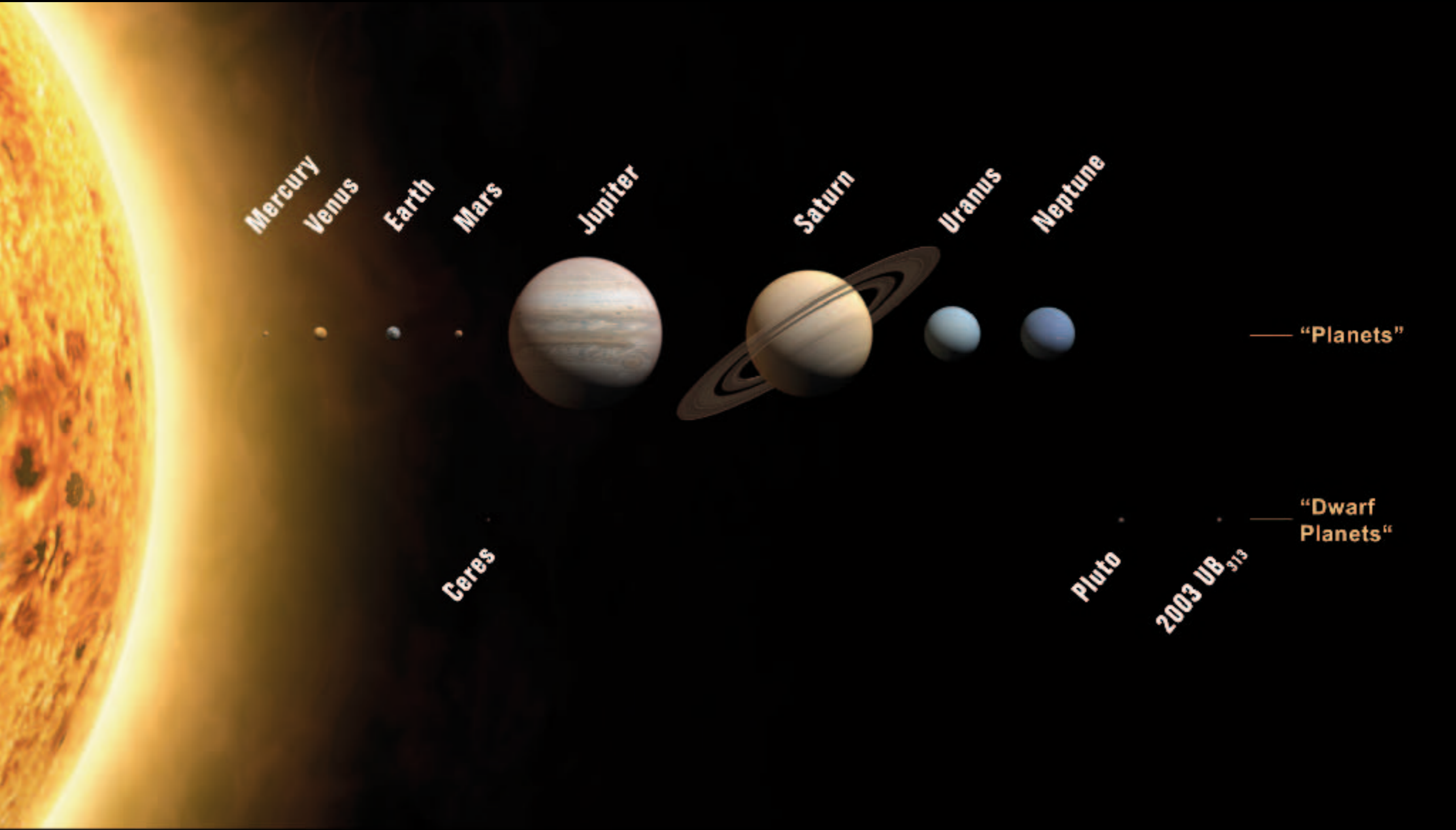




¿Es único el Sistema Solar?

Eva Villaver

Universidad Autónoma de Madrid



Mercury

Venus

Earth

Mars

Jupiter

Saturn

Uranus

Neptune

Ceres

Pluto

2003 UB₃₁₃

— "Planets"

— "Dwarf Planets"

Venus Express



ExoMars



JUICE



Cassini-Huygens



Bepi-Colombo



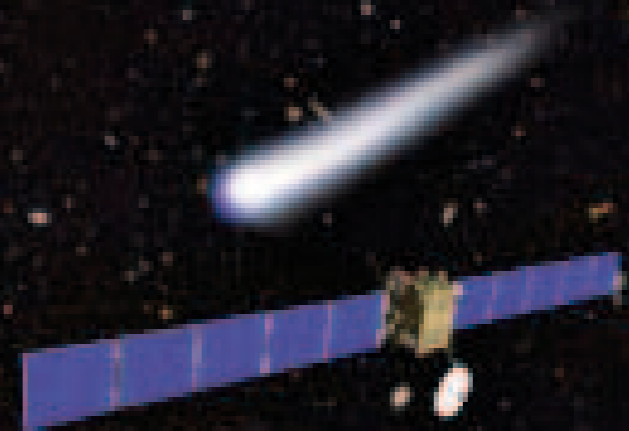
Mars Express



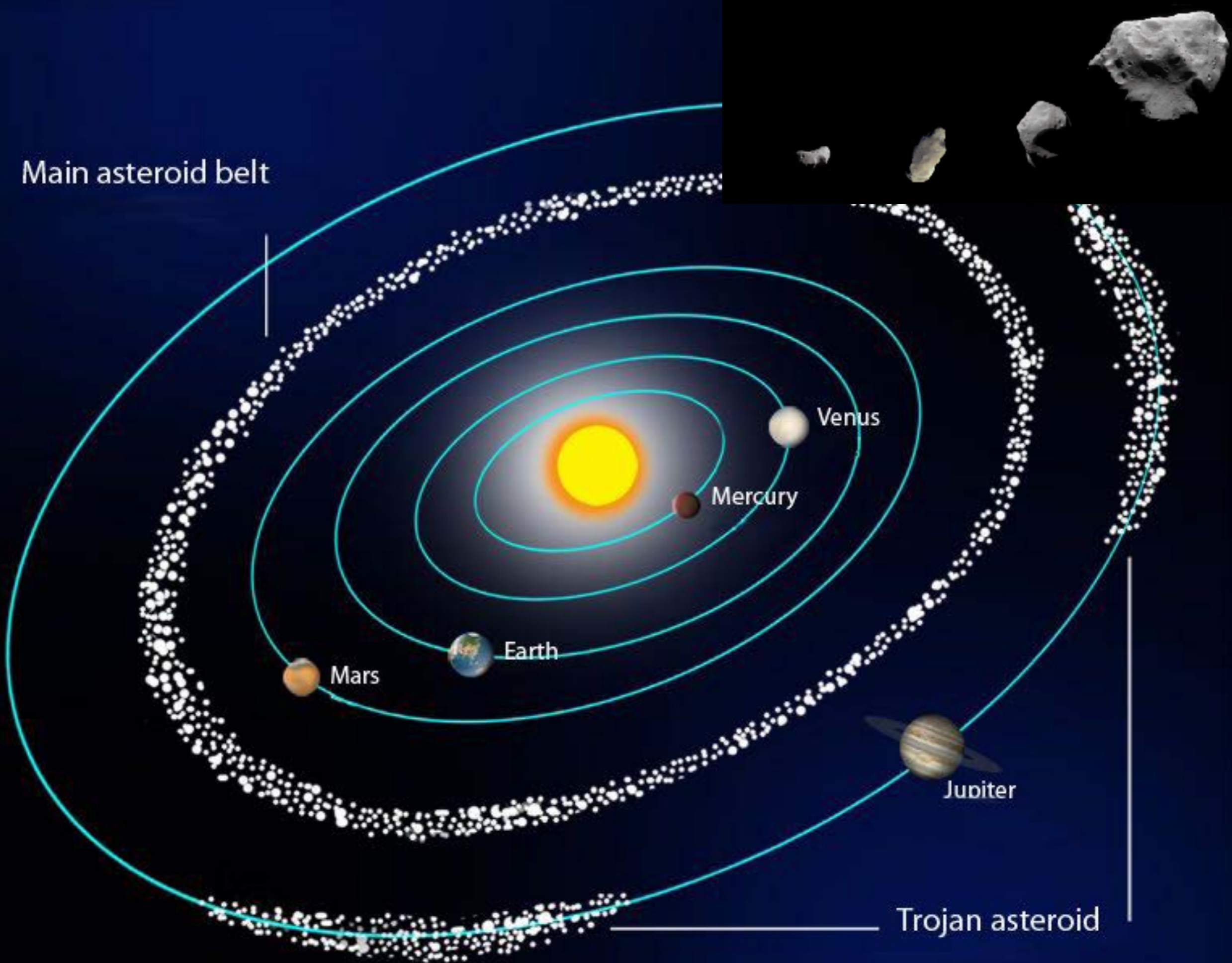
SMART-1



Rosetta



Main asteroid belt



Venus

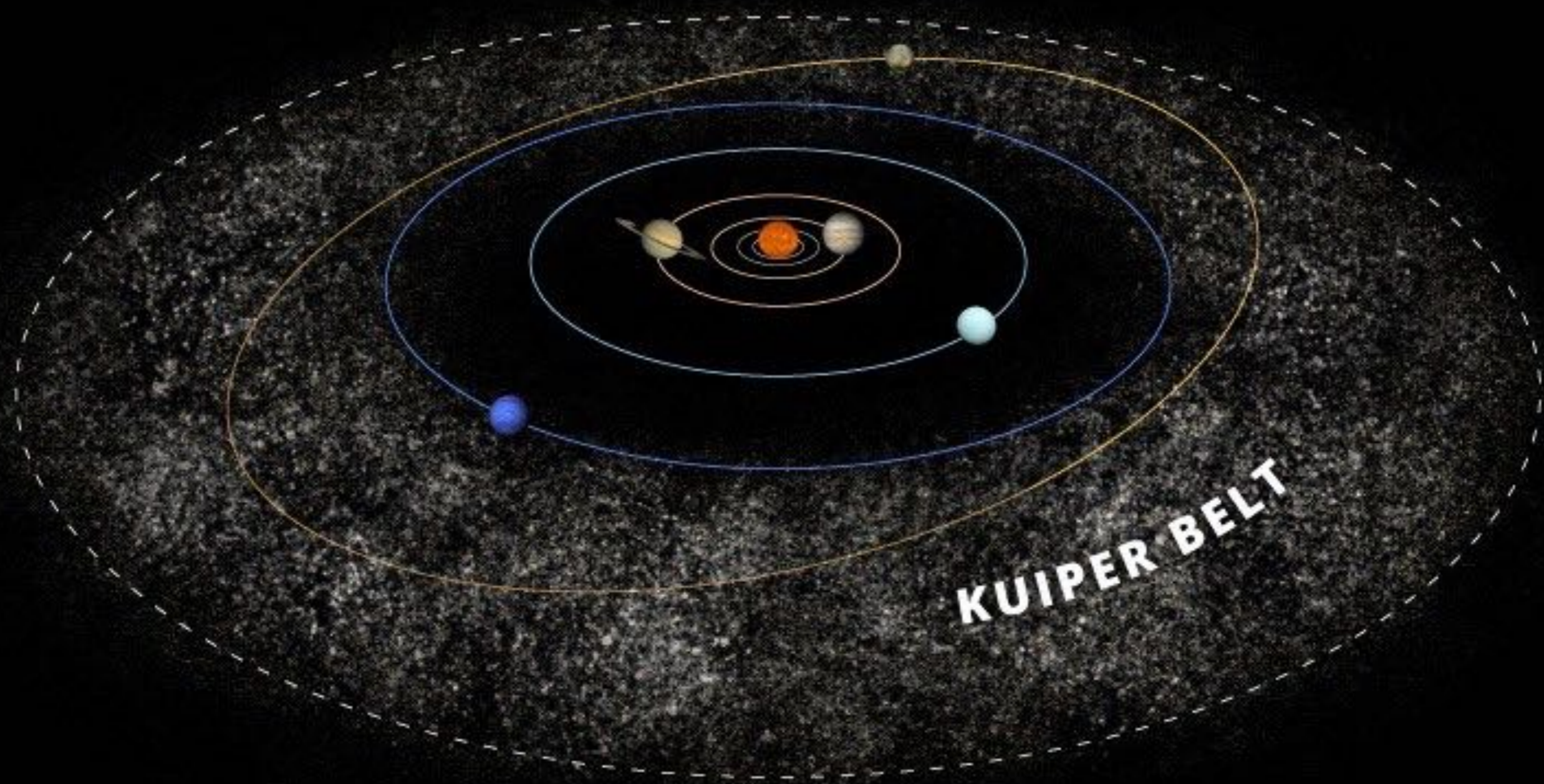
Mercury

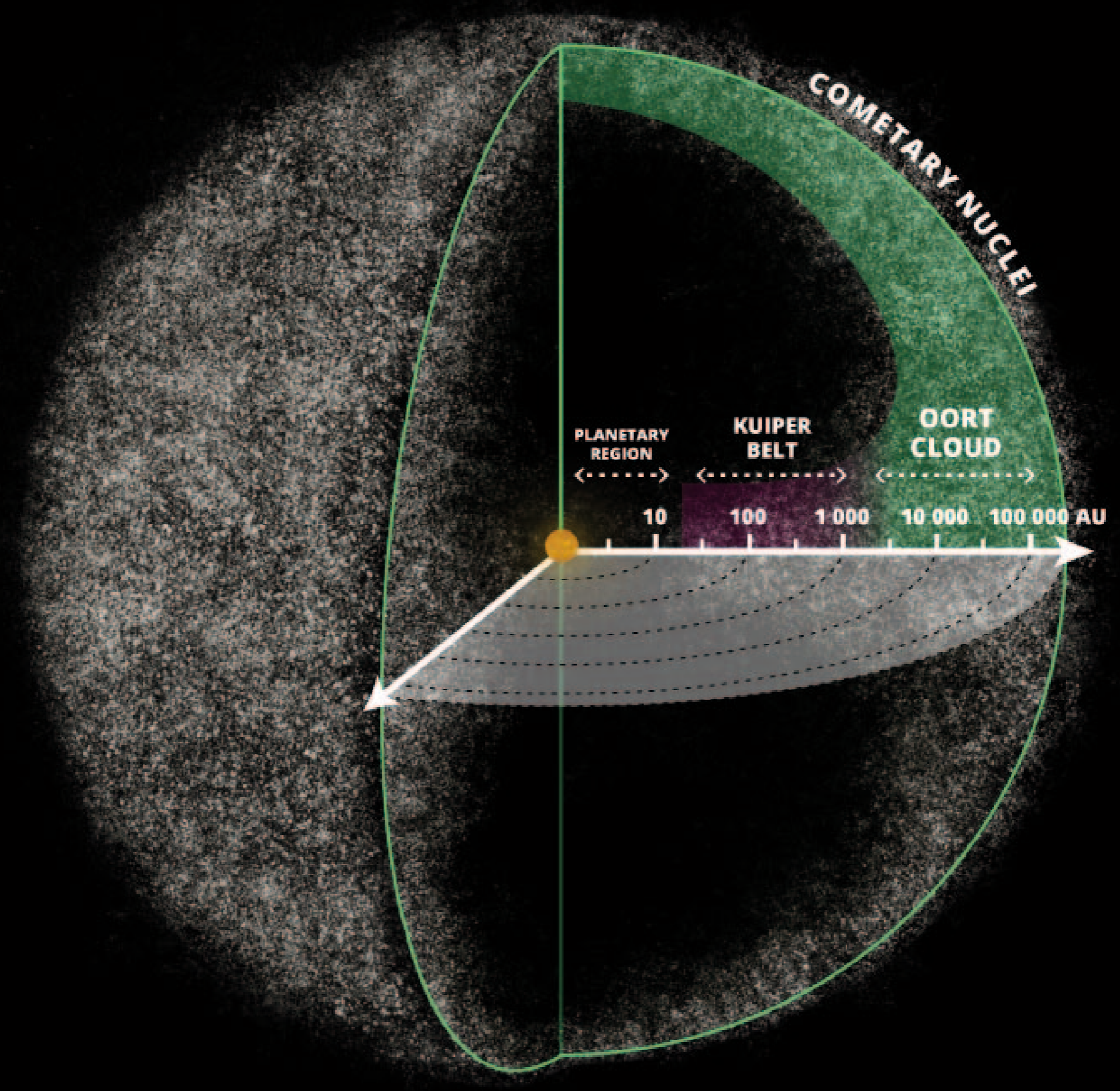
Earth

Mars

Jupiter

Trojan asteroid





¿Que tenemos en el Sistema Solar?

