Jet Propulsion Laboratory
California Institute of Technology

# Welcome Bob Picardo from the Planetary Society!

Gary Blackwood
John Ziemer
Manan Arya
David Webb

NASA Exoplanet Exploration Program

# NASA Exoplanet Exploration Program

Astrophysics Division, NASA Science Mission Directorate

*NASA's search for habitable planets and life beyond our solar system*

Program purpose described in **2014 NASA Science Plan**

1. Discover planets around other stars
2. Characterize their properties
3. Identify candidates that could harbor life

ExEP serves the science community and NASA by implementing NASA's space science vision for exoplanets

https://exoplanets.nasa.gov

# Discovery Method of First Exoplanet

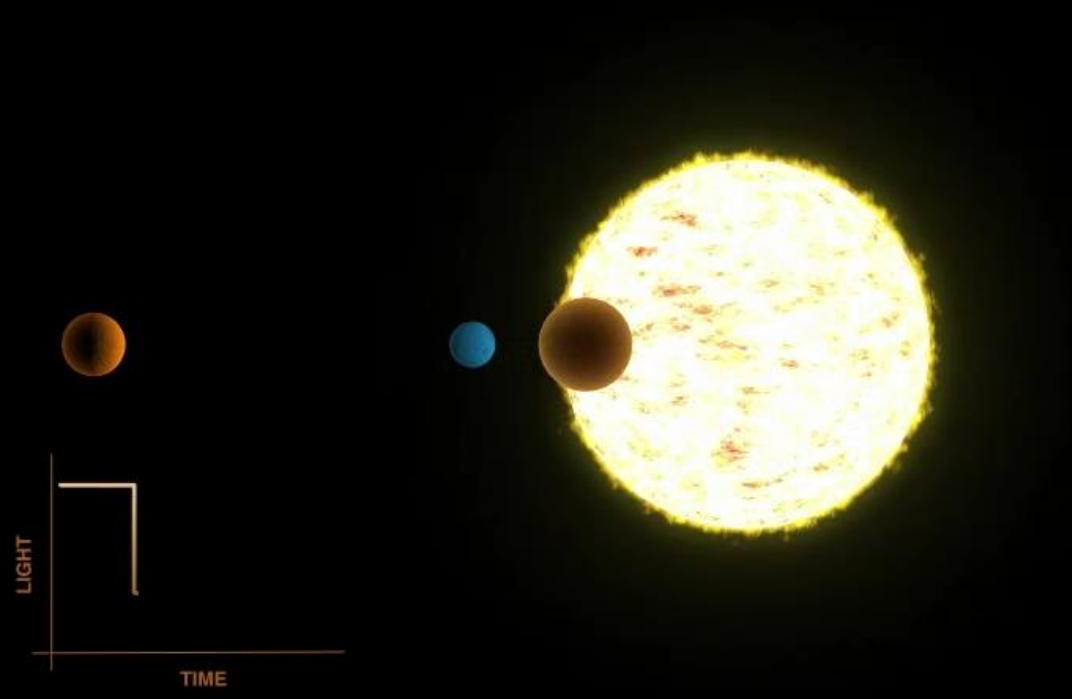
Doppler Spectroscopy or Radial Velocity Method

(the wobble method)

