

National Aeronautics and Space Administration



Astrophysics

AAAC Science Presentation

February 24, 2017



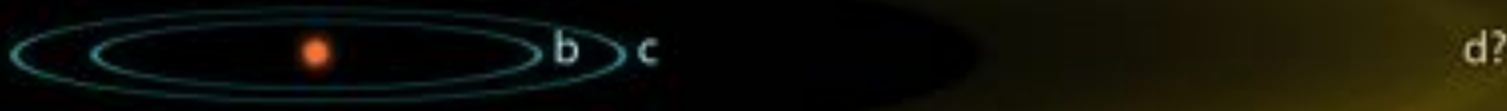
Kartik Sheth

Program Scientist, Astrophysics Division

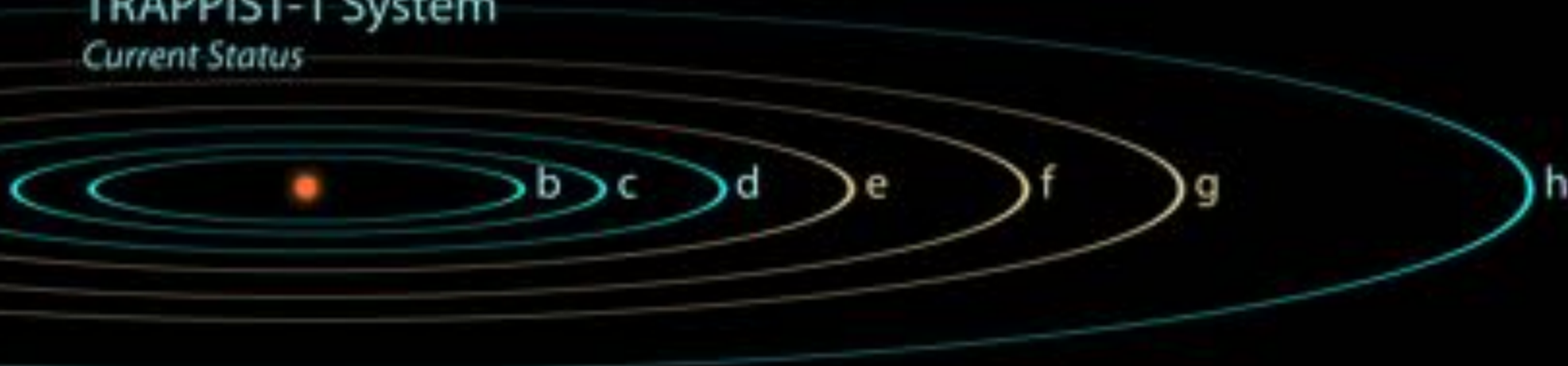
Spitzer Program Scientist

