First Results of

THE GIANT OUTER TRANSITING EXOPLANET MASS (GOT 'EM) SURVEY

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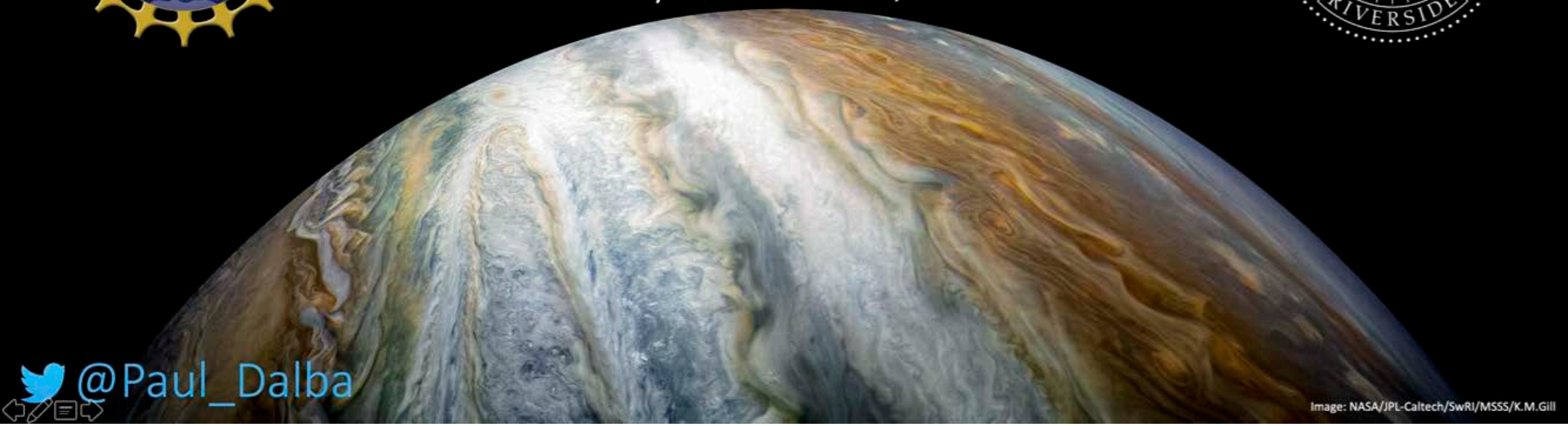