*Credit: NASA/JPL*

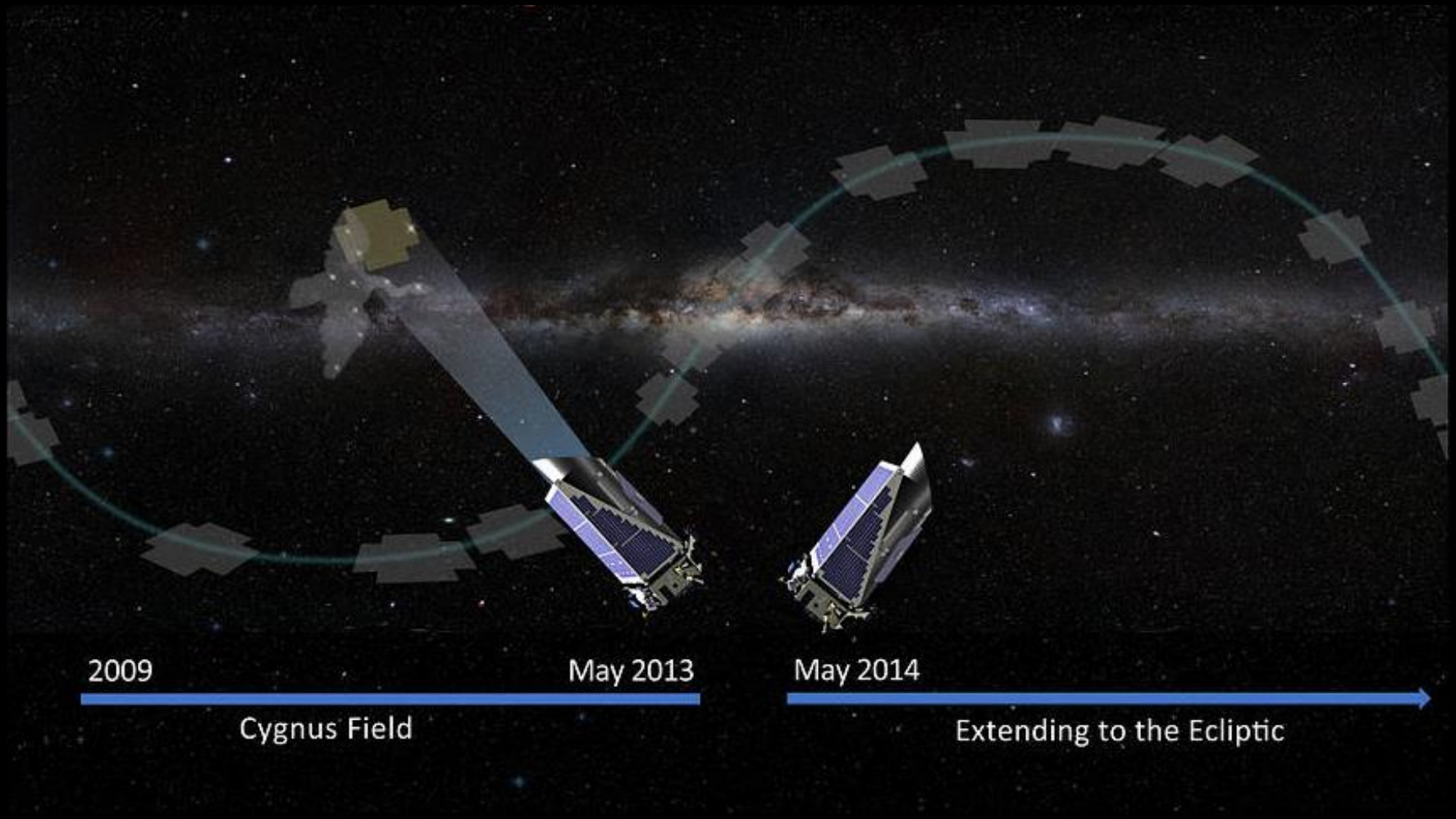
# Method Used by Kepler Telescope to Discover Exoplanets

Transit Method (Shadow Method)




