II Ciclo de Jornadas de Astronomía
de la AIIM-COIIM/INEI

LA APASIONANTE BÚSQUEDA DE PLANETAS HABITABLES

Ciudad Real 2018-05-17

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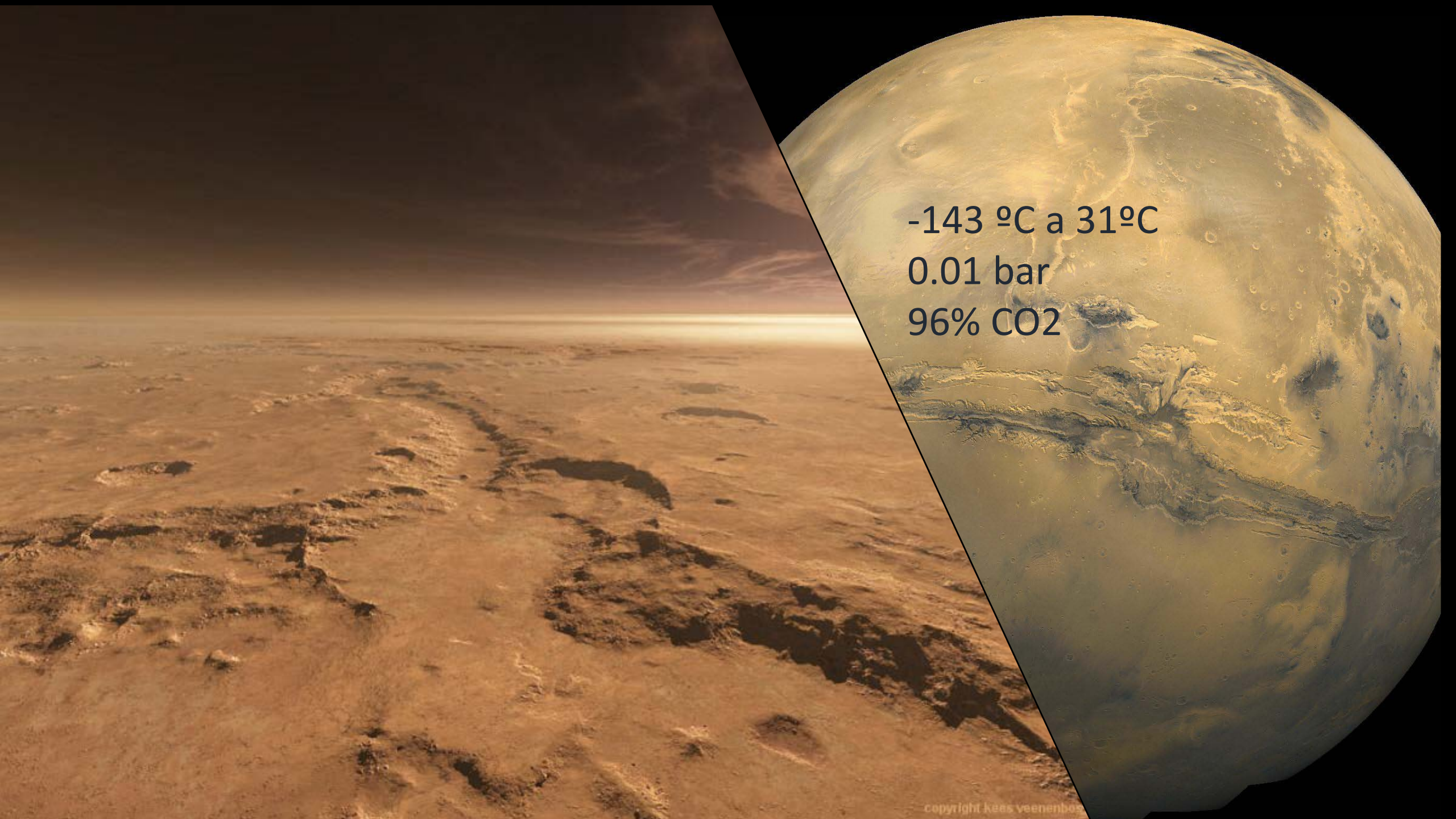
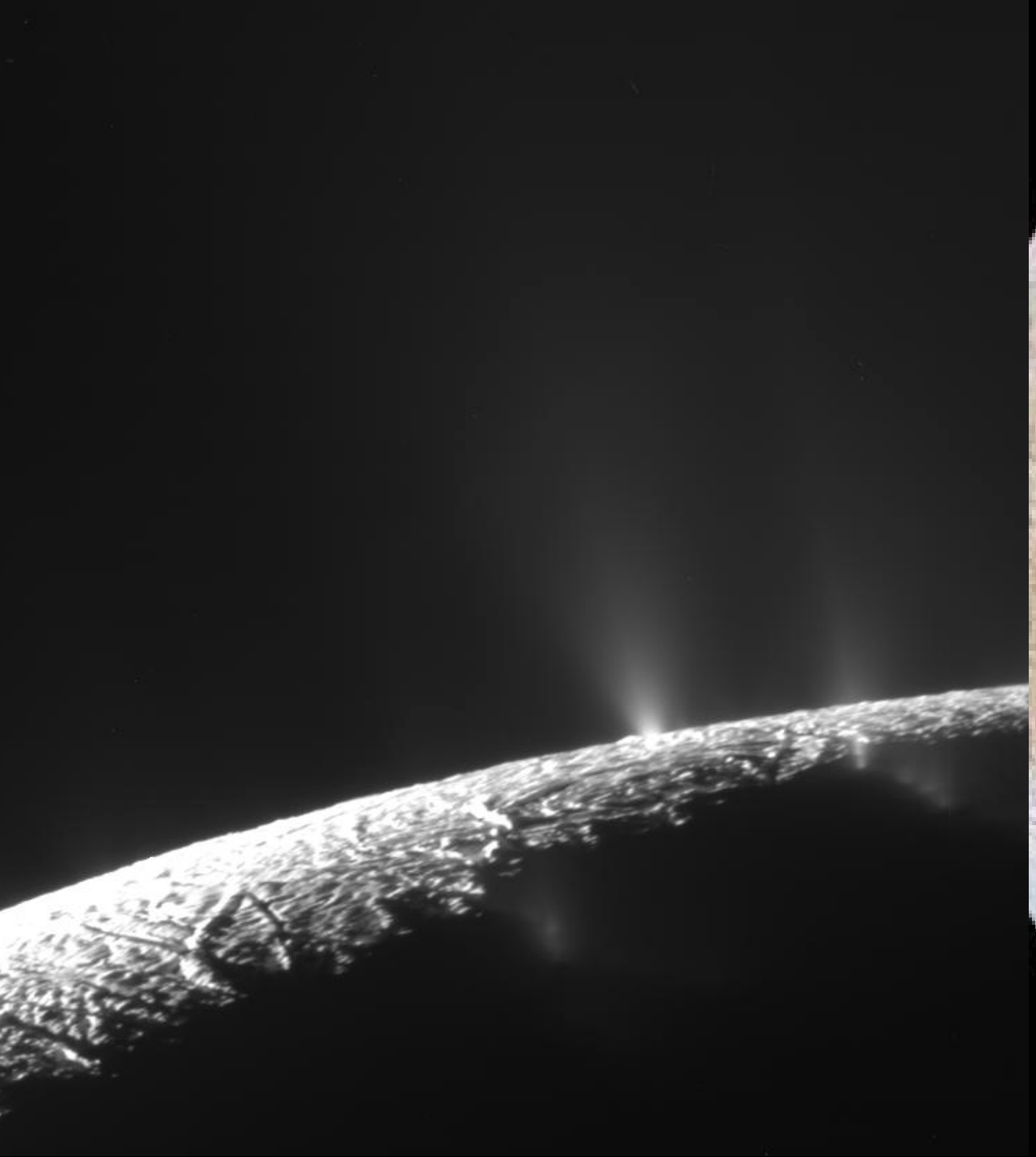
http://diarium.usal.es/guillermo

Fuentes: Las imágenes utilizadas en esta presentación, si no se indican expresamente, proceden de la NASA y ESA

462 ºC
92 bar

- 96.5% CO_2
- 3.5% N_2
- 0.015% SO_2
- 0.007% Ar
- 0.002% H_2O vapor
- 0.0017% CO
- 0.0012% He
- 0.0007% Ne


-143 ºC a 31ºC
0.01 bar
96% CO2



En nuestro sistema solar las posibilidades son muy limítadas, pero ¿y mas allá?

(Exoplanetas)

