

Discovery of an exoplanet quartet transiting HD 108236

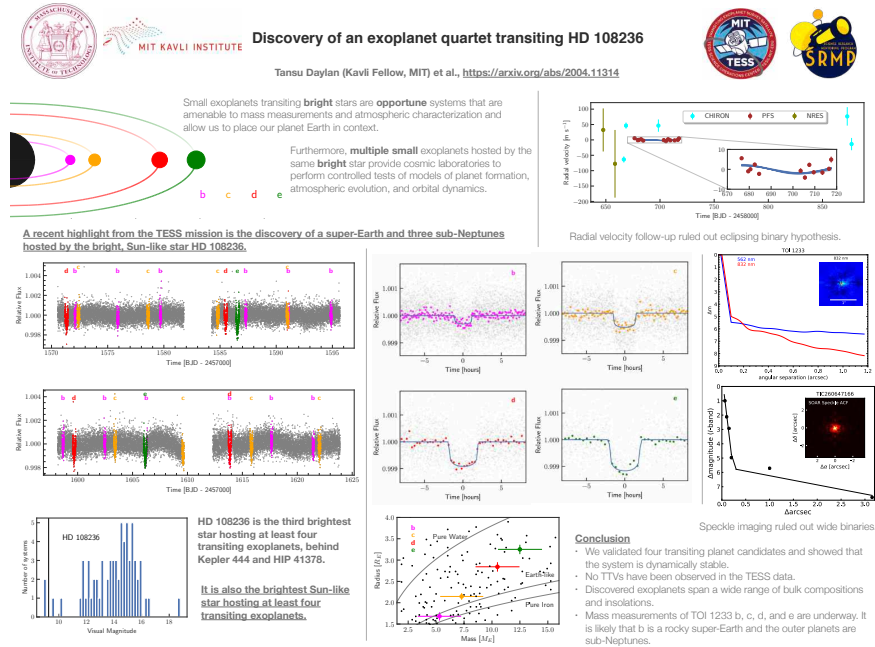
Tansu Daylan¹

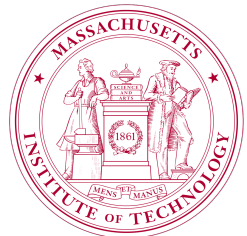
¹Massachusetts Institute of Technology

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Abstract

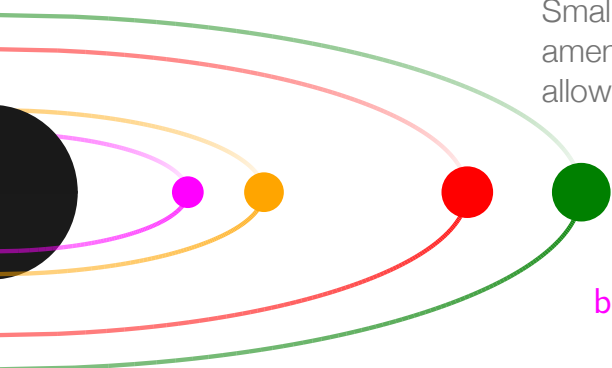
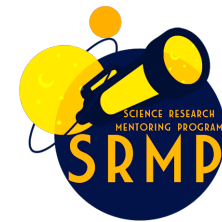
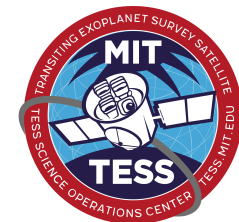
We report the discovery and validation of four extrasolar planets hosted by the nearby, bright, Sun-like (G3V) star HD 108236 using data from the Transiting Exoplanet Survey Satellite (TESS). We present transit photometry, reconnaissance and precise Doppler spectroscopy as well as high-resolution imaging, to validate the planetary nature of the objects transiting HD 108236, also known as the TESS Object of Interest (TOI) 1233. The innermost planet is a possibly-rocky super-Earth with a period of 3.79523 ± 0.00047 days and has a radius of $1.586 \pm 0.098 R_{\oplus}$. The outer planets are sub-Neptunes, with potential gaseous envelopes, having radii of 2.068 ± 0.10 – $0.091 R_{\oplus}$, $2.72 \pm 0.11 R_{\oplus}$, and 3.12 ± 0.13 – $0.12 R_{\oplus}$ and periods of 6.20370 ± 0.00064 – 0.00052 days, 14.17555 ± 0.00099 – 0.0011 days, and 19.5917 ± 0.0022 – 0.0020 days, respectively. With V and Ks magnitudes of 9.2 and 7.6, respectively, the bright host star makes the transiting planets favorable targets for mass measurements and, potentially, for atmospheric characterization via transmission spectroscopy. HD 108236 is the brightest Sun-like star in the visual (V) band known to host four or more transiting exoplanets. The discovered planets span a broad range of planetary radii and equilibrium temperatures, and share a common history of insolation from a Sun-like star ($R_{\oplus} = 0.888 \pm 0.017 R_{\oplus}$, $T_{\text{eff}} = 5730 \pm 50$ K), making HD 108236 an exciting, opportune cosmic laboratory for testing models of planet formation and evolution.





