

TOI-6478b

Building bridges between cold exo-Neptunes and the Solar System Ice Giants

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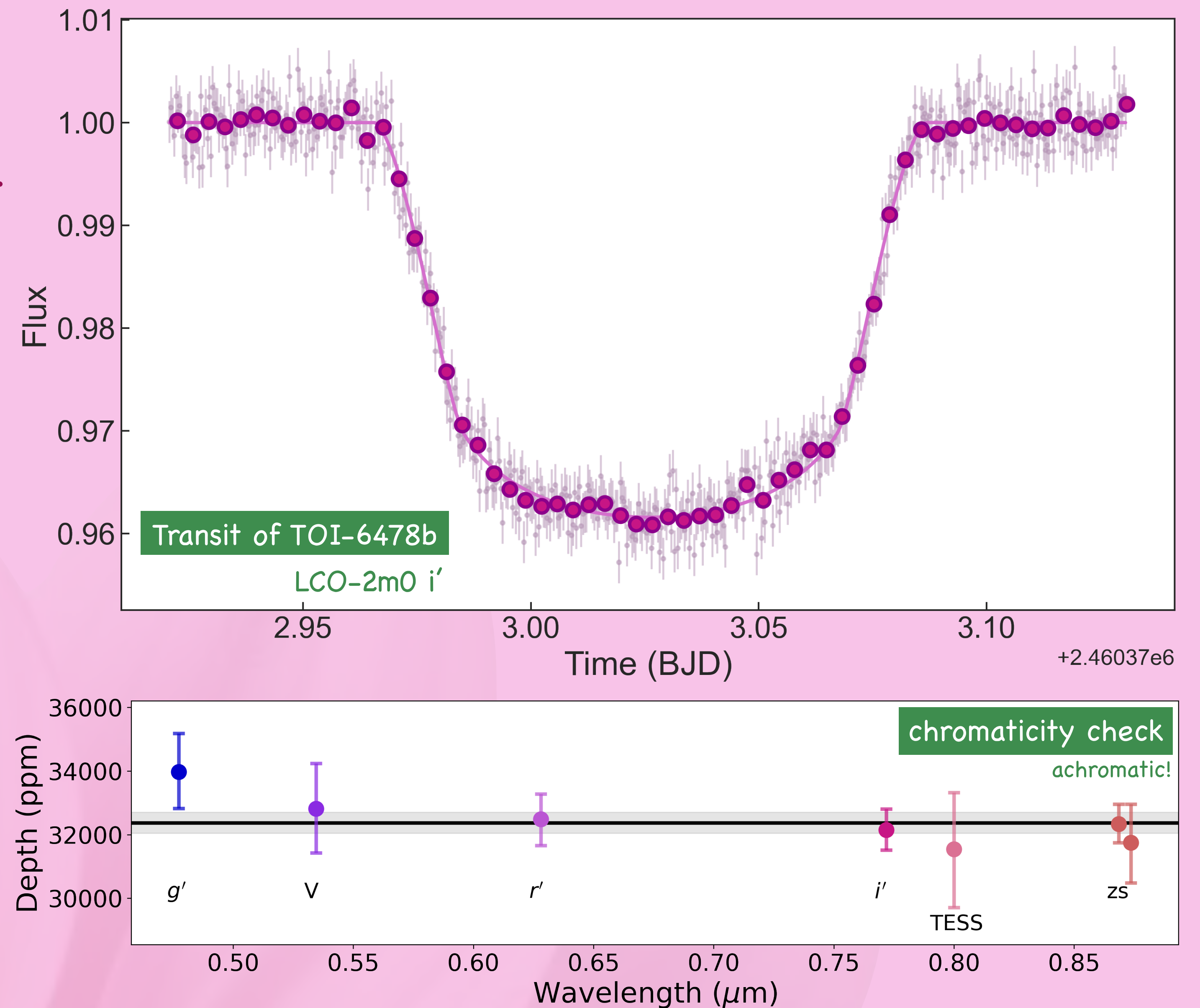
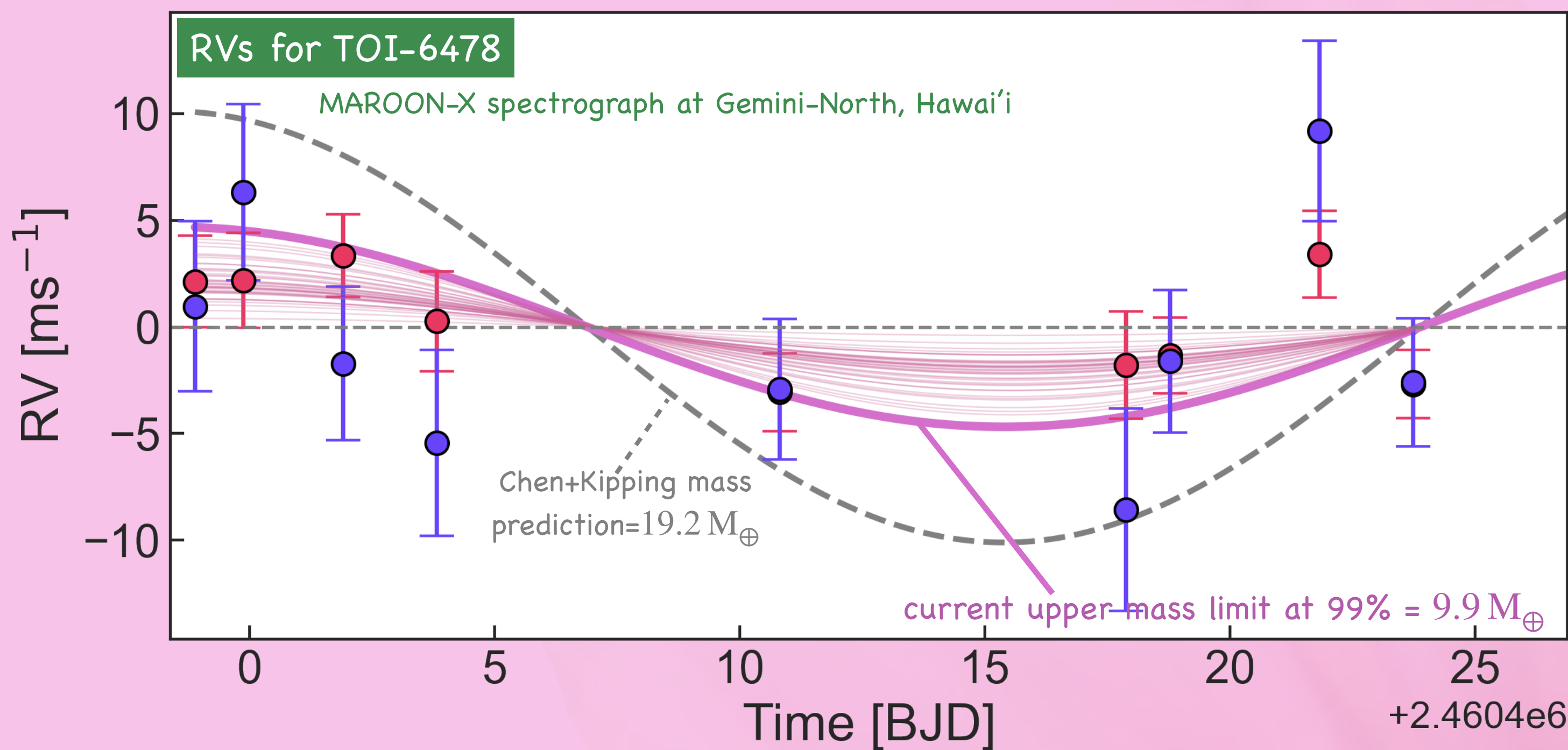
Scott et al. (submitted)