Science Mission Directorate

TRAPPIST-1 System *Initial Findings*



TRAPPIST-1 System *Current Status*

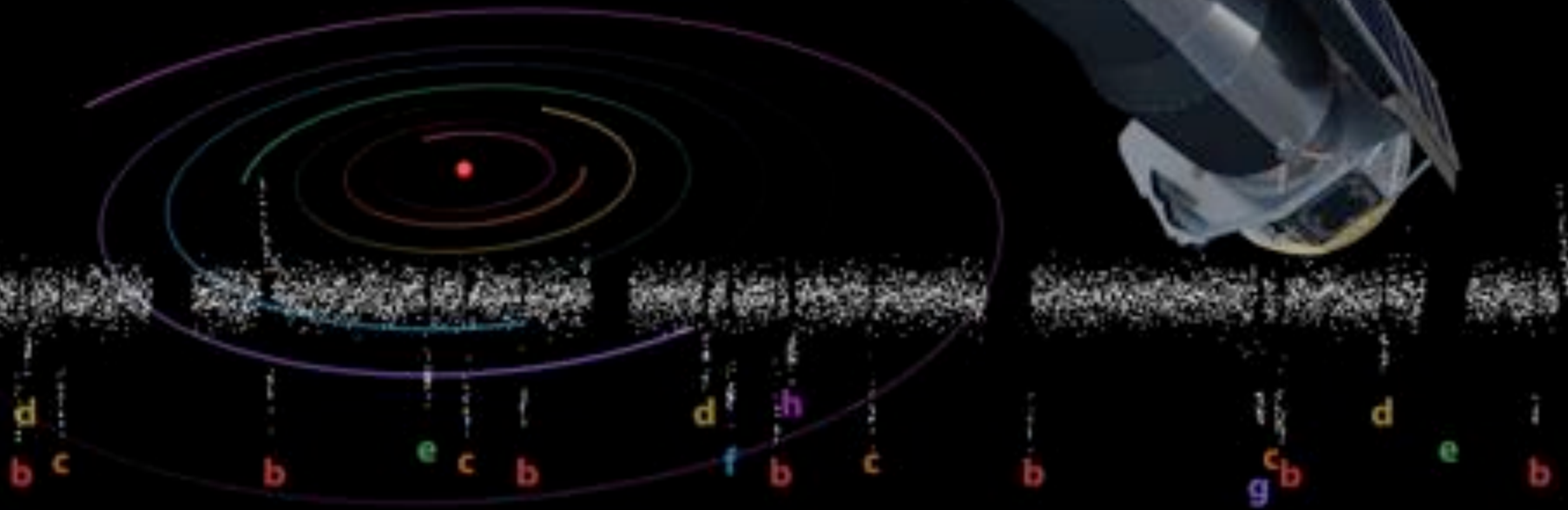
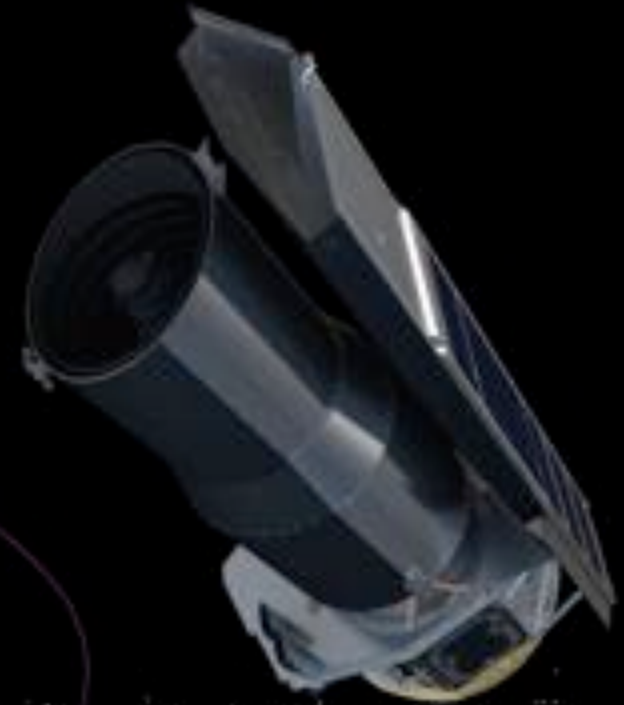


Gillon et al., 2017, Nature, 542, 456

Graphics courtesy: NASA/JPL-Caltech/ R. Hurt (IPAC)

