

Gliese 12 b

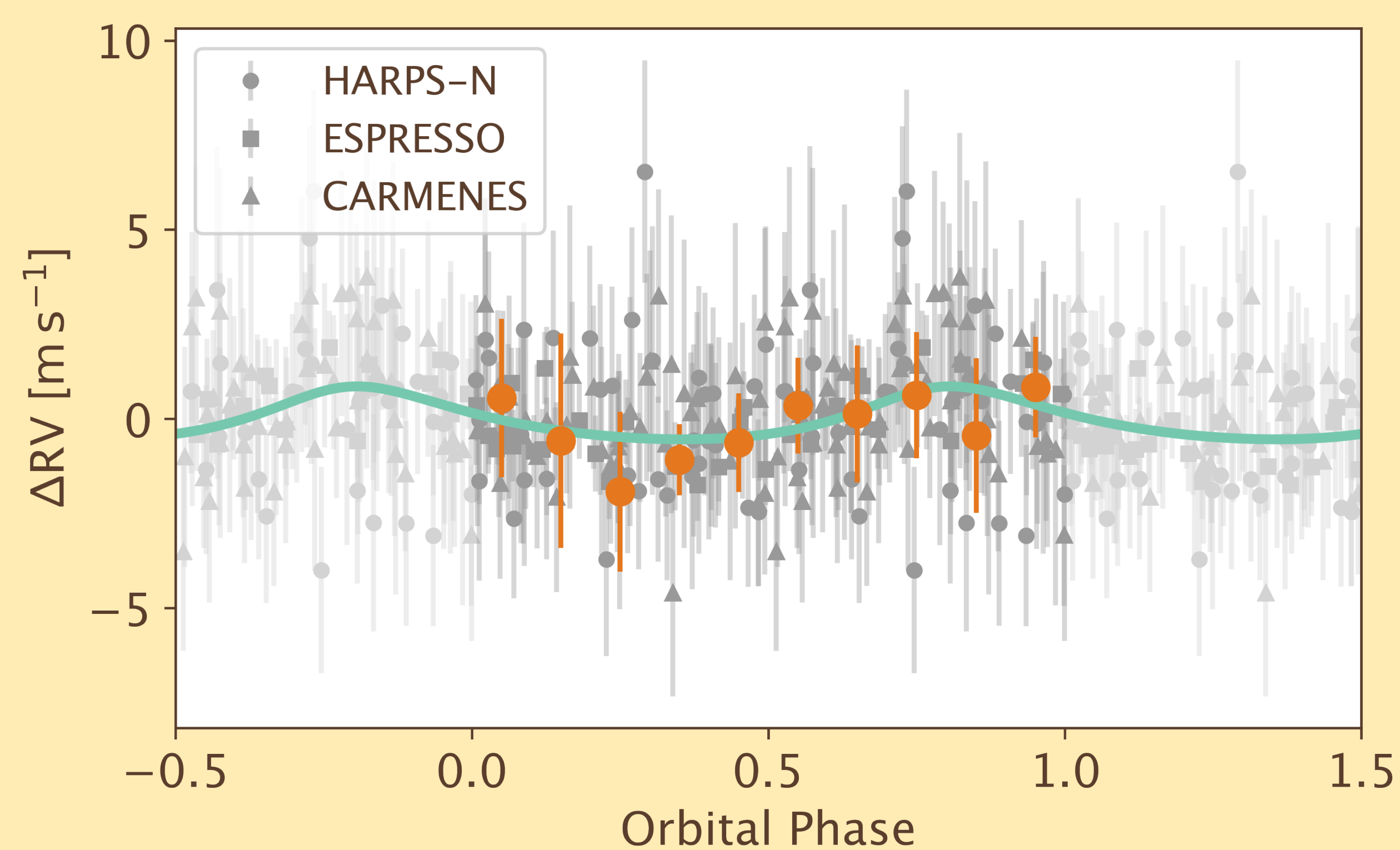
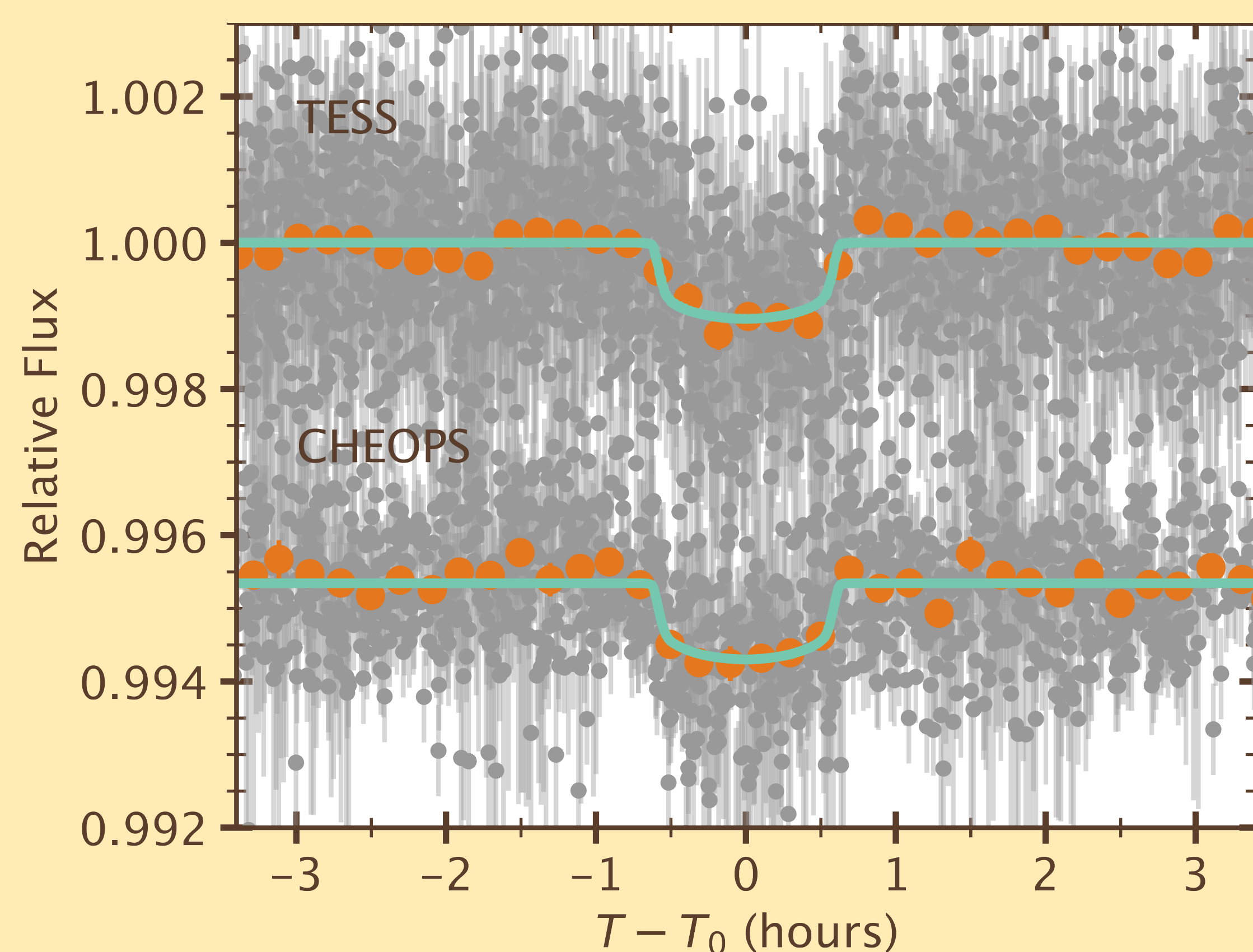
The mass of an exo-Venus, as revealed by HARPS-N, ESPRESSO, and CARMENES