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Planet Confirmation

- *TESS duo-transits in 2019 + 2023 with a duration of 3hrs.
- *Full transit event observed with LCO-2m0 and LCO-1m0 at Siding Springs Observatory on 2024-03-03.
- *Observed in 5 bands, transit is achromatic.
- *Confirmation of orbital period $\rightarrow$ 34.005 d.
- *Upper mass limit from RVs.



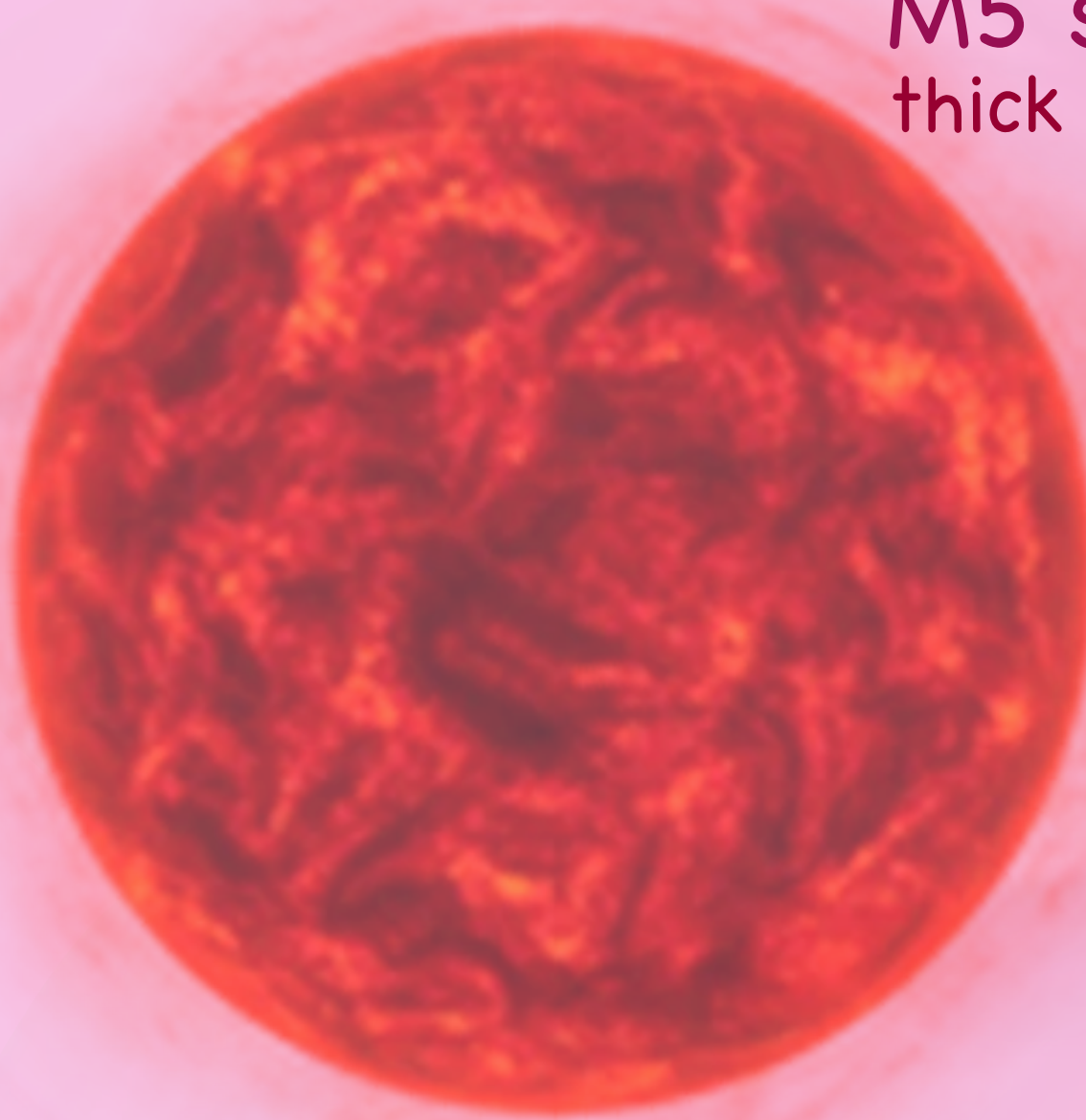
Know thy star, know thy planet

$$R_{\star} = 0.23 R_{\odot}$$

$$M_{\star} = 0.23 M_{\odot}$$

$$T_{\text{eff}} = 3230 \text{ K}$$

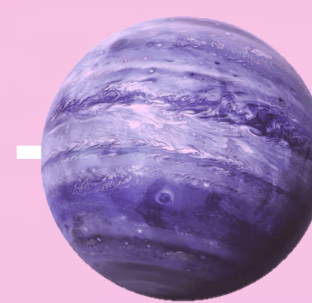
From SED fitting & Gaia DR3 parallax, and mass-radius relations



M5 star
thick disk

From stellar spectra:
optical spectroscopy-
Shane/Kast
(Miller&Stone1994)

