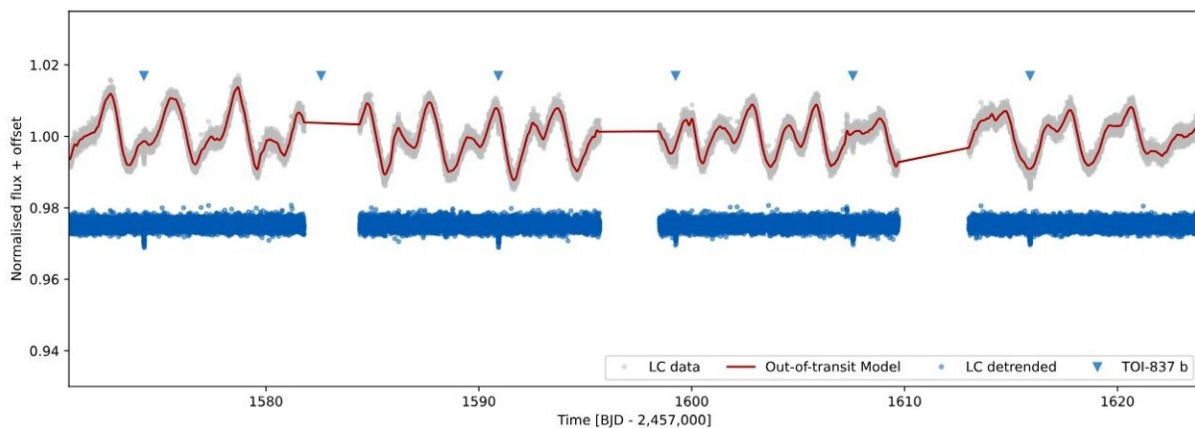


# TOI-837 b is a young Saturn-sized exoplanet with a massive core, observations find

May 2 2024, by Tomasz Nowakowski



TESS light curve for TOI-837. Credit: *arXiv* (2024). DOI: 10.48550/arxiv.2404.13750

European astronomers have performed photometric and spectroscopic observations of a distant giant exoplanet known as TOI-837 b. As a result, they found that TOI-837 b is a young Saturn-sized planet containing a massive core, which challenges current core formation

theories. The findings are presented in a paper [published](#) on the preprint server *arXiv*.

TOI-837 b was discovered in 2020, orbiting a young (about 35 million years old) dwarf star of spectral type F9/G0 in the open cluster IC 2602, about 465 [light years](#) away. The planet orbits its host every 8.32 days and was found to have a radius of approximately 0.77 Jupiter radii. The star TOI-837 is about the size of the sun, has a mass of about 1.14 [solar masses](#), and its [effective temperature](#) is nearly 6,000 K.

The team of astronomers, led by Oscar Barragán of the University of Oxford, UK, decided to conduct follow-up photometric and spectroscopic observations of TOI-837 b in order to further characterize its properties and nature. For this purpose, they employed NASA's Transiting Exoplanet Survey Satellite (TESS) and various ground-based facilities.

"We present an exhaustive photometric and spectroscopic analysis of TOI-837, a F9/G0 35 Myr young star, hosting a transiting exoplanet, TOI-837 b, with an [orbital period](#) of 8.32 days," the researchers wrote in the paper.

The observation found that TOI-837 b has a radius of 0.817 Jupiter radii and its mass is approximately 0.395 Jupiter masses, which yields a density at a level of  $0.89 \text{ g/cm}^3$ . The planet is separated from the star by 0.088 AU and its equilibrium temperature is estimated to be about 1,000 K.

The astronomers underlined that the derived properties of TOI-837 b, mainly its density, young age and distance to the star, suggest a core mass of approximately 70 Earth masses (0.22 Jupiter masses), therefore

accounting for about 60% of the planet's total mass.

The researchers noted that such a substantial core within a relatively young planetary body poses a challenge for current models of planet formation and core accretion, especially due to the relatively low stellar metallicity—at a level of 0.01 dex.

"Our investigation into the TOI-837 system and its intriguing companion, TOI-837 b, unveils a young Saturn-sized exoplanet that defies conventional expectations with its unexpected massive core," the authors wrote.

Due to its unique characteristics, TOI-837 b should be a target of advanced atmospheric characterization. For instance, a measurement of the planetary atmospheric bulk metal fraction has the potential to uncover the true nature of its significant core. Such studies could be performed with the James Webb Space Telescope (JWST).

**More information:** Oscar Barragán et al, TOI-837b is a Young Saturn-sized Exoplanet with a Massive  $70 M_{\oplus}$  Core, *arXiv* (2024). [DOI: 10.48550/arxiv.2404.13750](https://doi.org/10.48550/arxiv.2404.13750)

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