

TESS discovers three new planets nearby including temperate 'sub-Neptune'

Planetary system orbiting an unusually quiet star is ideal for future habitability searches
NASA's Transiting Exoplanet Survey Satellite, or TESS, has discovered three new worlds that are among the smallest, nearest exoplanets known to date. The planets orbit a star just 73 light years away and include a small, rocky super-Earth and two sub-Neptunes -- planets about half the size of our own icy giant.

The sub-Neptune furthest out from the star appears to be within a "temperate" zone, meaning that the very top of the planet's atmosphere is within a temperature range that could support some forms of life. However, scientists say the planet's atmosphere is likely a thick, ultradense heat trap that renders the planet's surface too hot to host water or life.

Nevertheless, this new planetary system, which astronomers have dubbed TOI-270, is proving to have other curious qualities. For instance, all three planets appear to be relatively close in size. In contrast, our own solar system is populated with planetary extremes, from the small, rocky worlds of Mercury, Venus, Earth, and Mars, to the much more massive Jupiter and Saturn, and the more remote ice giants of Neptune and Uranus.

There's nothing in our solar system that resembles an intermediate planet, with a size and composition somewhere in the middle of Earth and Neptune. But TOI-270 appears to host two such planets: both sub-Neptunes are smaller than our own Neptune and not much larger than the rocky planet in the system.

Astronomers believe TOI-270's sub-Neptunes may be a "missing link" in planetary formation, as they are of an intermediate size and could help researchers determine whether small, rocky planets like Earth and more massive, icy worlds like Neptune follow the same formation path or evolve separately.

TOI-270 is an ideal system for answering such questions, because the star itself is nearby and therefore bright, and also unusually quiet. The star is an M-dwarf, a type of star that is normally extremely active, with frequent flares and solar storms. TOI-270 appears to be an older M-dwarf that has since quieted down, giving off a steady brightness, against which scientists can measure many properties of the orbiting planets, such as their mass and atmospheric composition.

"There are a lot of little pieces of the puzzle that we can solve with this system," says **Maximilian Günther**, a postdoc in MIT's Kavli Institute for Astrophysics and Space Research and lead author of a study published in *Nature Astronomy* that details the discovery. "You can really do all the things you want to do in exoplanet science, with this system."

Günther and his colleagues detected the three new planets after looking through measurements of stellar brightness taken by TESS. The MIT-developed satellite stares at patches of the sky for 27 days at a time, monitoring thousands of stars for possible transits -- characteristic dips in brightness that could signal a planet temporarily blocking the star's light as it passes in front of it.

The team isolated several such signals from a nearby star, located 73 light years away in the southern sky. They named the star TOI-270, for the 270th "TESS Object of Interest" identified to date. The researchers used ground-based instruments to follow up on the star's activity, and confirmed that the signals are the result of three orbiting exoplanets: planet b, a rocky super-Earth with a roughly three-day orbit; planet c, a sub-Neptune with a five-day orbit; and planet d, another sub-Neptune slightly further out, with an 11-day orbit.

Günther notes that the planets seem to line up in what astronomers refer to as a "resonant chain," meaning that the ratio of their orbits are close to whole integers -- in this case, 3:5 for the inner pair, and 2:1 for the outer pair -- and that the planets are therefore in "resonance" with each other.

AK, with EarthSky and Wikipedia Notes



This infographic illustrates key features of the TOI 270 system, located about 73 light-years away in the southern constellation Pictor. The three known planets were discovered by NASA's Transiting Exoplanet Survey Satellite through periodic dips in starlight caused by each orbiting world. Insets show information about the planets, including their relative sizes, and how they compare to Earth. Temperatures given for TOI 270's planets are equilibrium temperatures, calculated without the warming effects of any possible atmospheres.