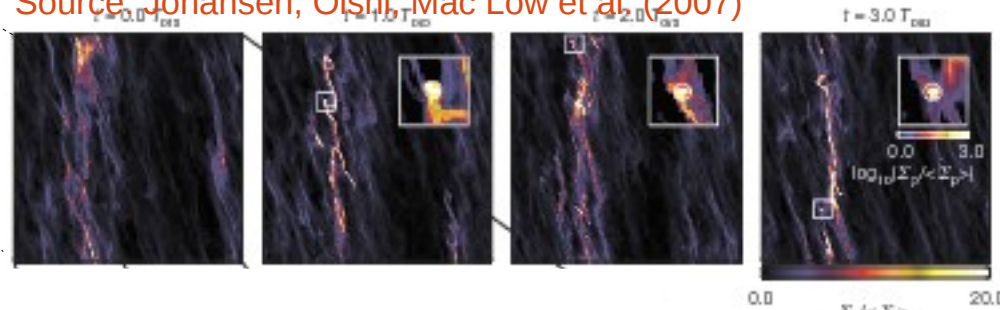
Source: Flock et al. (2011)

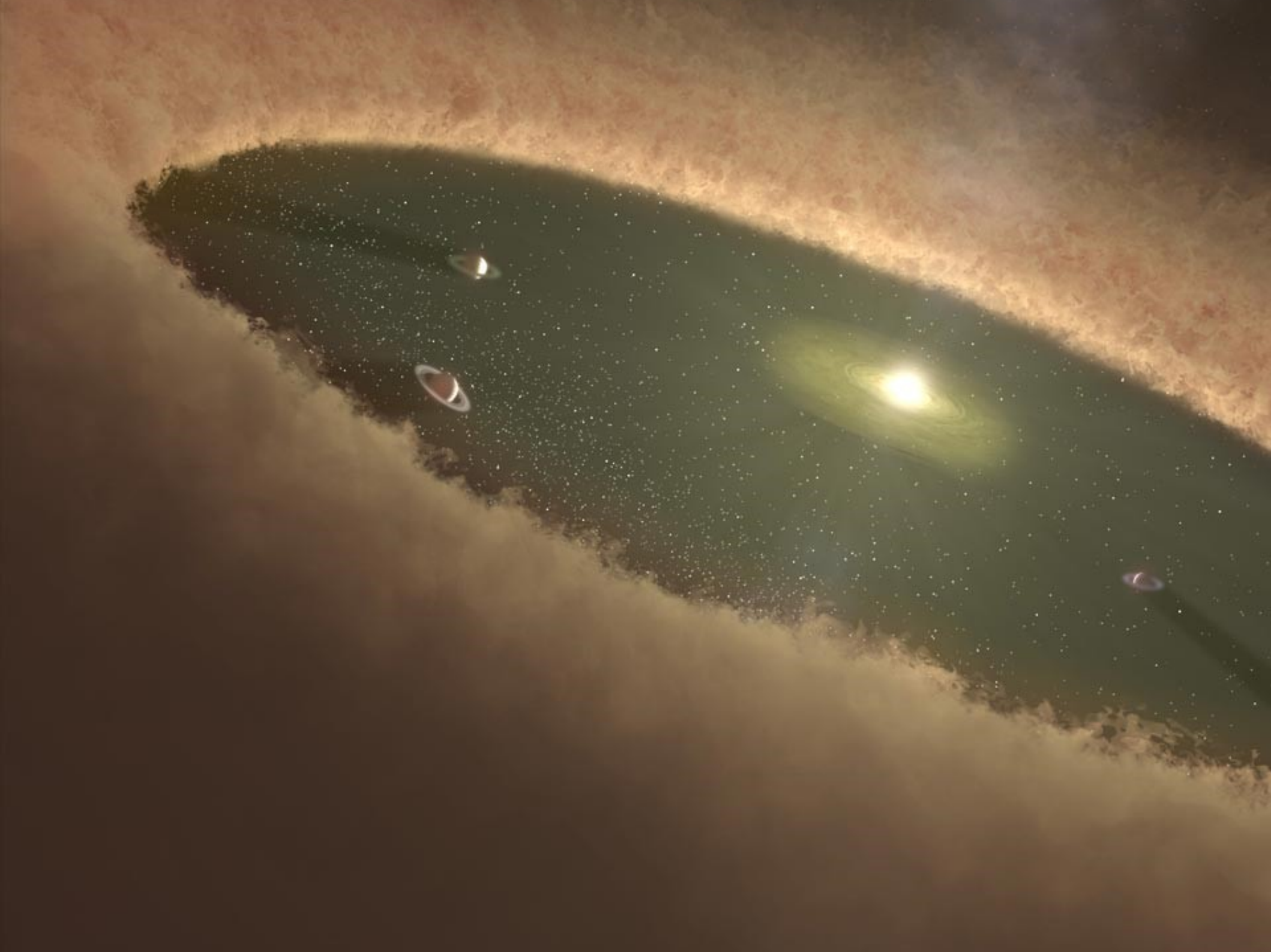


Source: Lyra et al. (2009)