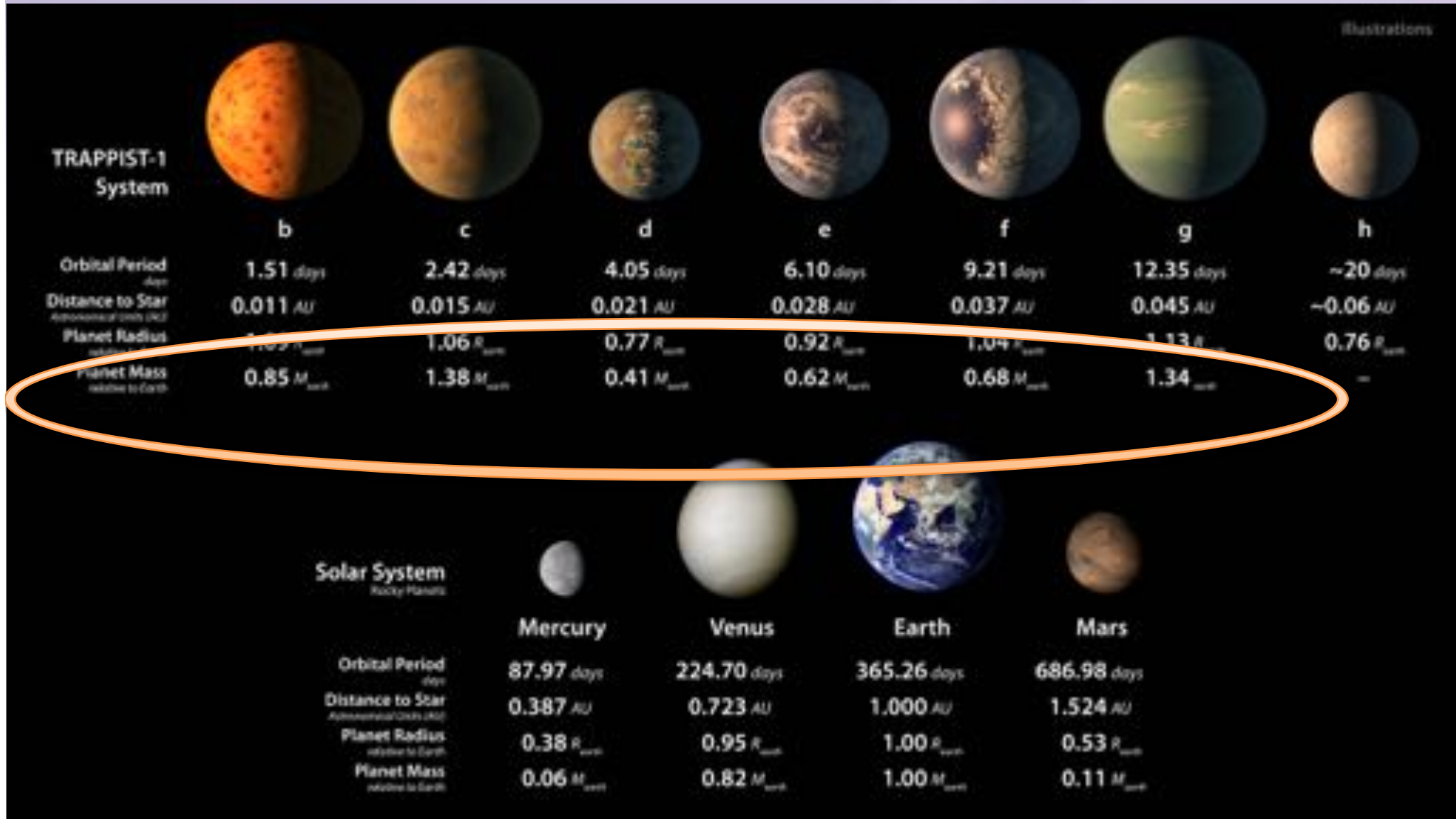
500 Hours:

Exploring the 7 Exoplanets of TRAPPIST-1
with NASA's Spitzer Space Telescope



Gillon et al., 2017, Nature, 542, 456
Graphics courtesy: NASA/JPL-Caltech

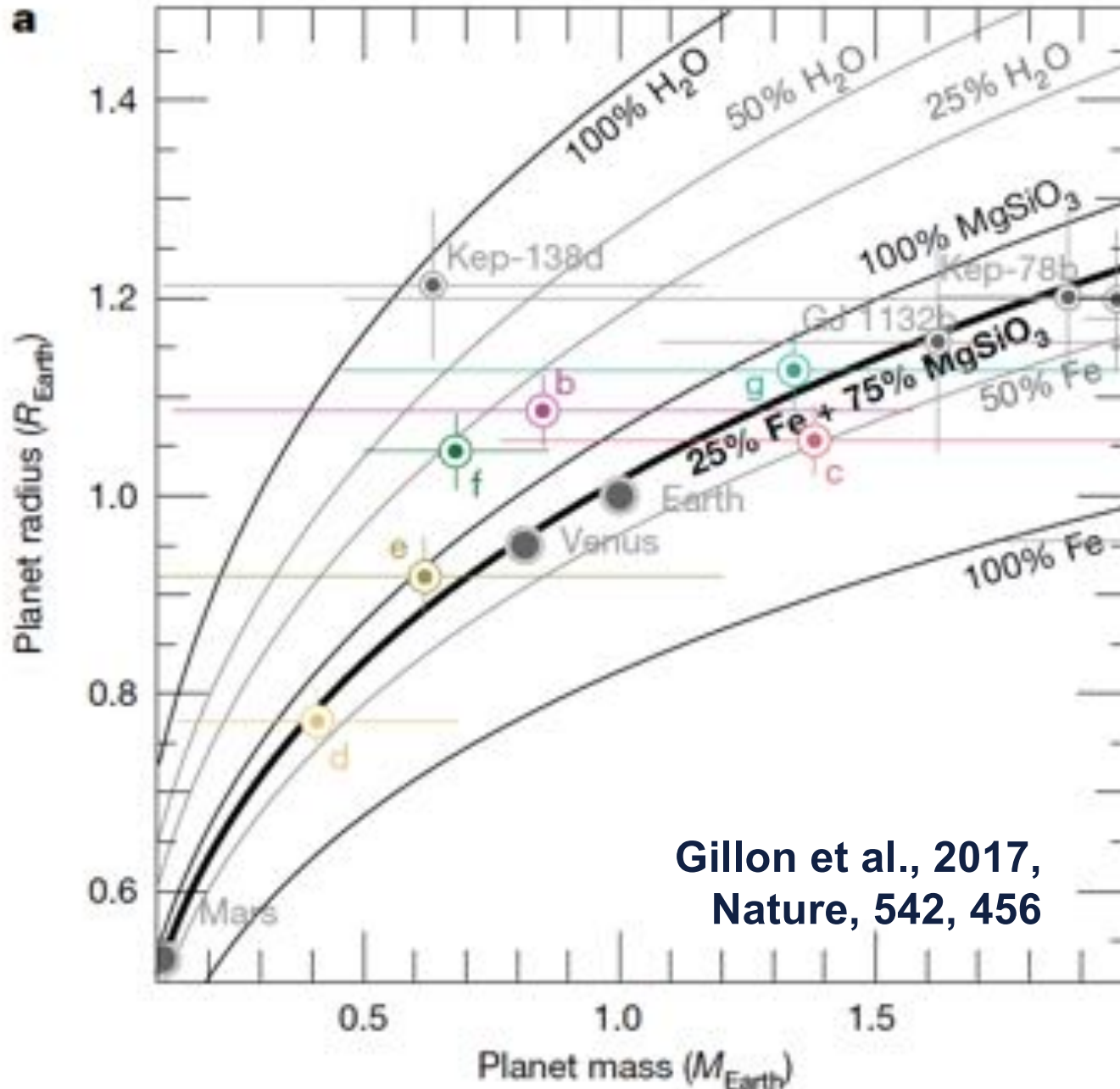
TRAPPIST-1 System



Gillon et al., 2017, Nature, 542, 456

Graphics courtesy: NASA/JPL-Caltech/ R. Hurt, T. Pyle (IPAC)