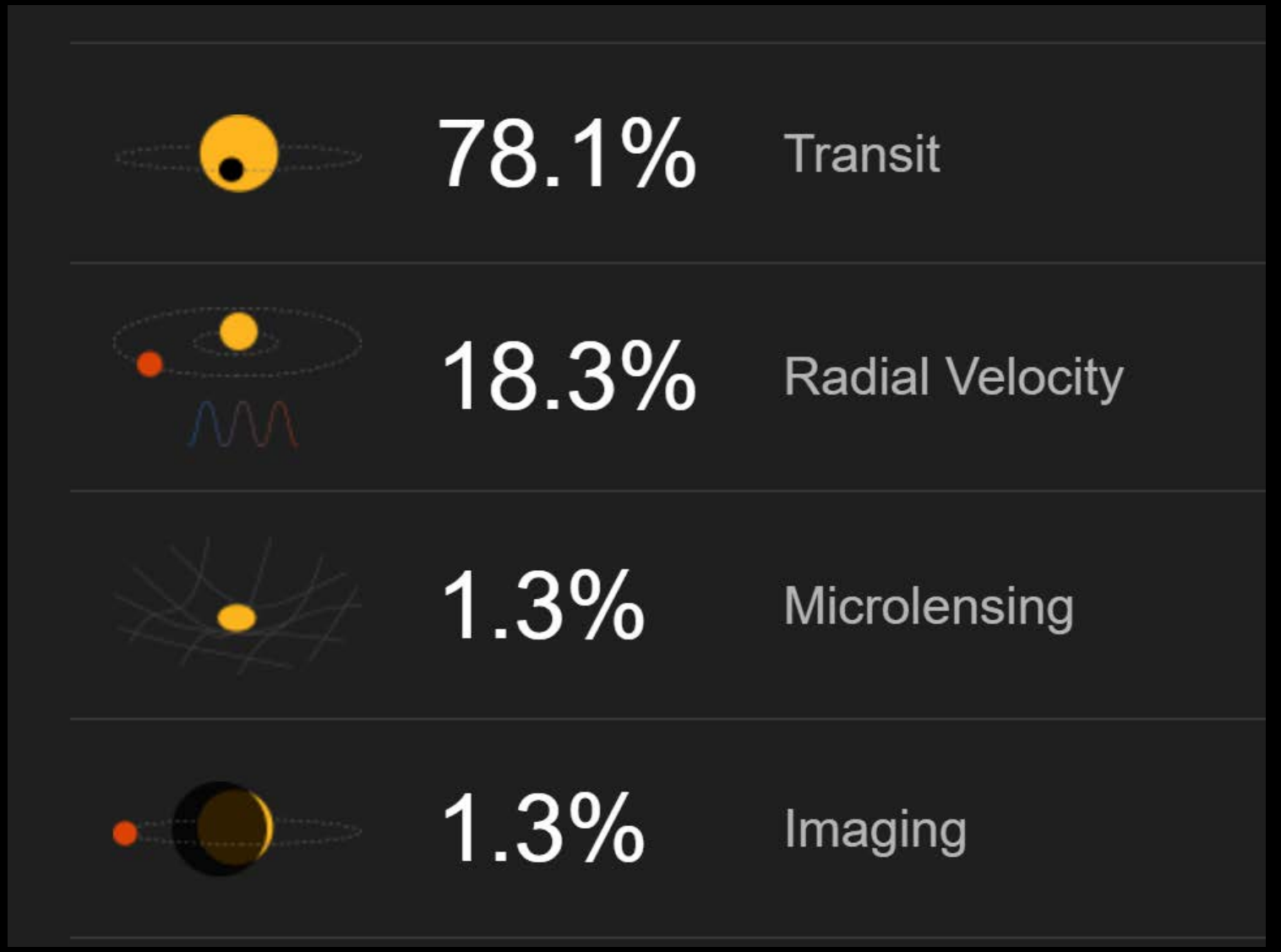
¿Hay mundos habitables?

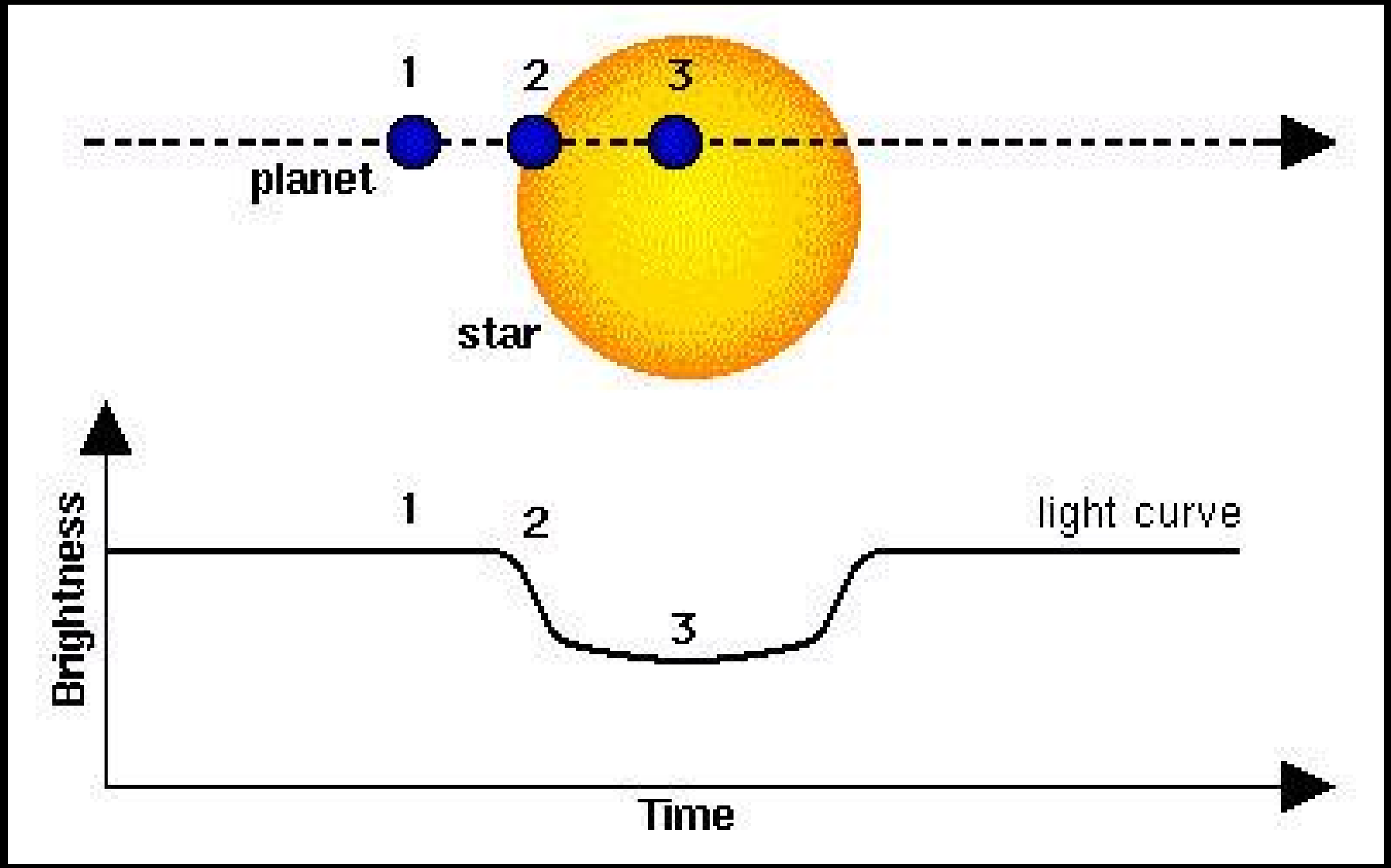
¿Hay vida?