1. *Orbitas circulares y prograde*
2. *Mismo plano*
3. *Gigantes gaseosos más allá de la línea de hielos*
4. *No planeta rocoso 0.4au*
5. *No gigante más allá de 40au*



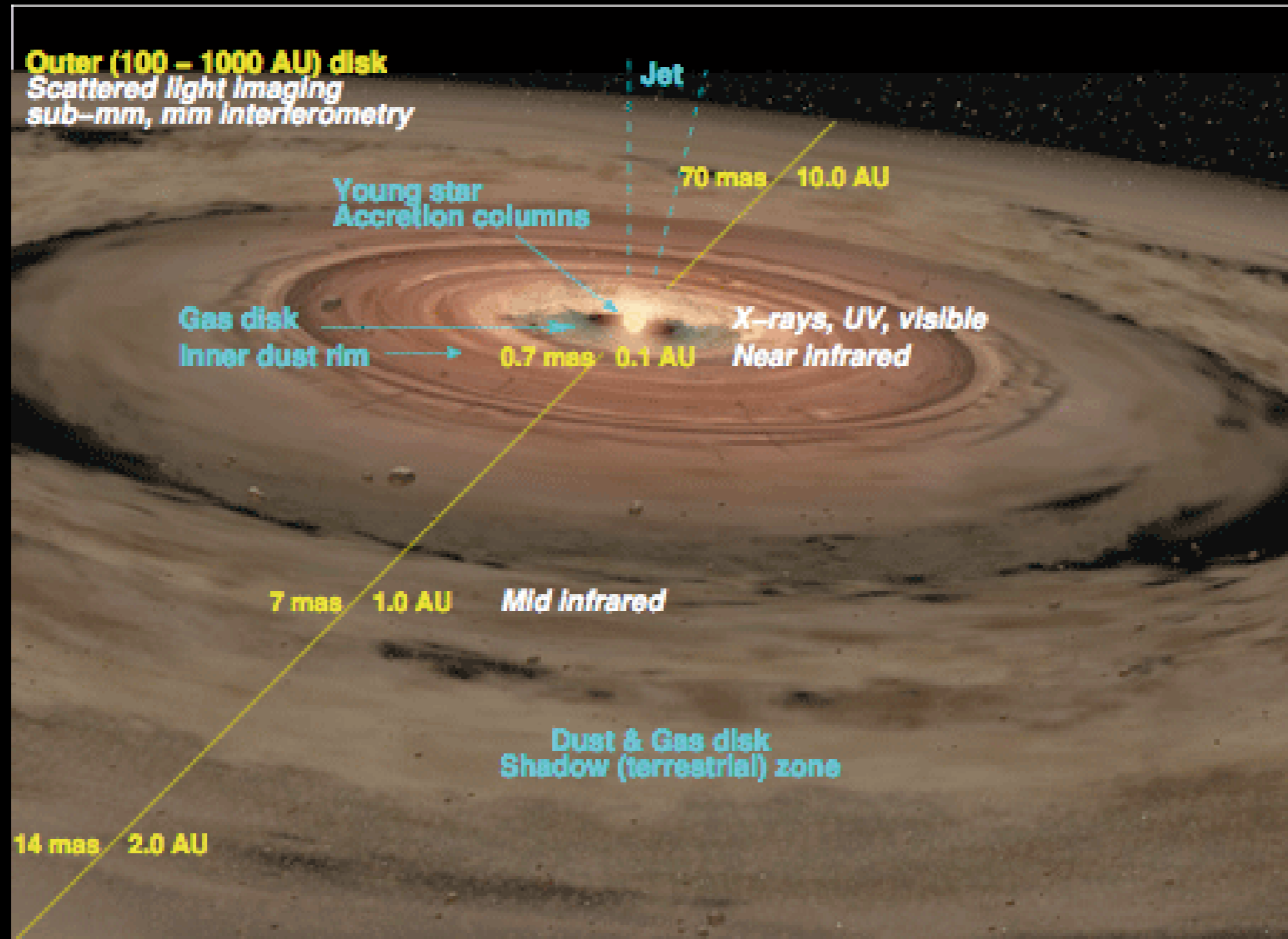
La Formación de estrellas....y planetas

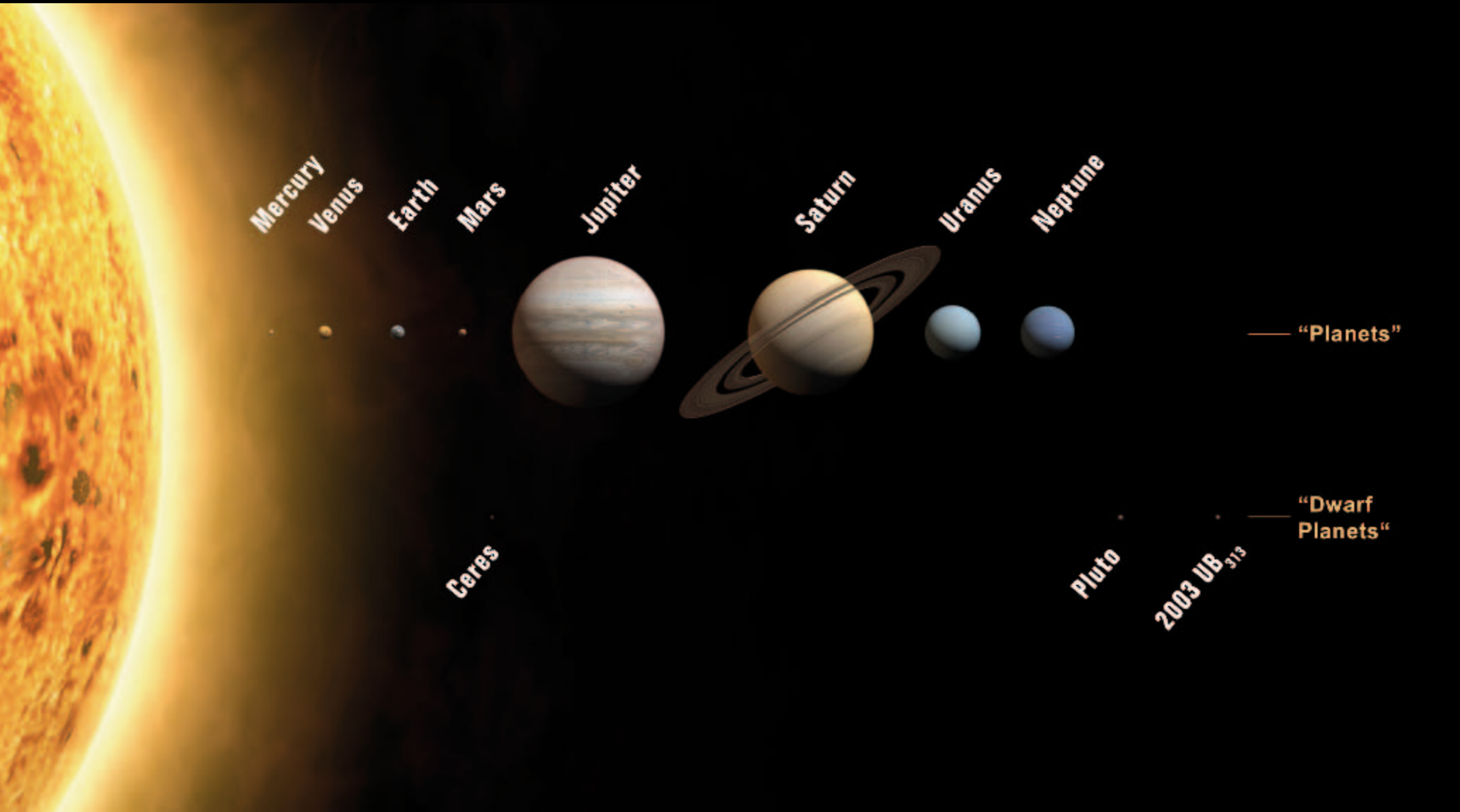


Credit: NASA, ESA, and the Hubble Heritage Team (AURA/STScI)



Formación de un sistema planetario





Mercury

Venus

Earth

Mars

Jupiter

Saturn

Uranus

Neptune

Ceres

Pluto

2003 UB₃₁₉

— “Planets”

— “Dwarf Planets”

1995 primer planeta alrededor de una estrella como el sol



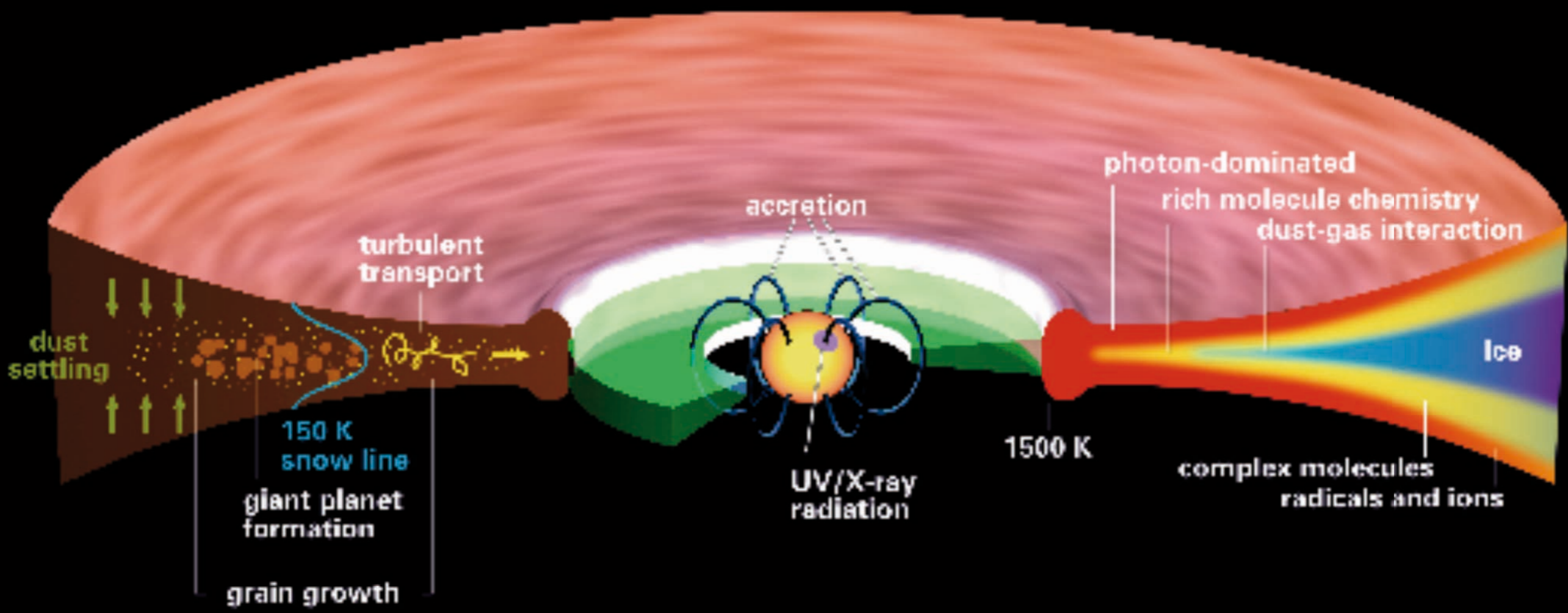
51 PEGASUS B

48 años-luz

Mayor & Queloz (1995)