*Credit: NASA/JPL*

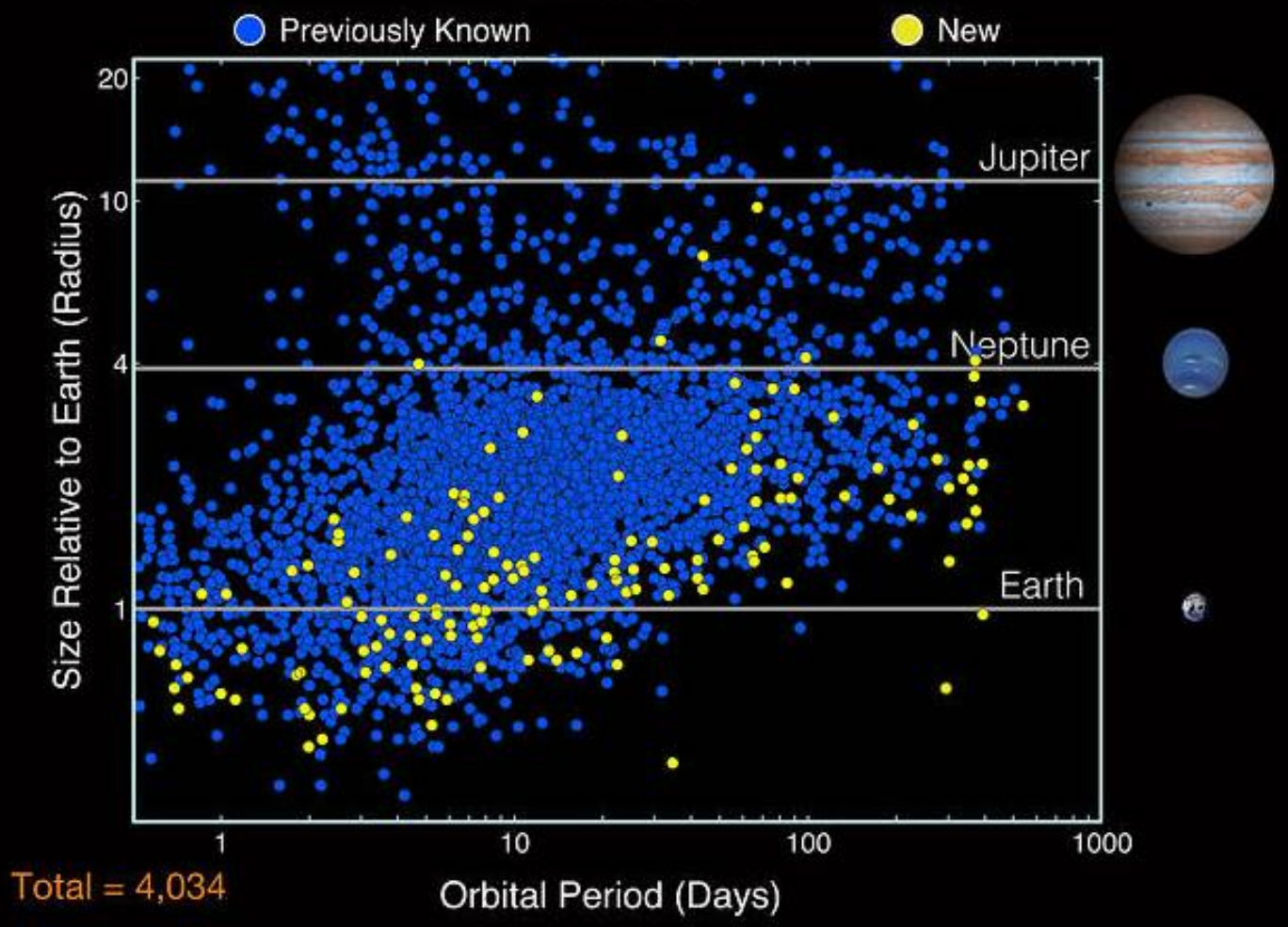
# Kepler / K2




*Credit: NASA Ames*

# New Kepler Planet Candidates

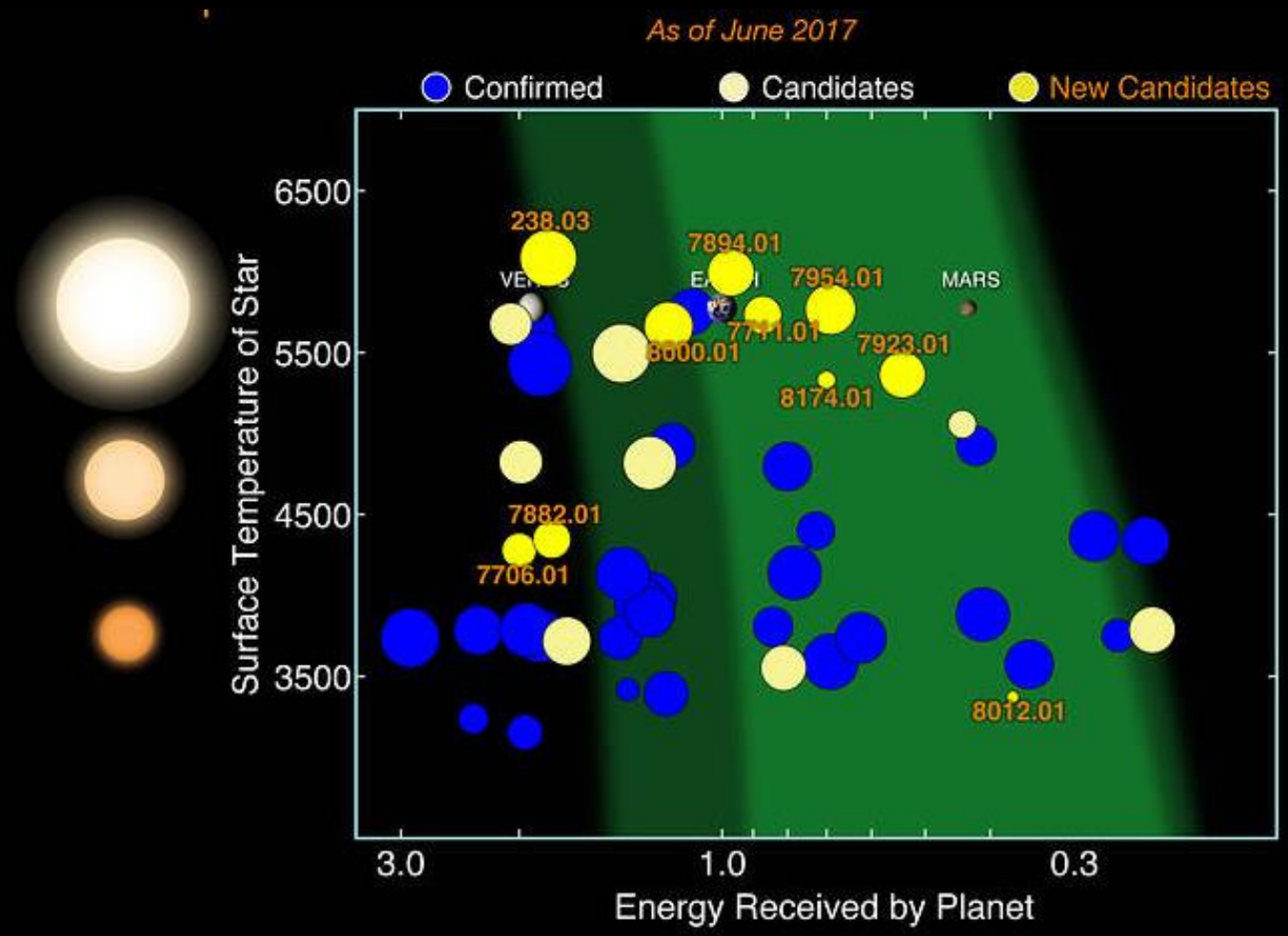
As of June 2017




*Credit: NASA/Ames Research Center/W. Stenzel*

# Kepler Habitable Zone Planets

As of June 2017




*Credit: NASA/Ames Research Center/W. Stenzel*

# A Familiar Habitable Zone

*Credit: Luc Forsyth*