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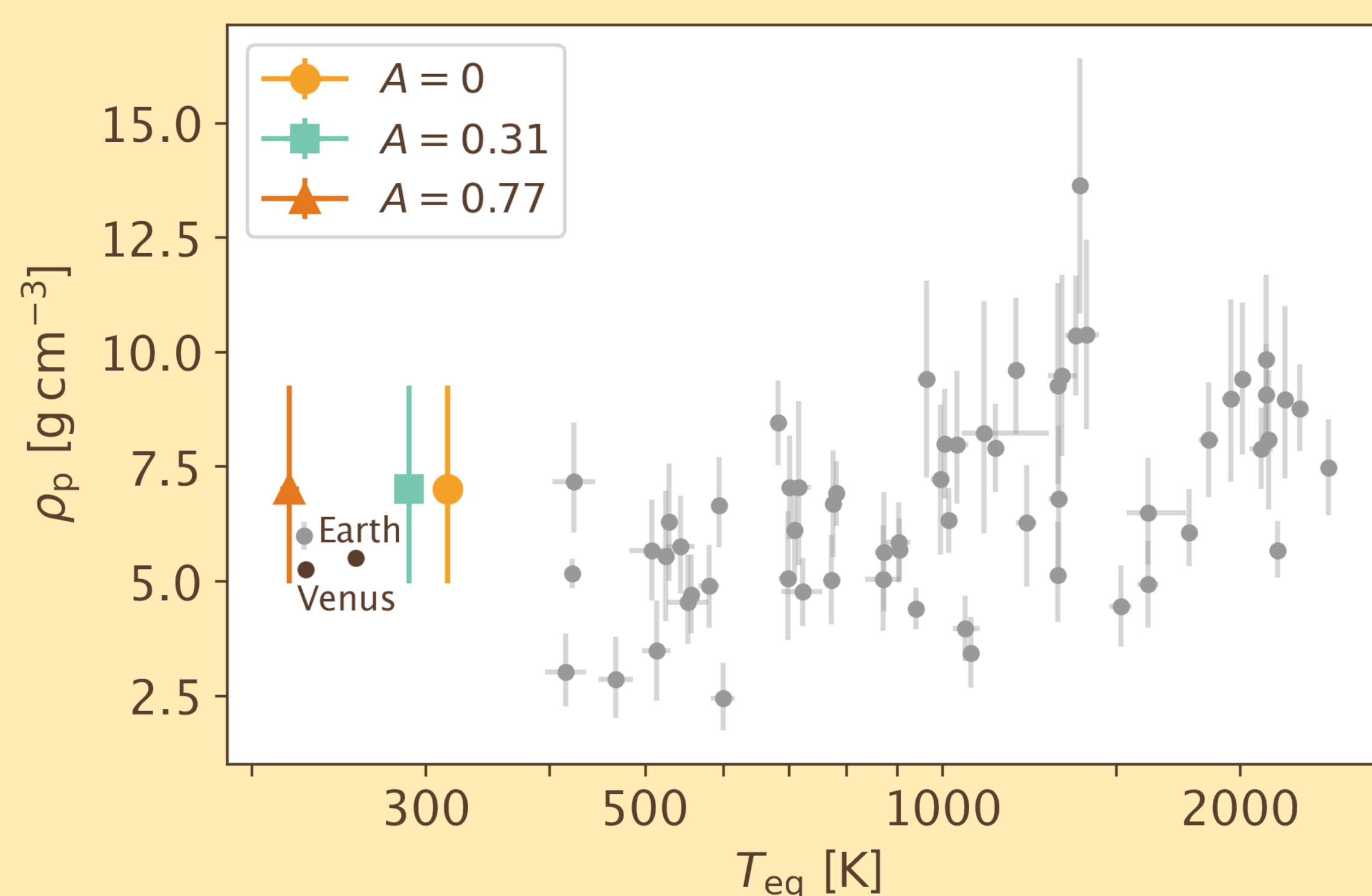