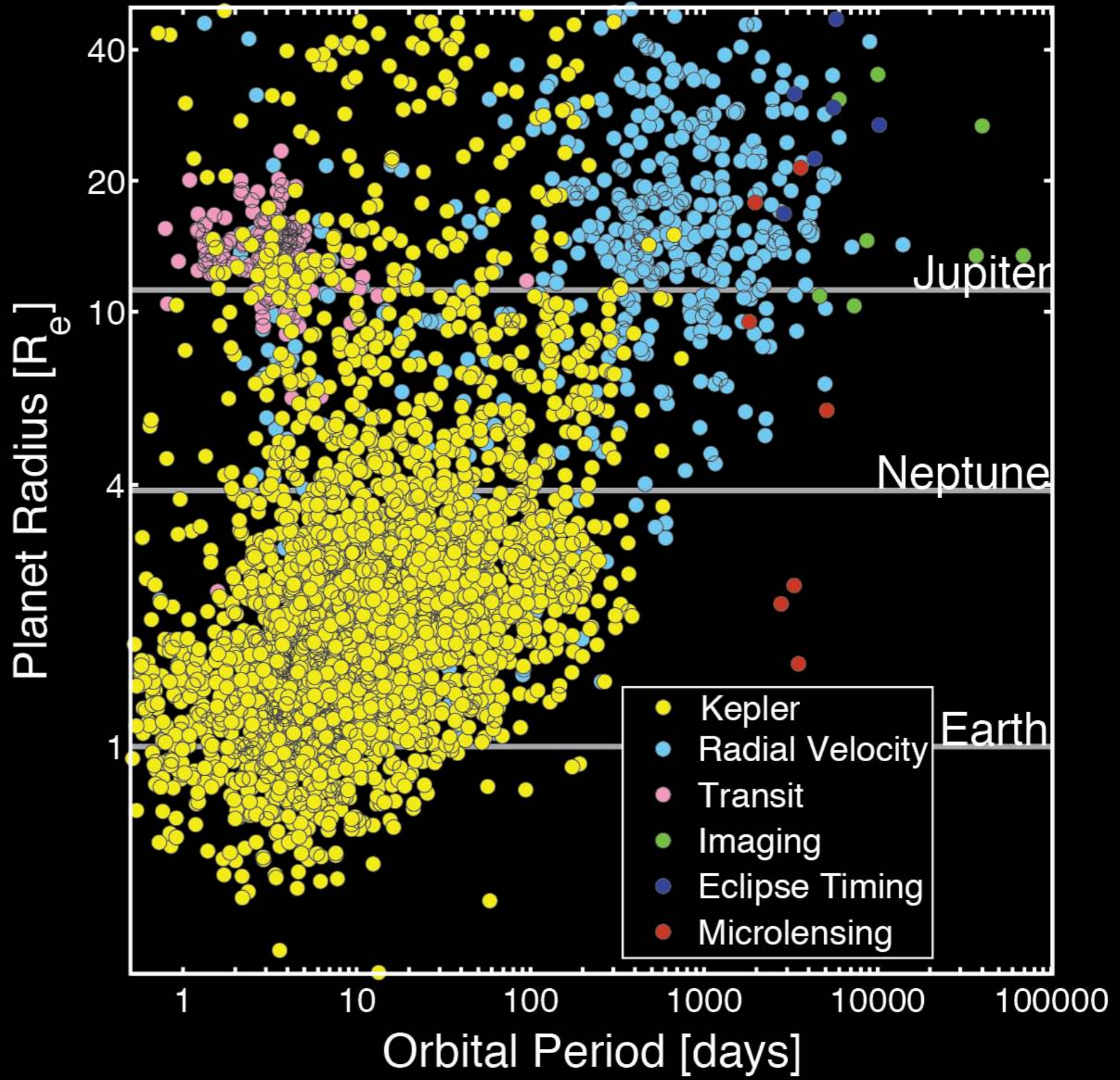
102 horas de período

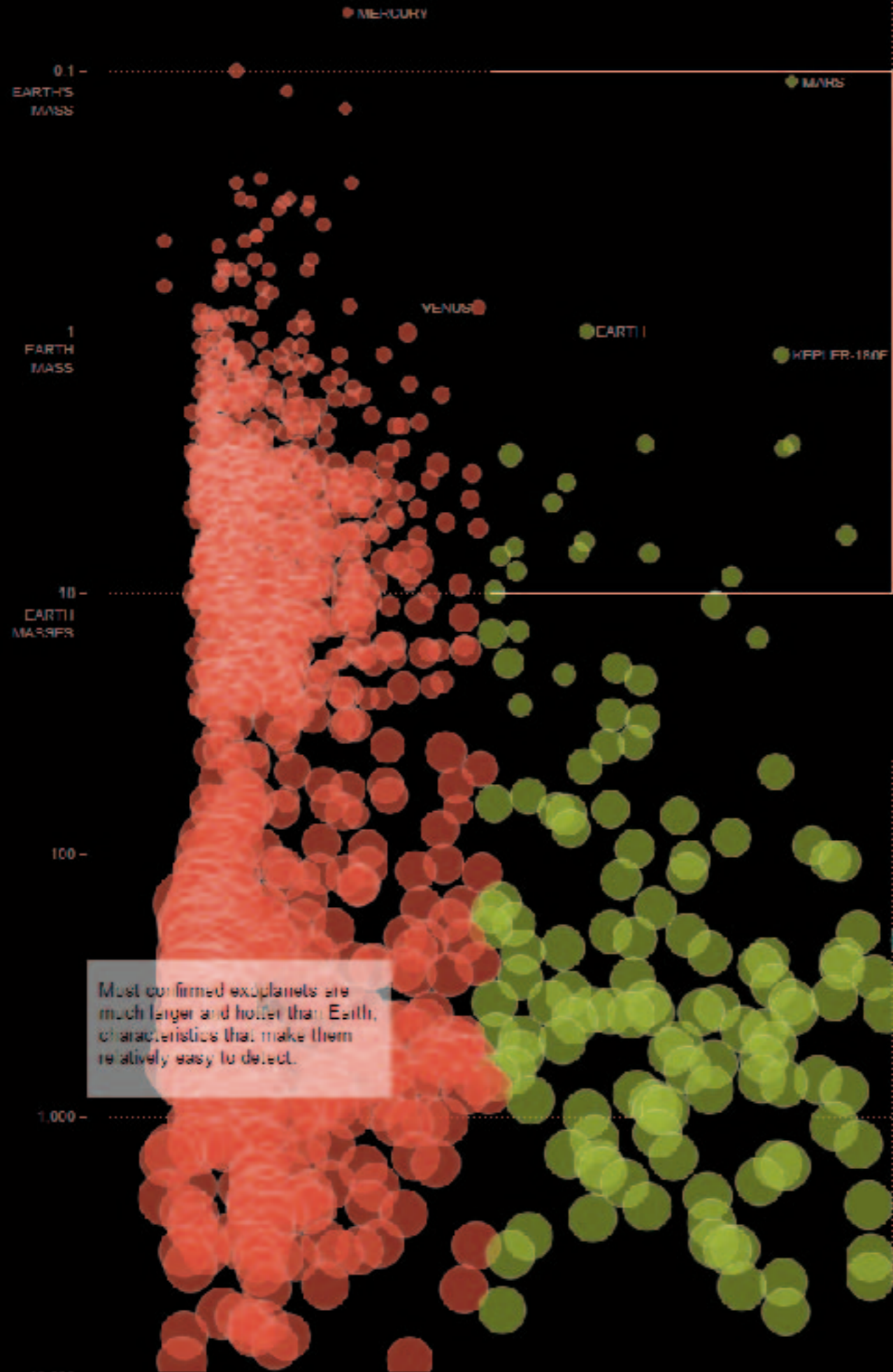




1995-2018

(**3453** PLANETAS
CONFIRMADOS)



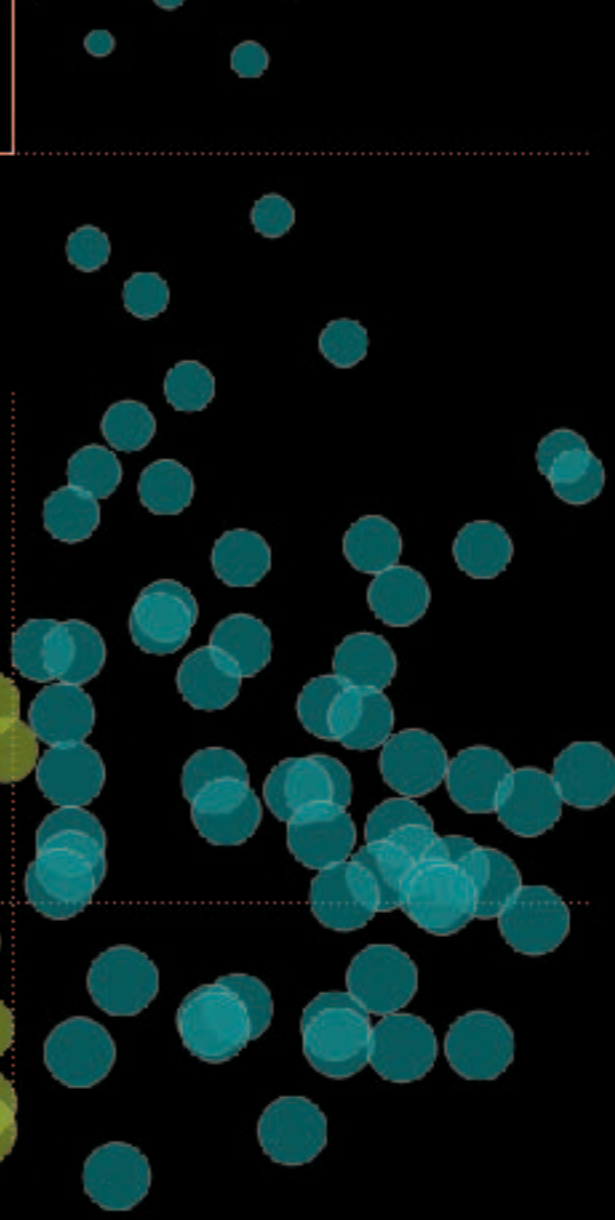


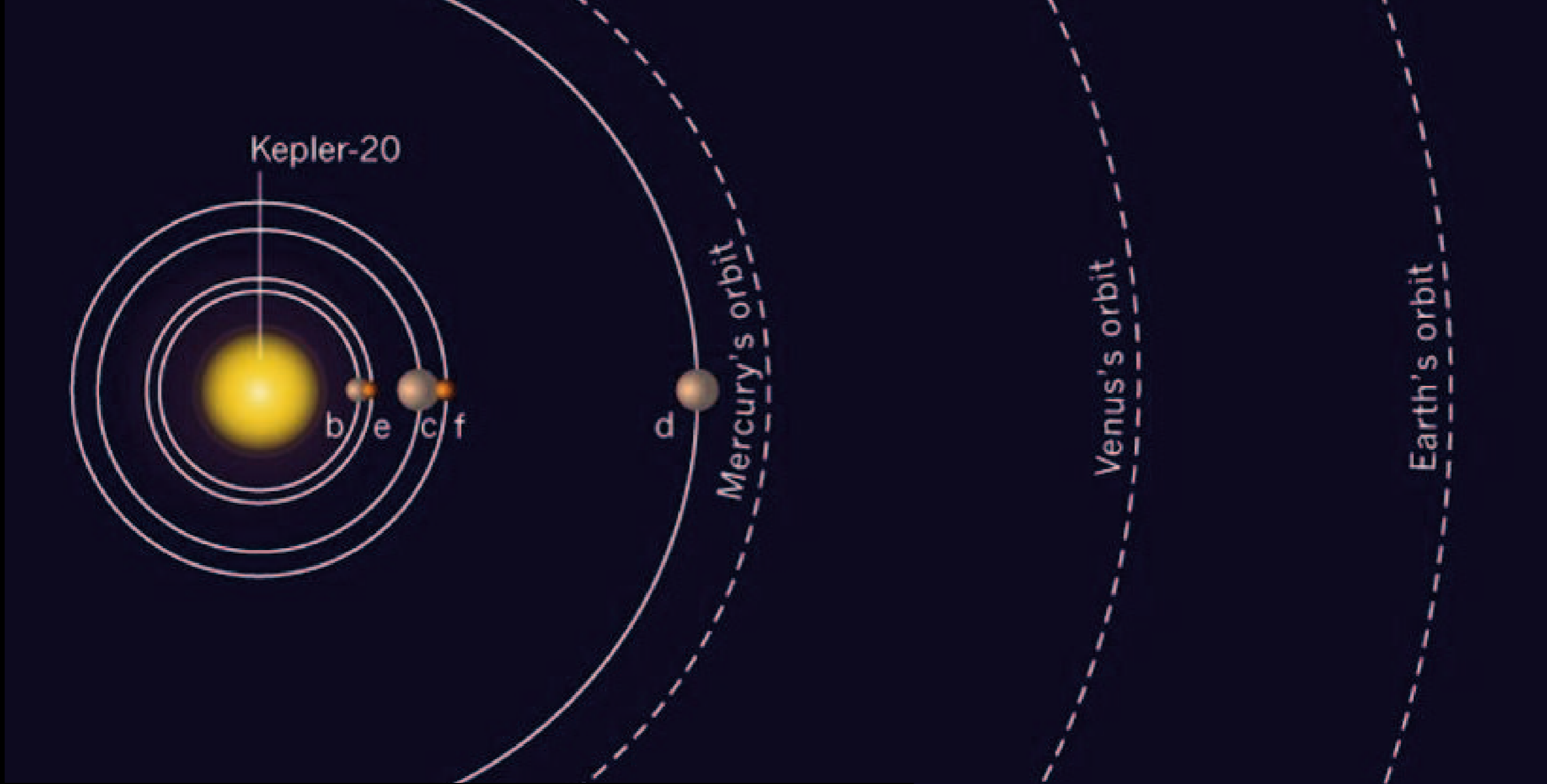
DIFF IN A BOX

Planets in the box have the right atmospheric pressure and the right temperature to keep surface water in a liquid state. In our solar system Earth and Mars are in the box, Venus and Mercury outside. The cold gas giants are literally off the chart.

The logarithmic scale used initially here allows for an easier comparison of the exoplanets. The linear scale shows how shallow the habitability zone is.

Logarithmic Linear





Kepler-20e

Venus

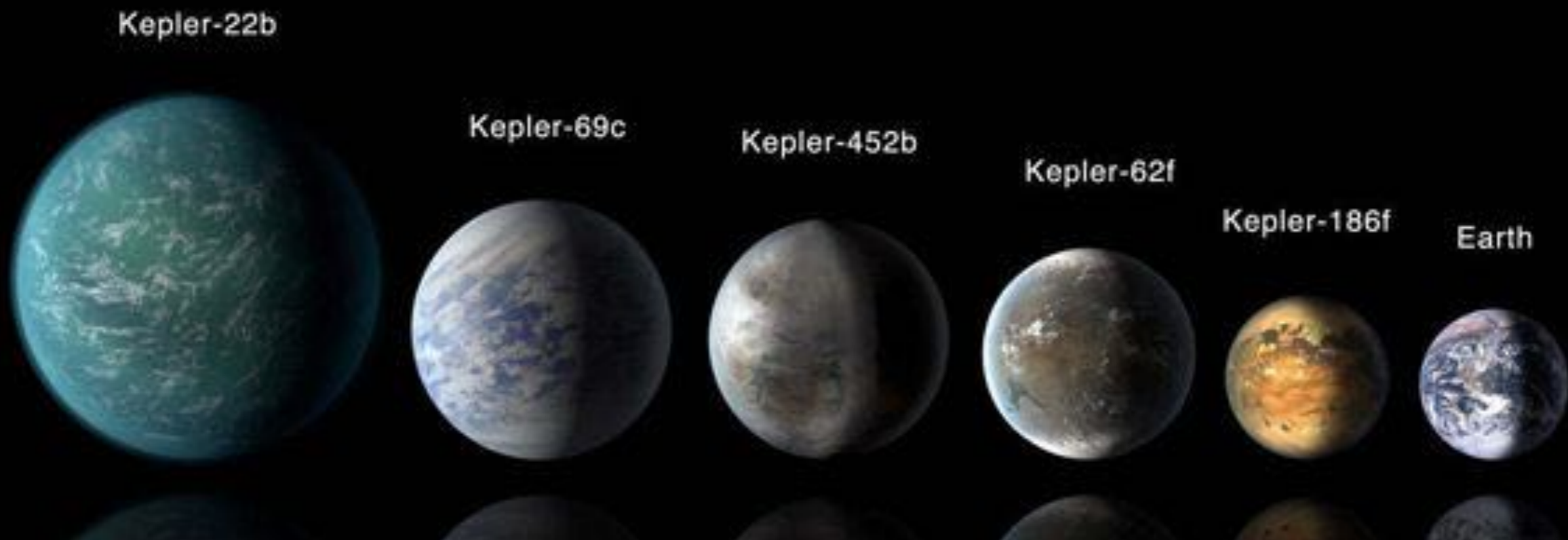
Earth

Kepler-20f



¿Que **NO** tenemos en el Sistema Solar?