# Show Me the Planets! Trappist-1

Seven Exoplanets Above the Fold – 3 in the Habitable Zone

"All the News That's Fit to Print"

The New York Times

Late Edition

Today, patchy morning fog, partly sunny, warm, high 64. Tonight, mostly cloudy, mild, low 52. Tomorrow, clouds and sunshine, showers, high 66. Weather map is on Page B9.

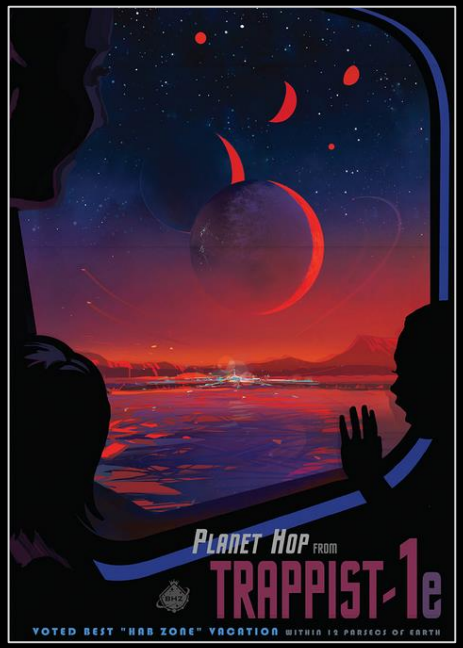
VOL. CLXVI ... No. 57,517 © 2017 The New York Times Company NEW YORK, THURSDAY, FEBRUARY 23, 2017 $2.50