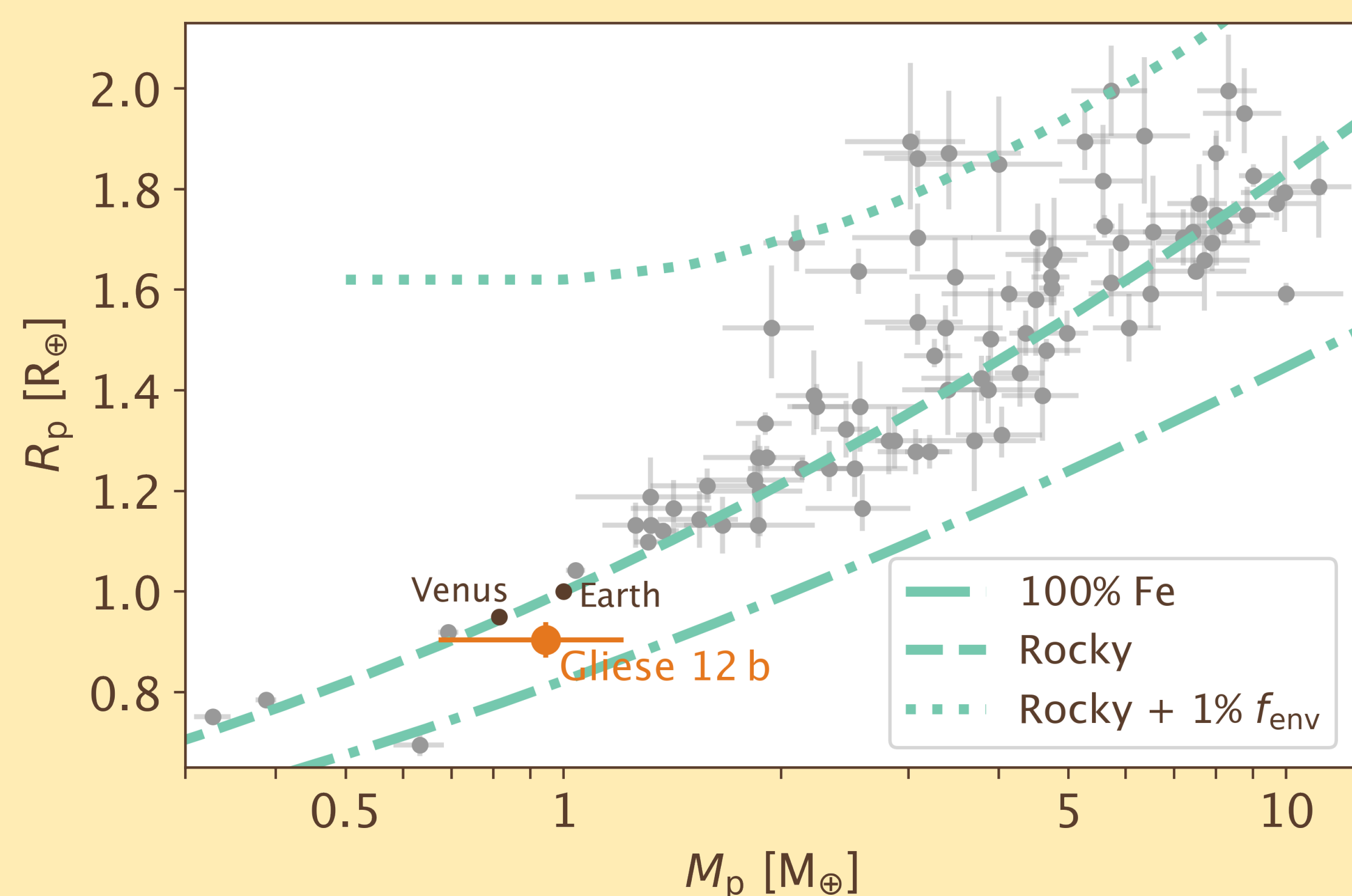
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Submitted to MNRAS [1]