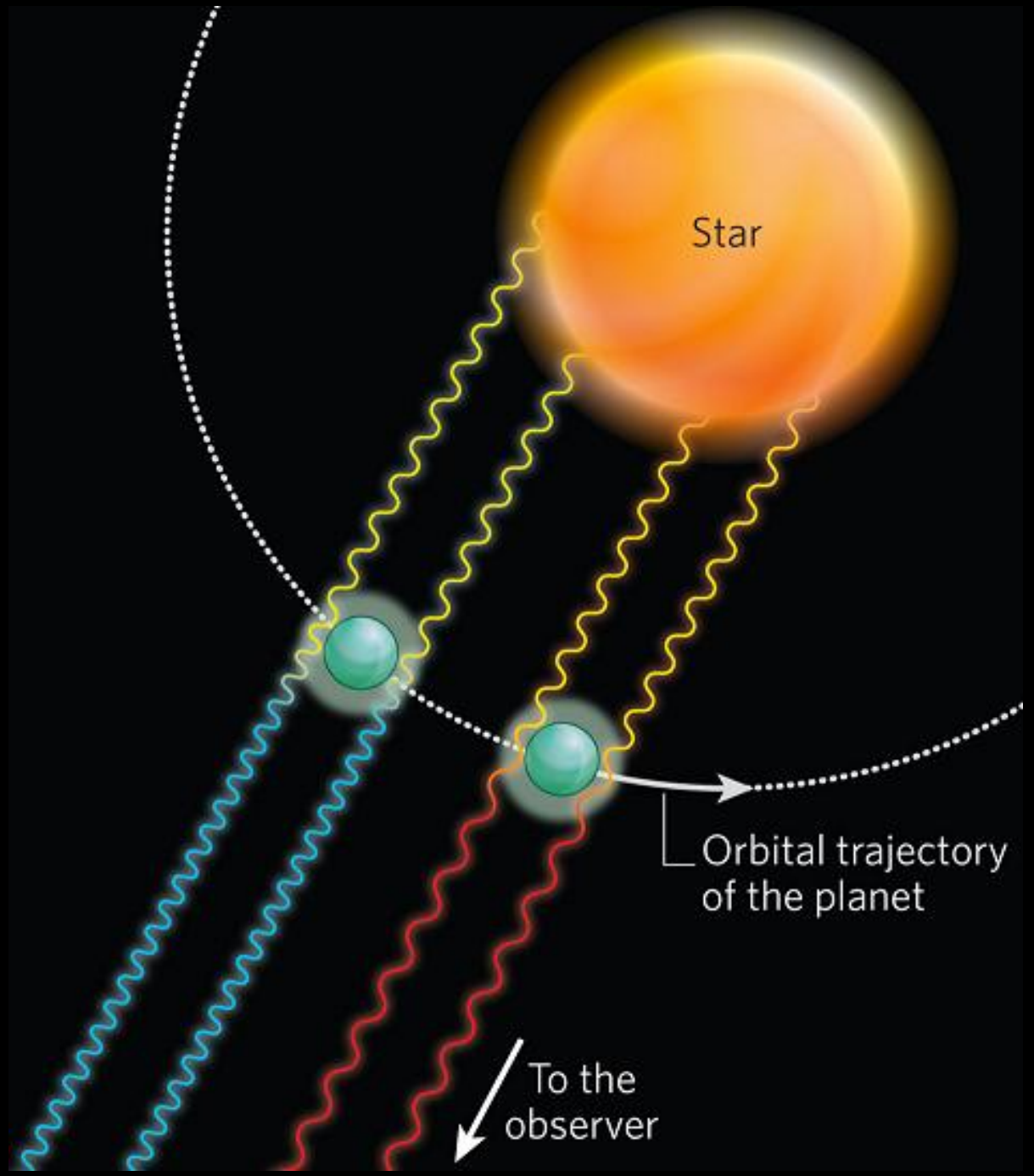
Empecemos buscando planetas

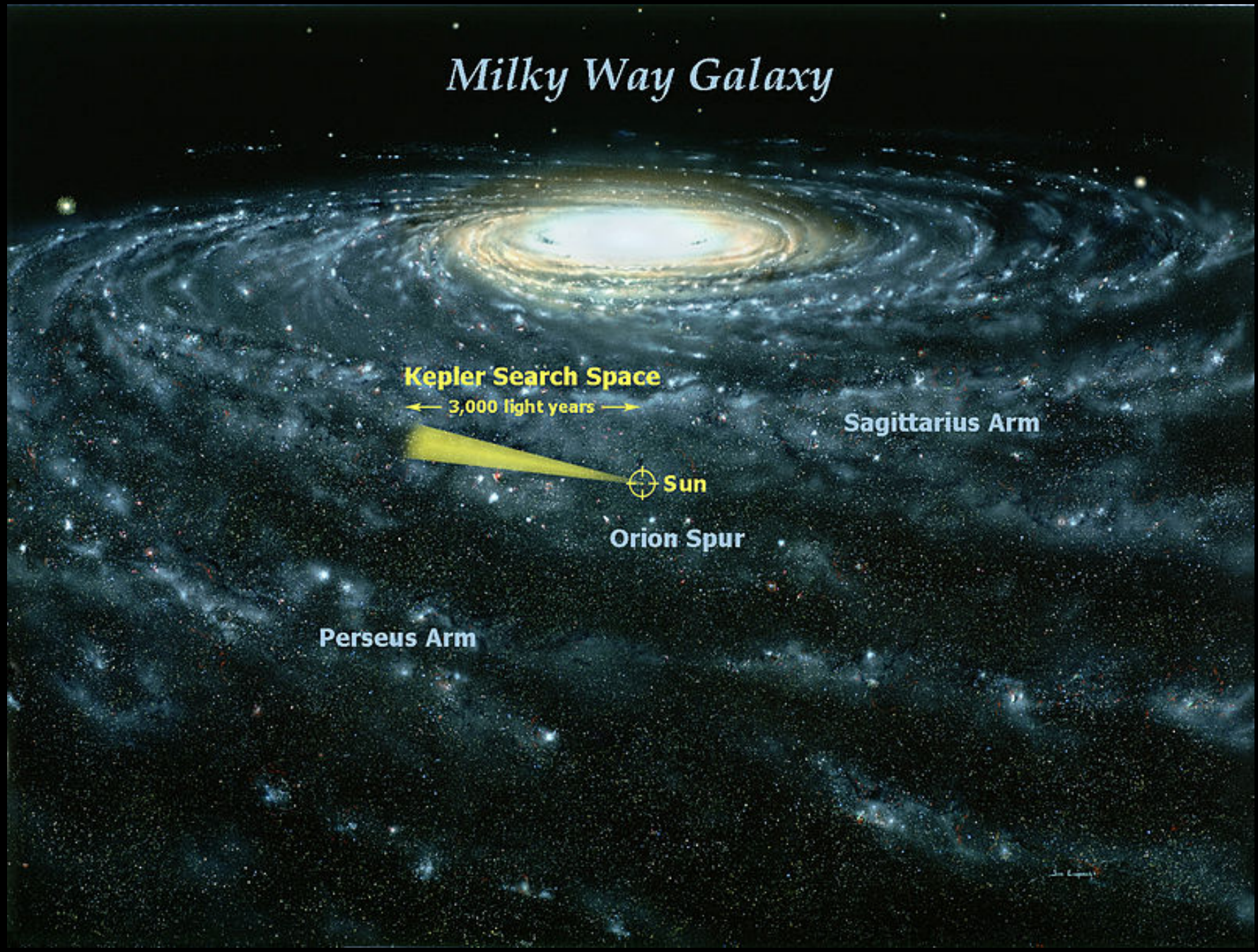
¿Cómo?

https://exoplanets.nasa.gov/5-ways-to-find-a-planet/index.html



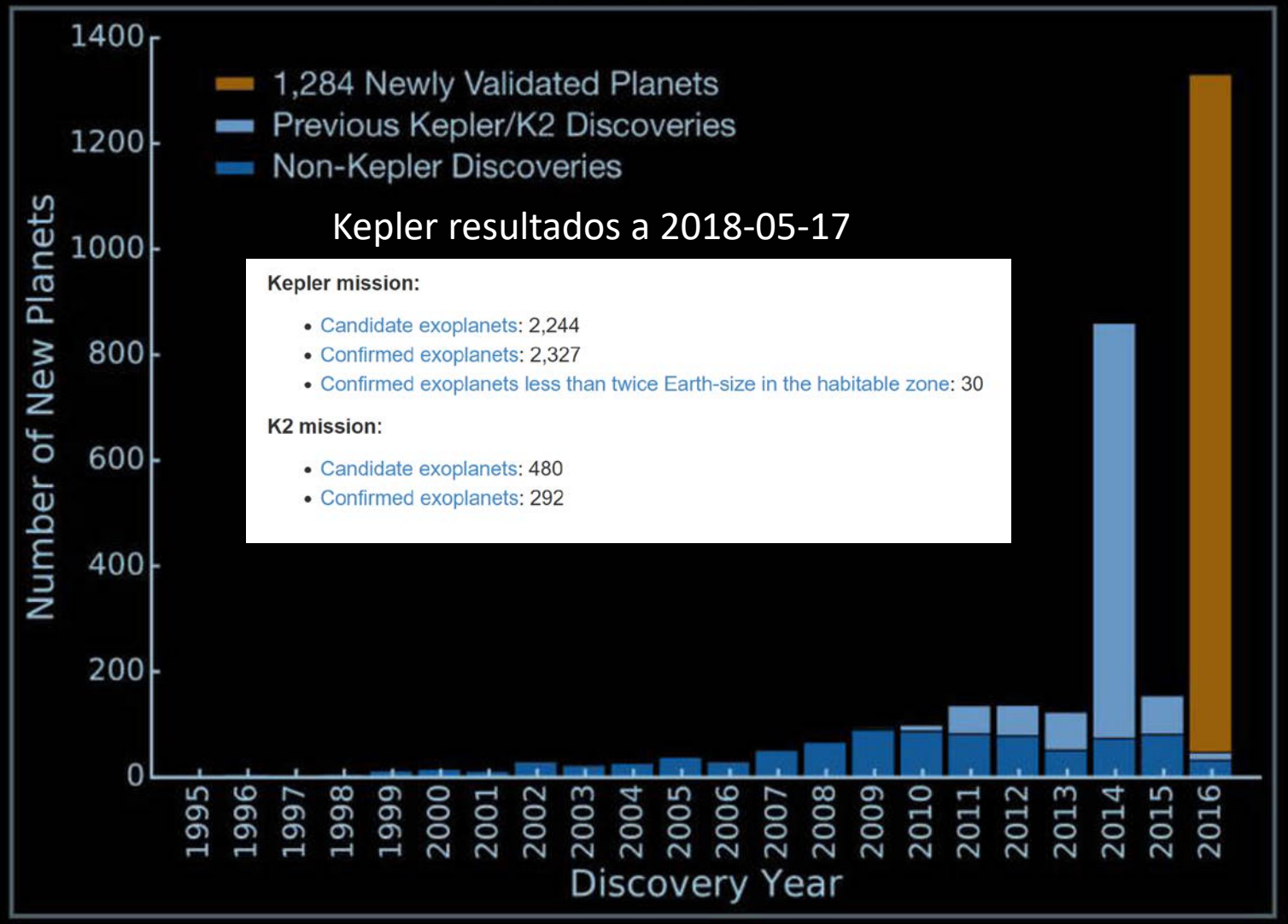

1
2
3
planet
star
Brightness
1
2
3
light curve
Time


Star
Orbital trajectory
of the planet
To the
observer


Milky Way Galaxy
Kepler Search Space
3,000 light years
Sagittarius Arm
Sun
Orion Spur
Perseus Arm

Exoplanet Discoveries Through the Years

As of May 10, 2016



Kepler resultados a 2018-05-17

Kepler mission:

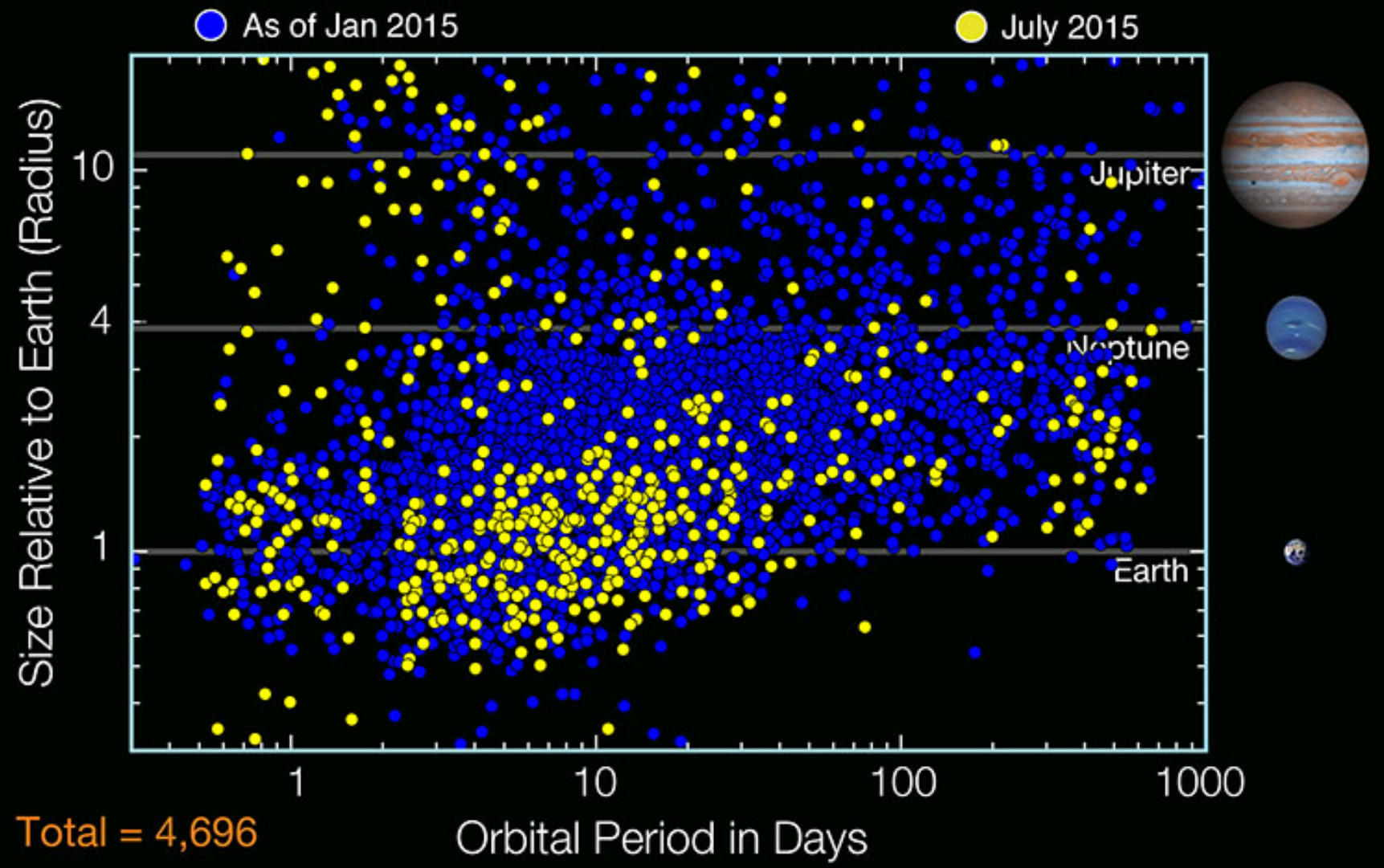
- Candidate exoplanets: 2,244
- Confirmed exoplanets: 2,327
- Confirmed exoplanets less than twice Earth-size in the habitable zone: 30