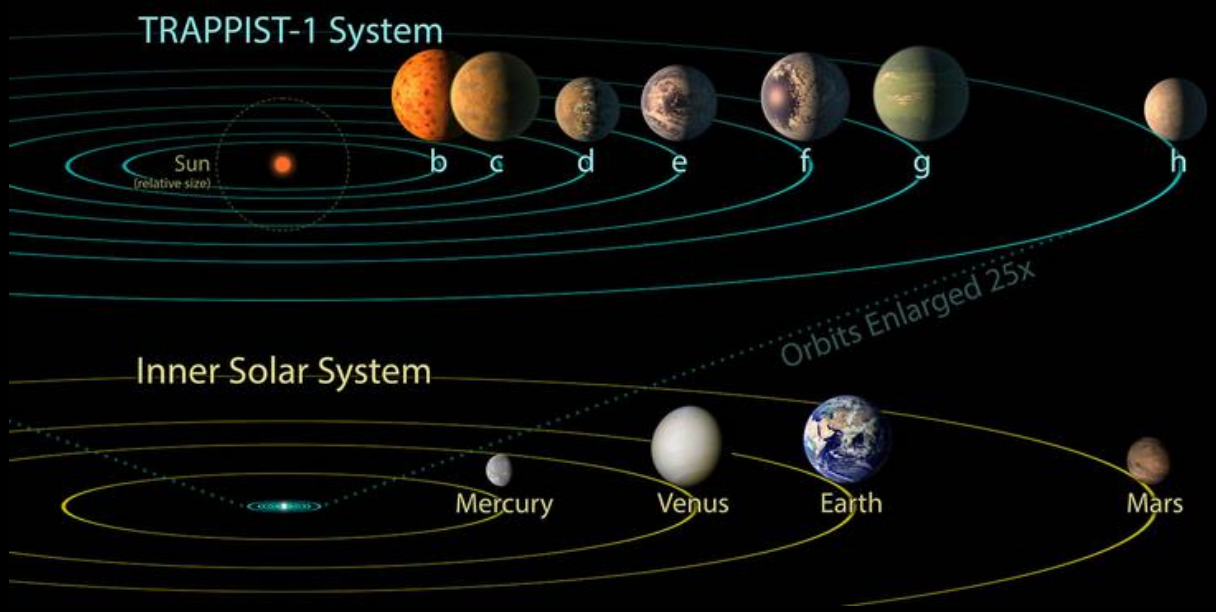
JPL-CALTECH/NASA

A rendering of newly discovered Earth-size planets orbiting a dwarf star named Trappist-1 about 40 light-years from Earth. Some of them could have surface water.

# Trappist-1 Discovery

The Richest Set of Earth-sized Planets Ever Found

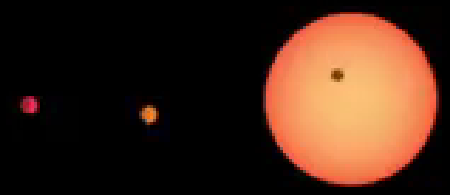



*Credit: NASA/JPL*

ExEP's role: Supported PI, Spitzer, & HQ to develop materials for the public release. Set up dedicated site https://exoplanets.nasa.gov/trappist1/ with original stories, image & video gallery, virtual reality views, travel poster

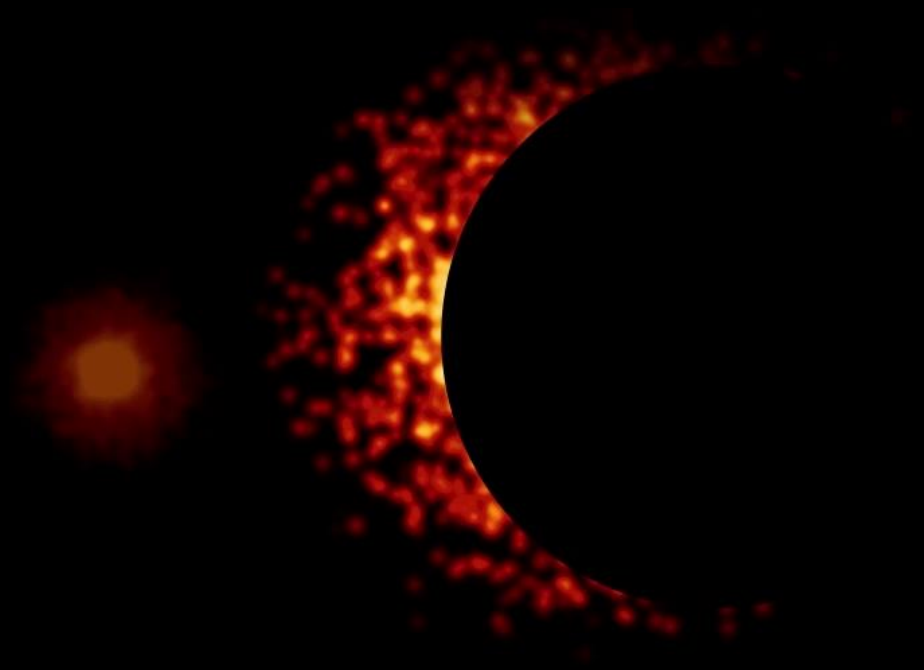
# How Spitzer Observed the Trappist-1 System