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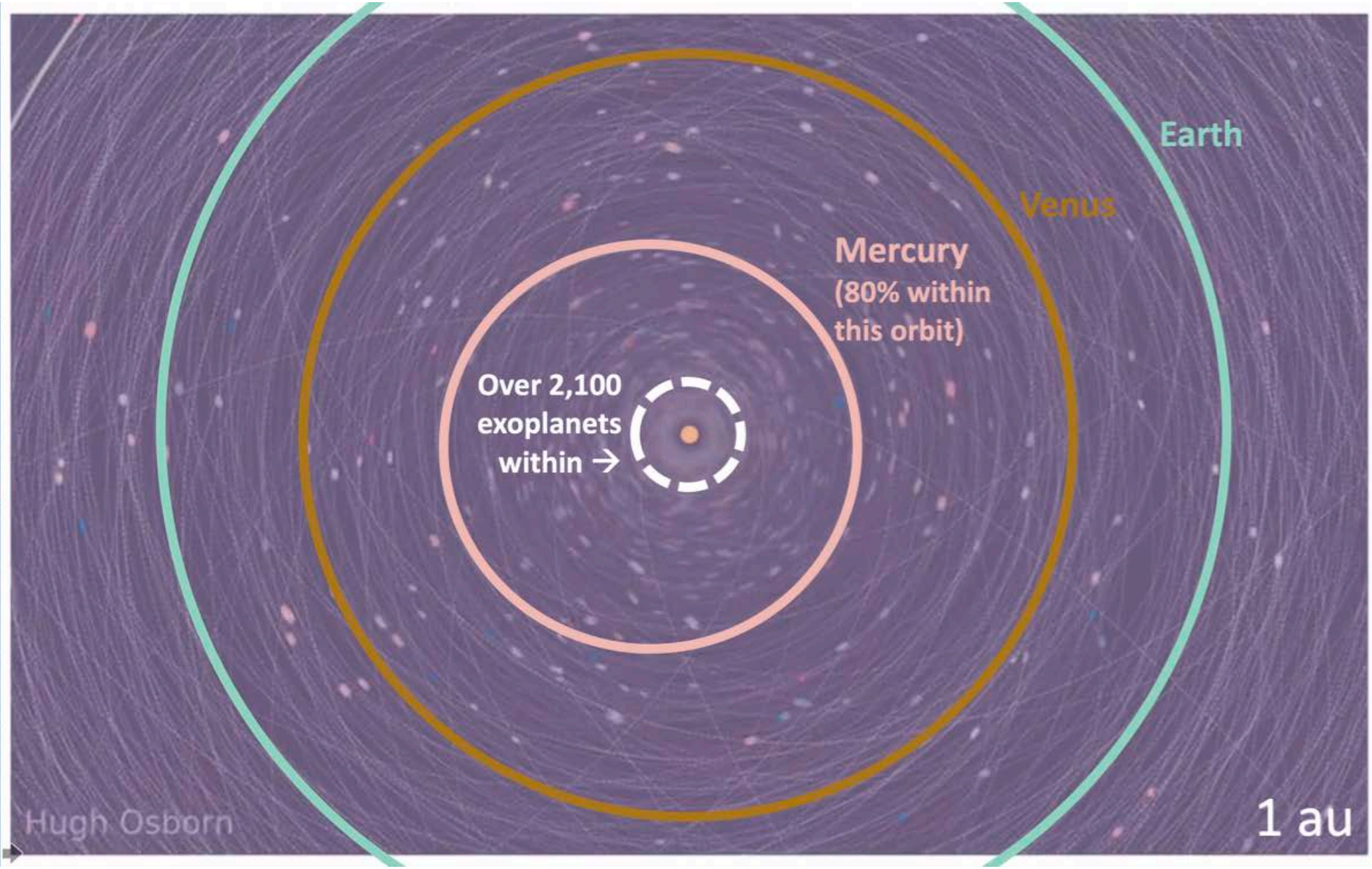
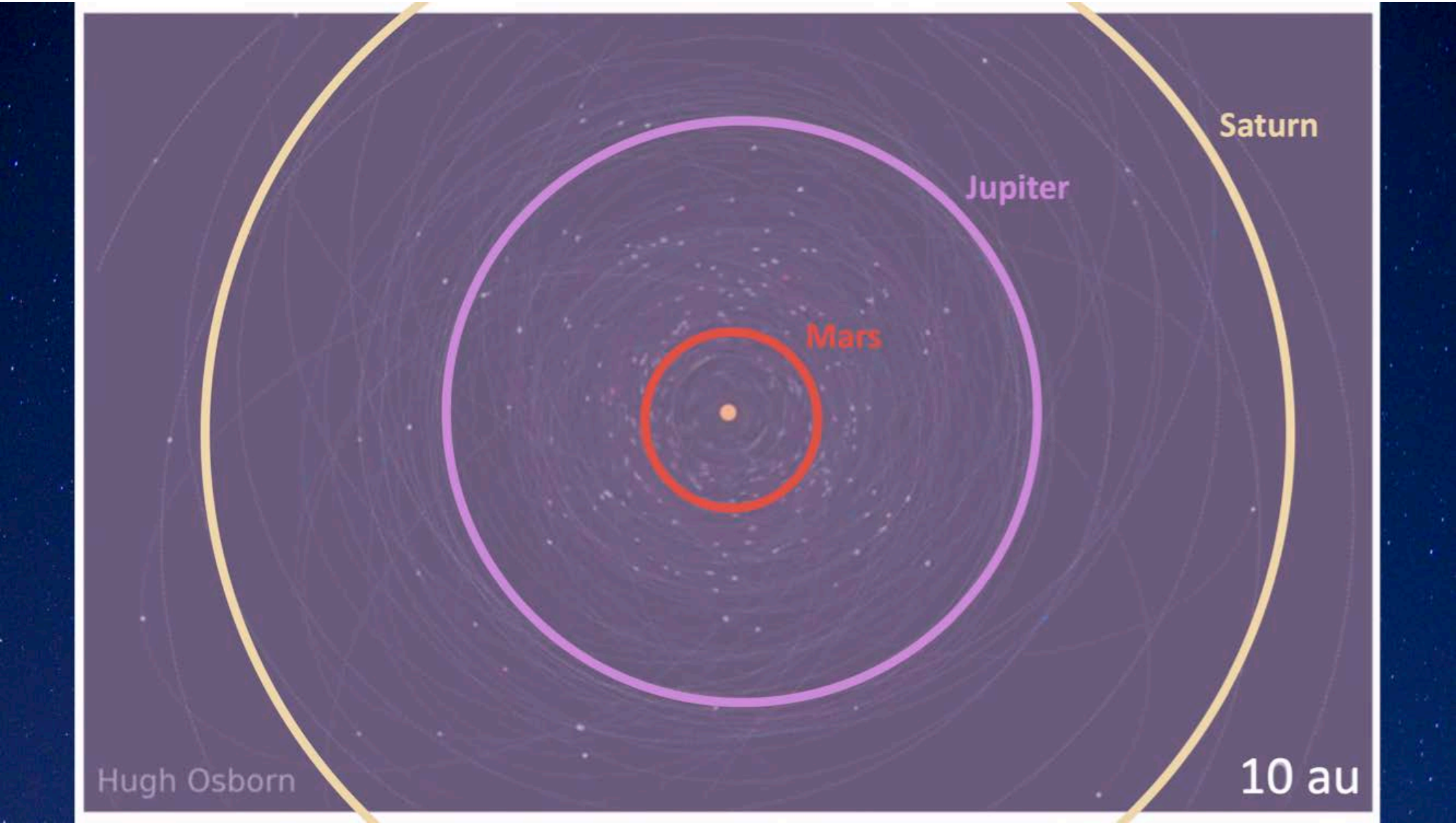
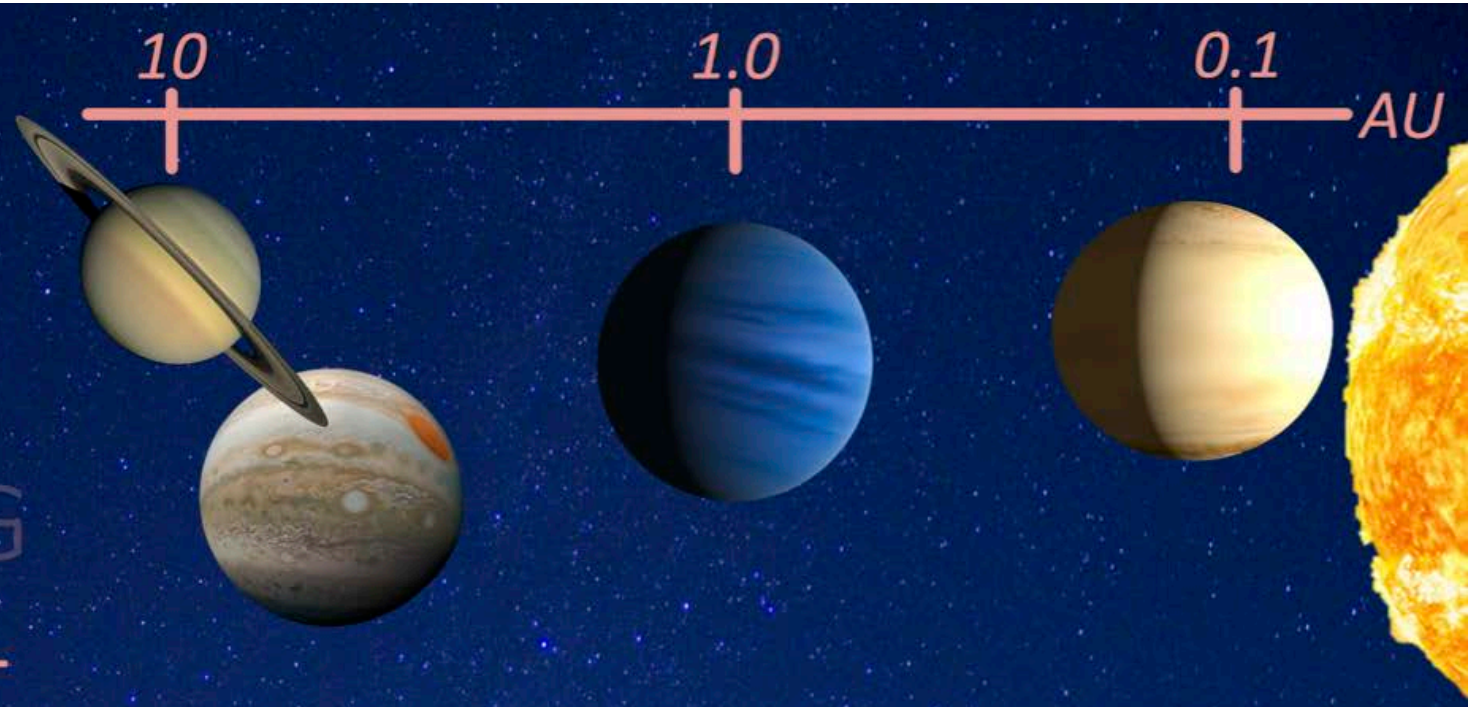
Image: NASA/JPL-Caltech/SwRI/MSSS/K.M.Gill