K2 mission:

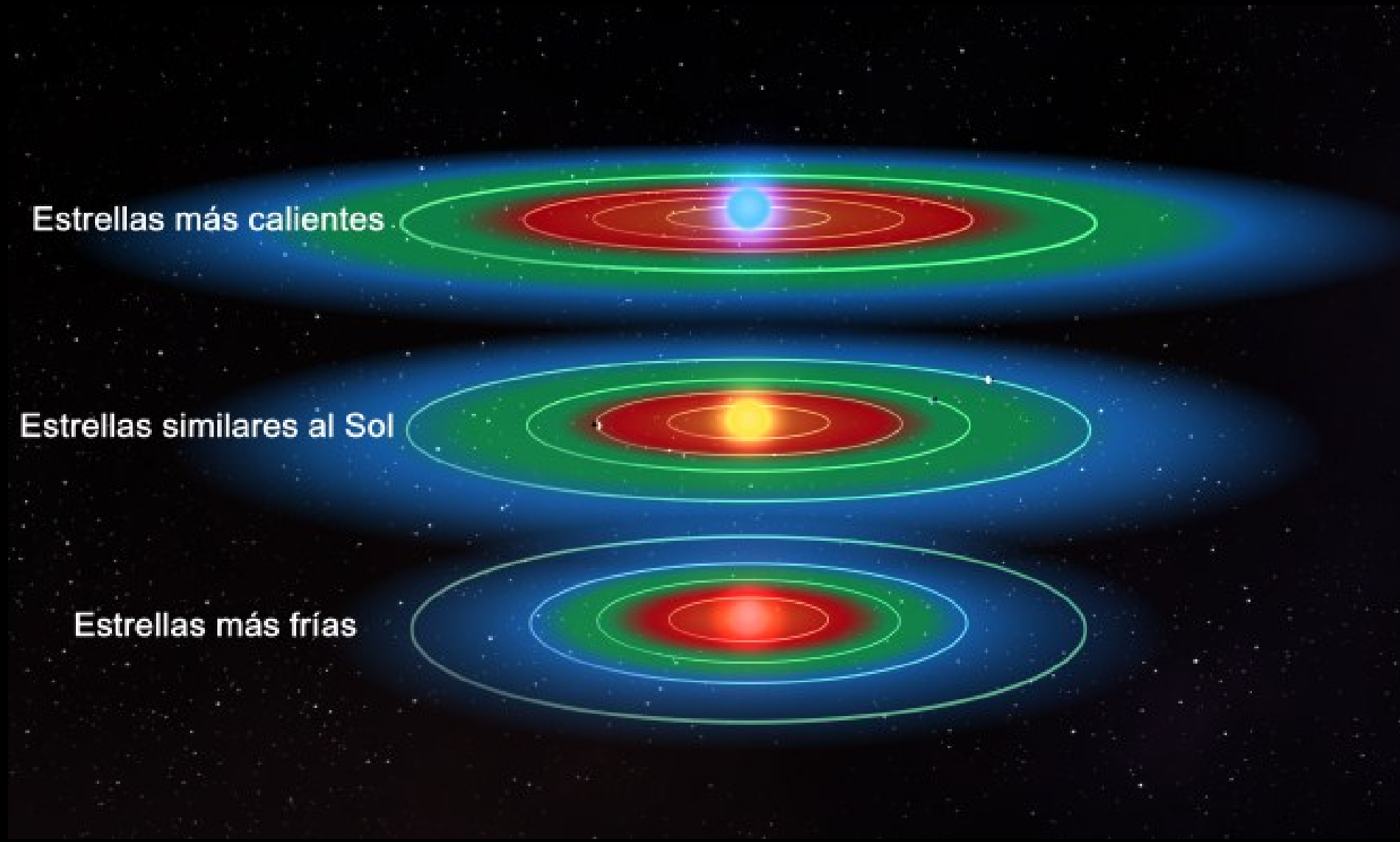
- Candidate exoplanets: 480
- Confirmed exoplanets: 292