Planetary Composition

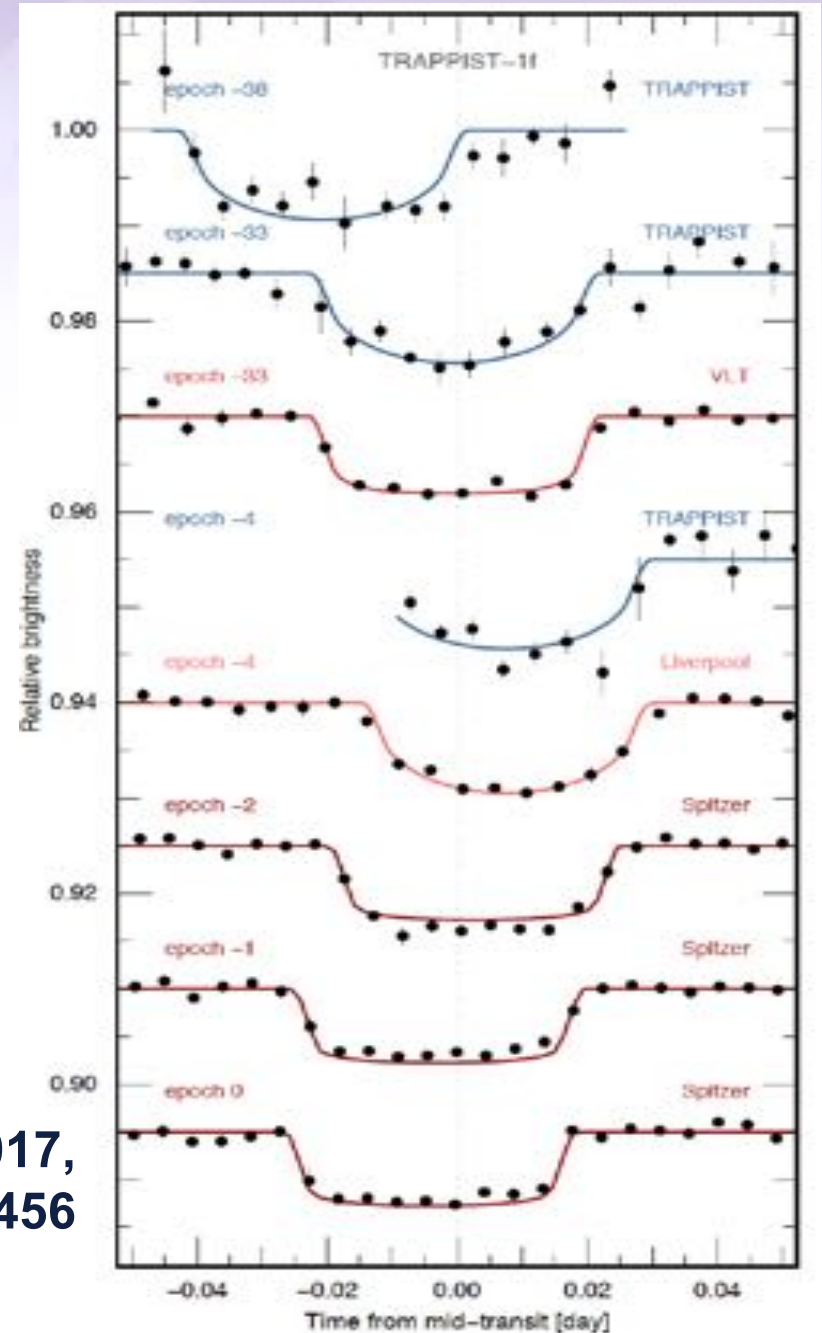


- Mass estimates for the six inner planets suggests rocky compositions.
- Precision of mass estimates not yet sufficient to constrain fraction of volatiles
- Need follow up with Hubble, Webb to better understand atmospheric conditions

Transit Timing Variations

- Inner planets form a near-resonant chain
 - Pc/Pb, Pd/Pc, Pe/Pd, Pf/Pe, Pg/Pf: 8/5, 5/3, 3/2, 3/2, 4/3
 - Substantial TTVs – from few 10s to 30 minutes
 - Favored theoretical model → disk-driven inward migration (Cresswell et al. 2006; Terquen et al. 2007)
 - Implication is planets should have a volatile rich composition (reflecting where they formed) with lower densities than Earth.