*Credit: NASA/JPL*

# Techniques to Detect Exoplanets

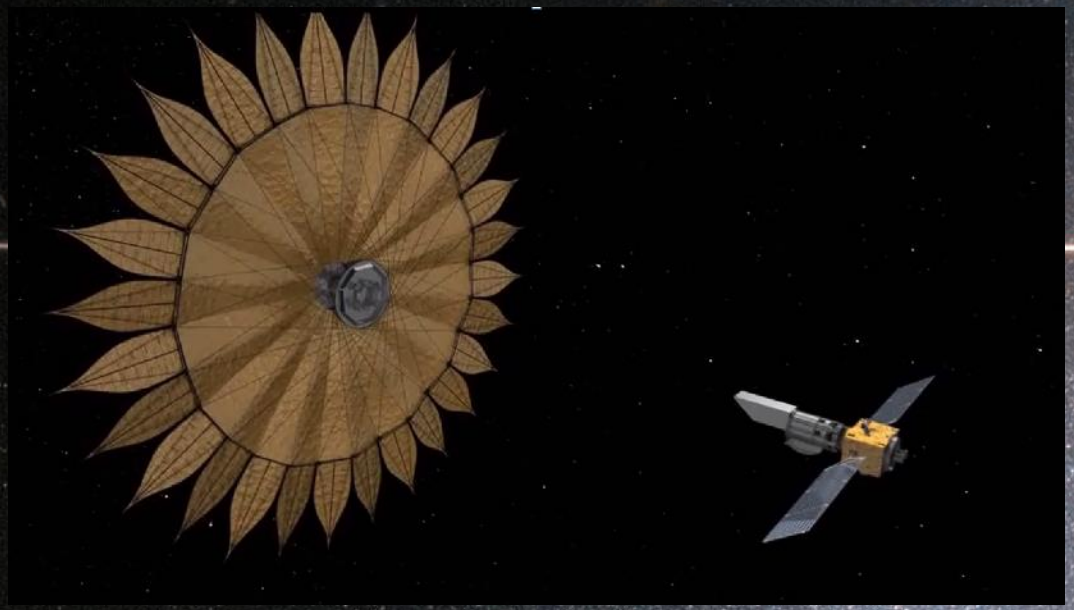
Direct Imaging

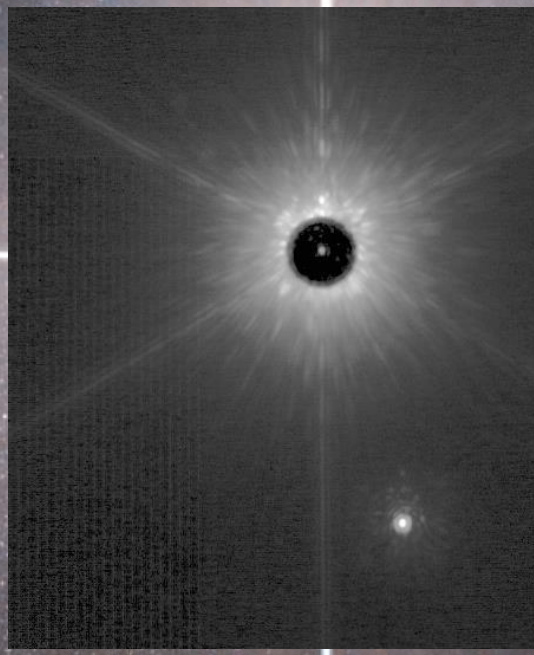


*Credit: NASA/JPL*

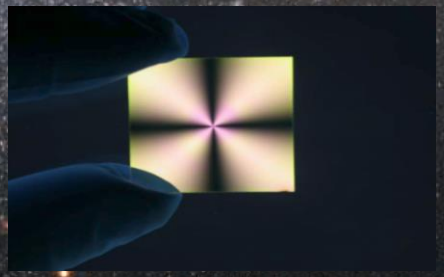
# Starlight Suppression is the Key Technology in the Search for Life on Earth-Size Exoplanets

External Occulters (Starshades)