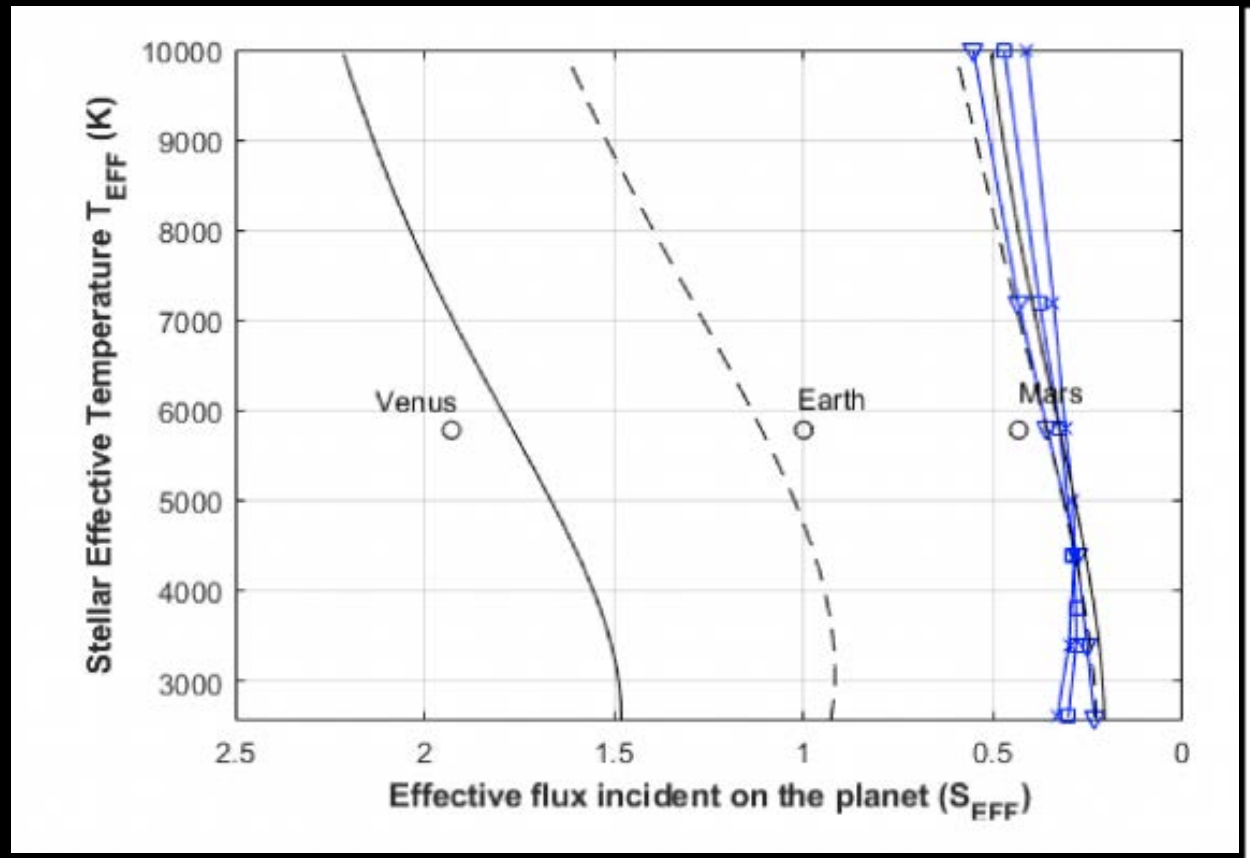
New Kepler Planet Candidates

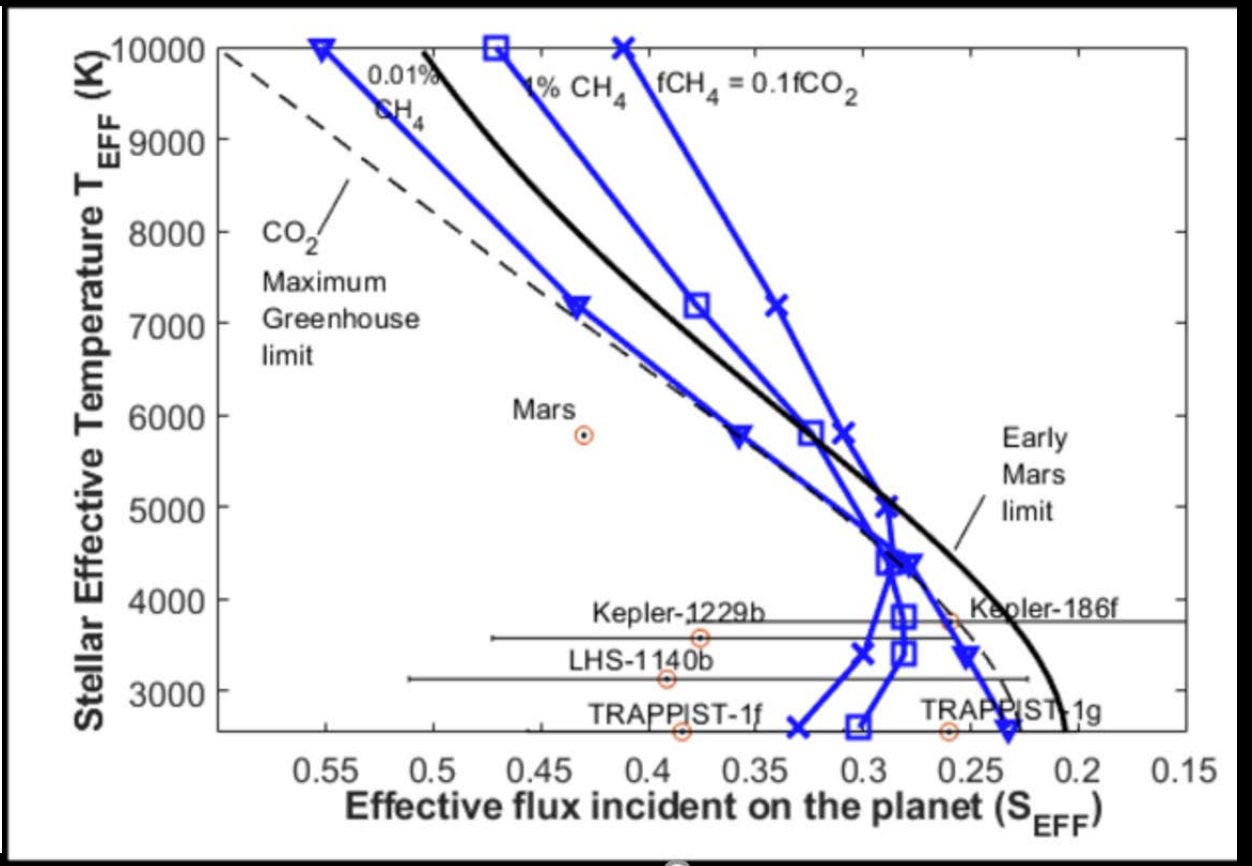
As of July 23, 2015



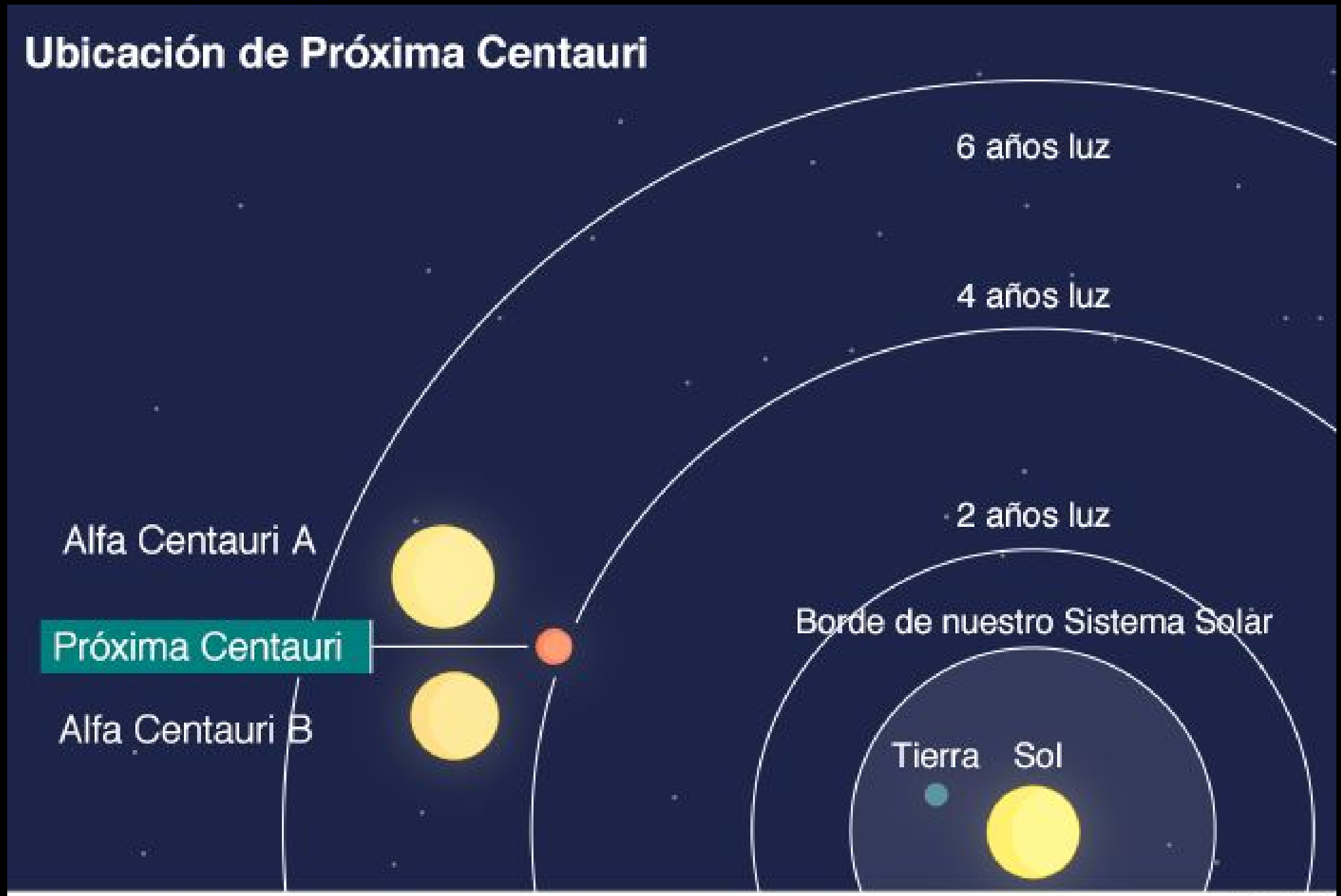
Zona habitable



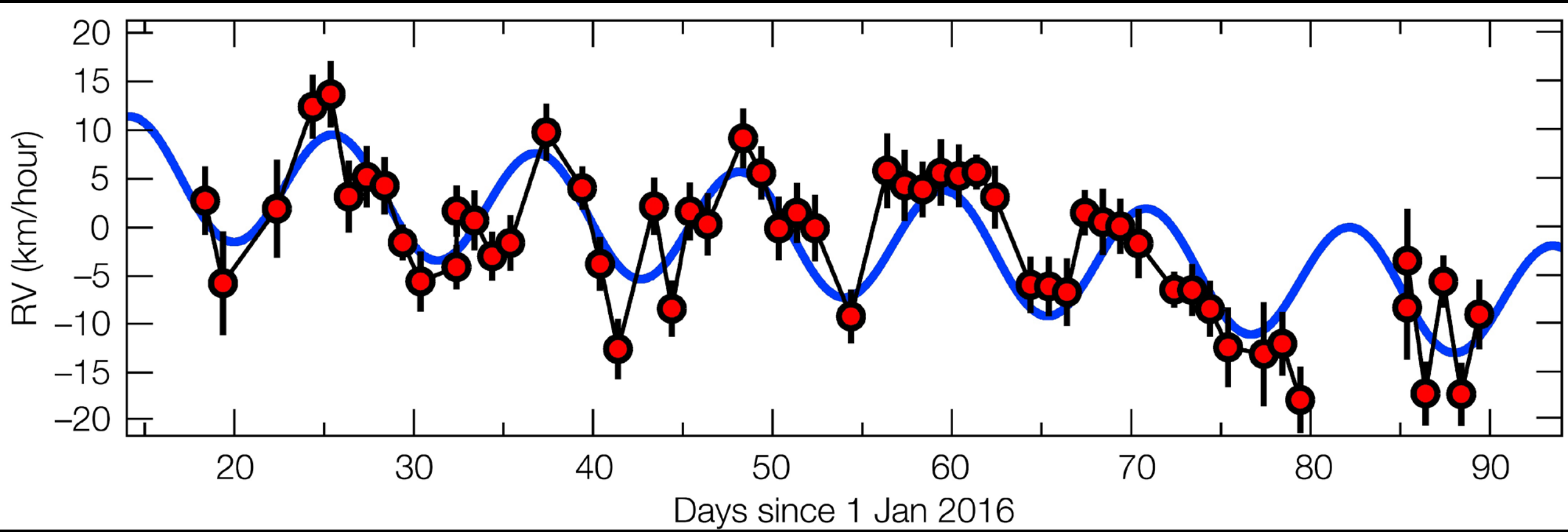




https://arxiv.org/pdf/1805.02801.pdf

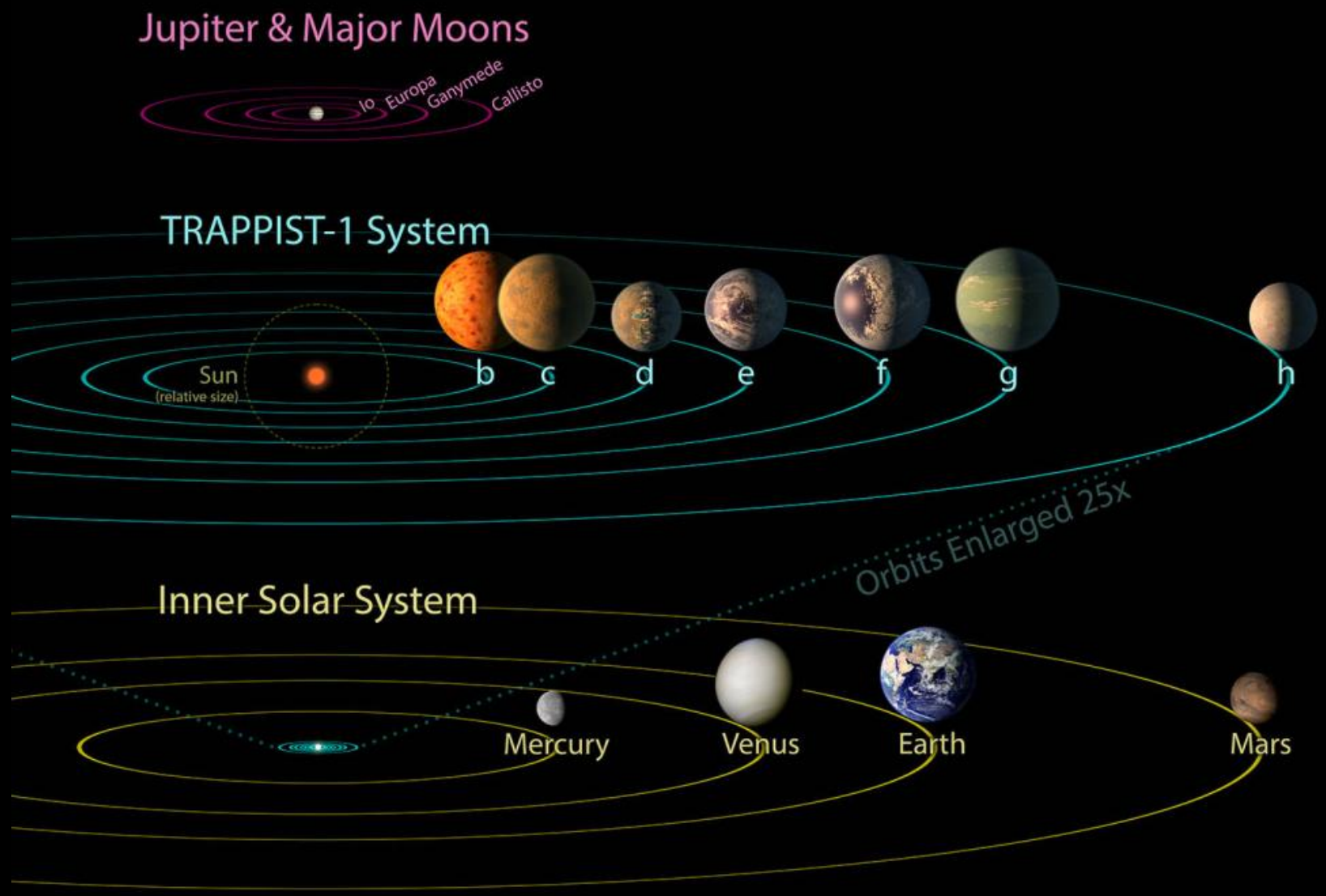

Ubicación de Próxima Centauri
6 años luz
4 años luz
2 años luz
Alfa Centauri A
Próxima Centauri
Alfa Centauri B
Borde de nuestro Sistema Solar
Tierra
Sol
Fuente: ESO
BBC


PALE RED DOT
Habitable Zone
Proxima b Orbit
Period: 11.186 days
Minimum mass: 1.27 Earth masses
Mercury's Orbit
Sun
Proxima Centauri
Mass: 0.12 solar masses
Luminosity: 0.00155 solar luminosities
Rotation period: 83 days
Temperature: 2800 Celsius
Distance to Earth: 4.23 light-years



Motion of Proxima Centauri towards and away from Earth is changing with time. Sometimes Proxima Centauri is approaching Earth at about 5 km/hand at times receding at the same speed. This regular pattern of changing radial velocities repeats with a period of 11.2 days. Careful analysis of the resulting tiny Doppler shifts showed that they indicated the presence of a planet with a mass at least 1.3 times that of the Earth, orbiting about 7 million kilometres from Proxima Centauri — only 5% of the Earth-Sun distance.