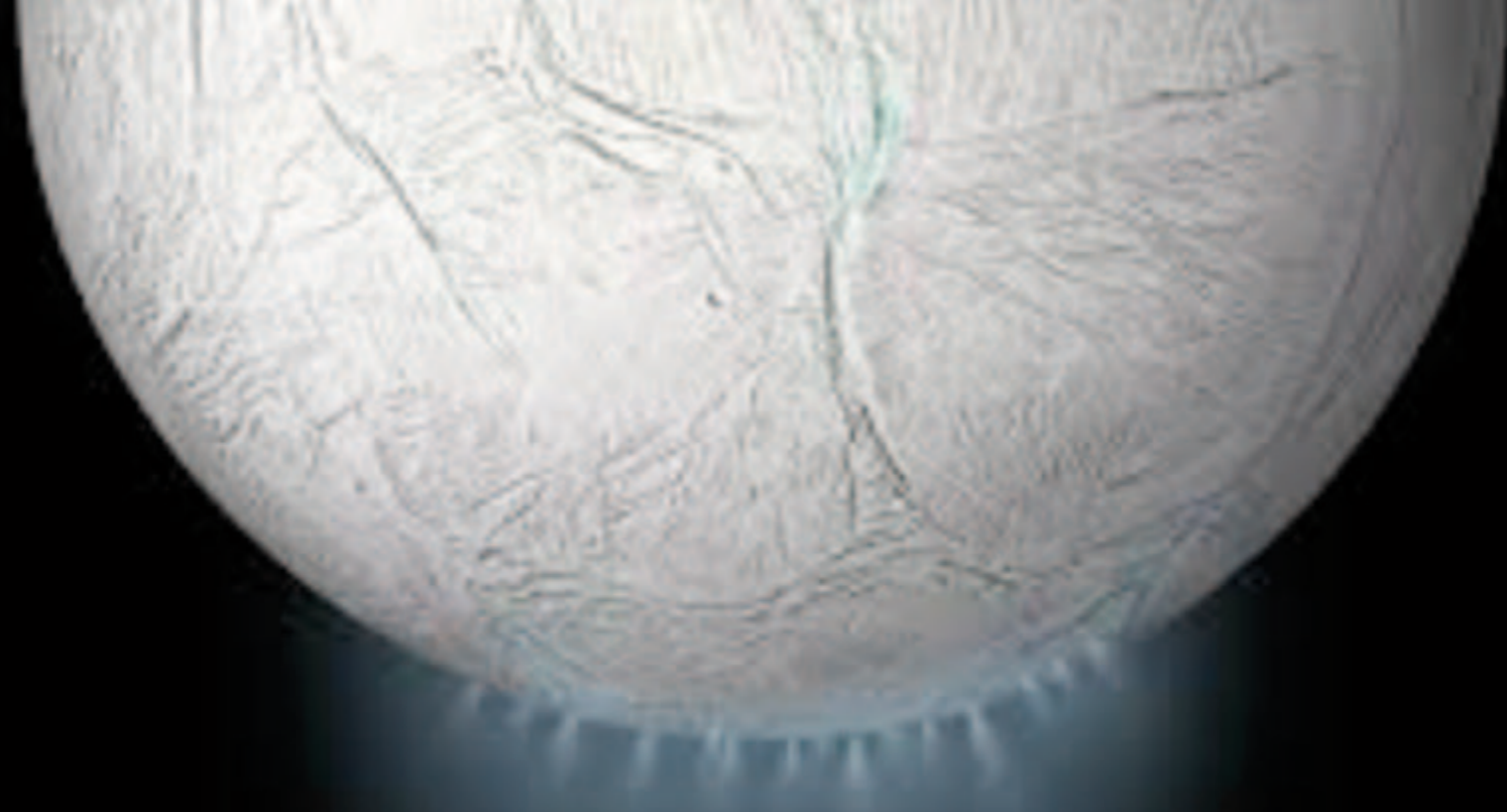
1. No tenemos Super-Tierras
2. No tenemos planetas internos



Vida: ¿detección remota?

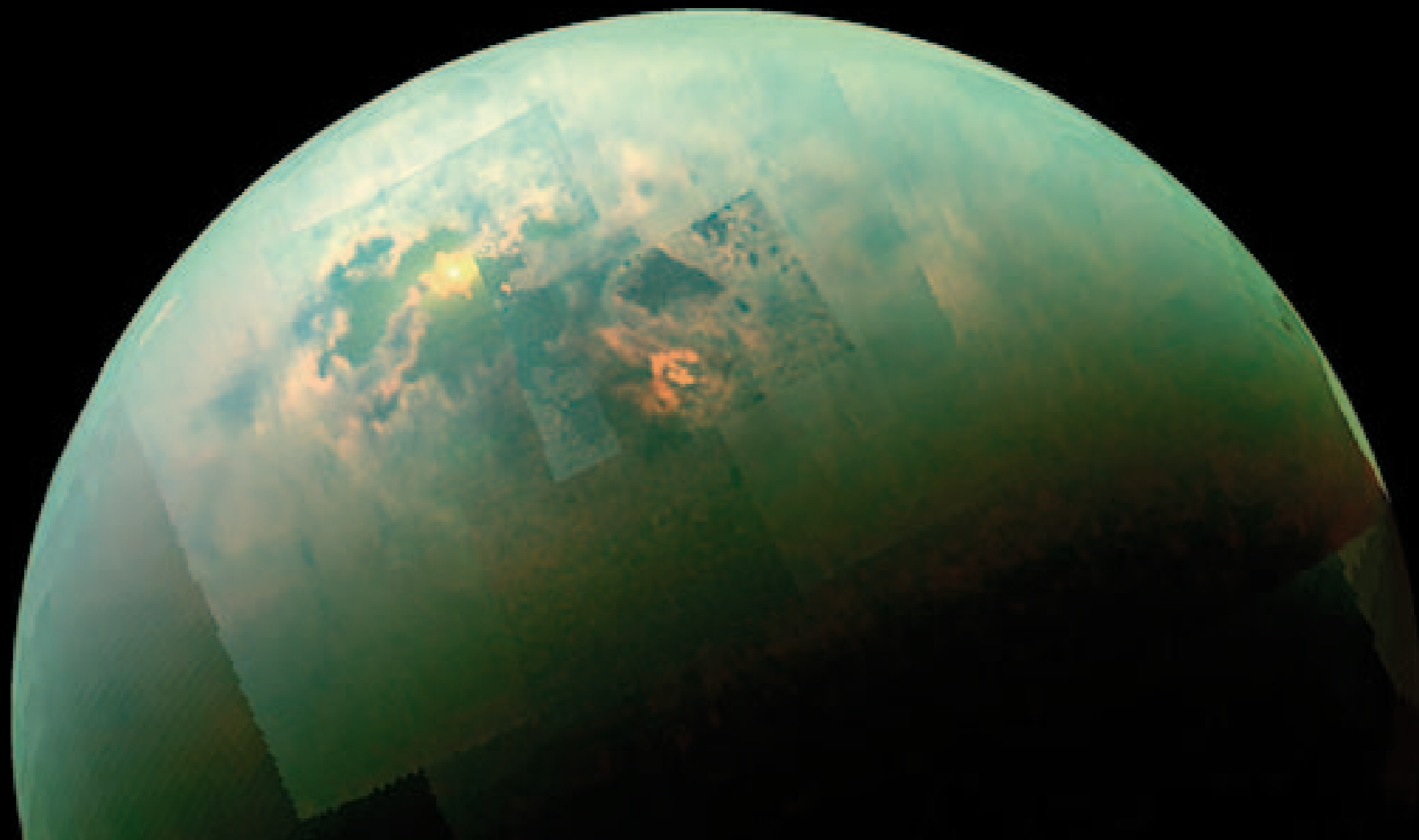
A composite image of space. In the upper left, a bright, glowing purple and white comet streaks across the dark blue sky. Below it, a blue meteor with a green tail streaks downwards. The background is filled with numerous small, white stars. On the right side, a large, brown, cratered planet is visible, with a blue and white planet partially visible above it. The text "Asteroides son la clave" is centered in the middle of the image.

