TESS discovers an old warm Jupiter-like exoplanet
6 October 2022, by Tomasz Nowakowski

Using the Transiting Exoplanet Survey Satellite (TESS), an international team of astronomers has detected a new old and warm Jupiter-like alien world orbiting a G-dwarf star. The newfound exoplanet, designated TOI-5542 b, is the size of Jupiter—about 30% more massive than the solar system's biggest gas giant. The finding is reported in a paper published September 29 on the arXiv pre-print server.

The newfound exoplanet has a radius of approximately 1.01 Jupiter radii and a mass of 1.32 Jupiter masses, which yields a density at a level of 1.6 g/cm$^3$. It orbits its parent star every 75.12 days, at a distance of 0.33 AU from it. The planet's equilibrium temperature was estimated to be 441 K, therefore the astronomers classified it as a warm Jupiter.

The host TOI-5542 is of spectral type G3V, has a radius of about 1.06 solar radii and is 11% less massive than the sun. The star has an effective temperature of some 5,700 K, luminosity at a level of approximately 1.05 solar luminosities and its age is estimated to be 10.8 billion years. The metallicity of TOI-5542 was measured to be approximately -0.21.

Taking into account that TOI-5542 is nearly 11 billion years old, the researchers underlined that its exoplanet is therefore one of the oldest known long-period warm Jupiters and one of the few with an age estimate.

"TOI-5542b is one of the oldest known warm Jupiters and it is cool enough to be unaffected by inflation due to stellar incident flux, making it a valuable contribution in the context of planetary composition and formation studies," the authors of the paper concluded.
Given that TOI-5542 b has a circular orbit, the researchers noted that it is difficult to predict a formation or migration pathway for this planet. They assume that it likely formed via disk migration or in situ formation as other mechanisms that are more likely to leave a planet on an eccentric orbit around its parent star.