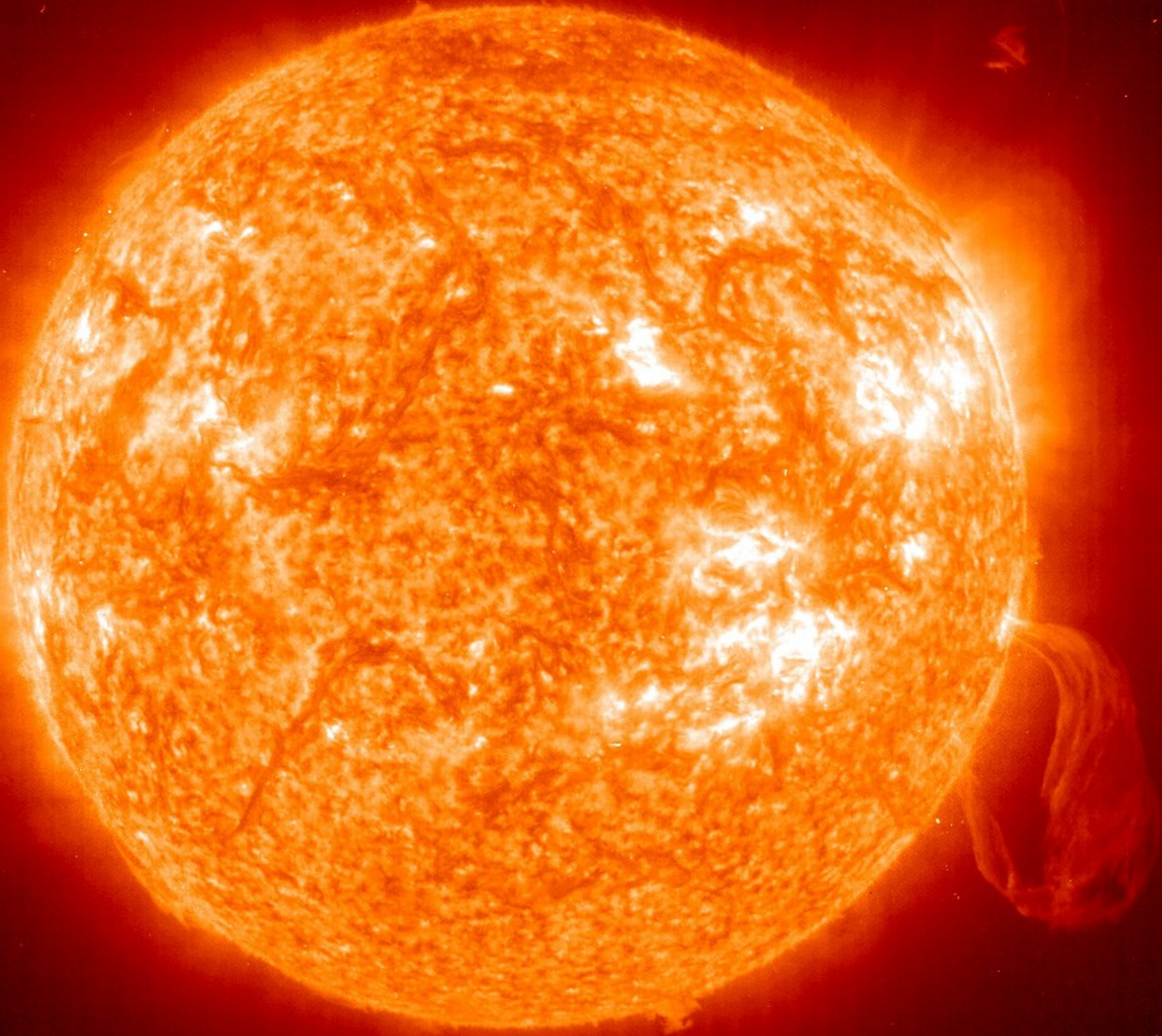


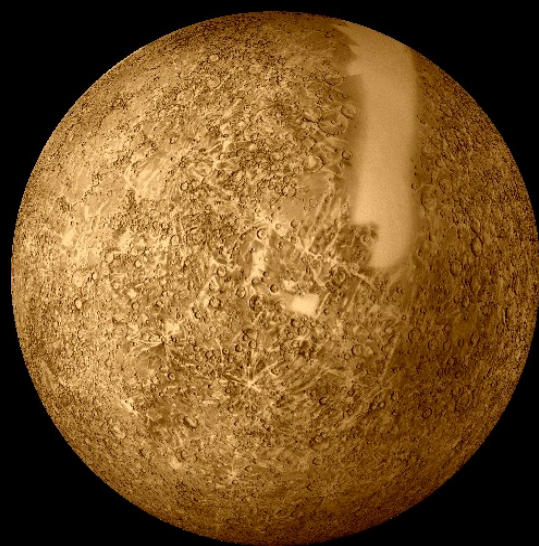
Source: Johansen, Oishi, Mac Low et al. (2007)



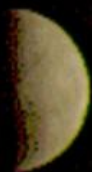


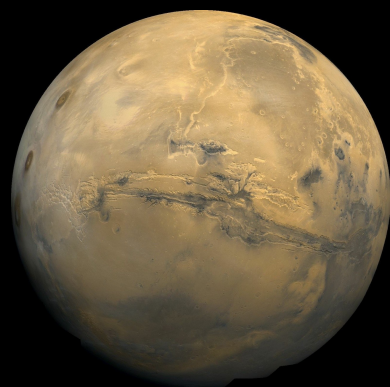
...about four and a half billion years later...