ESO/G. Anglada-Escudé - https://www.eso.org/public/images/eso1629d/


Jupiter & Major Moons
Io
Europa
Ganymede
Callisto
TRAPPIST-1 System
Sun
(relative size)
b
c
d
e
f
g
h
Orbits Enlarged 25x
Inner Solar System
Mercury
Venus
Earth
Mars

Illustrations

TRAPPIST-1 System

Feb. 2018

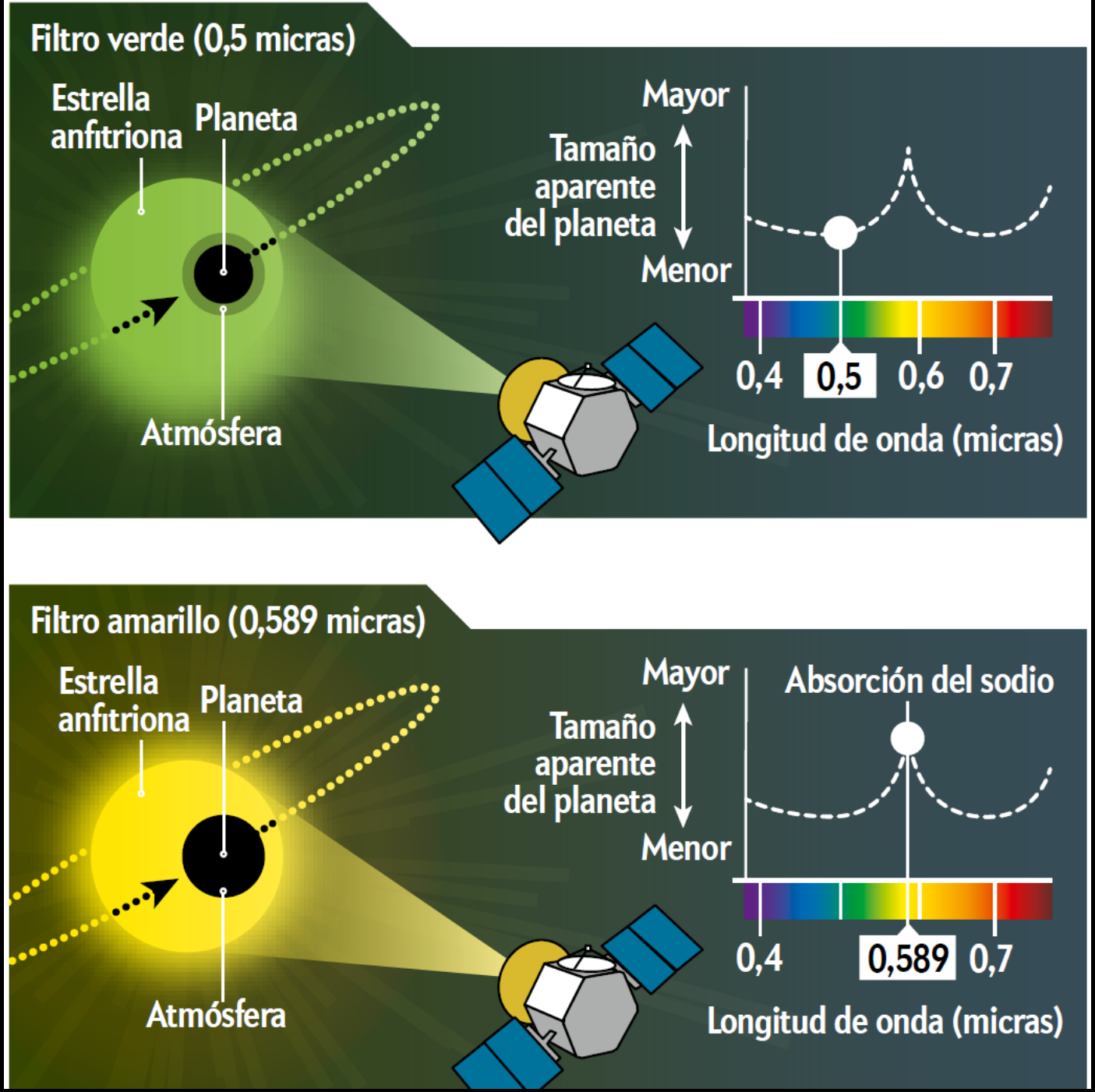
	b	c	d	e	f	g	h
Orbital Period	1.51 *days*	2.42 *days*	4.05 *days*	6.10 *days*	9.21 *days*	12.36 *days*	18.76 *days*
Distance to Star	0.0115 *AU*	0.0158 *AU*	0.0223 *AU*	0.0293 *AU*	0.0385 *AU*	0.0469 *AU*	0.0619 *AU*
Planet Radius	1.12 R_{earth}	1.10 R_{earth}	0.78 R_{earth}	0.91 R_{earth}	1.05 R_{earth}	1.15 R_{earth}	0.77 R_{earth}
Planet Mass	1.02 M_{earth}	1.16 M_{earth}	0.30 M_{earth}	0.77 M_{earth}	0.93 M_{earth}	1.15 M_{earth}	0.33 M_{earth}
Planet Density	0.73 ρ_{earth}	0.88 ρ_{earth}	0.62 ρ_{earth}	1.02 ρ_{earth}	0.82 ρ_{earth}	0.76 ρ_{earth}	0.72 ρ_{earth}
Surface Gravity	0.81 *g*	0.96 *g*	0.48 *g*	0.93 *g*	0.85 *g*	0.87 *g*	0.55 *g*

