Hundreds of **TESS Exoplanets** Might Be **Larger** than We Thought

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— In a study of the transit depth accuracy of TESS-Gaia Light Curves (TGLC), we discovered a population-wide bias of planet radii in the literature. Validated with Kepler, TGLC reveals a median 6% underestimation in the published radii of more than 200 TESS planets.

The doubt

Since the launch of TESS, people have worried about light contamination: the large TESS pixels blend targets with nearby stars and reduce both the precision and accuracy of the light curves.

The TESS-Gaia Light Curve (TGLC; Han & Brandt 2023) was designed to alleviate this problem. Using point-spread functions, TGLC models and removes background stars in the FFIs using Gaia DR3 as priors. The resulting light curves achieve higher photometric precision and more reliable signal amplitudes.

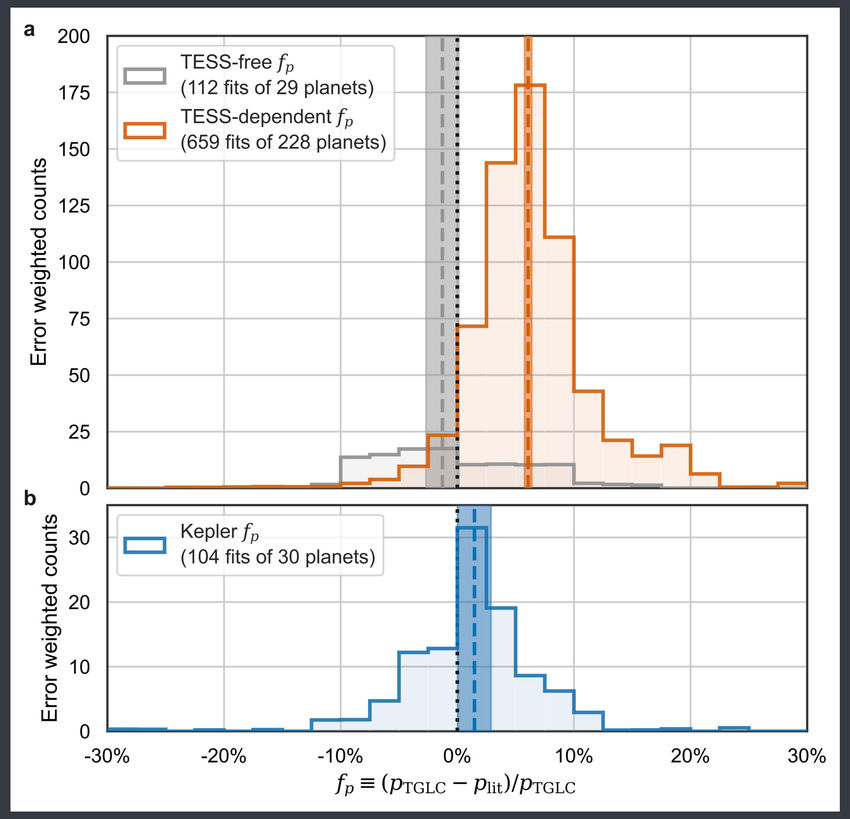
An instinct was to compare the signal amplitudes measured with TGLC to the literature values, and we found something unexpected…

The method

We tested the signal-amplitude accuracy of TGLC using the transit depths of known TESS exoplanets. For every single-planet system, we fitted each individual TGLC sector independently and documented the resulting planet-to-star radius ratio ($p \equiv r_p/r_\star$). Comparing these radius ratios directly measures differences in transit depth—the signal amplitude we aim to test.

The discovery

We compared the radius ratios (p) measured by TGLC to the literature values of ~250 TESS planets and plotted the fractional difference (f_p) in panel a. Most fits show a positive fractional difference. In other words, the TGLC light curves appear to measure larger planets—or deeper transits—than the literature.



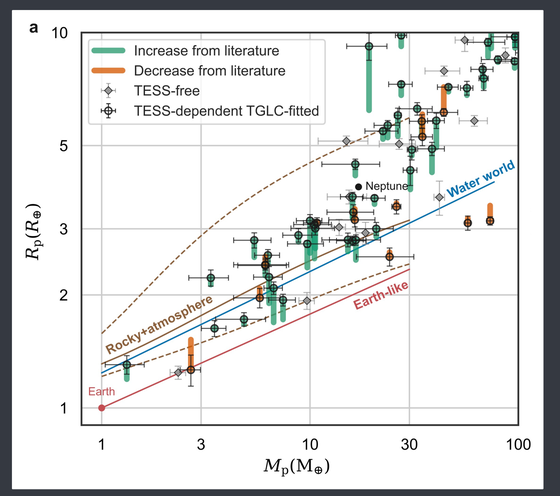
← A closer look showed that TESS planets were measured differently. Most are “TESS-dependent” (orange), meaning their reported radii rely on transit depths from TESS light curves. A smaller set are “TESS-free” (gray), where the transit depth of the TESS data is allowed to float and does not determine the final planet radius. Only the TESS-dependent planets show disagreement with TGLC.

← It is, however, not obvious at this stage whether the literature or TGLC is correct. We then applied the exact same method to measure the radius ratios of 30 Kepler planets. The TGLC results match the Kepler literature values (panel b), which are far less affected by contamination.

We therefore conclude that TGLC recovers accurate transit depths, while **more than 200 TESS planets** in the literature have **underestimated radii by a median of 6%.**

The impact

A direct impact of this finding is the migration of these planets in mass–radius–density space (see below). Most TESS-dependent planets shift upward in radius and downward in density. On average, these planets are about 6% larger and roughly 20% less dense. With these revised radii, many of the affected planets fall into different compositional regimes than previously believed.



In addition, although our test focuses on single-planet systems for simplicity, the same bias is expected to apply across the full TESS sample because of unaccounted contamination. This suggests that not only the ~200 planets analyzed here, but potentially the vast majority of TESS planets, may be larger than previously thought.

Te Han, Paul Robertson, Timothy Brandt, Shubham Kanodia, Caleb Cañas, Avi Shporer, George Ricker, and Corey Beard (ApJL, 2025)