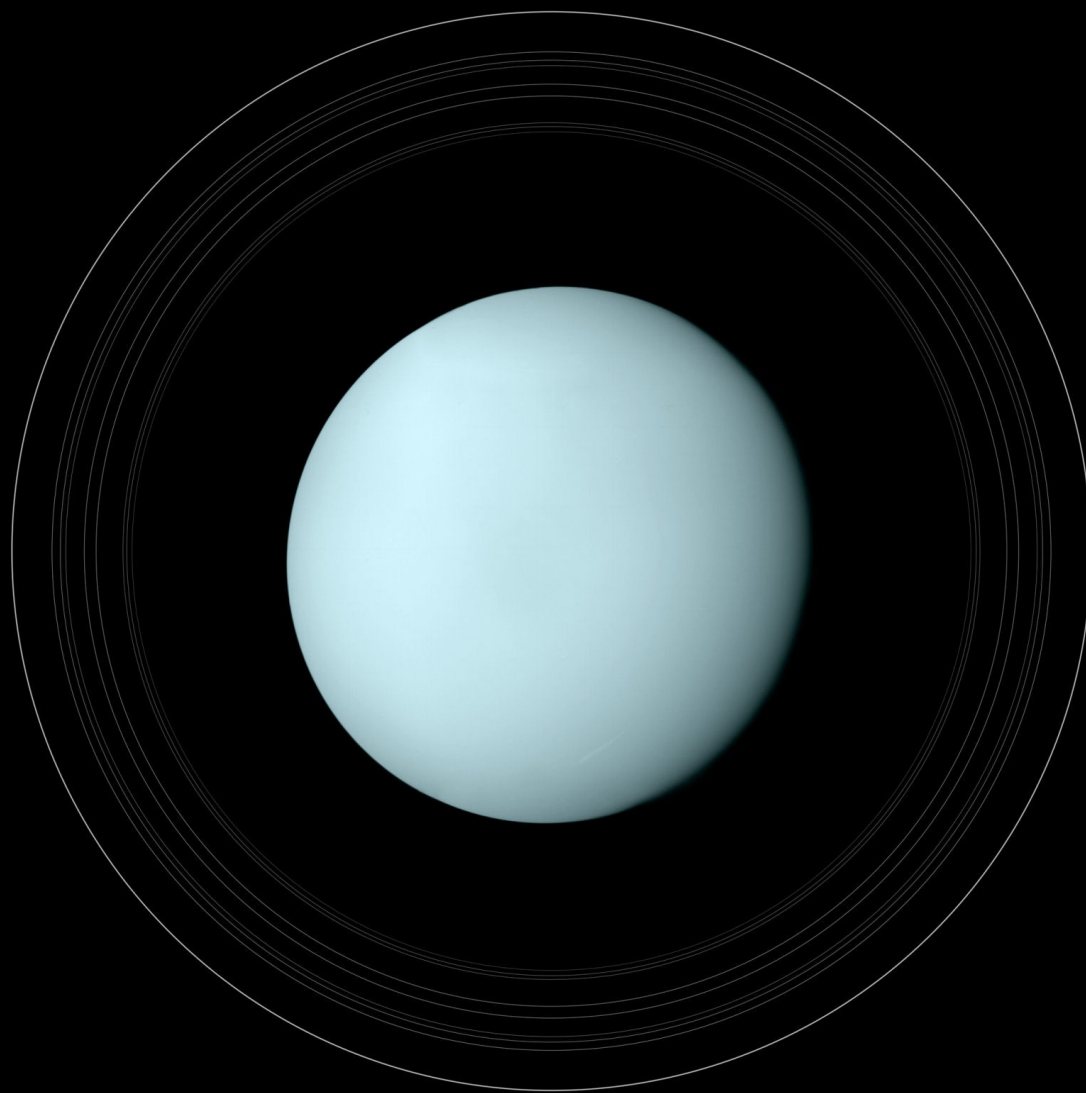


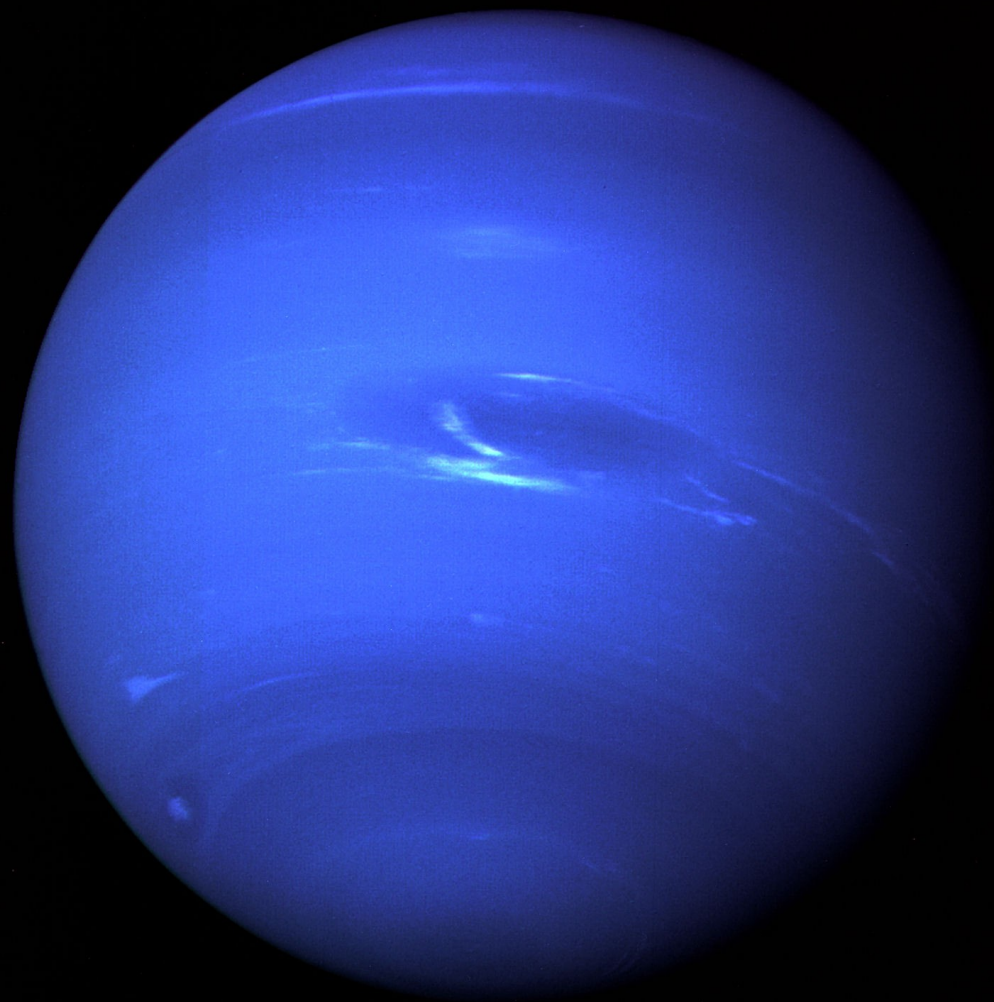




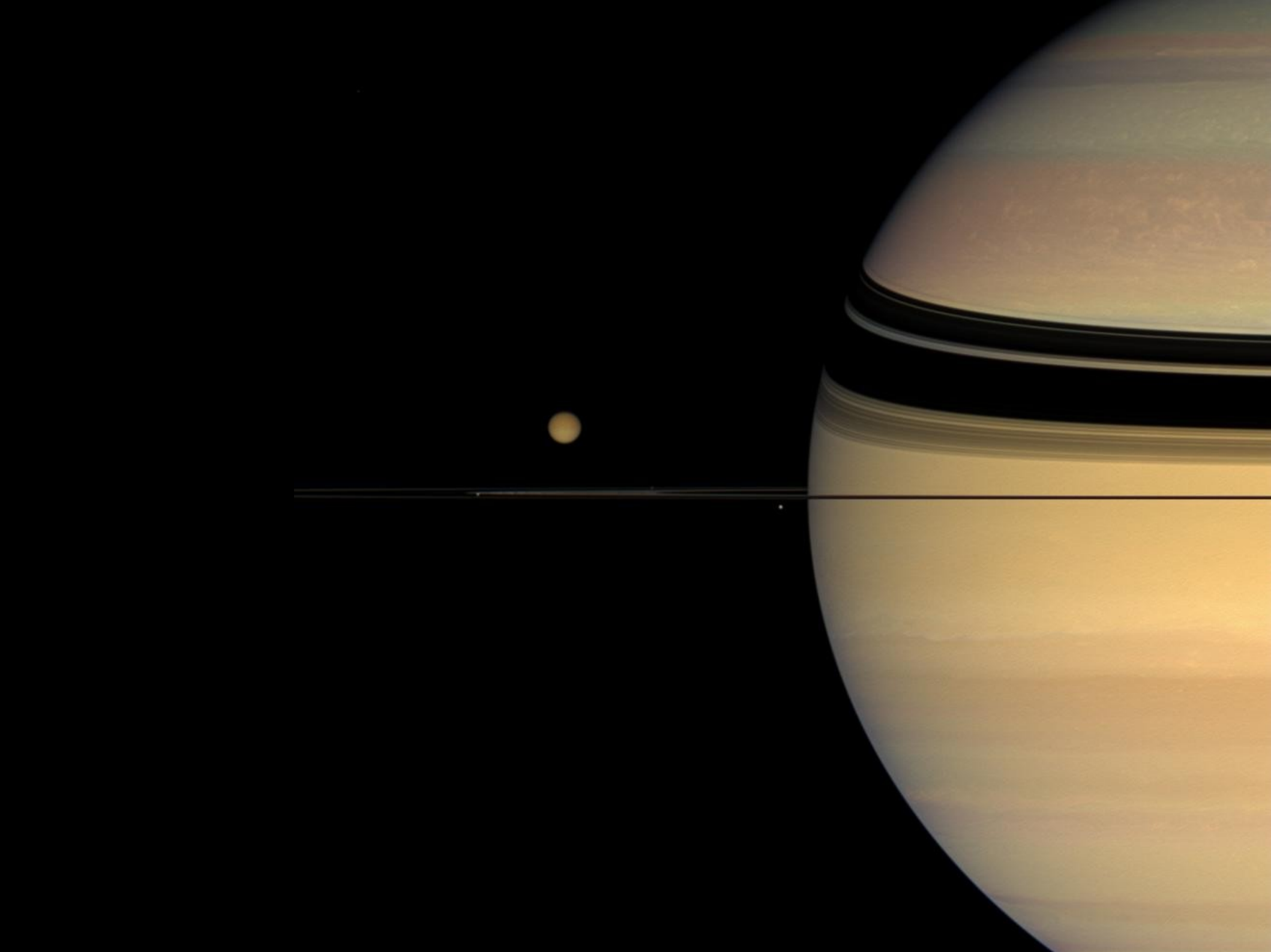




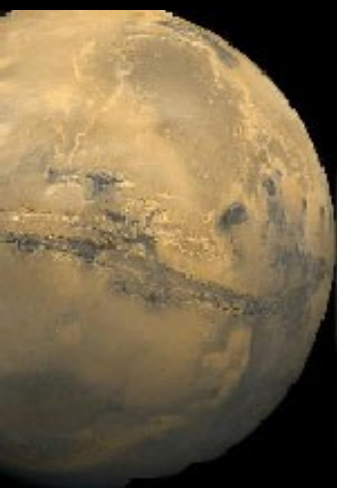












Mars
6804.9 km

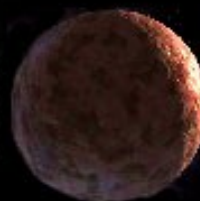
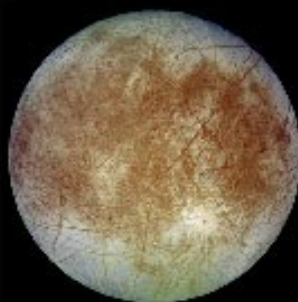
Ganymede
5262 km