Gillon et al., 2017,
Nature, 542, 456

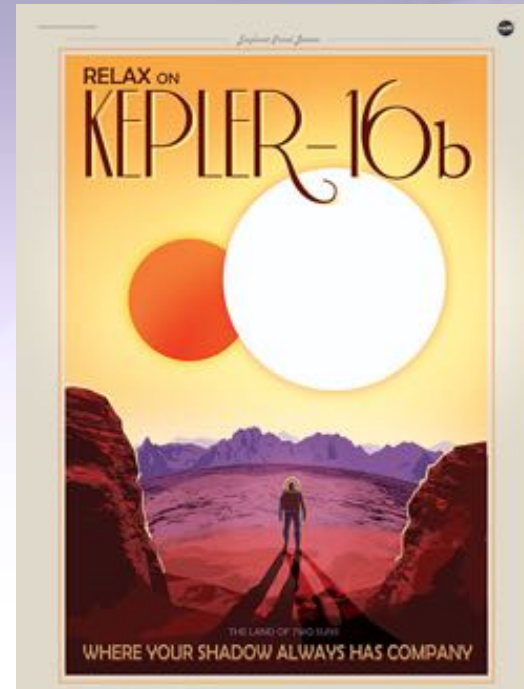


Scene from TRAPPIST-1e

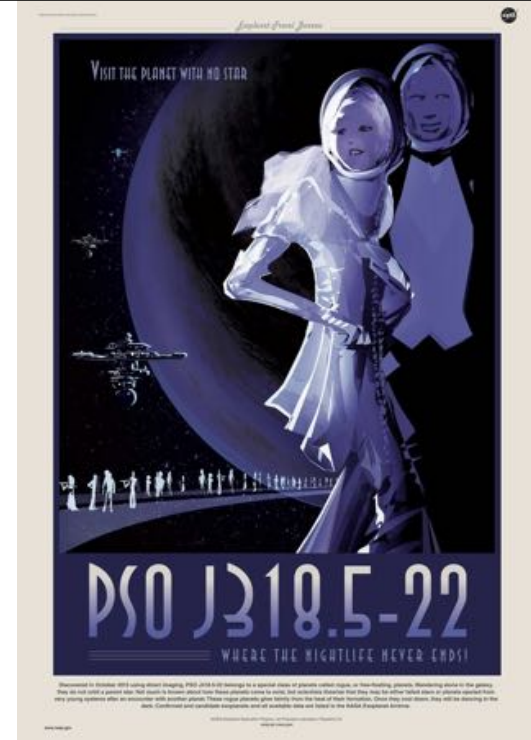
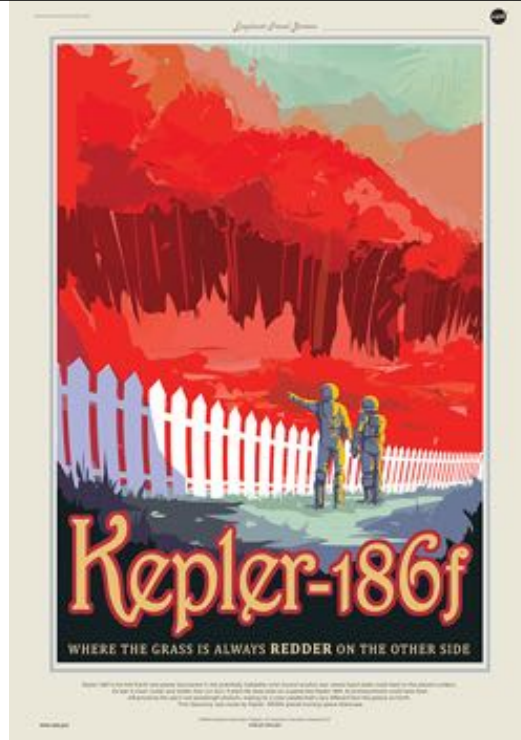