Earth
Venus
Mercury
(80% within
this orbit)
Over 2,100
exoplanets
within →
Hugh Osborn
1 au


Saturn
Jupiter
Mars
Hugh Osborn
10 au

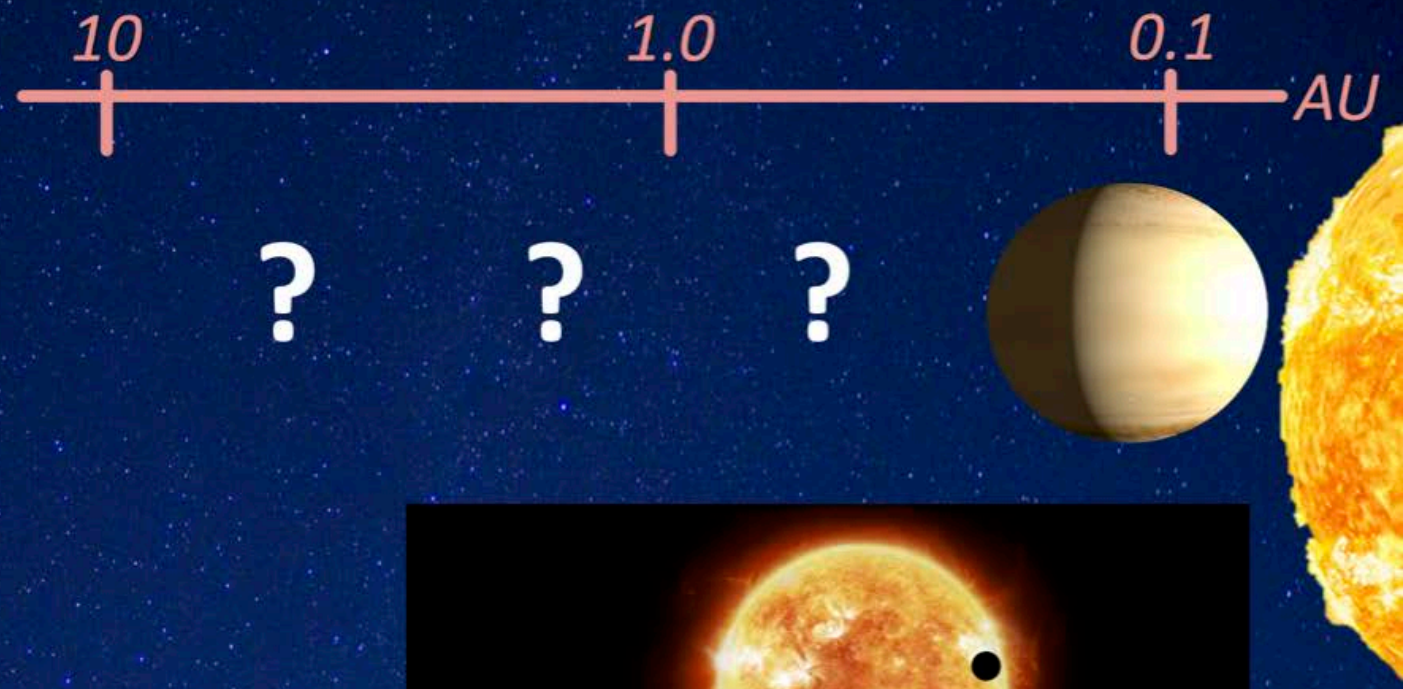
GIANT
OUTER
TRANSITING
EXOPLANET
MASS
SURVEY