Titan
5150 km

Mercury
4879.4 km

Callisto
4821 km

Io
3643 km



Moon
3476.2 km

Europa
3122 km

Triton
2706.8 km

Pluto
2390 km

Sedna
~ 1500 km

Titania
1578 km

Rhea
1528 km

Oberon
1523 km

Iapetus
1436 km

Quaoar
1200 km



Charon
1186 km

Umbriel
1169.4 km

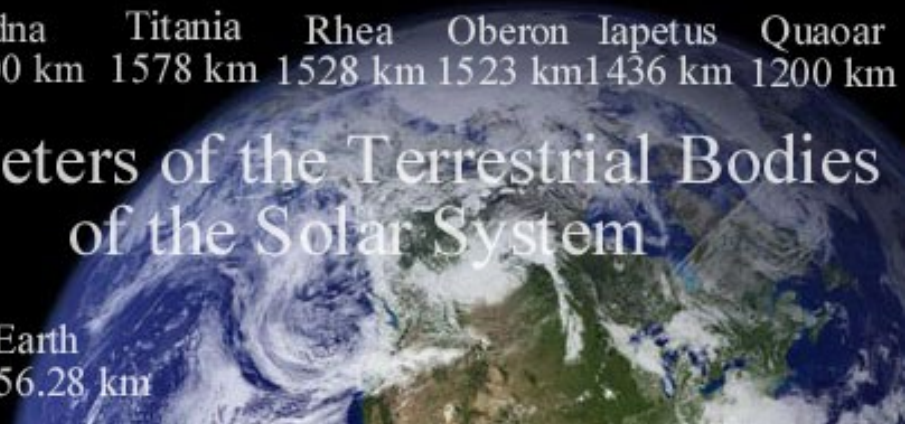
Ariel
1158 km

Dione
1118 km