Solar System

Rocky Planets

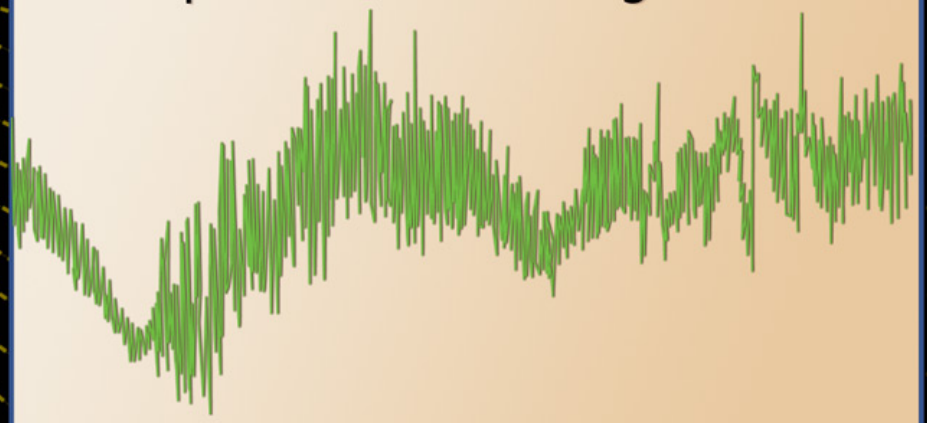
	Mercury	Venus	Earth	Mars
Orbital Period	87.97 *days*	224.70 *days*	365.26 *days*	686.98 *days*
Distance to Star	0.387 *AU*	0.723 *AU*	1.000 *AU*	1.524 *AU*
Planet Radius	0.38 R_{earth}	0.95 R_{earth}	1.00 R_{earth}	0.53 R_{earth}
Planet Mass	0.06 M_{earth}	0.82 M_{earth}	1.00 M_{earth}	0.11 M_{earth}
Planet Density	0.98 ρ_{earth}	0.95 ρ_{earth}	1.00 ρ_{earth}	0.71 ρ_{earth}
Surface Gravity	0.38 *g*	0.90 *g*	1.00 *g*	0.38 *g*

Fuente:
Investigación y Ciencia
Mayo 2018



Starlight filters through planetary atmosphere

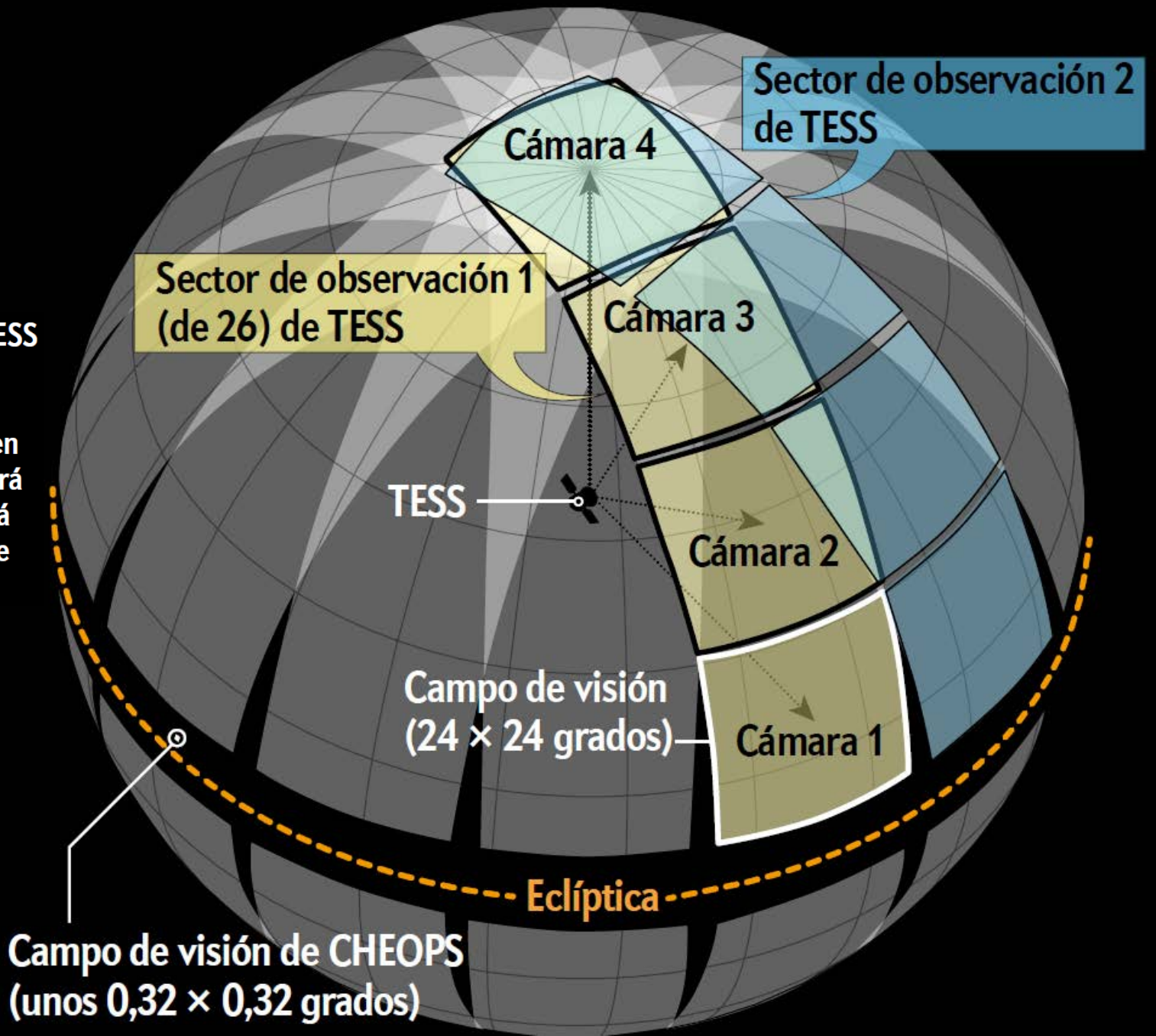
Methane in the planet's atmosphere absorbs starlight

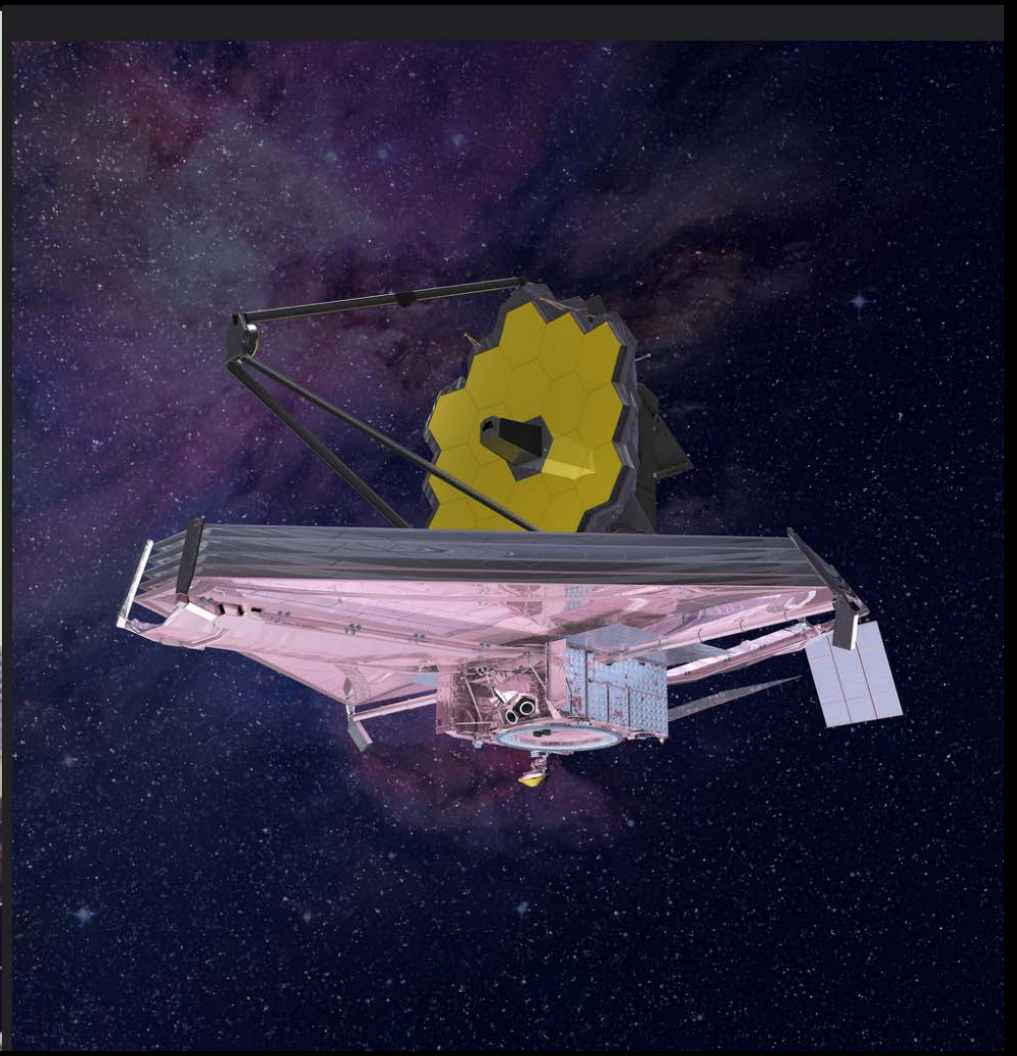



Exoplanet
Missions
JWST
AFTA
TESS
New Worlds
Telescope
Kepler
Spitzer
Hubble
Ground-based
Observatories
2001
Decadal
Survey
New Worlds
New Horizons
2010
Decadal
Survey

https://arxiv.org/pdf/1804.05050.pdf

Mientras Kepler busca planetas en una pequeña área del cielo, TESS será capaz de examinar alrededor del 90 por ciento de la esfera celeste. Las cuatro cámaras del telescopio le brindarán un gran campo de visión, que cubrirá 24 por 96 grados. Dividirá el cielo en 26 sectores de observación parcialmente superpuestos y se pasará un mes estudiando cada uno. CHEOPS, por el contrario, estudiará estrellas individuales en las que los astrónomos ya sospechen que existen mundos a fin de obtener mejores datos.