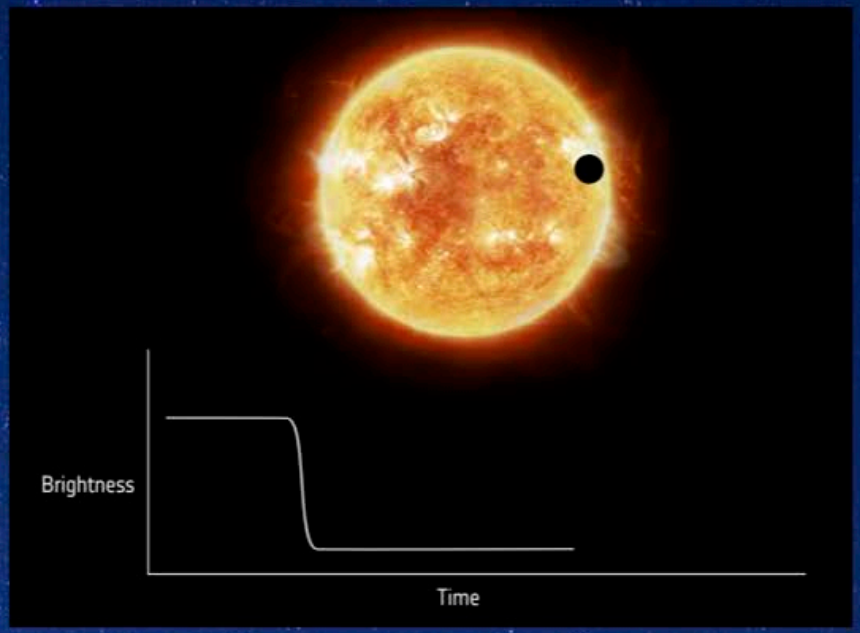
Masses are 1 piece of the puzzle of…

- How planets form
- How planets reach their current orbits
- How they affect other planets

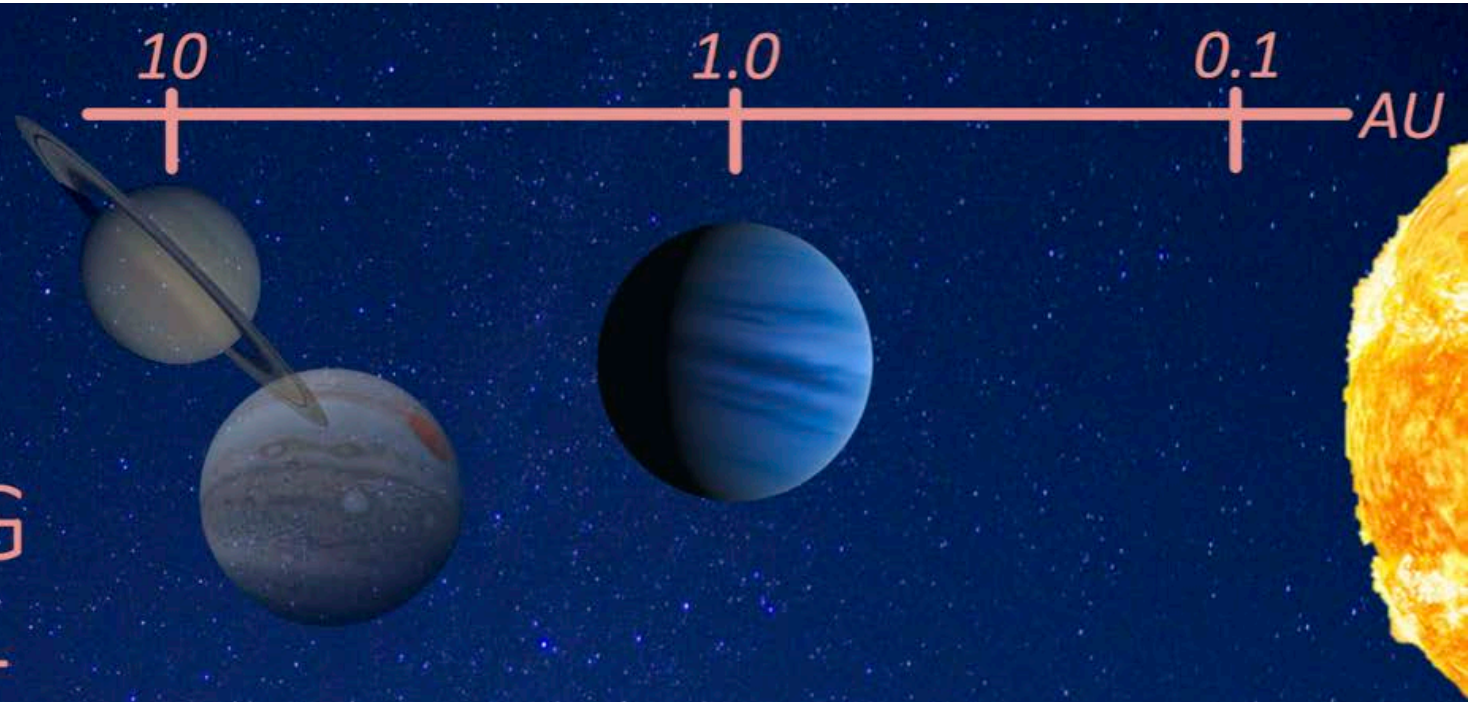
GIANT OUTER TRANSITING EXOPLANET MASS *SURVEY*