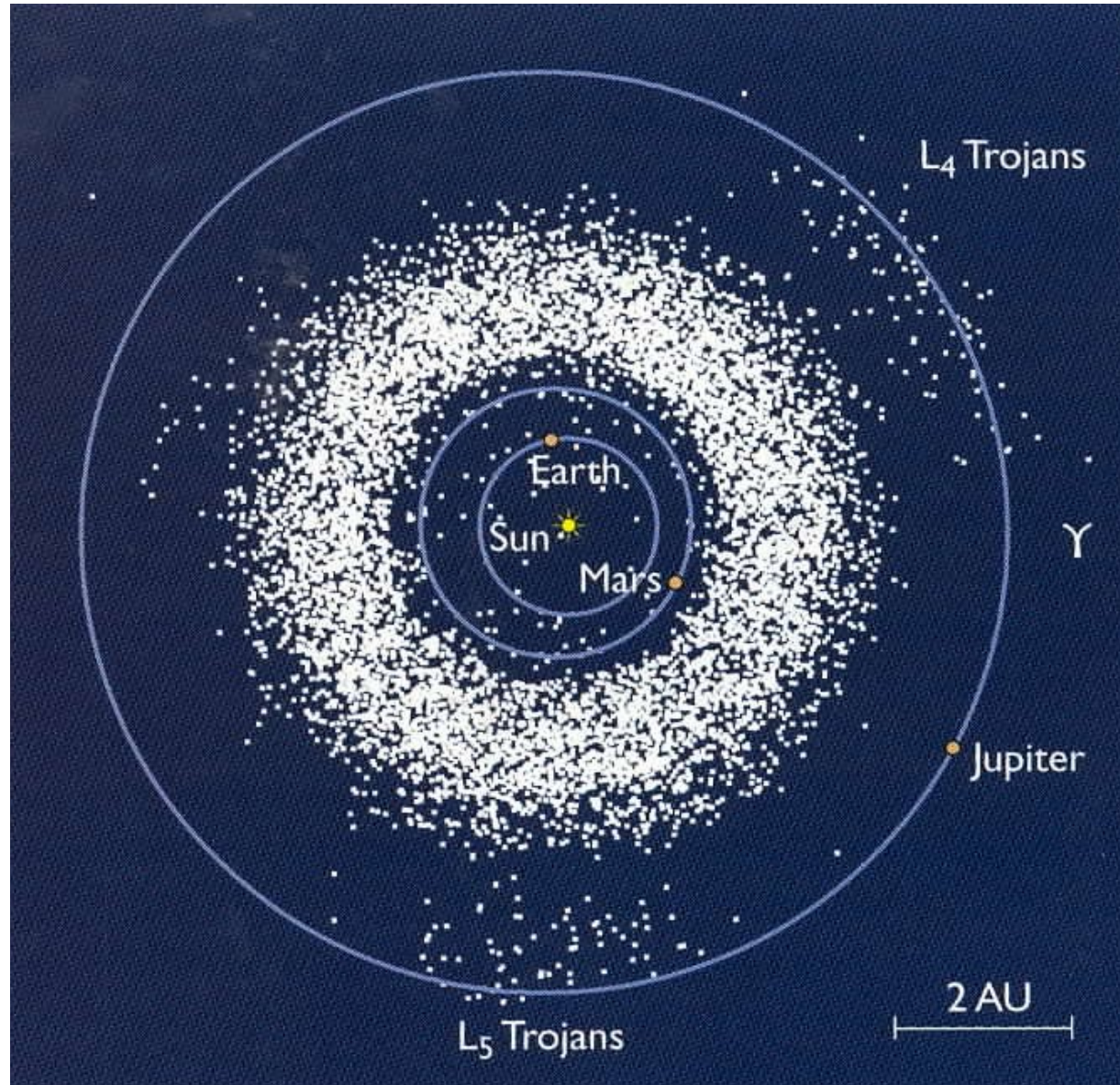
Tethys
1059 km

Diameters of the Terrestrial Bodies of the Solar System

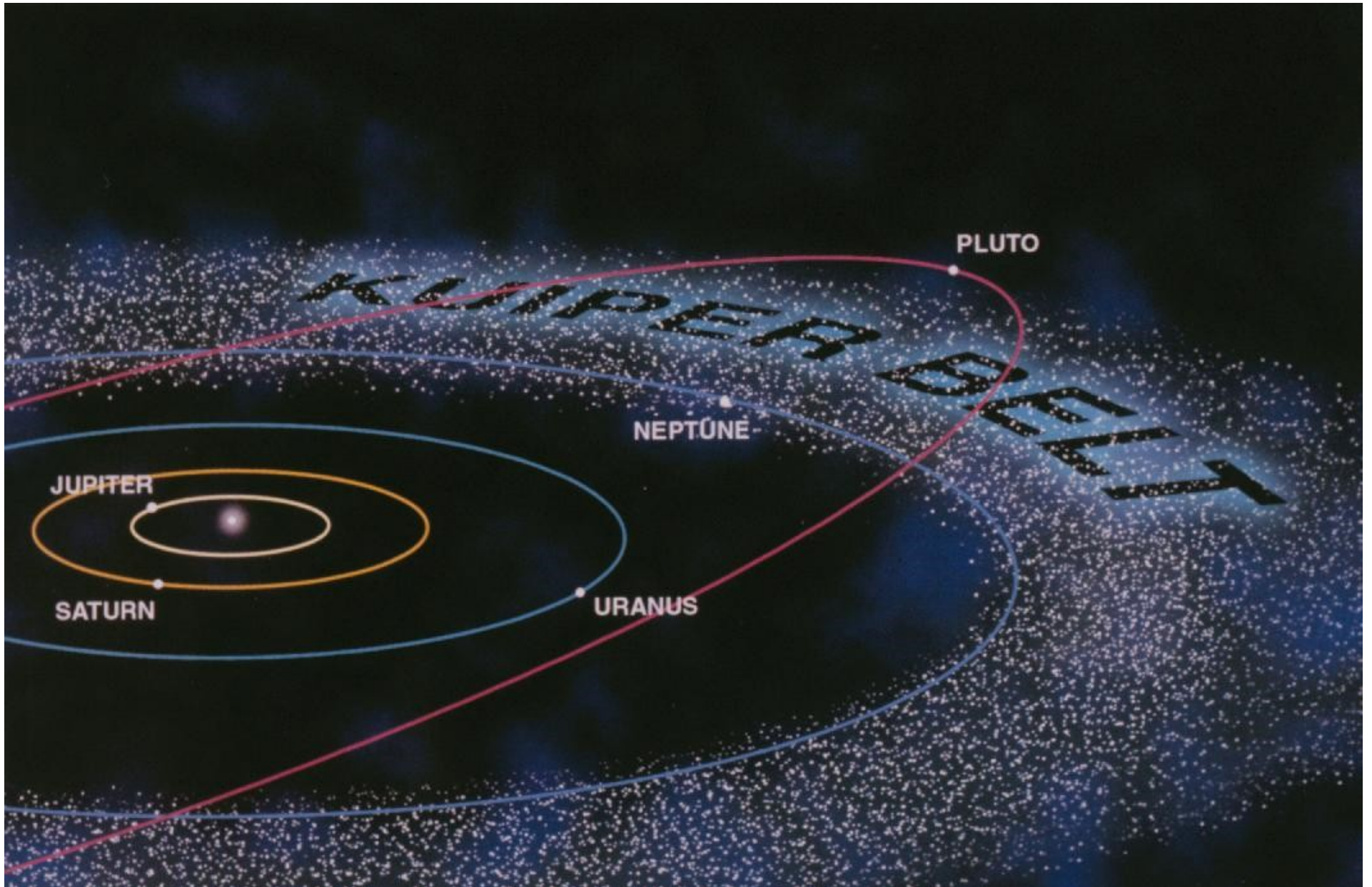
Earth
12,756.28 km



Asteroid Belt



Kuiper Belt



Dysnomia



Eris

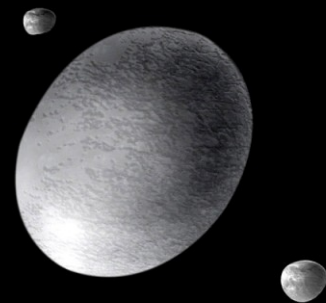
Charon



Pluto



2005 FY₉



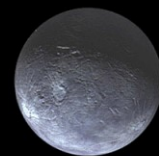