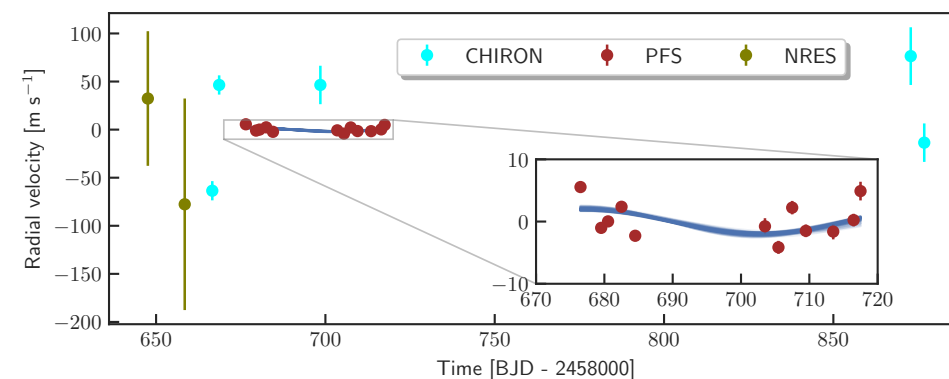
TESS discovery of a super-Earth and three sub-Neptunes hosted by the bright, Sun-like star HD 108236

Tansu Daylan (Kavli Fellow, MIT) et al., <https://arxiv.org/abs/2004.11314>



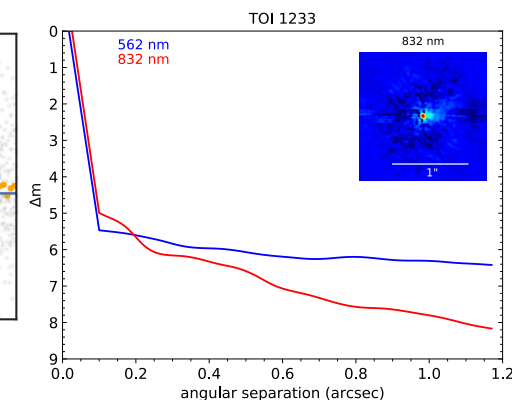
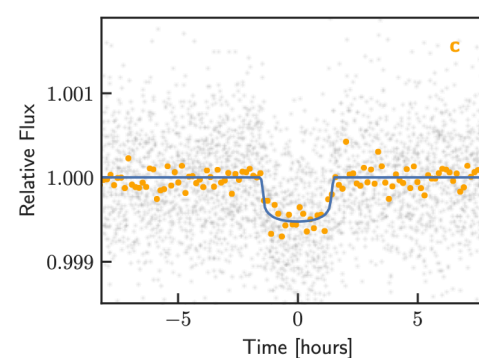
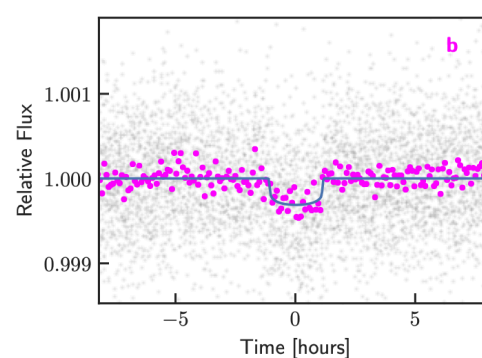
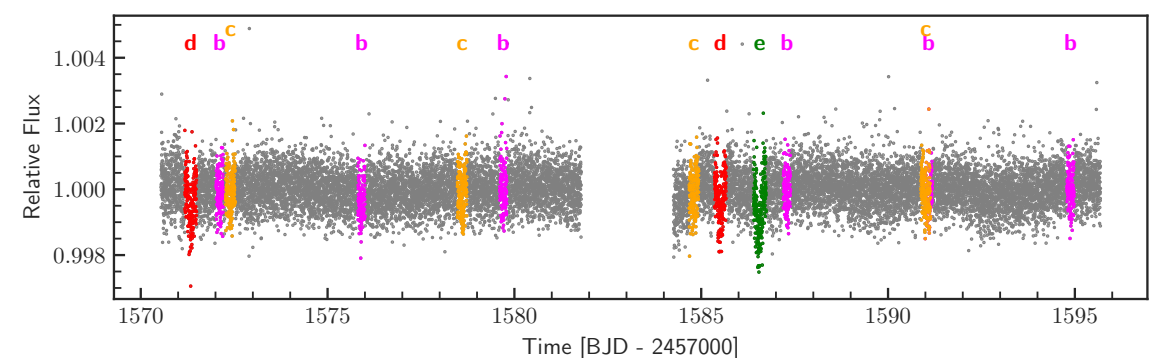
Small exoplanets transiting **bright** stars are **opportune** systems that are amenable to mass measurements and atmospheric characterization and allow us to place our planet Earth in context.