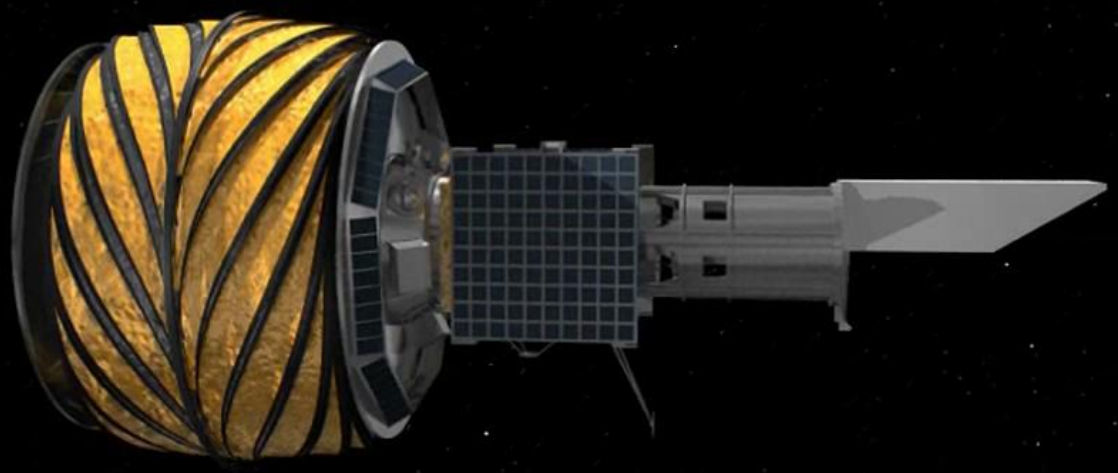


Internal Occulters (Coronagraphs)



# Starshade (External Occulter)

Blocks Starlight, Controls Diffraction prior to Entering Telescope



*Credit: NASA/JPL*

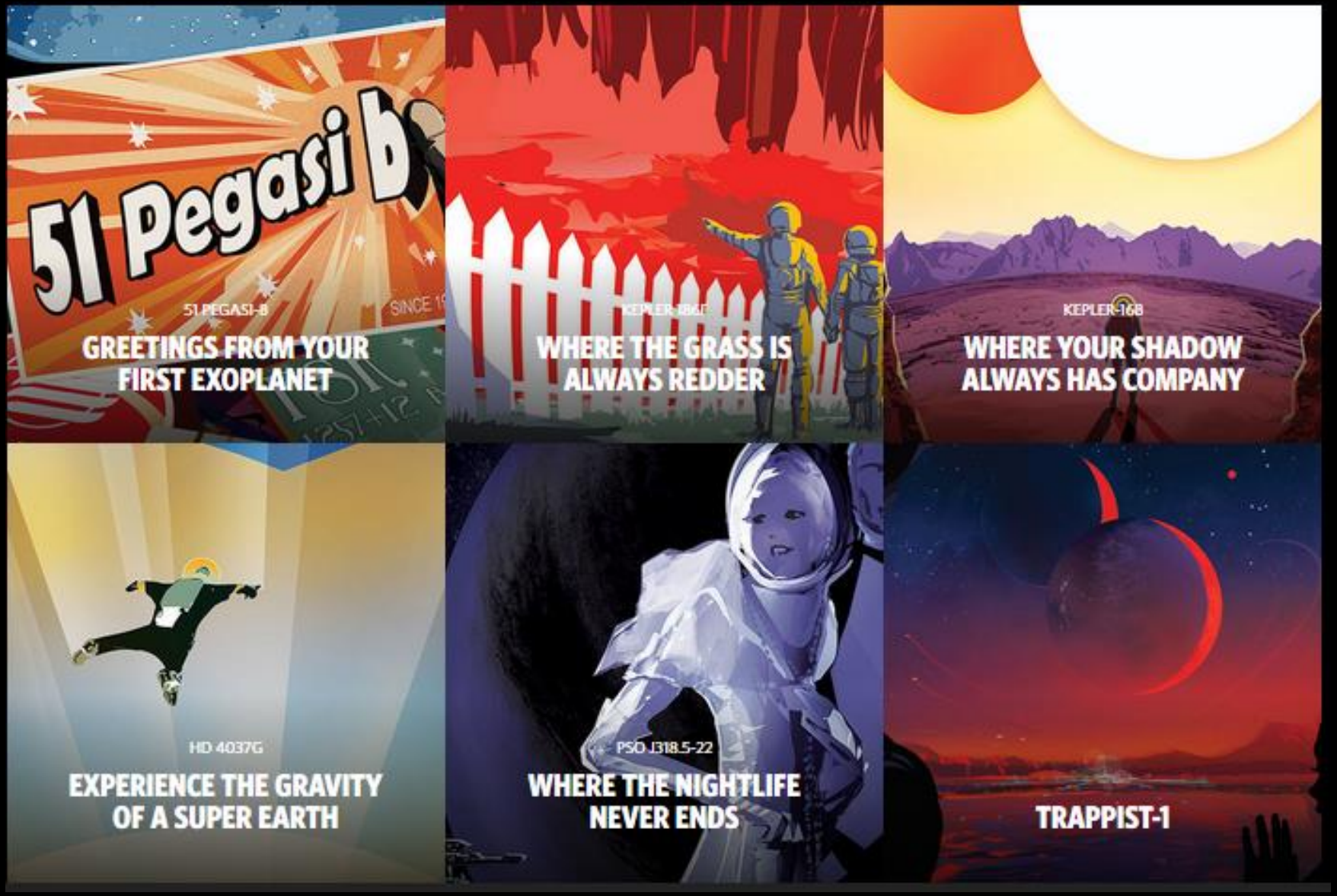
# Early Inner Disk Deployment Trials at JPL