Gliese 12 is a nearby (~ 12 pc), metal-poor ($[\text{Fe}/\text{H}] = -0.32 \pm 0.06$) M dwarf that was found to host a Venus-sized planet with an orbital period of ~ 12.76 days [2,3]. We analysed over 137 days of TESS, CHEOPS and MuSCAT2/3 photometry [2,3] using juliet [4] and found an updated radius value of $R_p = 0.904^{+0.037}_{-0.034} R_\oplus$.



To obtain a **mass**, we fit a Keplerian and a quasi-periodic GP to a dataset of ~ 200 RV measurements from HARPS-N, ESPRESSO, and CARMENES using pyaneti [5,6]. P and T_0 were informed by the results of the photometric fit. We found an RV semi-amplitude of $K = 0.70^{+0.19}_{-0.20} \text{ m s}^{-1}$ (3.6σ) and a mass of $M_p = 0.95^{+0.26}_{-0.27} M_\oplus$ (3.5σ). These results were independently confirmed by a joint fit using pyorbit [7,8].

Below, we show Gliese 12 b plotted alongside small ($R_p \leq 2 R_\oplus$) targets from the PlanetS catalogue [9]. The mass and radius we obtained result in a density of $\rho_p = 7.0^{+2.3}_{-2.1} \text{ g cm}^{-3}$, meaning Gliese 12 b has a similar density to the Earth ($\rho_\oplus = 5.5 \text{ g cm}^{-3}$) within 2σ . This planet has an equilibrium temperature of $T_{\text{eq}} = 315 \pm 7 \text{ K}$, assuming a Bond albedo of zero, meaning it occupies a **unique** region in density- T_{eq} parameter space, populated only by the likes of LHS 1140 b [10] and the TRAPPIST-1 planets [11]. We find that Gliese 12 b has a **predominantly rocky interior** and that it is unlikely to have retained any of its primordial gaseous envelope due to the X-ray history of the host star [1].



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References:

[1]Turner, Eschen, Murgas et al. (submitted), [2]Dholakia et al. (2024), [3]Kuzuhara et al. (2024), [4]Espinoza et al. (2019), [5,6]Barragán et al. (2019, 2022), [7,8]Malavolta et al. (2016, 2018), [9]Parc et al. (2024), [10]Cadieux et al. (2024), [11]Agol et al. (2021)



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