Asteroides son la clave

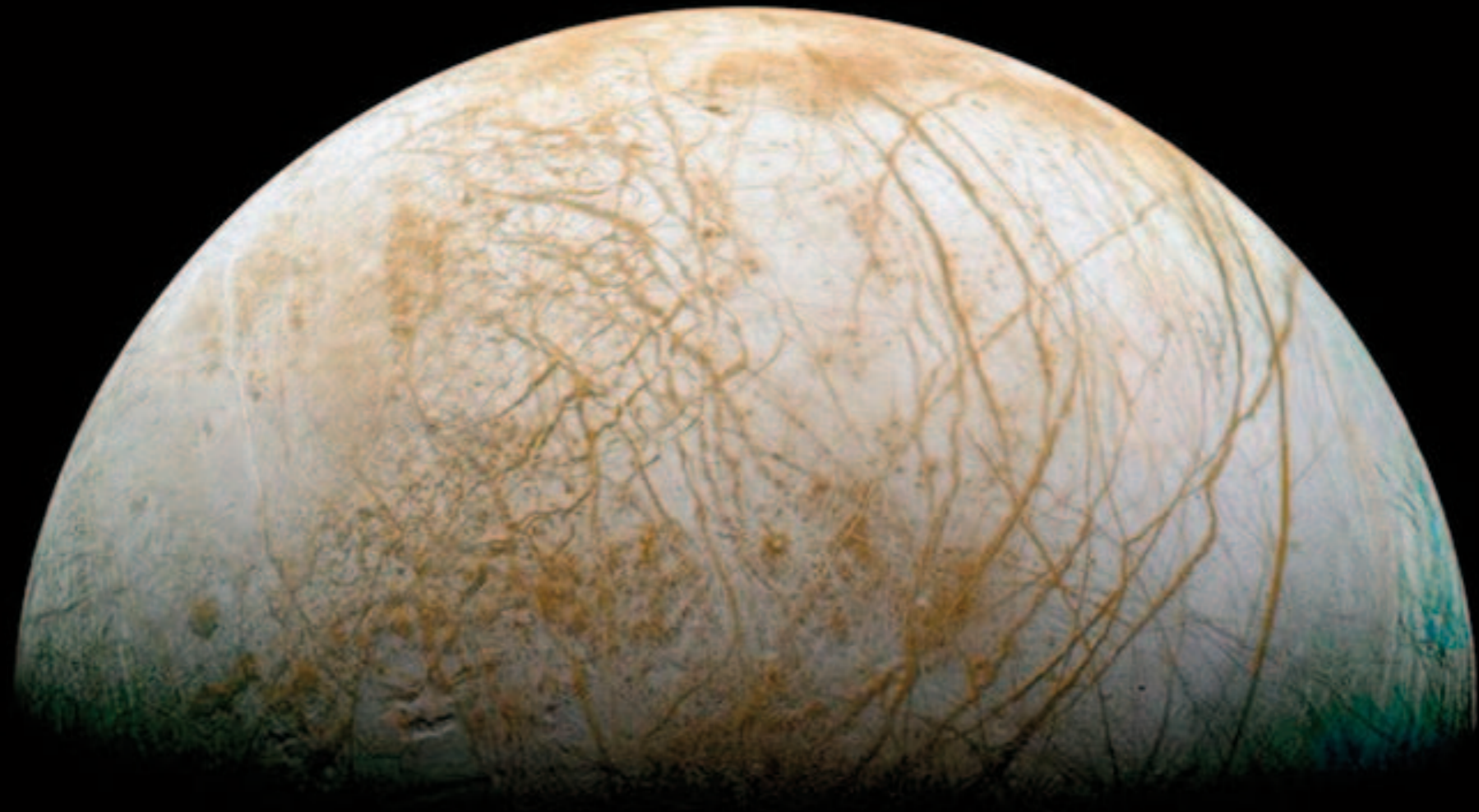


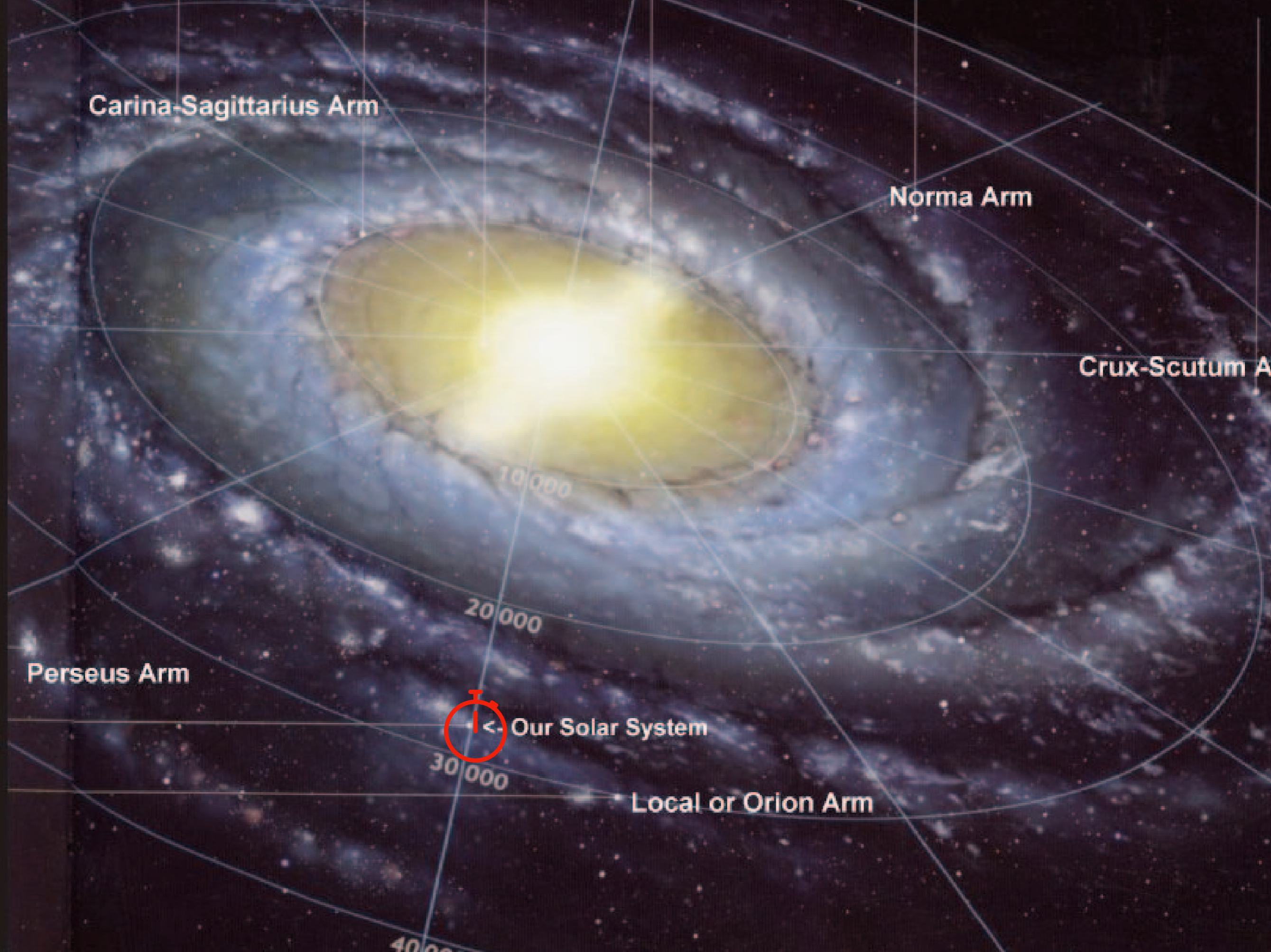
Encelado, H₂O

Titán, NH_3 y CH_4



Europa, H₂O





Carina-Sagittarius Arm

Norma Arm

Crux-Scutum Arm

Perseus Arm

← Our Solar System

Local or Orion Arm

10,000

20,000

30,000

40,000

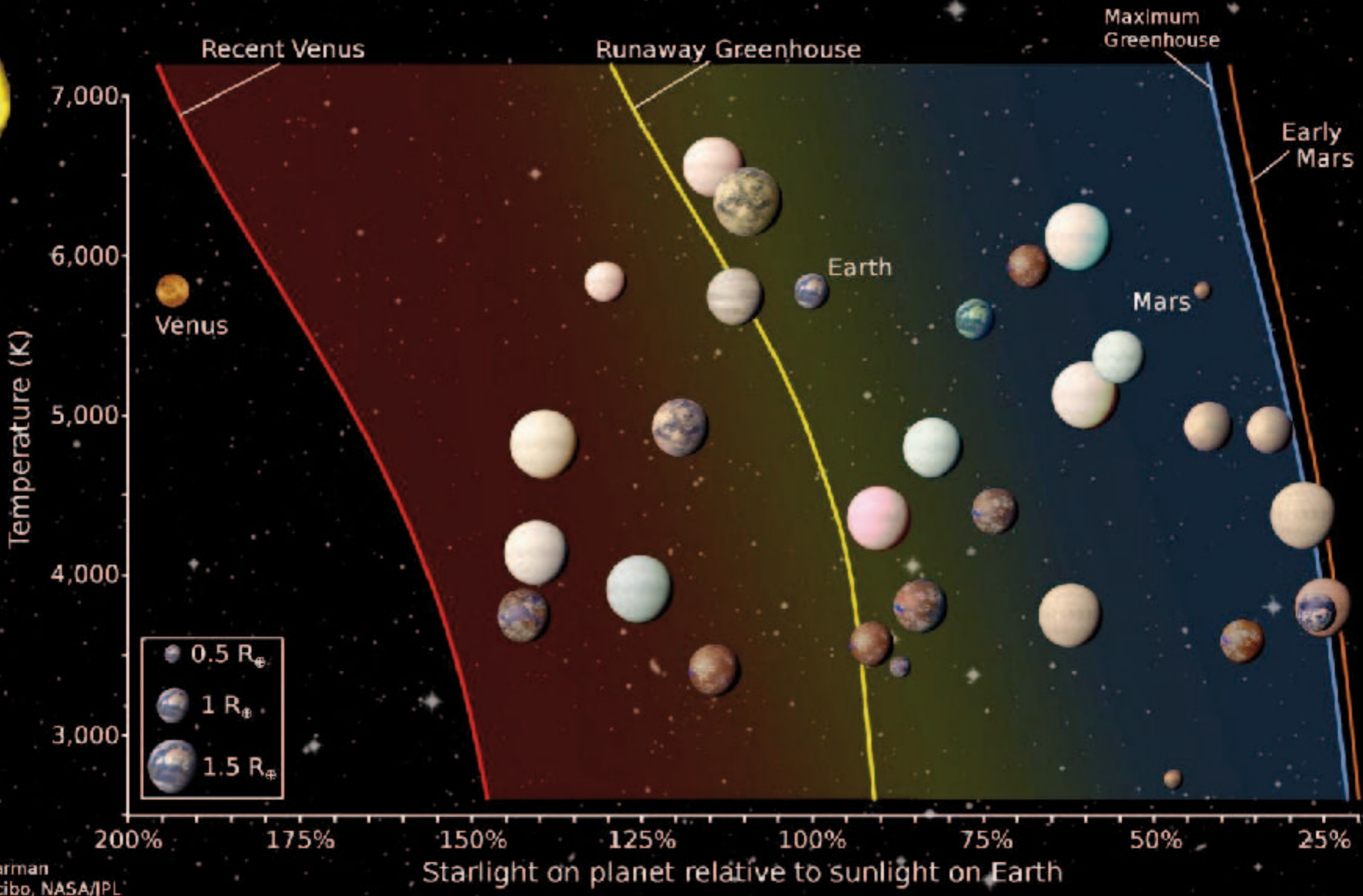
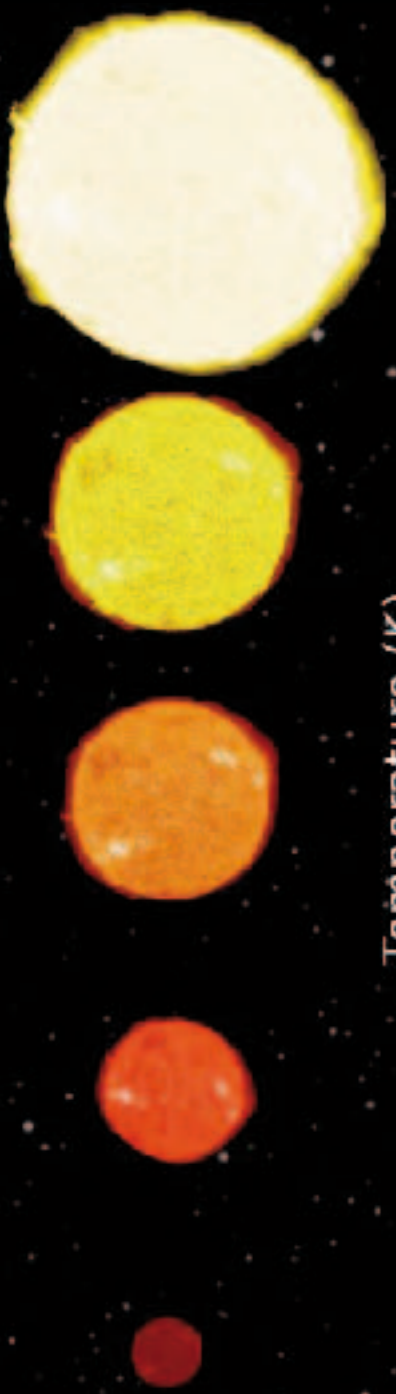
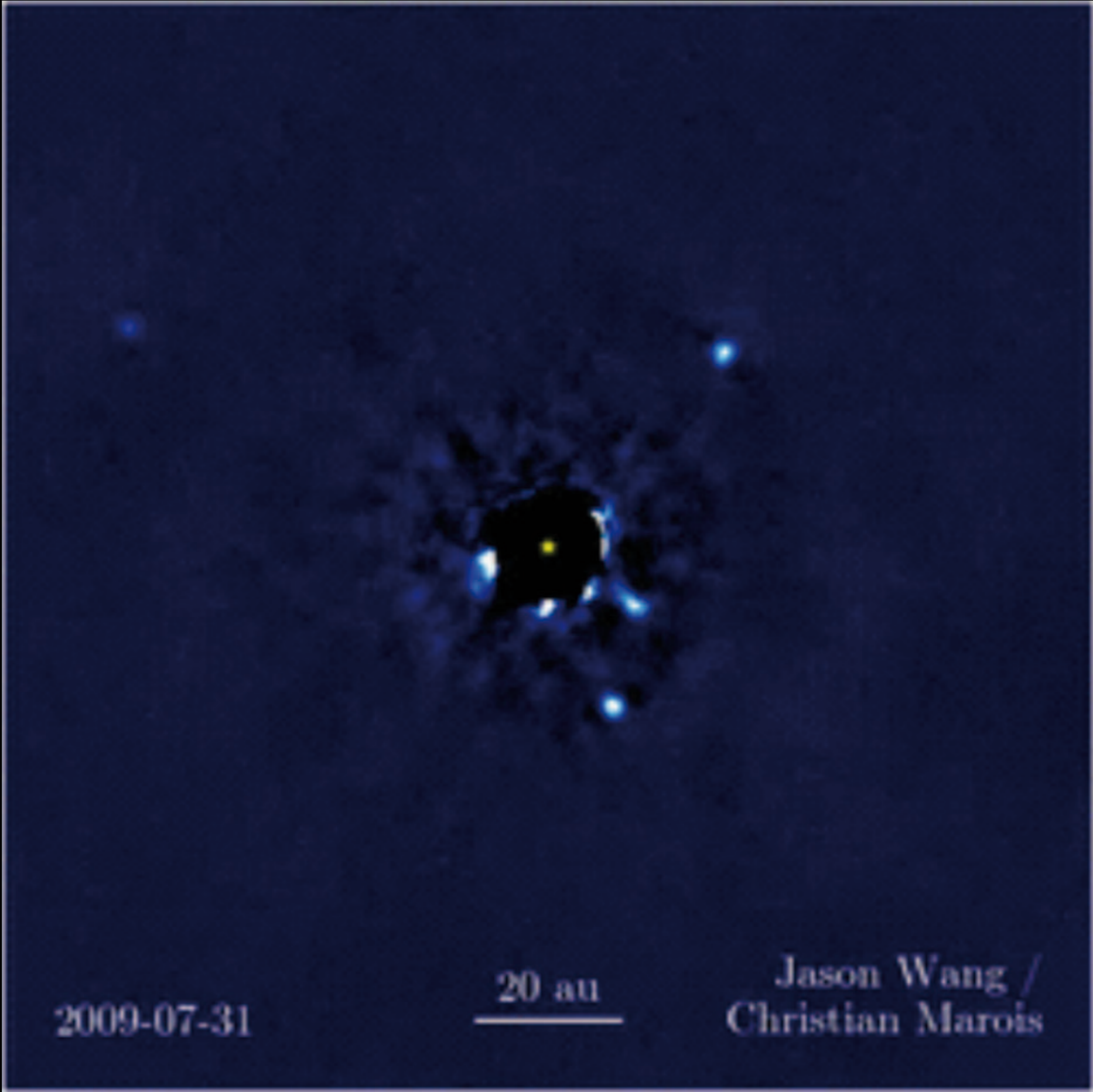


Image Credit: Chester Harman
Planets: PHL at UPR Arecibo, NASA/JPL

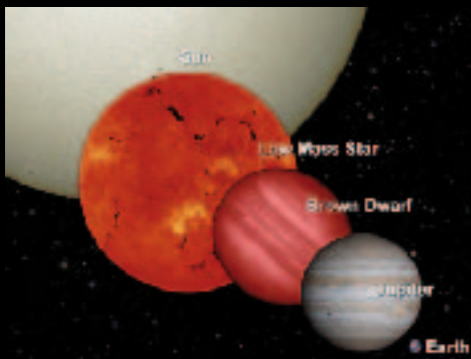


2009-07-31

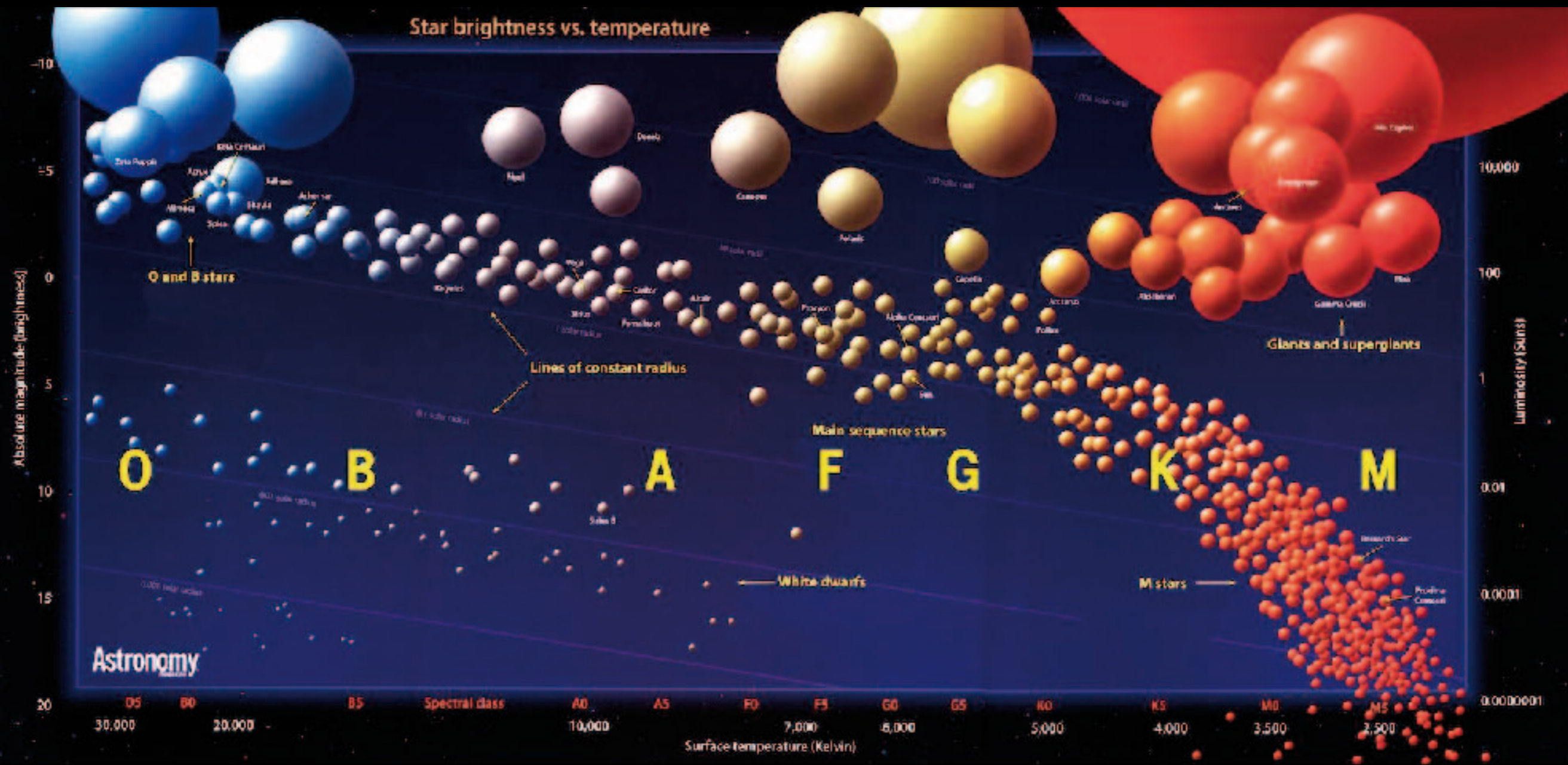
20 au

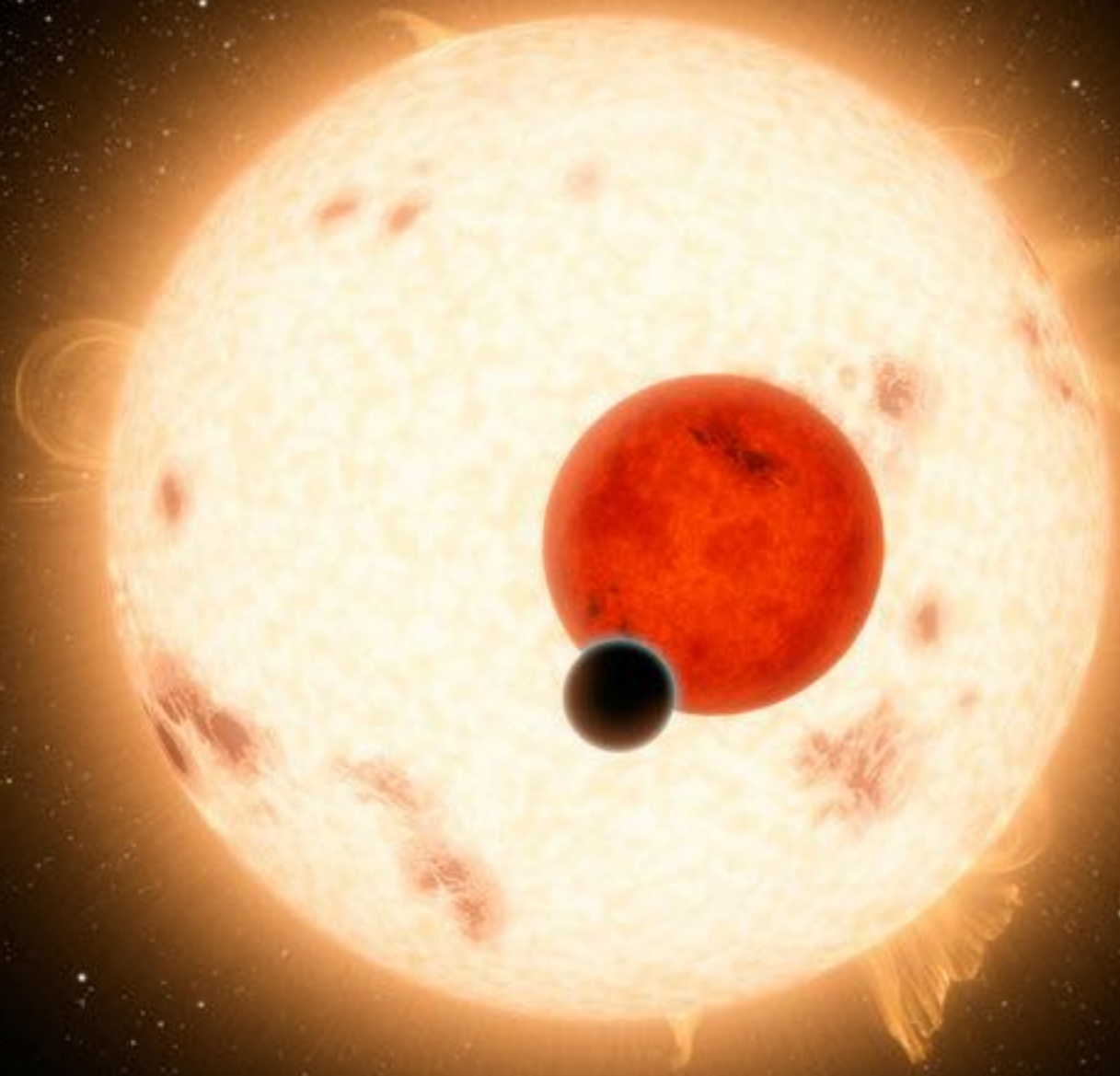
Jason Wang /
Christian Marois

La estrella



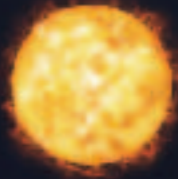
Star brightness vs. temperature





hoto by NASA/JPL-Caltech/R. Hurt via Getty Images)