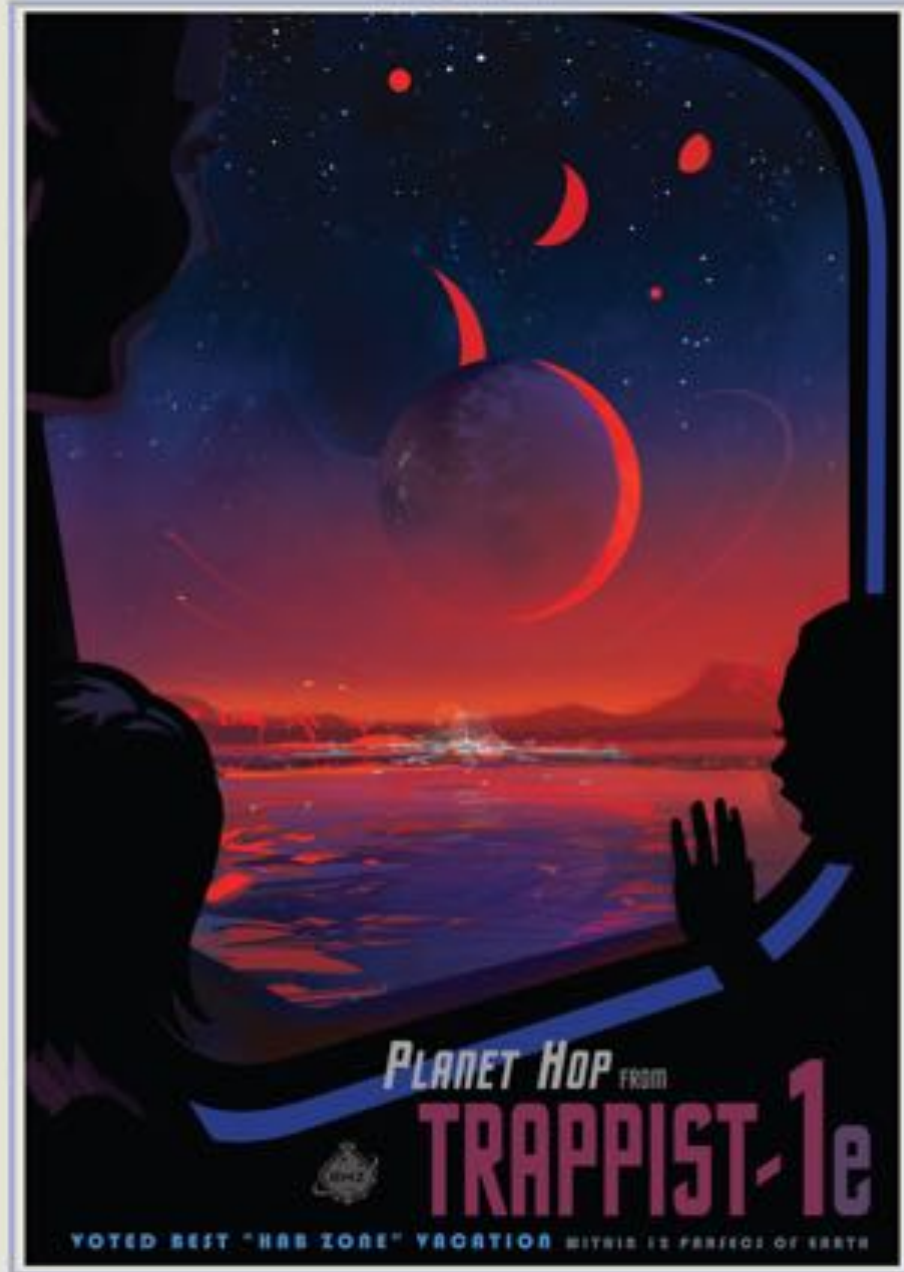
Artists's concept

Graphics courtesy: NASA/JPL-Caltech/T. Pyle (IPAC)



<https://exoplanets.nasa.gov/alien-worlds/exoplanet-travel-bureau/>





While the light years from Earth, a planet called TRAPPIST-1e offers a more relaxing view without having to go too far, courtesy of the single star-traveler vicinity of our own galaxy. But these planets are nice. They are also Earth-sized planets in an astronomical distance system nearby our own. These carbon-rich worlds could contain their own life, but they are not. Not exactly around a corner. Any of these could feature liquid water, but the planet TRAPPIST-1e, located in the TRAPPIST-1 system, the only system that also allows liquid water to flow freely on its surface. This system was discovered by the TRAPPIST-1 telescope and the Spitzer Space Telescope. TRAPPIST-1e is the only planet in the TRAPPIST-1 system. The planets also are members of the TRAPPIST-1 system. Take a planet-hopping vacation through the TRAPPIST-1 system.