~Neptune
-sized



$$R_P = 4.6 R_{\oplus}$$

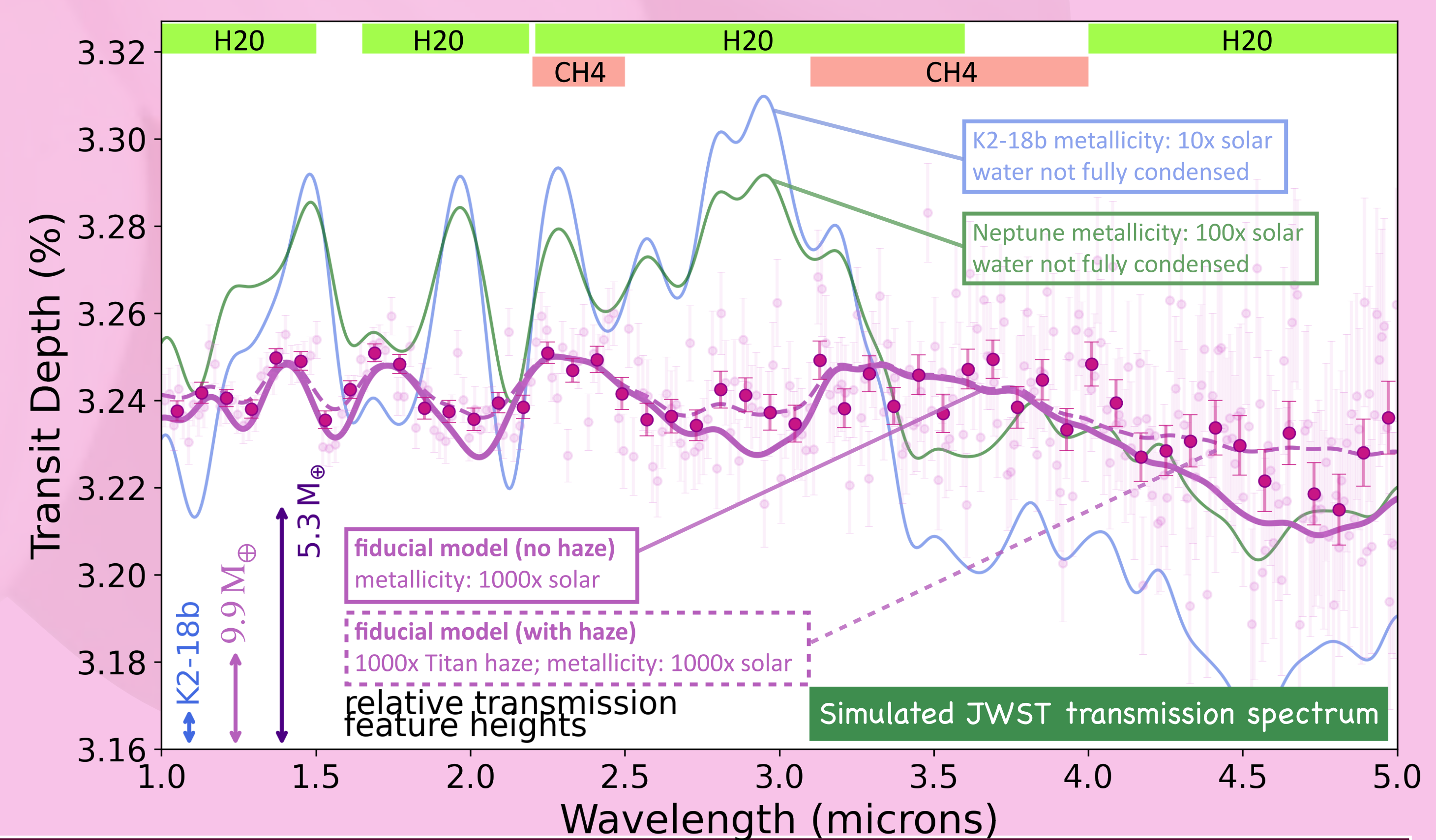
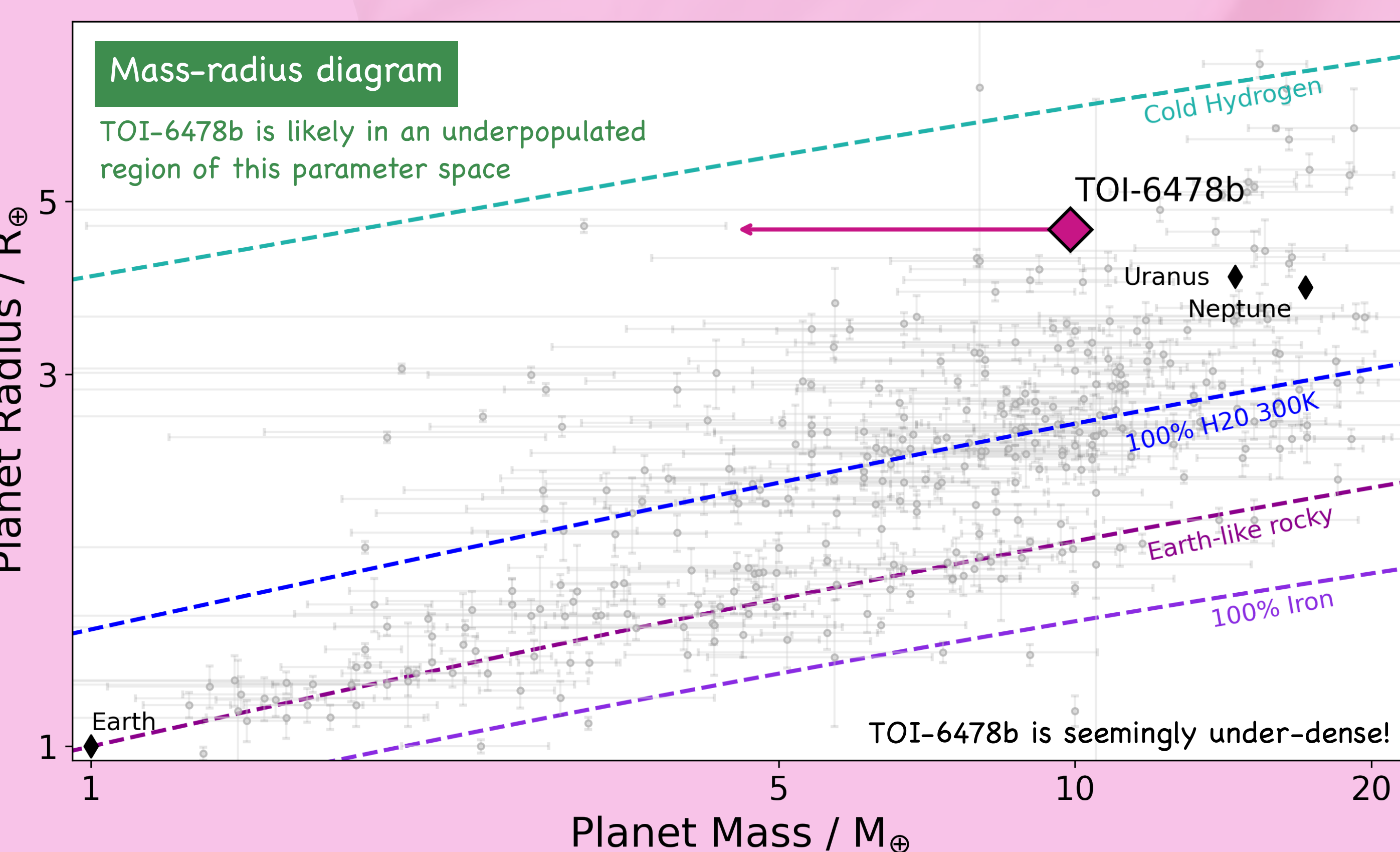
$$T_{\text{eq}} = 205 \text{ K}$$

$$P = 34.005 \text{ d}$$

$$M_P \leq 9.9 M_{\oplus}$$

From global modelling:
allesfitter (Günther
&Daylan2019, 2021)

TOI-6478b in context



	TOI-6478b	K2-18b	Mars	Neptune
P/d	34	33	687	60195
T_{eq}/K	205	284	210	47
$R_p/R_{\star}$	4.6	2.4	0.5	3.8
a/ice	0.9	0.5	1	20

Ice line @ 210K
[Ice line is 1.5 au for Solar System - approx the distance of Mars]

- *TOI-6478b formed **beyond the ice line**.
- *Thanks to its M5 host star, it has a **cold temperature (205K)** despite a relatively **short orbital period of 34d**.
- *Its seemingly **low density** further **enhances its transmission signal**, permitting **detailed atmospheric characterisation** with JWST.
- *It can provide a clear window into the **composition and dynamics** of a **cold, Neptune-like atmosphere**.
- *TOI-6478b can therefore build a **bridge between the cold exo-Neptune population and the Solar System Ice giants**.