Furthermore, **multiple small** exoplanets hosted by the same **bright** star provide cosmic laboratories to perform controlled tests of models of planet formation, atmospheric evolution, and orbital dynamics.

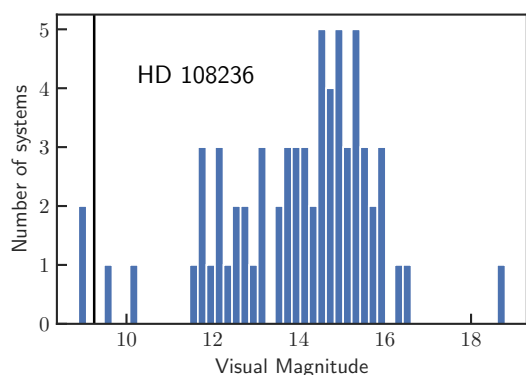
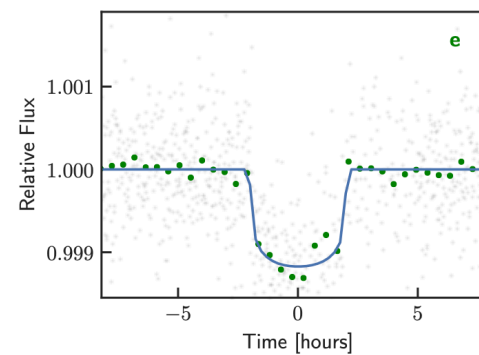
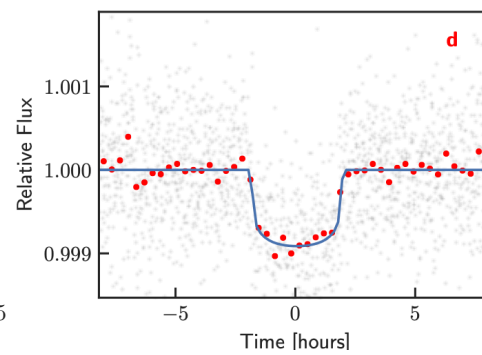
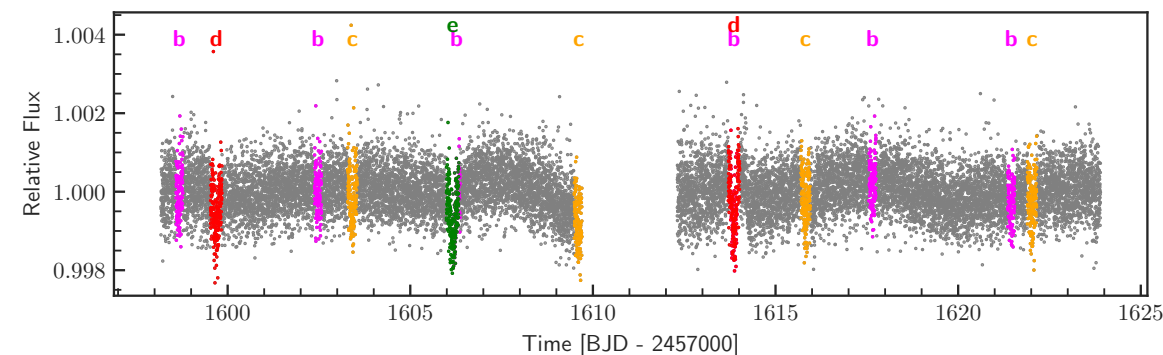


Radial velocity follow-up ruled out eclipsing binaries with similar brightness.

A recent highlight from the TESS mission is the discovery of the exoplanet quartet transiting HD 108236.

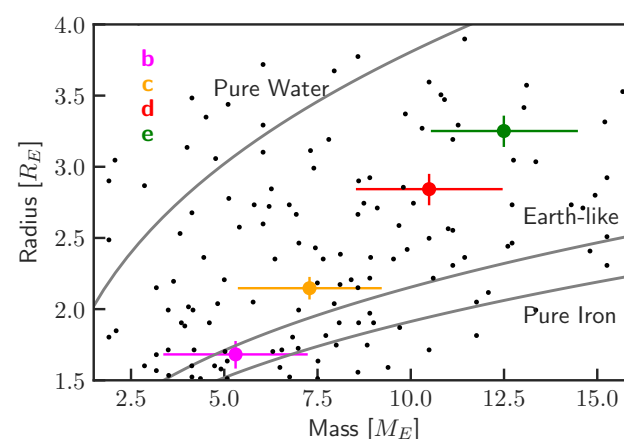


High resolution imaging ruled out wide binaries.



HD 108236 is the third brightest star hosting at least four transiting exoplanets, behind Kepler 444 and HIP 41378.

It is also the brightest Sun-like star hosting at least four transiting exoplanets.



Conclusion

- No TTVs have been observed in the TESS data.
- The system has been shown to be dynamically stable.
- Mass measurements of TOI 1233 b, c, d, and e are underway. It is likely that b is a rocky super-Earth and the outer planets are sub-Neptunes.
- The exoplanets span a wide range of bulk compositions and insulations.