Masses and radii complete the puzzle



GIANT OUTER TRANSITING EXOPLANET MASS SURVEY

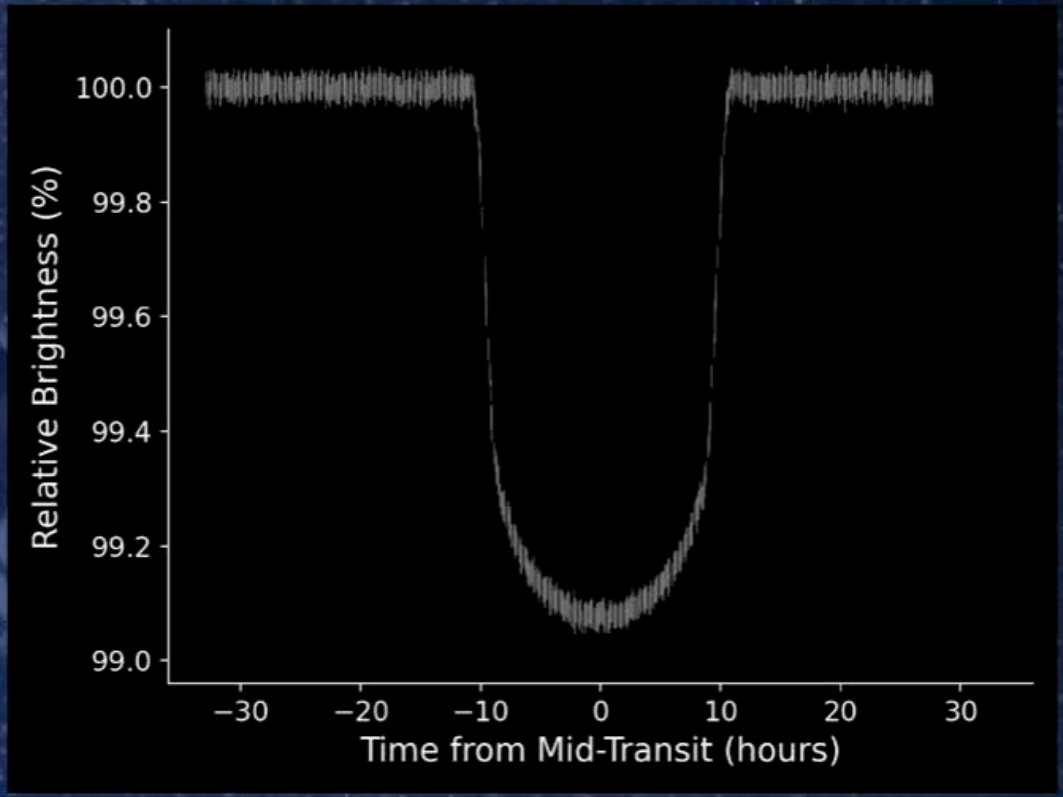


Do giant, outer planets form or migrate differently than those much closer (or much farther) from their host stars?

Kepler-1514 b

- Duration of Orbit: **218 days (0.8 AU)**
- Size: **10% larger than Jupiter**
- Temperature: **390 K (240° F)**

*How **massive** is it?*



Dalba et al. (2020)