2003 EL₆₁



Sedna



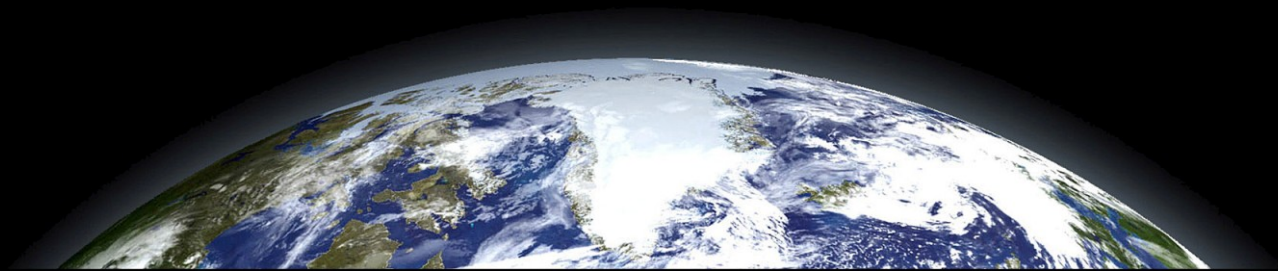
Orcus



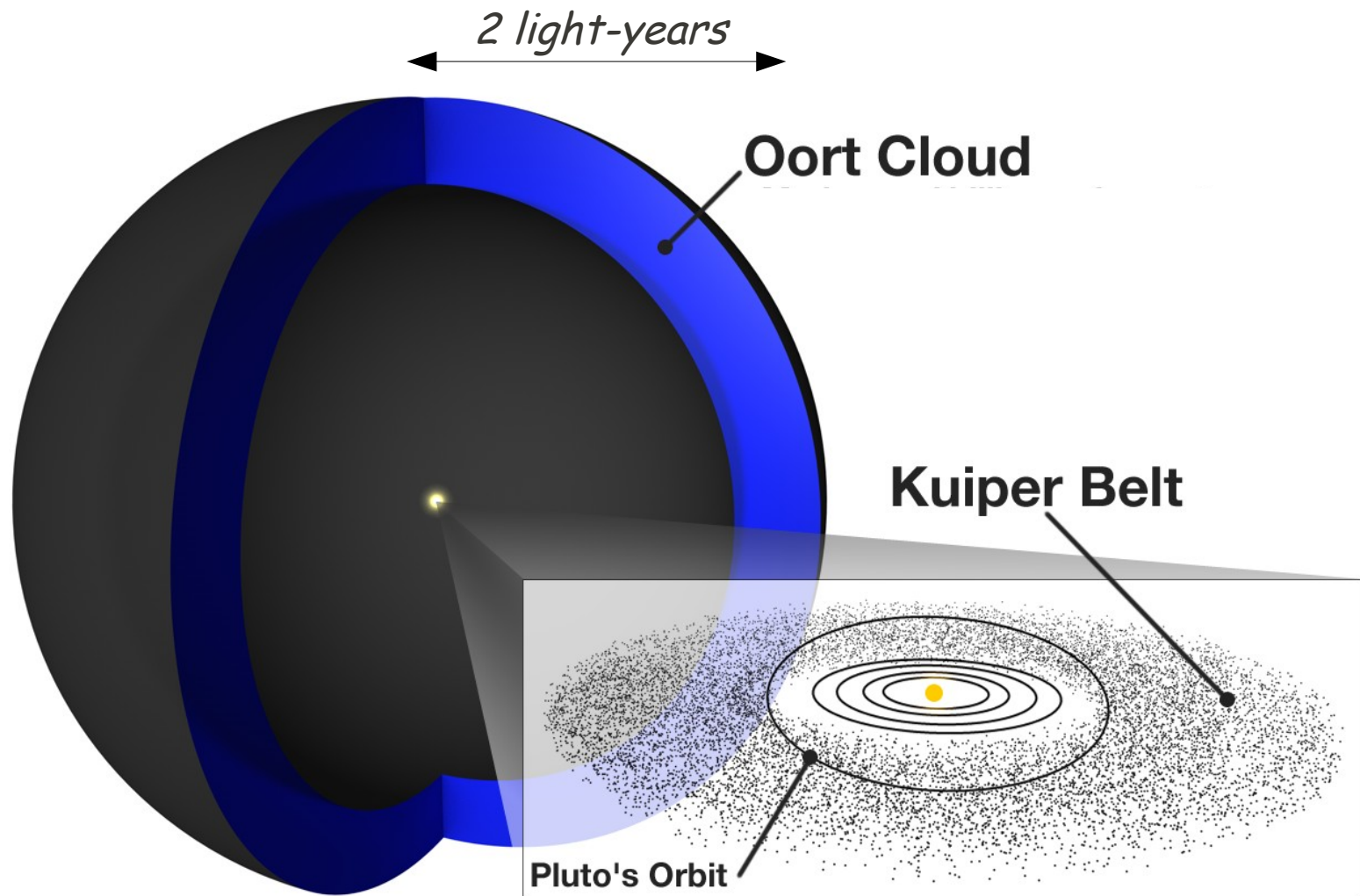
Quaoar



Varuna



Oort Cloud



Tour of Time Scales of the Solar System

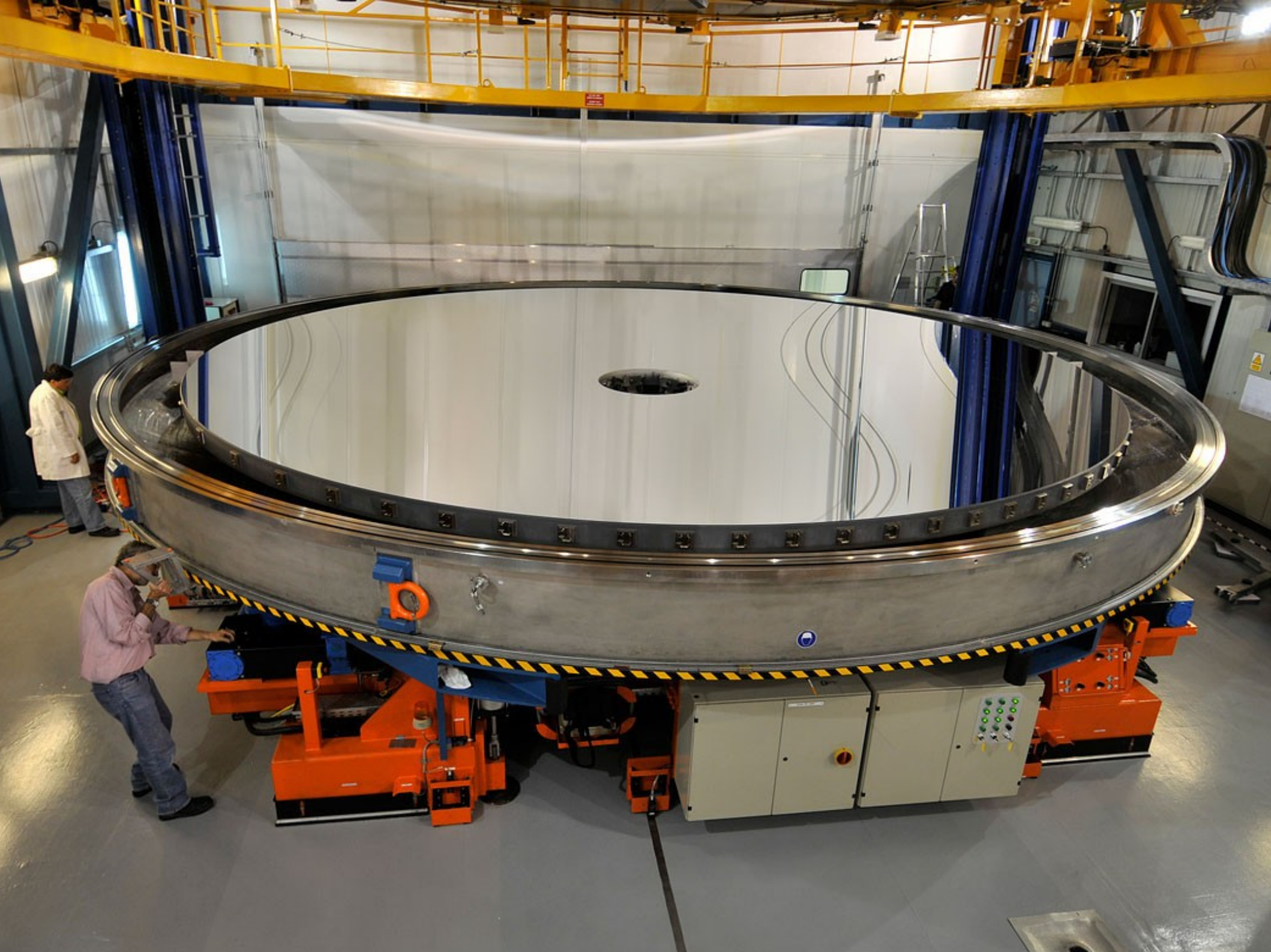
How high could you jump on different
objects in the Solar System?

How do we know this?

We have been searching...

