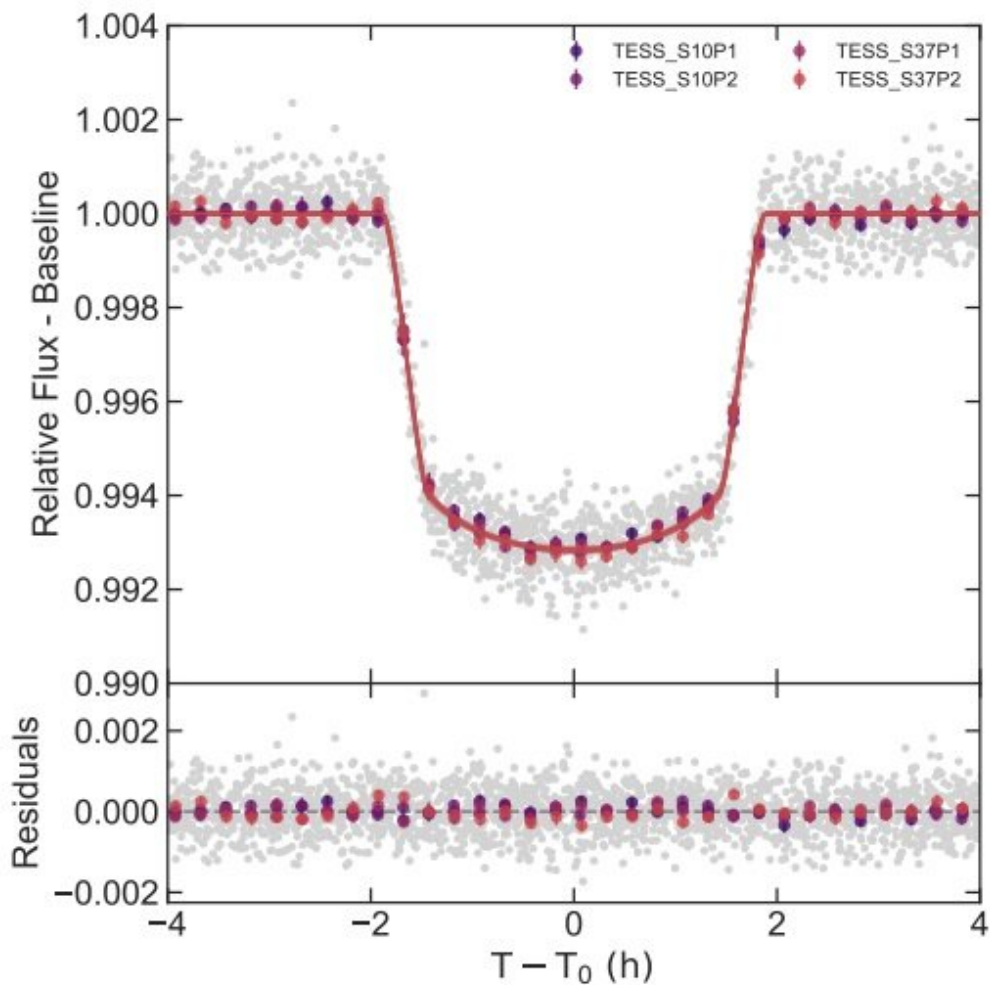


# TESS detects new 'hot Jupiter' exoplanet orbiting a rapidly rotating star

December 29 2022, by Tomasz Nowakowski



Phase-folded light curve model for TOI-778 b from the TESS data. Credit: Clark et al., 2022.

Using NASA's Transiting Exoplanet Survey Satellite (TESS), an international team of astronomers has detected a new "hot Jupiter" exoplanet. The newfound alien world, estimated to be nearly three times as massive as Jupiter, orbits a rapidly rotating star known as TOI-778. The finding is reported in a paper published December 16 on the *arXiv* pre-print server.

TESS is conducting a survey of about 200,000 of the brightest stars near the sun with the aim of searching for transiting exoplanets. So far, it has identified more than 6,100 candidate exoplanets (TESS Objects of Interest, or TOI), of which 282 have been confirmed so far.

Now, a group of researchers led by Jake T. Clark of the University of Southern Queensland, has recently confirmed another TOI monitored by TESS. They report that a transit signal has been identified in the light curve of a rapidly rotating early F3V-dwarf star designated TOI-778 (also known as HD 115447). The planetary nature of the signal was confirmed by follow-up ground-based photometry and velocity measurements.

"The candidate planet was detected by TESS during Sector 10, in the first year of operation as it surveyed the southern sky," the astronomers wrote in the paper.

The newfound planet received designation TOI-778 b. It has a radius of 1.37 Jupiter radii and is approximately 2.8 times more massive than Jupiter. TOI-778 b orbits its host every 4.63 days, at a distance of about 0.06 AU from it. The planet's equilibrium temperature was estimated to be some 1,561 K.

Based on the parameters of TOI-778 b, the astronomers classified it as a "hot Jupiter" [exoplanet](#). In general, the so-called "hot Jupiters" are similar in characteristics to the solar system's biggest planet, with orbital

periods of less than 10 days. Such exoplanets have high surface temperatures, as they [orbit](#) their parent stars very closely. TOI-778 b appears to be somewhat inflated when compared to other "hot Jupiters" of similar masses.

The parent star TOI-778 is a fast rotator—with rotational velocity at a level of nearly 40 km/s. The star is about 71 percent larger and 40 percent more massive than the sun. The researchers estimate that TOI-778 is about 1.95 billion years old and its [effective temperature](#) is around 6,700-6,800 K. The distance to the star was measured to be some 528 light years.

The study also found that the orbit TOI-778 b is close to being aligned with the stellar equator, with a host star sky-projected obliquity of 19 degrees. Hence, the astronomers suppose that this planet sedately migrated through its host's disk, rather than reaching its current location through more chaotic means.

"TOI-778 b joins a cohort of other hot Jupiters with well-aligned orbits, suggesting that disk migration is the likely case of their evolution to their current positions," the authors of the paper concluded.

**More information:** Jake Clark et al, [Spinning up a Daze: TESS Uncovers a Hot Jupiter orbiting the Rapid-Rotator TOI-778](#), *arXiv* (2022). [DOI: 10.48550/arxiv.2212.08242](https://doi.org/10.48550/arxiv.2212.08242)

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