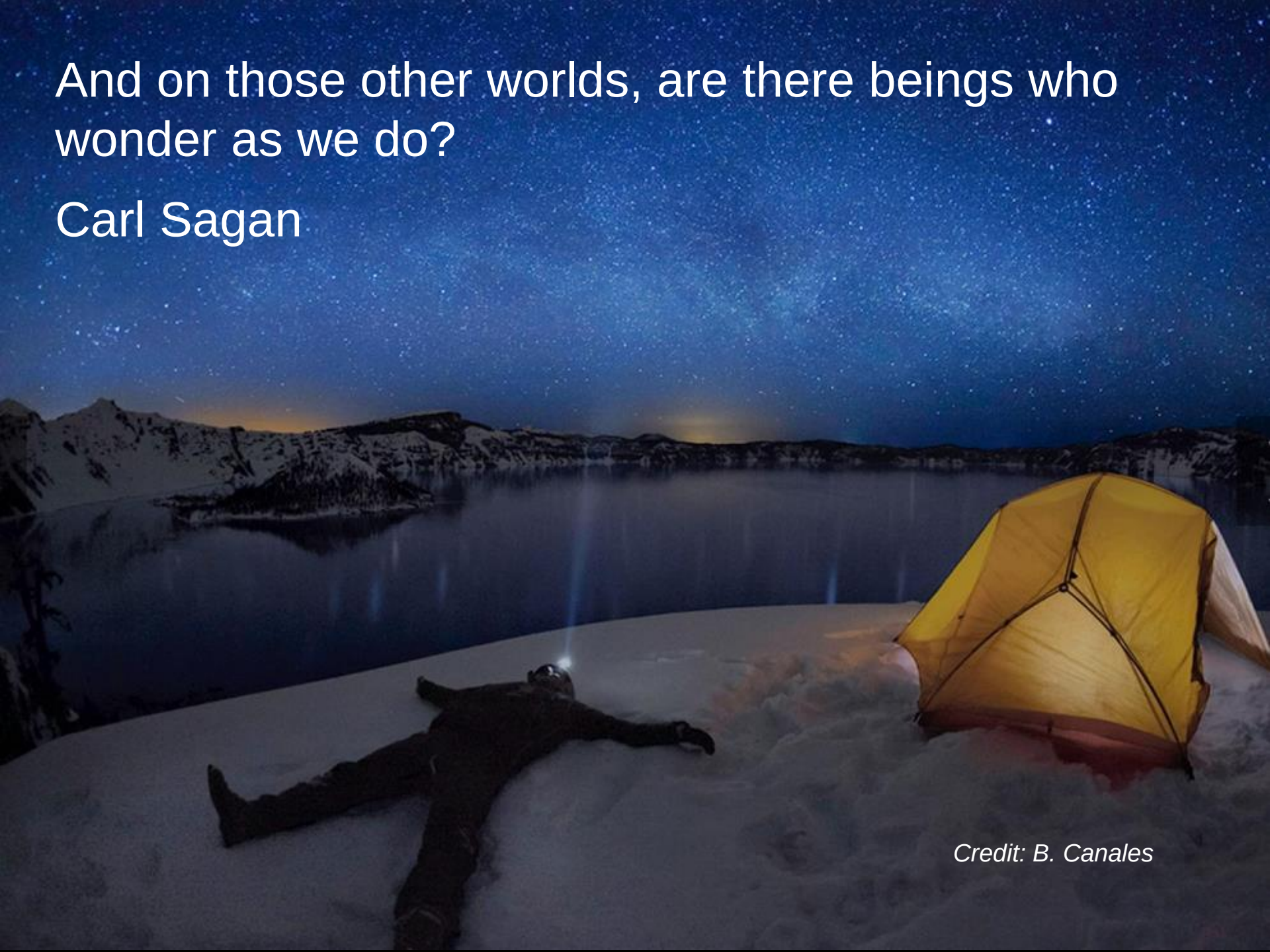
*Credit: NASA/JPL*

# Starshade Optical Shield

*Credit: NASA/JPL*

# Exoplanet Travel Bureau




And on those other worlds, are there beings who wonder as we do?
Carl Sagan
Credit: B. Canales

Jet Propulsion Laboratory
California Institute of Technology

jpl.nasa.gov