The Mass of Kepler-1514 b

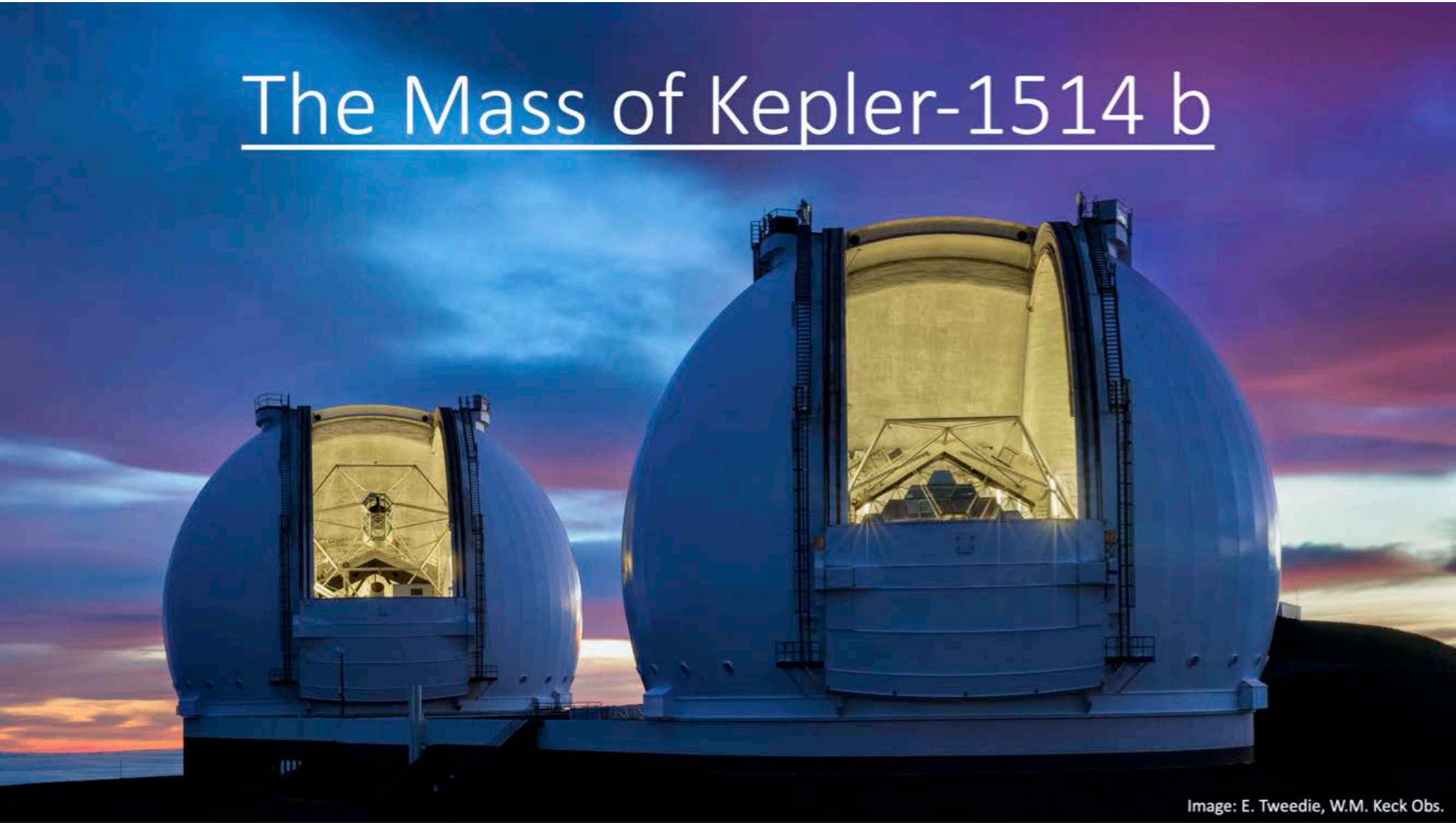
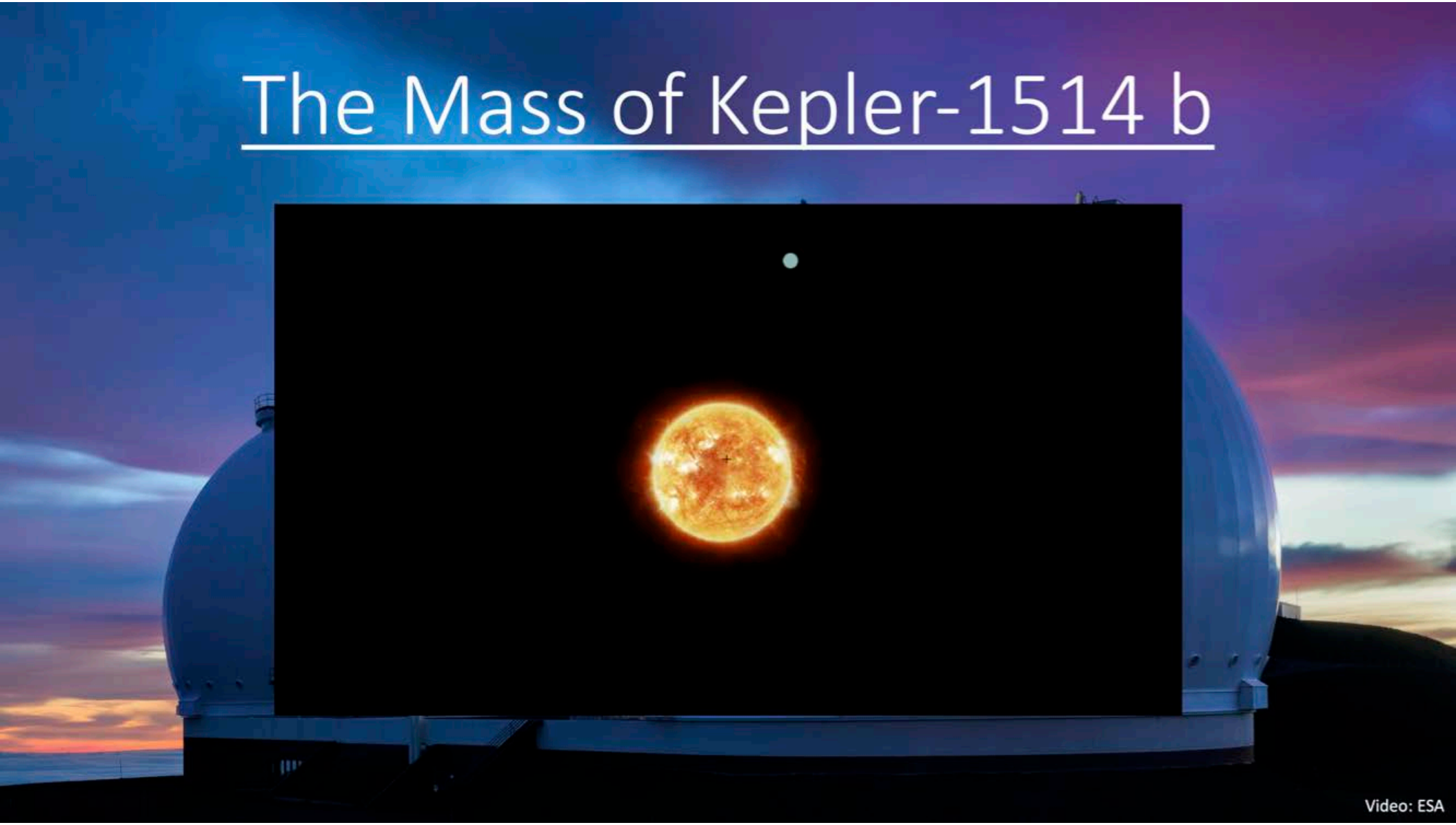


Image: E. Tweedie, W.M. Keck Obs.