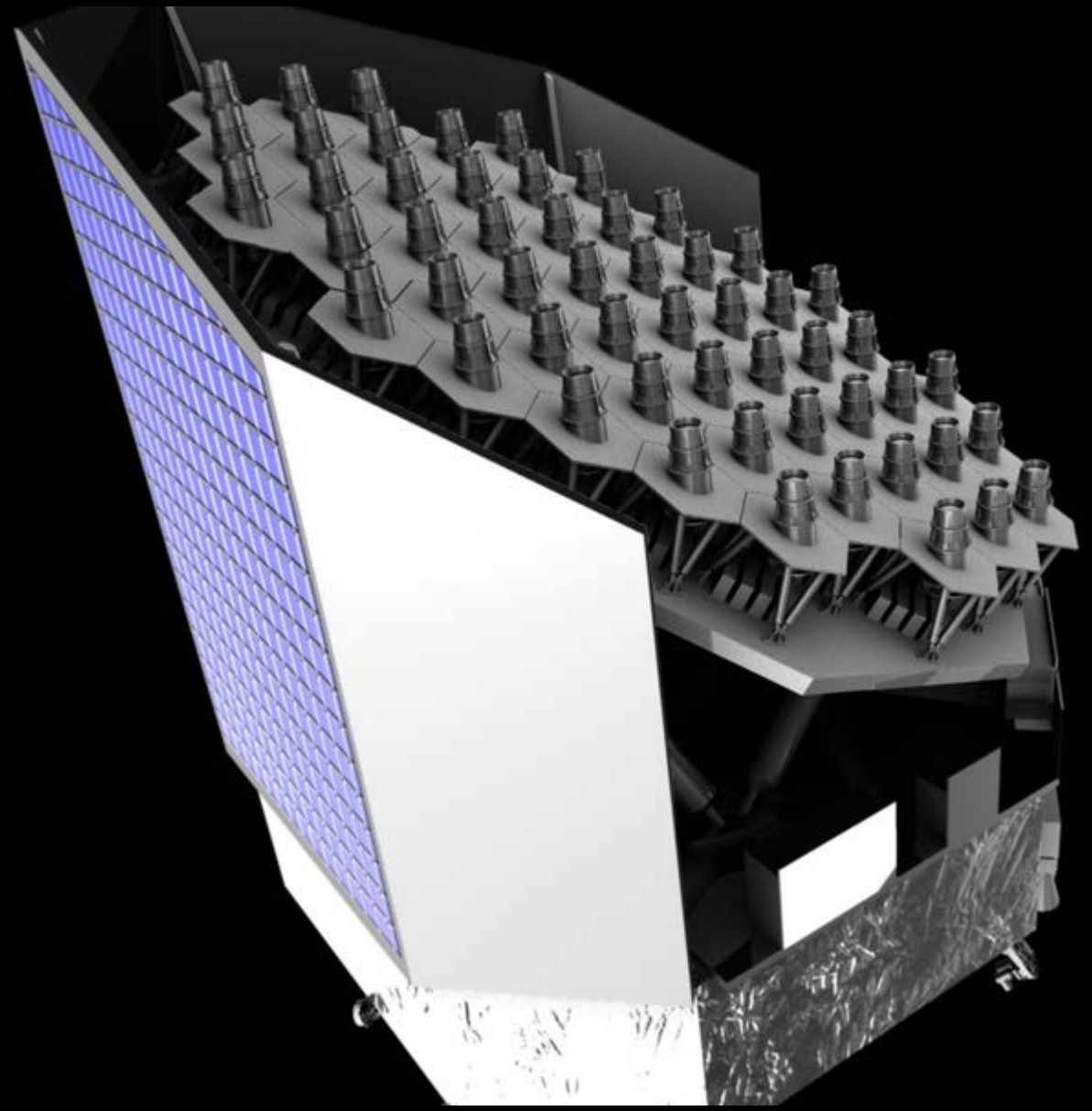


https://jwst.nasa.gov/origins.html

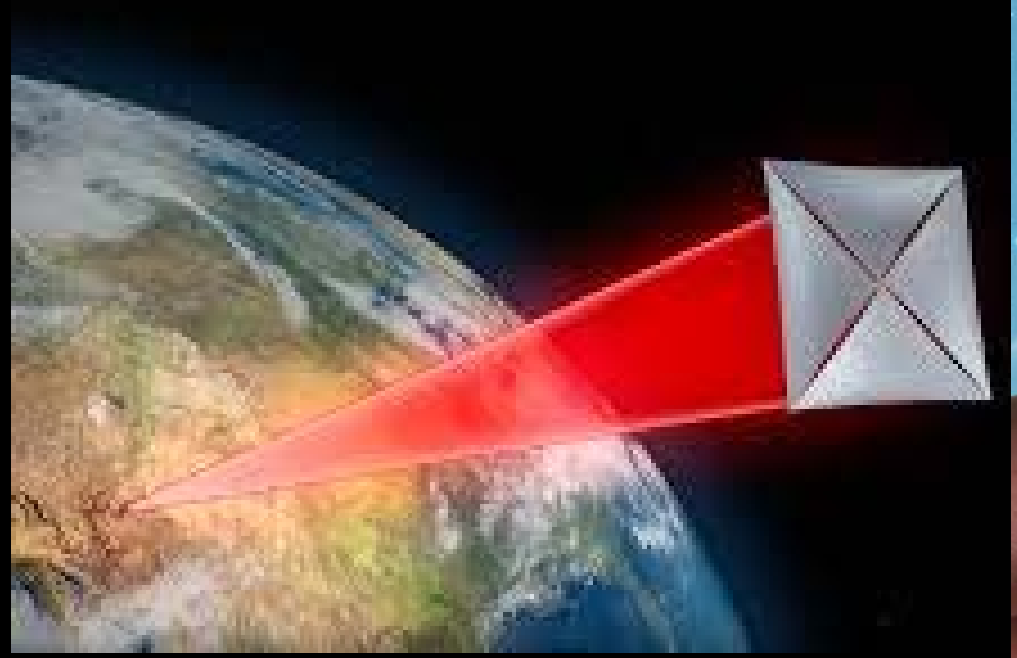
PLATO

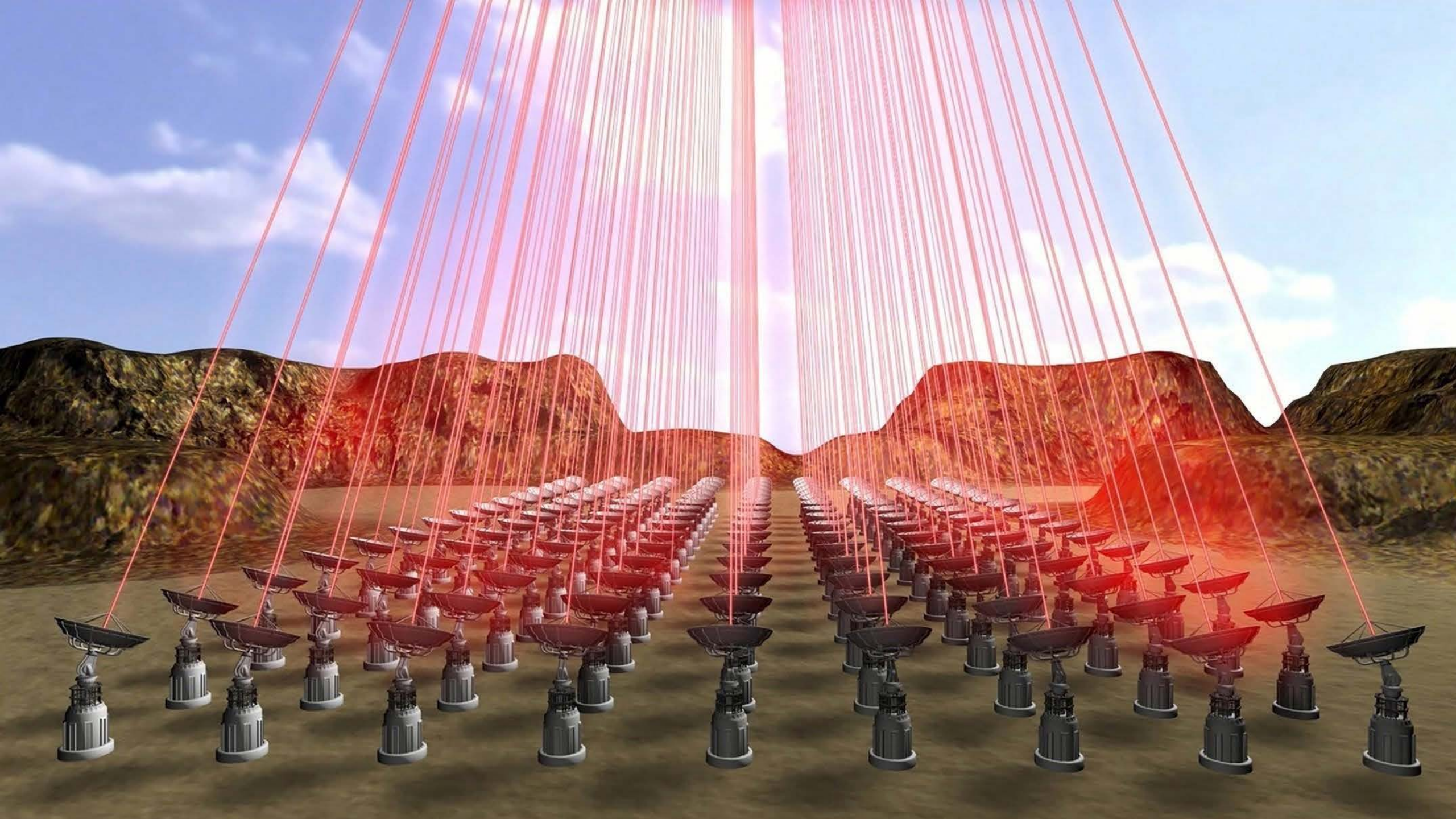
http://sci.esa.int/plato/

PLAnetary Transits and Oscillations of stars (PLATO) is th third medium-class mission in ESA's Cosmic Vision programme Its objective is to find and study large number of extrasolar planetary systems, with emphas on the properties of terrestrial planets in the habitable zone around solar-like stars. PLATO ha also been designed to investigat seismic activity in stars, enablin the precise characterisation of the planet host star, including its age.



¿Podremos visitar estos mundos?





- Continuará ….