Sun
Distance: 0 LY
Planets: 8
Planets in Habitable Zone: 3
(Venus, Earth, Mars)



Proxima Centauri
Distance: 4.2 LY
Planets: 1
Planets in Habitable Zone: 1
(Proxima Centauri b)



Tau Ceti
Distance: 11.7 LY
Planets: 5
Planets in Habitable Zone: 1
(Tau Ceti e)



Kapteyn
Distance: 39.0 LY
Planets: 1
Planets in Habitable Zone: 1
(Kapteyn b)



Wolf 1069
Distance: 14 LY
Planets: 3
Planets in Habitable Zone: 1
(Wolf 1069 c)



Gliese 687
Distance: 14.7 LY
Planets: 1
Planets in Habitable Zone: 1
(Gliese 687 b)



Gliese 876
Distance: 15.0 LY
Planets: 4
Planets in Habitable Zone: 2
(Gliese 876 c, b)



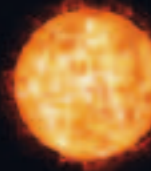
Gliese 832
Distance: 16.1 LY
Planets: 1
Planets in Habitable Zone: 1
(Gliese 832 c)



GJ 682
Distance: 36.6 LY
Planets: 1
Planets in Habitable Zone: 1
(GJ 682 b)



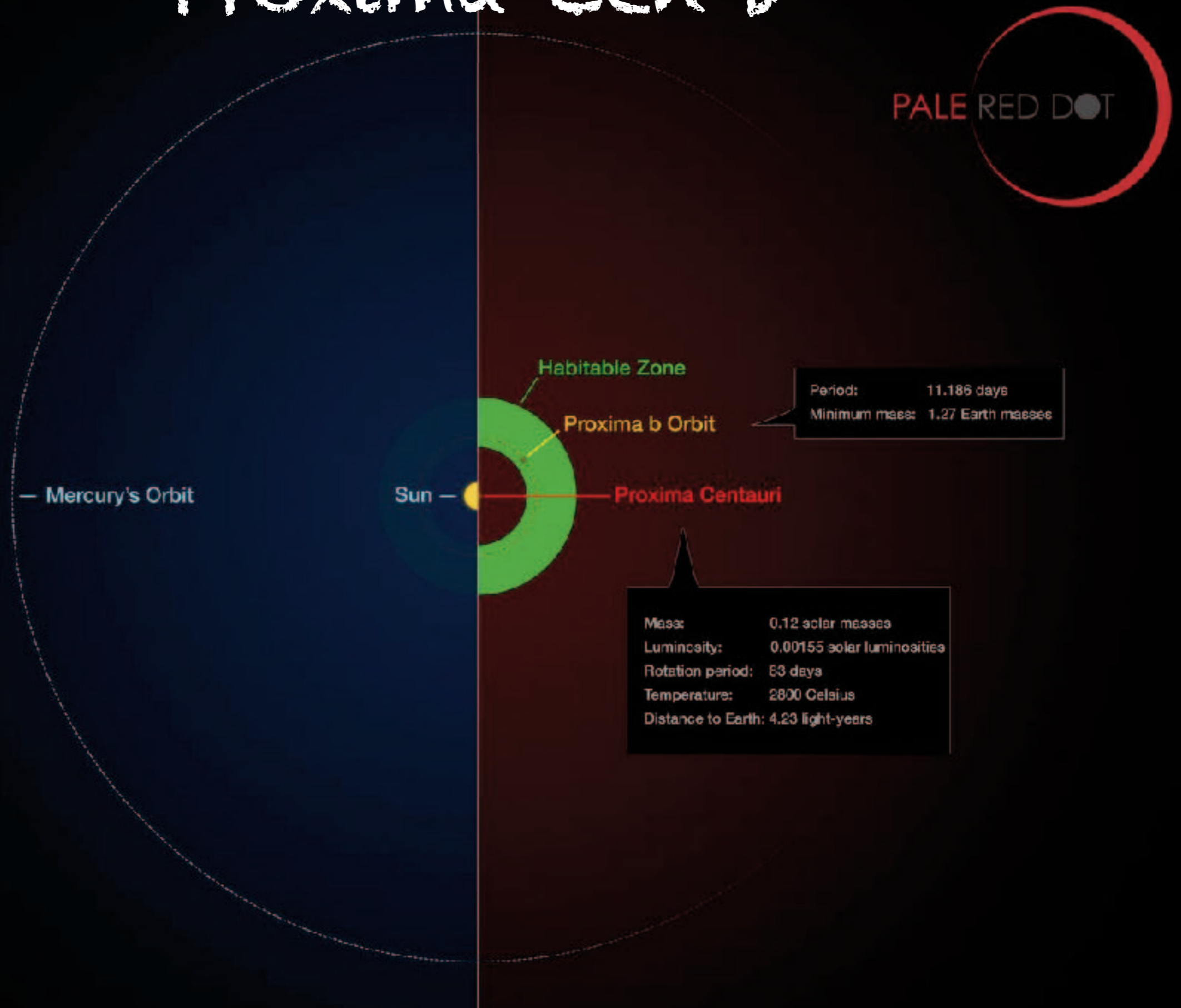
HD 20794
Distance: 39.8 LY
Planets: 3
Planets in Habitable Zone: 1
(HD 20794 d)



Trappist-1
Distance: 39.5 LY
Planets: 7



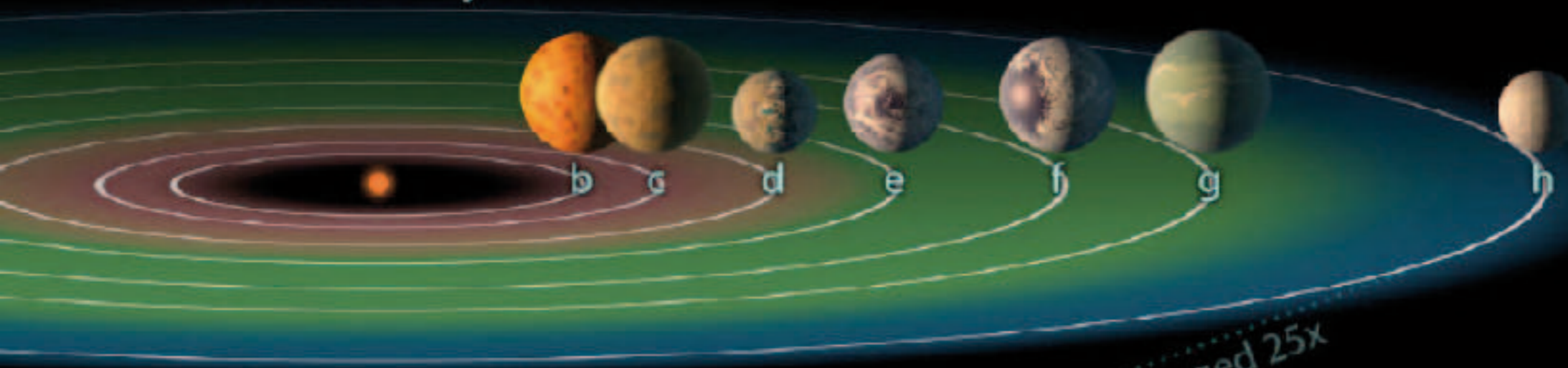
Proxima Centauri



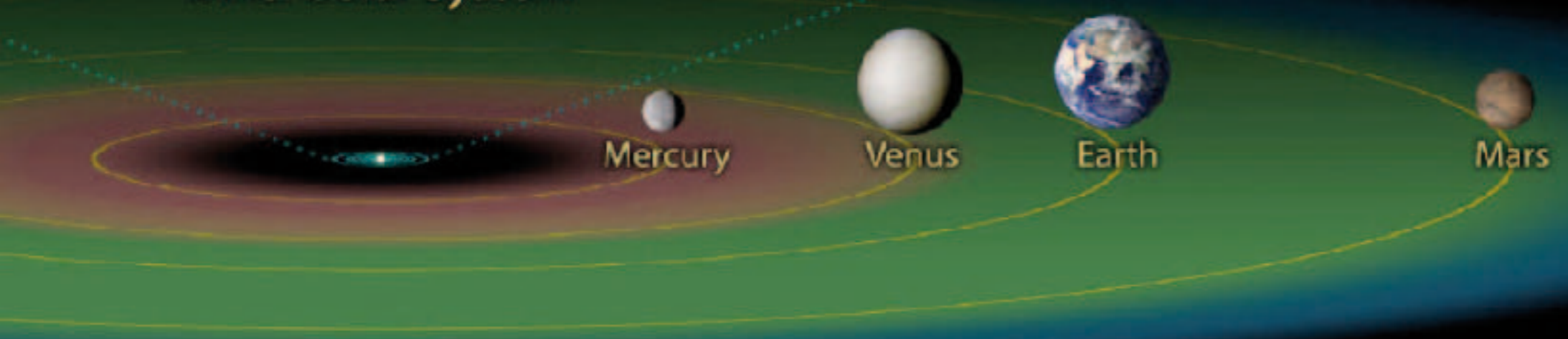
Anglada-Escudé (2016)

