

KOI-5Ab: Illustration of the triple stellar system, and the planet transiting across the face of its host. Credits: Caltech/R. Hurt (IPAC)

A triple stellar system

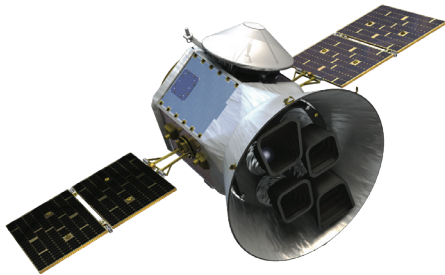
The unusual world KOI-5Ab

NASA's **Transiting Exoplanet Survey Satellite (TESS)** is an Explorer-class mission, operated by MIT, that is designed to detect planets in our galaxy transiting their host stars. TESS is NASA's second planet-hunting mission, following in the footsteps of **Kepler**.

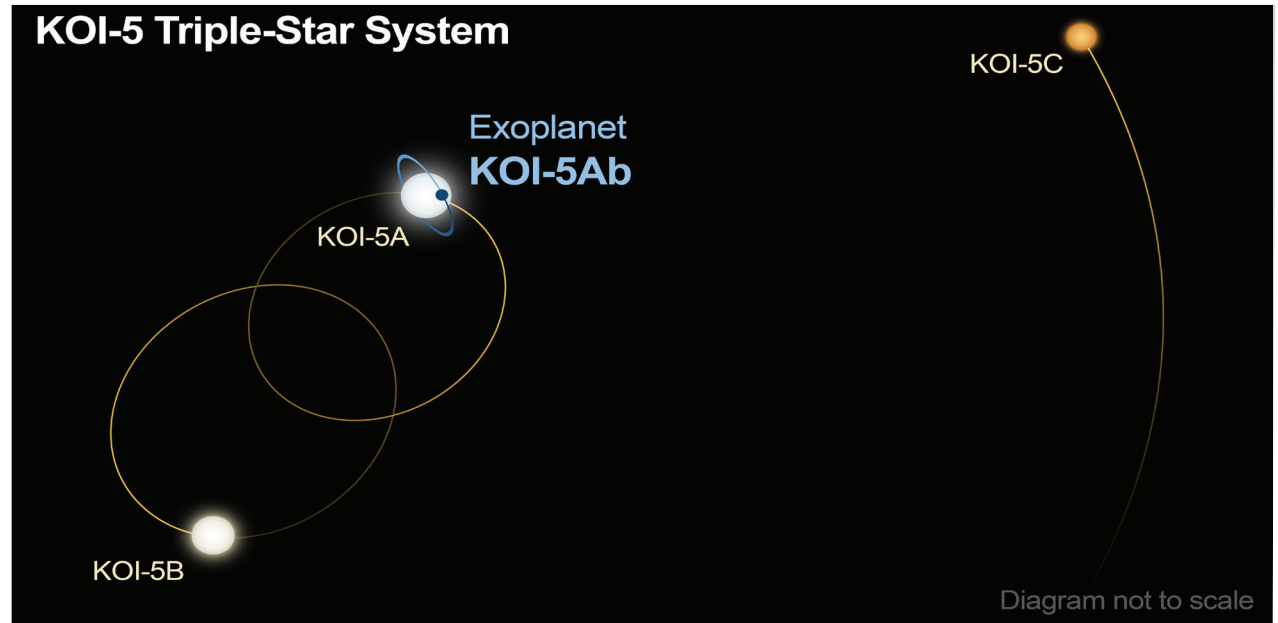
It is with Kepler that scientists first discovered KOI-5Ab, a candidate planet about half the size of Saturn orbiting a Sun-like star in a multi-star system. First detected in 2009, this fascinating system was left as a candidate planet due to the plethora of other new discoveries made by Kepler that took center stage at the time.

At the end of its mission in 2018, Kepler had discovered 2,394 exoplanets, with an additional 2,366 planets still to be confirmed. Scientists however had not forgotten about KOI-5Ab, and once TESS was launched, new observations of the system were obtained.

With observations collected in 2019, TESS also identified KOI-5Ab as a candidate planet and dubbed it TOI-1241b. The TESS data also indicated that the planet orbits its star every five days.



Combining data from Kepler, TESS (shown above; image credit: NASA's Goddard Space Flight Center), and ground-



The triple stellar system with the unusual planet KOI-5Ab. The diagram indicates the host star - Star A -, its companion which orbits every 30 years - Star B -, and the external gravitationally bound star which orbits the internal system every 400 years - Star C -. The planet was discovered originally by Kepler and confirmed using TESS and ground-based facilities. At half the mass of Saturn, the planet orbits its host every 5 days and has a tilted orbit at 50 degrees relative to the orbital plane of Stars A and B. Credits: Caltech/R. Hurt IPAC.

based facilities, scientists were able to confirm that KOI-5Ab is indeed a planet, most likely gaseous in composition, and similar in size to that of Jupiter or Saturn. They also found that the planet orbits a star similar to our Sun, and that this star is one of three within the system.

This triple system consists of Star A - the planet host; Star B - the close companion of Star A, which it orbits every 30 years; and Star C - a star that is gravitationally bound to the system and orbits Stars A and B every 400 years. The

system is additionally unusual in that the orbital plane of the planet is not aligned with the orbital plane of Star B. This could indicate that Star B "kicked" the planet as it was developing, thus causing the skewed orbit and making it migrate inward.

Triple-star systems like this one are relatively rare and make up about 10% of all star systems. The unusual arrangement of the stars within this system provide a unique insight into how the universe makes planets.