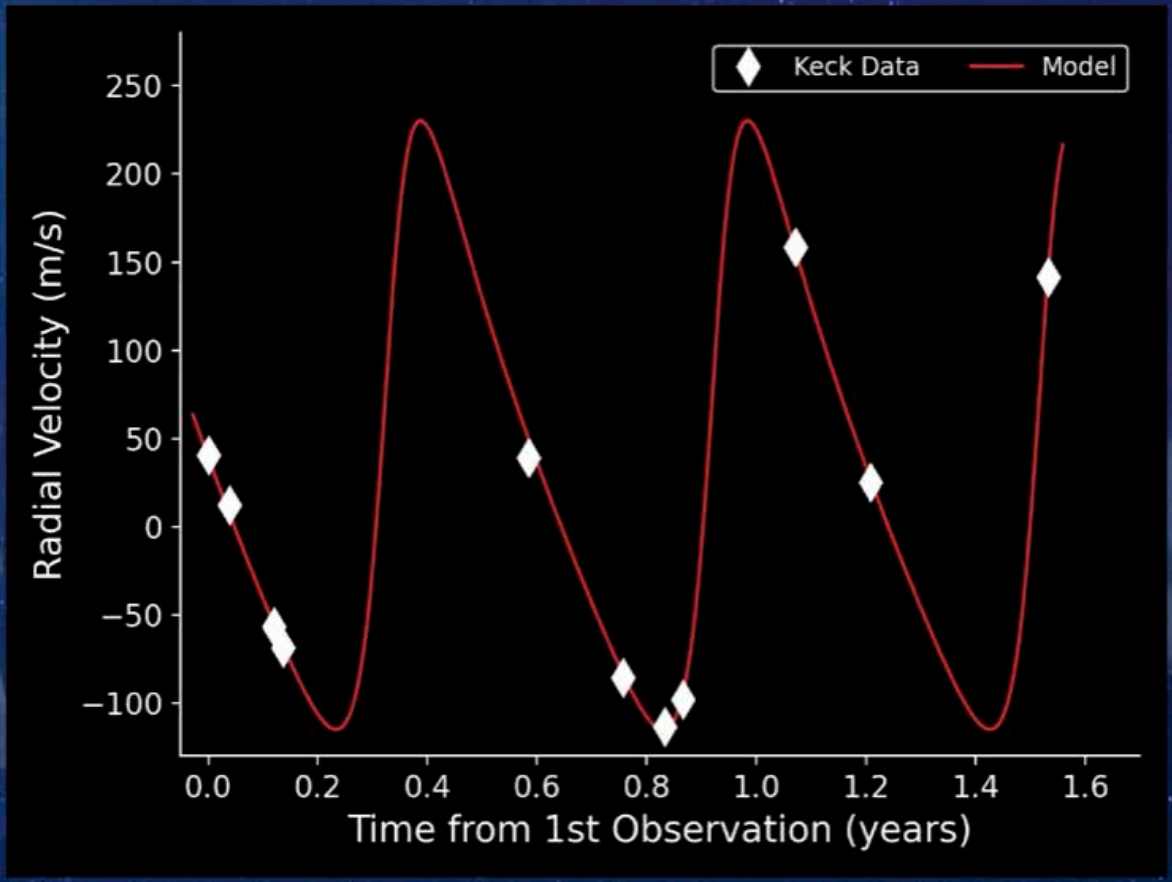
The Mass of Kepler-1514 b



The Mass of Kepler-1514 b

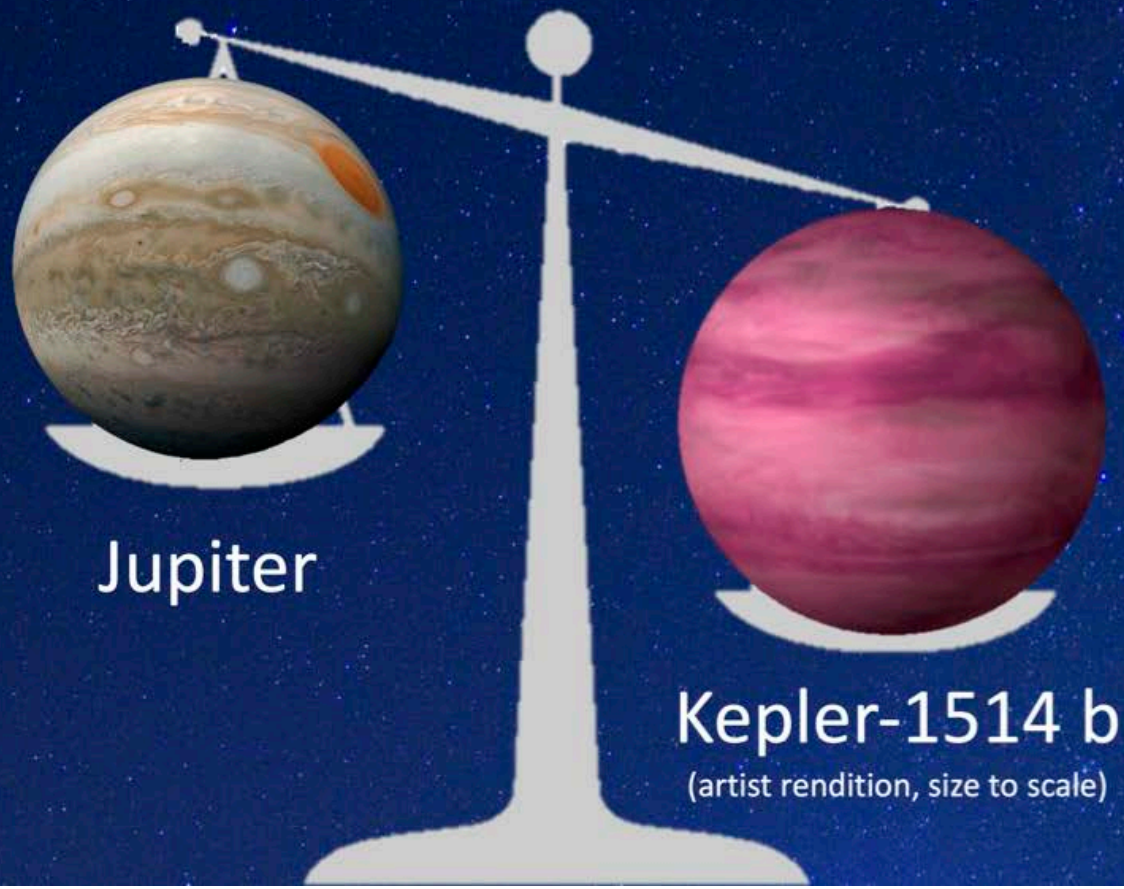
- Mass: **5.3x that of Jupiter**
- Orbital Eccentricity: **0.4**
  - *Circular orbit: 0.0*
  - *Jupiter orbit: 0.05*