TRAPPIST-1

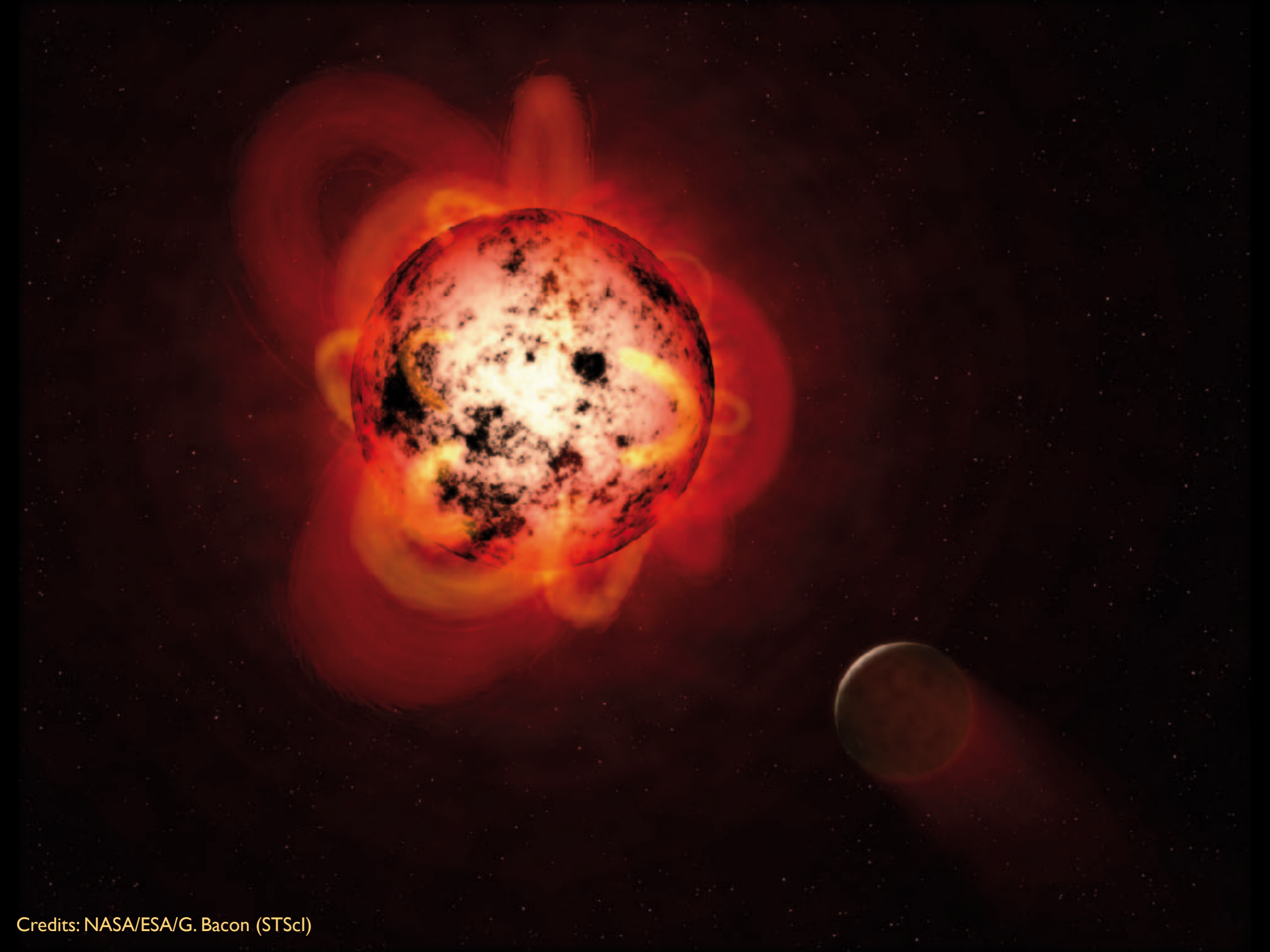
TRAPPIST-1 System

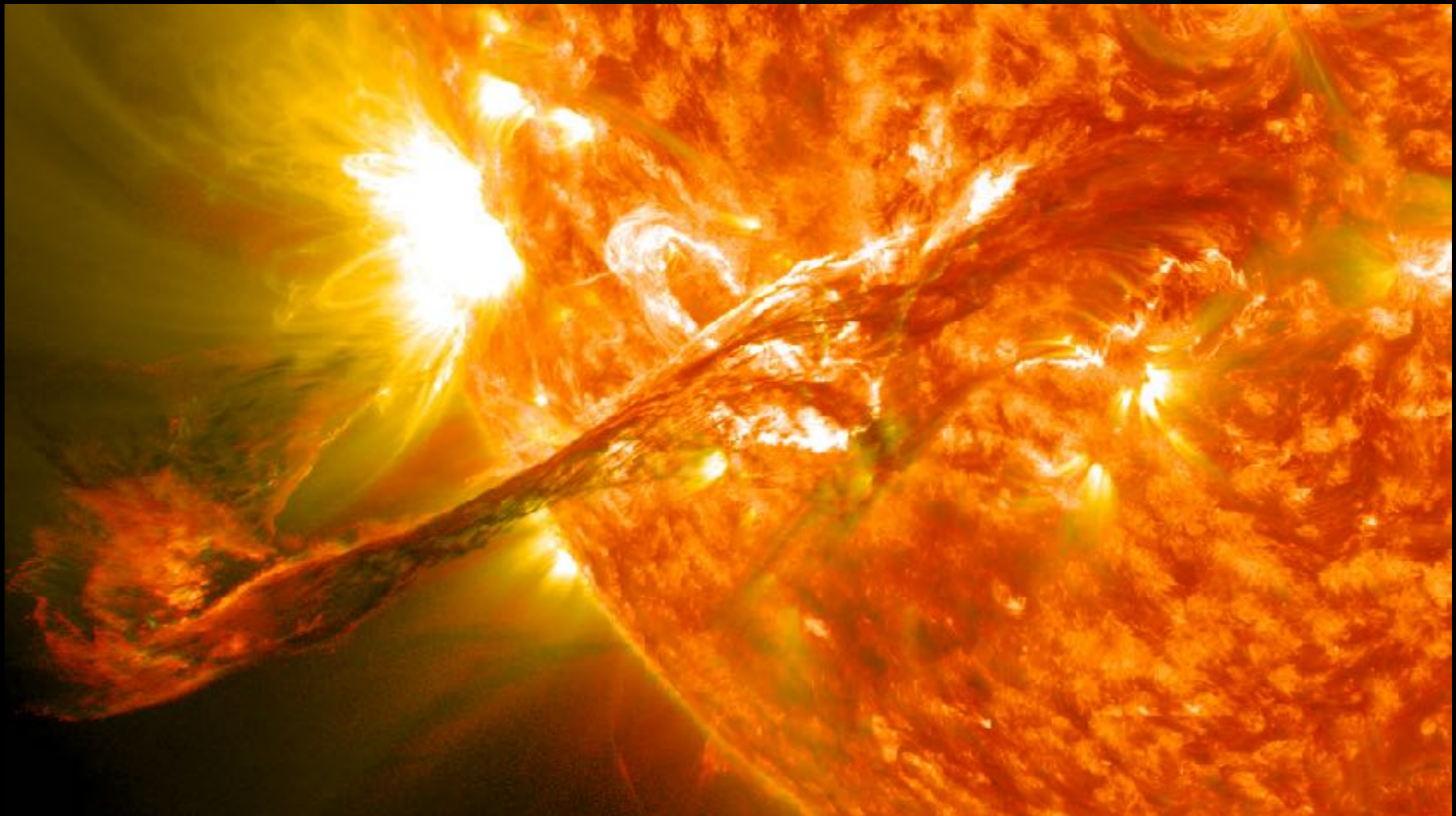
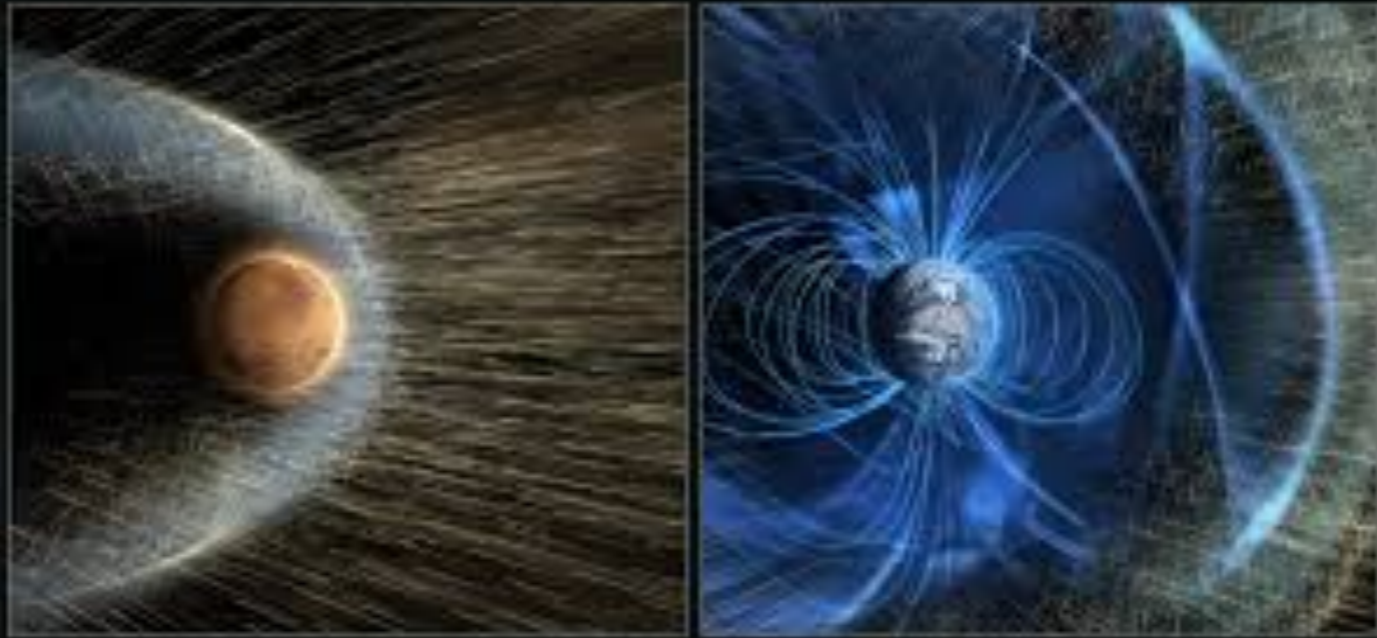