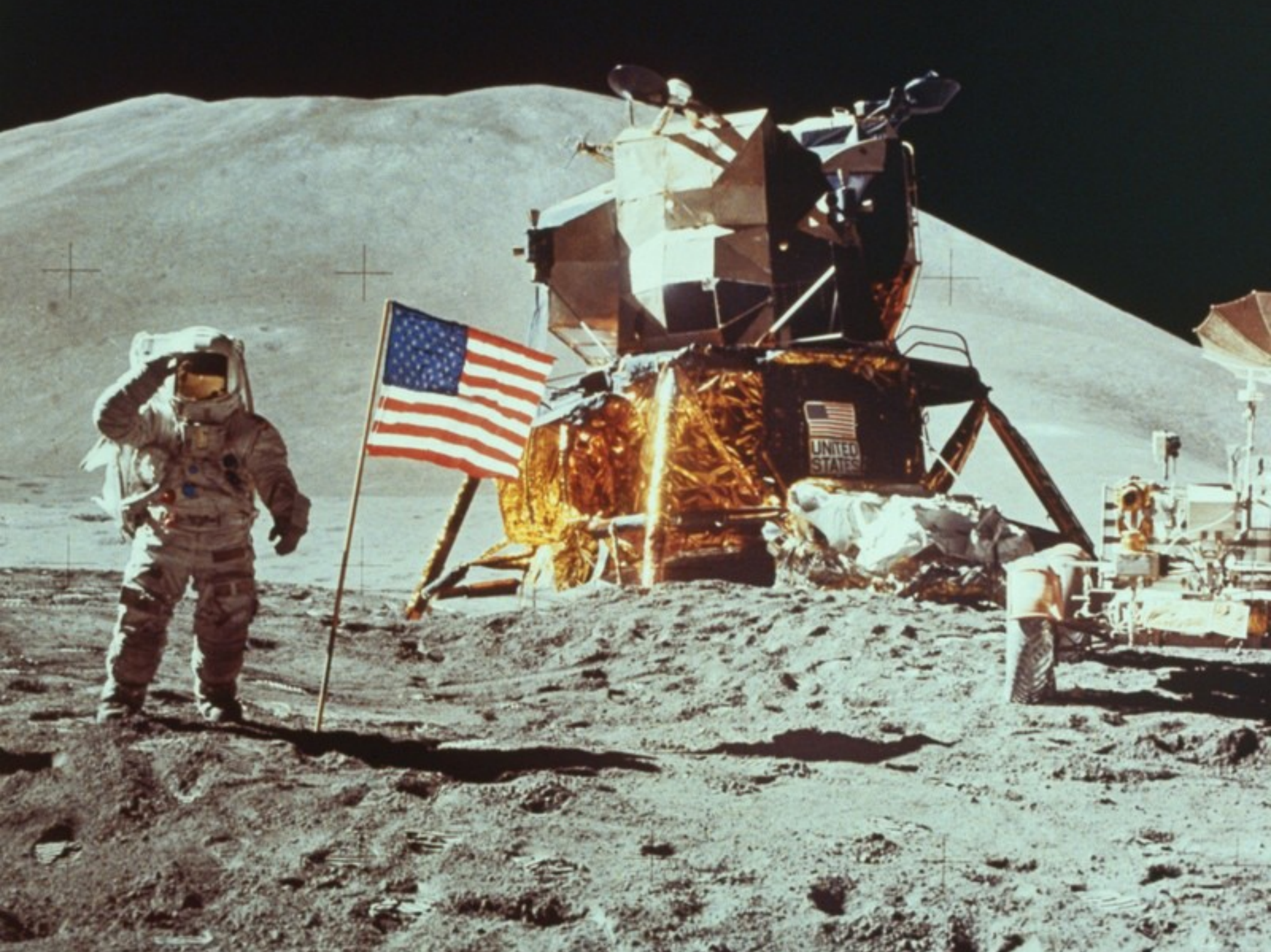


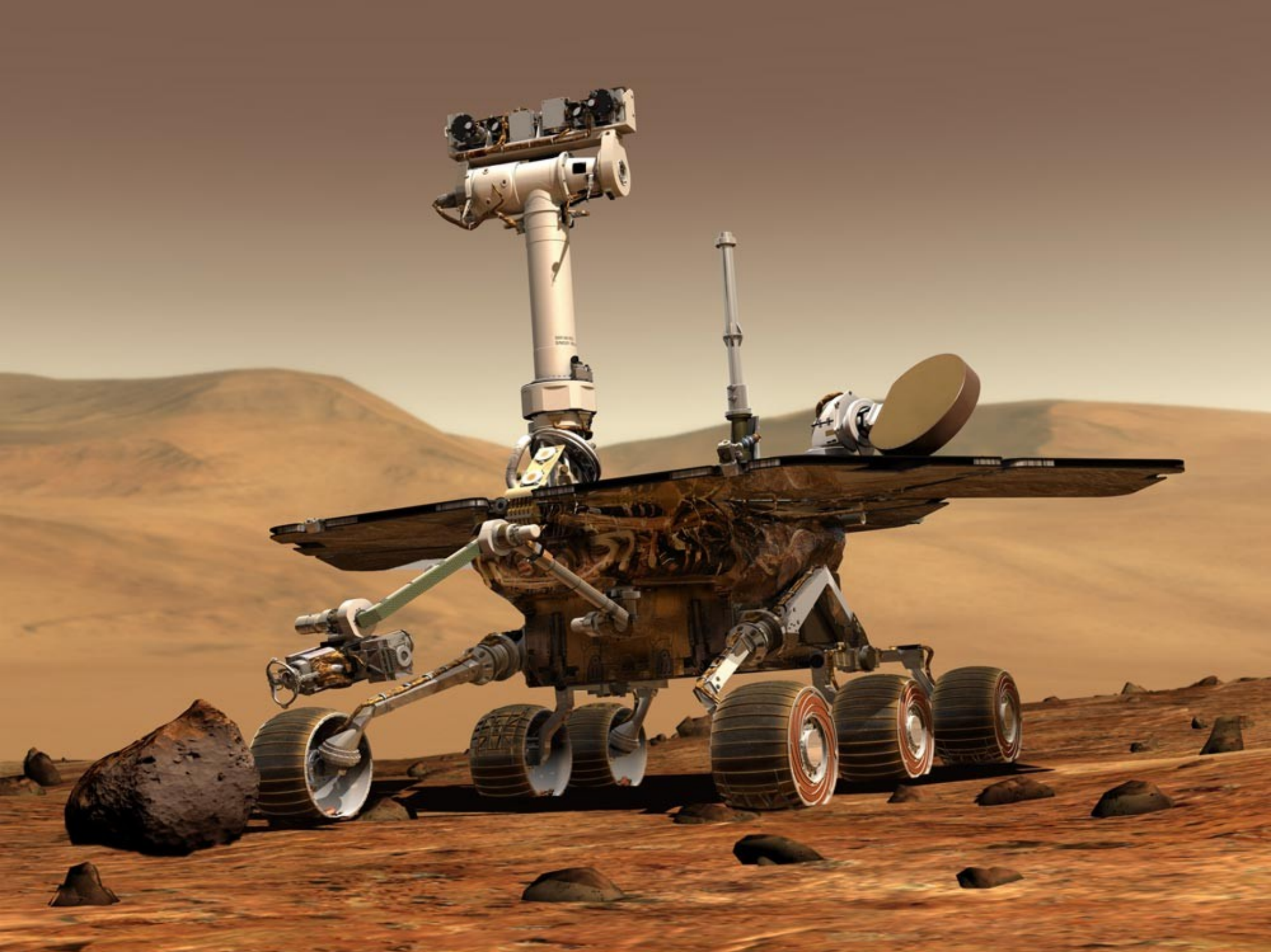






We've gone places...



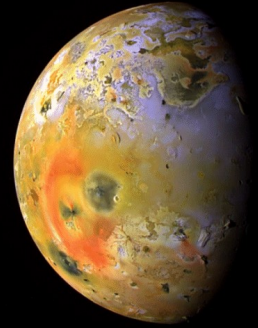


We brought things back...



We've found clues...





PIECES IN THE PUZZLE OF THE 'SECRETS OF THE SOLAR SYSTEM'