What can we learn about ***Kepler-1514 b****?*



Dalba et al. (2020)

Kepler-1514 b: A Dense Giant Planet

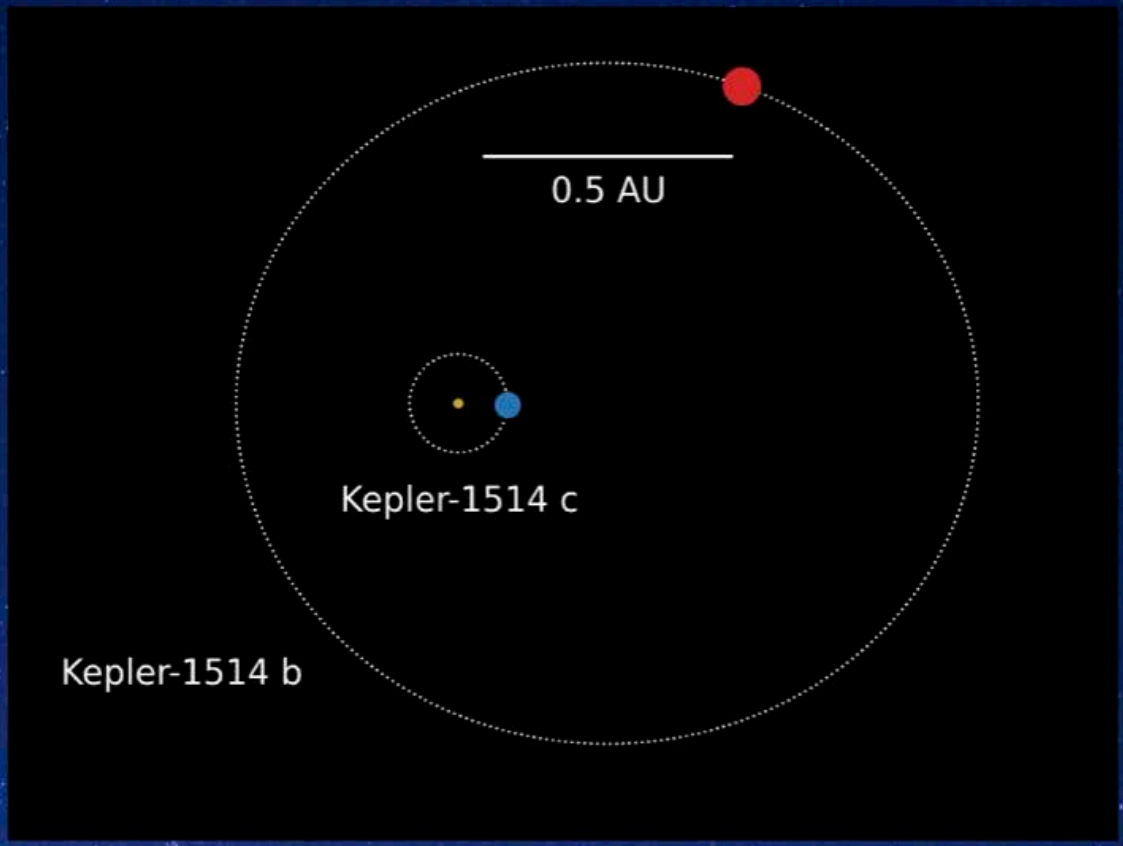


- Bulk density is 3.7x Jupiter's and 7.1x Saturn's
- 95th percentile in bulk density for outer giant exoplanets
- Motivates future work to explore interior distribution of H_2, He, and heavier elements.

Images: NASA/JPL

Kepler-1514 b: An Eccentric Migration?

- Orbital eccentricity provides a clue to planetary migration
- Survivor of planet-planet scattering?
  - Existence of inner, Earth-size planet (Kepler-1514 c) raises doubt
- Future observations can explore these scenarios.
- More mass and orbit measurements of outer, giant planets will place these planets in context of hot Jupiter and the Solar System giants.



Dalba et al. (2020)

Acknowledgements

We recognize and acknowledge the cultural role and reverence that the summit of Maunakea has within the indigenous Hawaiian community. We are deeply grateful to have the opportunity to conduct observations from this mountain.

Colleagues, Coauthors, and Collaborators

- Stephen Kane
- Howard Isaacson
- Steven Giacalone
- Andrew Howard
- Lauren Weiss
- Eddie Schwieterman
- Joey Rodriguez
- Andrew Vanderburg
- Jason Eastman
- Adam Kraus
- Trent Dupuy
- BJ Fulton
- Erik Petigura
- *California Planet Search*
- *TESS-Keck Survey*

Institutions and Funding

National Science Foundation

University of California Riverside

Check out GOT 'EM Survey 1 paper (now accepted to *A.J.*): arxiv.org/abs/2012.04676

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