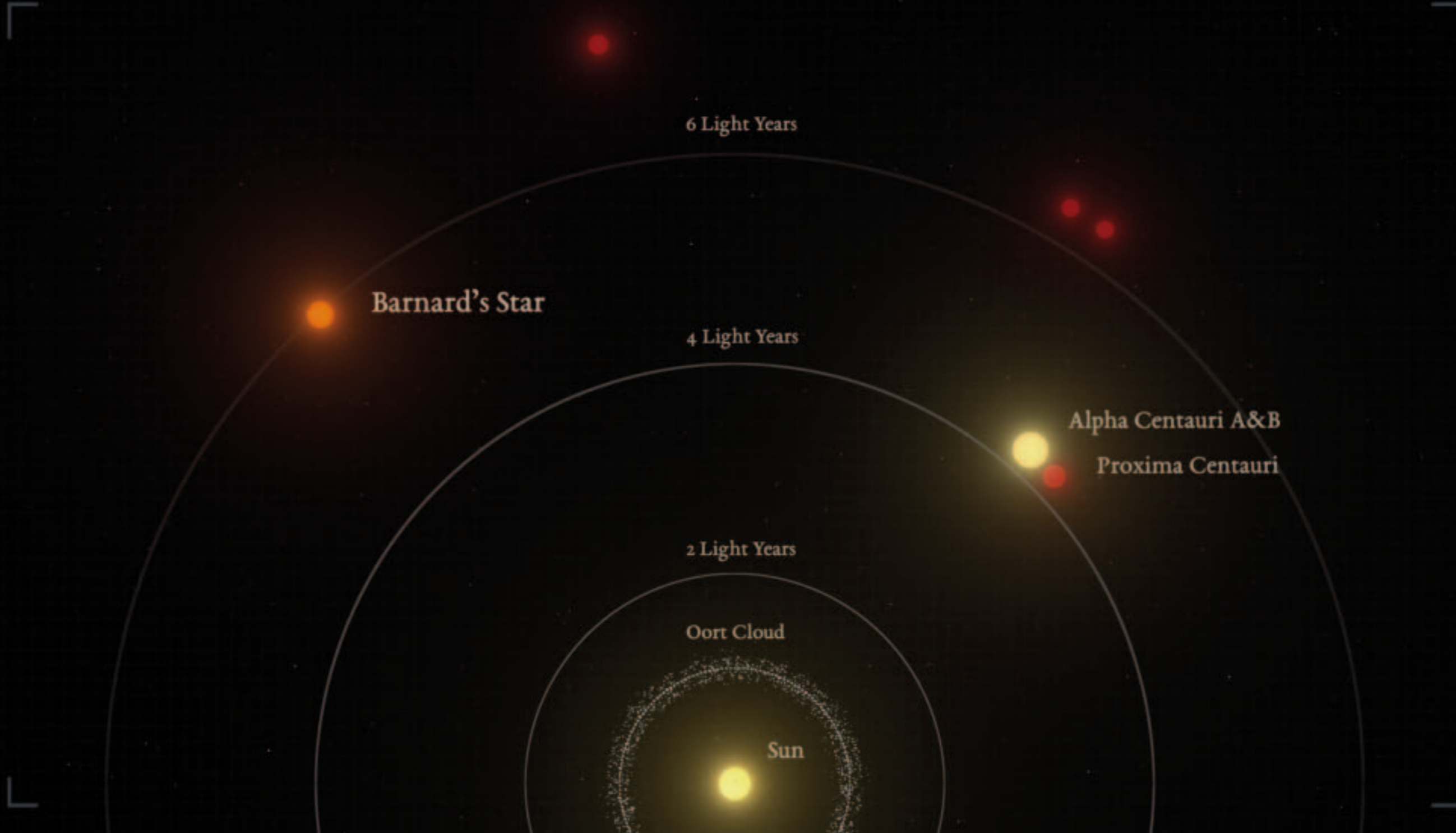
Inner Solar System



Enlarged 25x







Barnard's Star

6 Light Years

4 Light Years

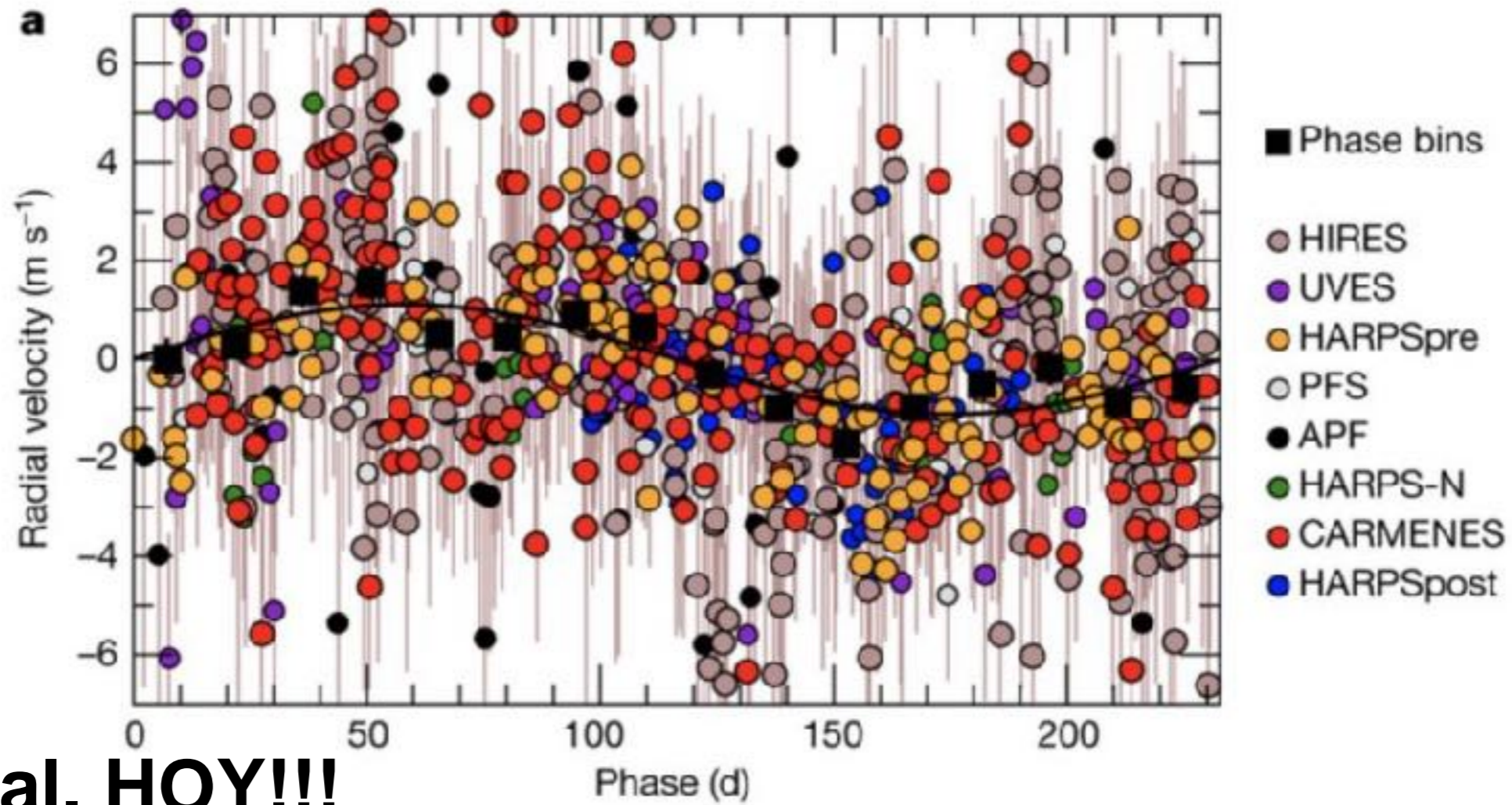
Alpha Centauri A&B

Proxima Centauri

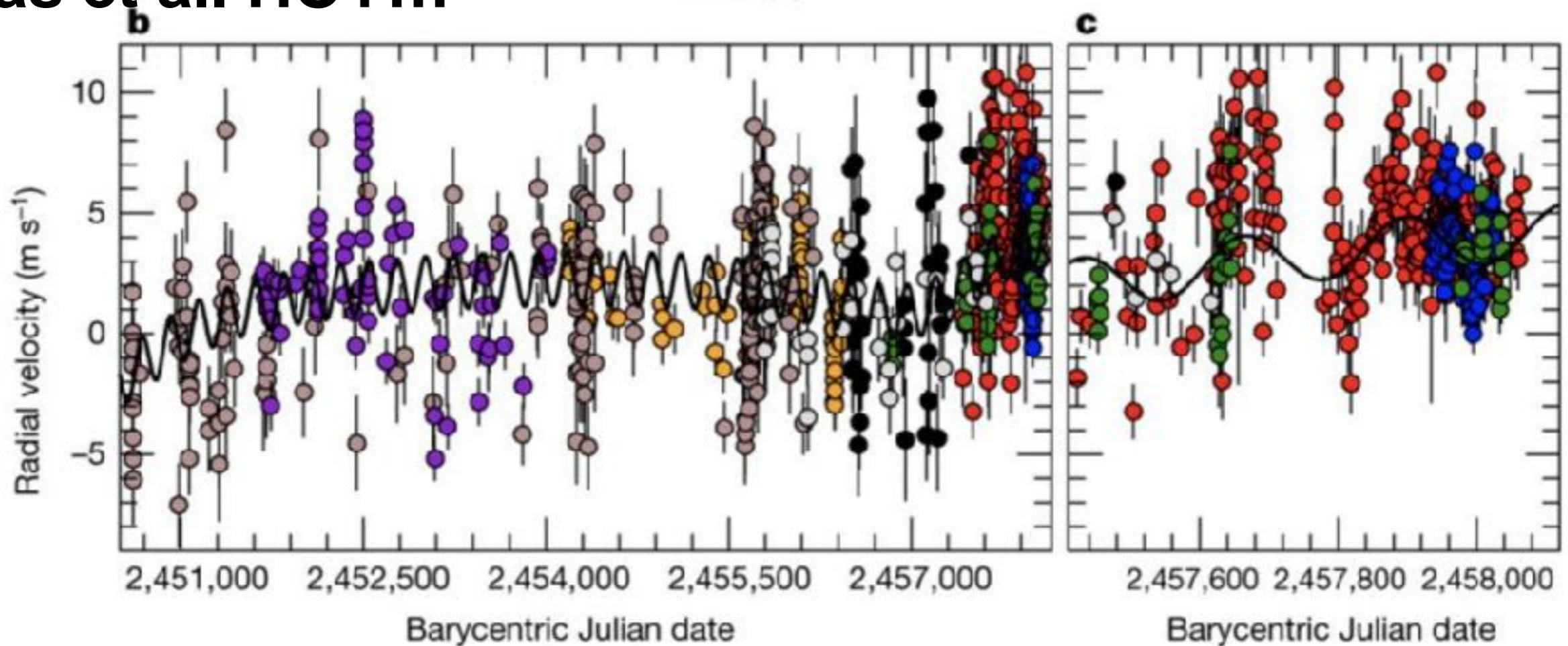
2 Light Years

Oort Cloud

Sun

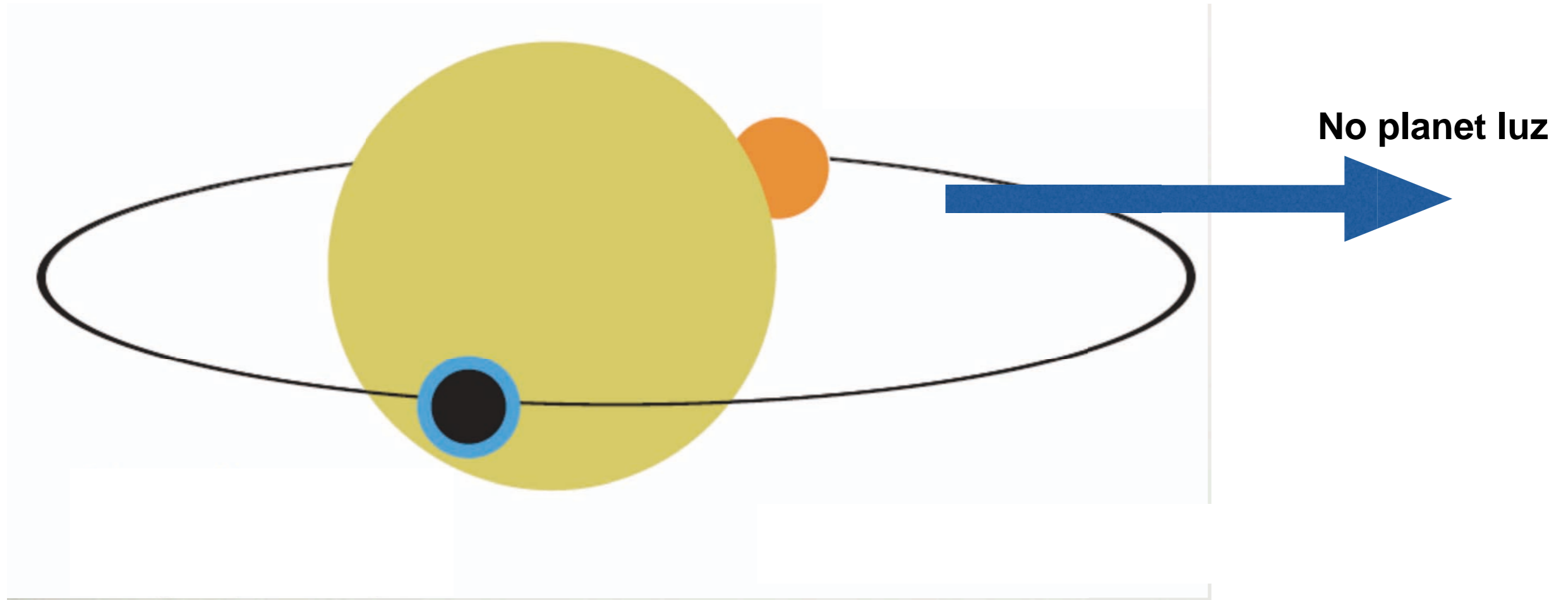


Ribas et al. HOY!!!



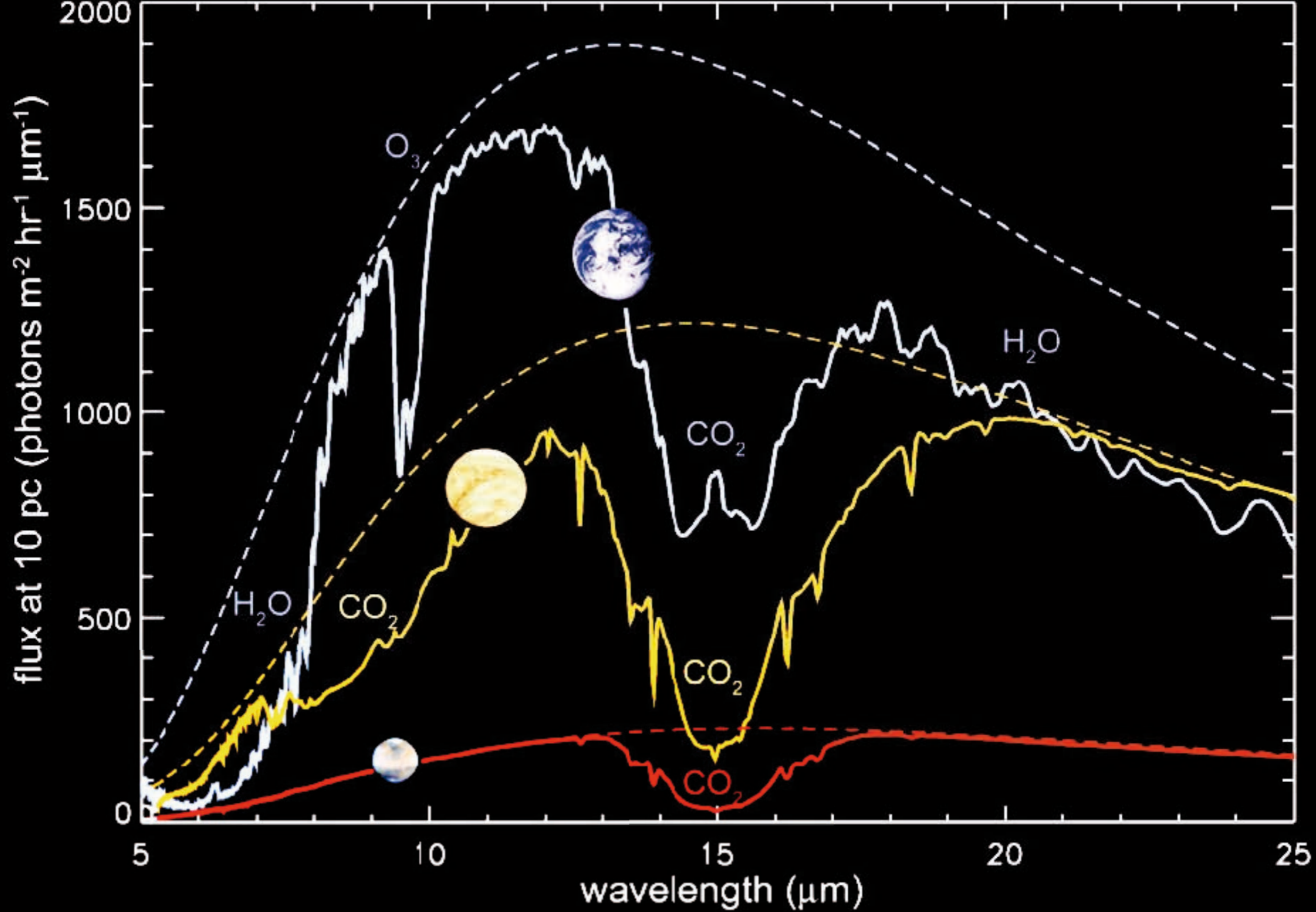
*Objetivo último:
Detección de biomarcadores*

Atmósferas exoplanetarias

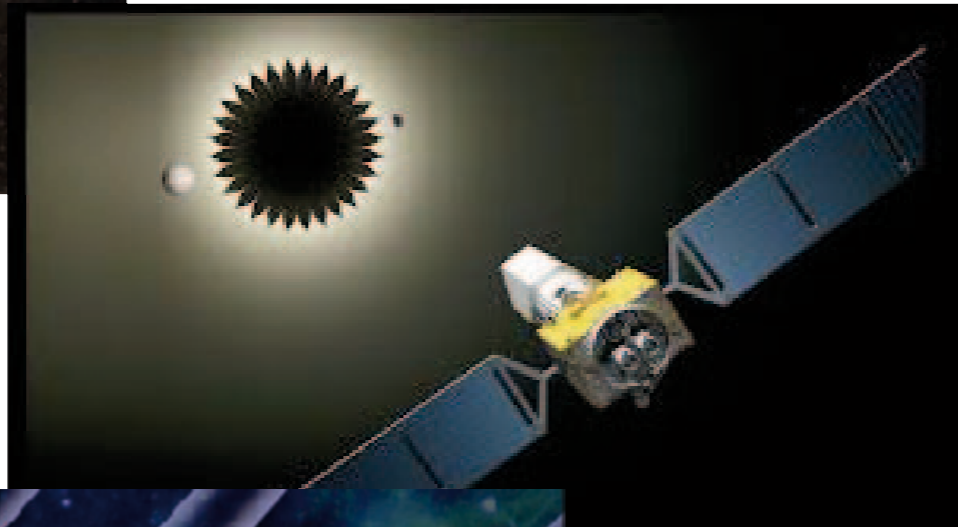
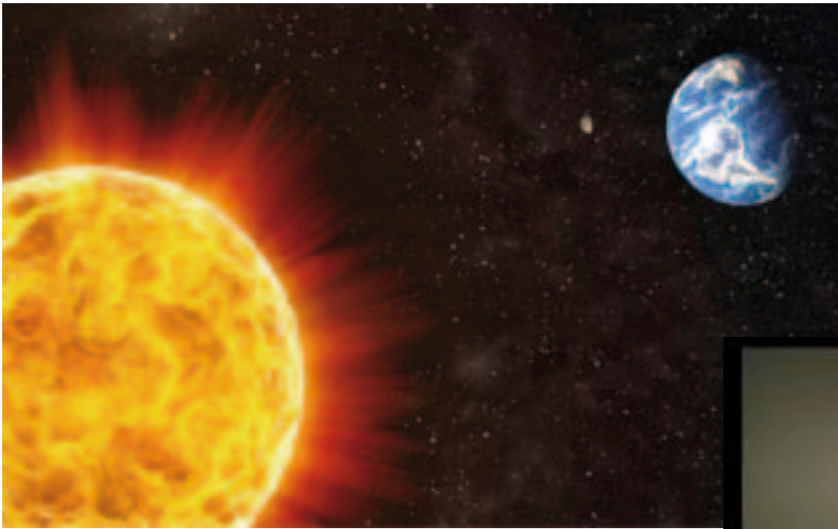


Seager & Deming (2010)

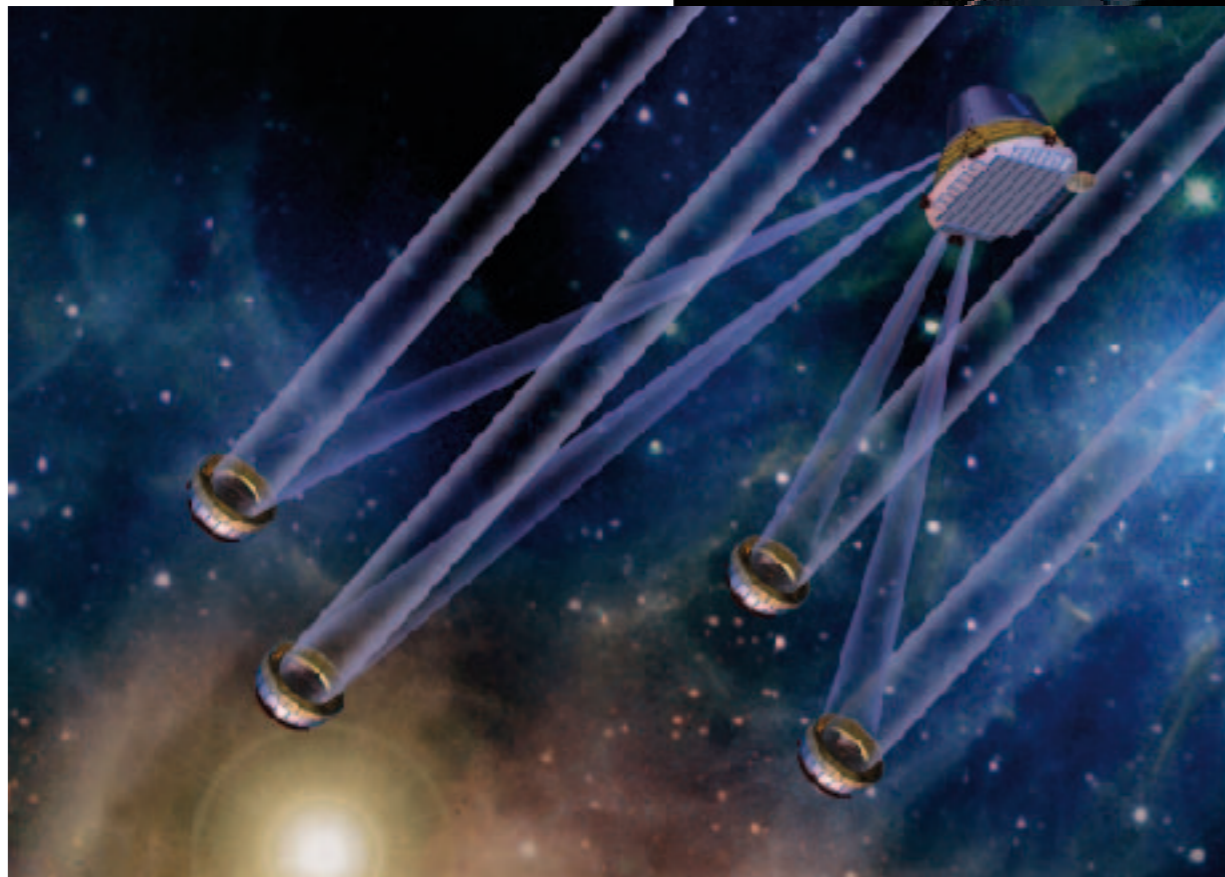
Espectro en transmisión →
Detección directa de la atmósfera



Retos



Ocultadores: NWT



*INTERFEROMETROS EN
EL ESPACIO
DARWIN; TFP, SIM*



Definir el contexto de nuestra existencia:

¿Uno entre muchos?

o

¿Una excepción aislada?

