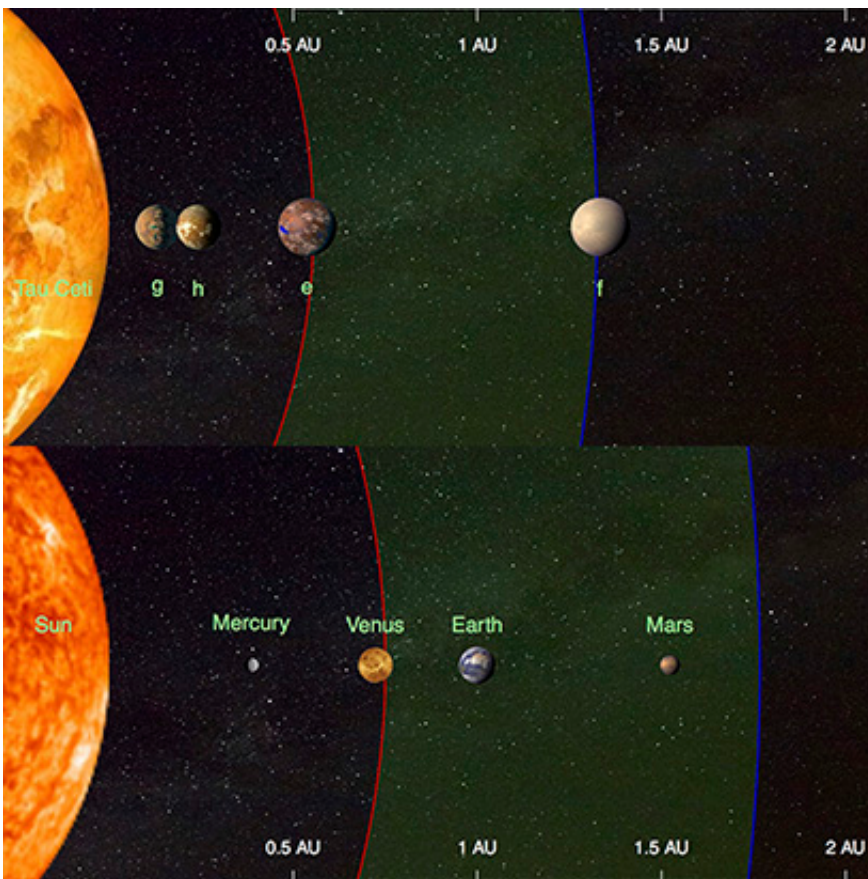


Four Earth-sized planets detected orbiting the nearest sun-like star

August 9 2017, by Tim Stephens



This illustration compares the four planets detected around the nearby star tau Ceti (top) and the inner planets of our solar system (bottom). Credit: Fabo Feng

A new study by an international team of astronomers reveals that four Earth-sized planets orbit the nearest sun-like star, tau Ceti, which is

about 12 light years away and visible to the naked eye. These planets have masses as low as 1.7 Earth mass, making them among the smallest planets ever detected around nearby sun-like stars. Two of them are super-Earths located in the habitable zone of the star, meaning they could support liquid surface water.

The [planets](#) were detected by observing the wobbles in the movement of tau Ceti. This required techniques sensitive enough to detect variations in the movement of the star as small as 30 centimeters per second.

"We are now finally crossing a threshold where, through very sophisticated modeling of large combined data sets from multiple independent observers, we can disentangle the noise due to stellar surface activity from the very tiny signals generated by the gravitational tugs from Earth-sized orbiting planets," said coauthor Steven Vogt, professor of astronomy and astrophysics at UC Santa Cruz.

According to lead author Fabo Feng of the University of Hertfordshire, UK, the researchers are getting tantalizingly close to the 10-centimeter-per-second limit required for detecting Earth analogs. "Our detection of such weak wobbles is a milestone in the search for Earth analogs and the understanding of the Earth's habitability through comparison with these analogs," Feng said. "We have introduced new methods to remove the noise in the data in order to reveal the weak planetary signals."

The outer two planets around tau Ceti are likely to be candidate habitable worlds, although a massive debris disc around the star probably reduces their habitability due to intensive bombardment by asteroids and comets.

The same team also investigated tau Ceti four years ago in 2013, when coauthor Mikko Tuomi of the University of Hertfordshire led an effort in developing data analysis techniques and using the star as a benchmark

case. "We came up with an ingenious way of telling the difference between signals caused by planets and those caused by star's activity. We realized that we could see how star's activity differed at different wavelengths and use that information to separate this activity from signals of planets," Tuomi said.

The researchers painstakingly improved the sensitivity of their techniques and were able to rule out two of the signals the team had identified in 2013 as planets. "But no matter how we look at the star, there seem to be at least four [rocky planets](#) orbiting it," Tuomi said. "We are slowly learning to tell the difference between wobbles caused by planets and those caused by stellar active surface. This enabled us to essentially verify the existence of the two outer, potentially habitable planets in the system."

Sun-like stars are thought to be the best targets in the search for habitable Earth-like planets due to their similarity to the sun. Unlike more common smaller stars, such as the red dwarf stars Proxima Centauri and Trappist-1, they are not so faint that planets would be tidally locked, showing the same side to the star at all times. Tau Ceti is very similar to the sun in its size and brightness, and both [stars](#) host multi-planet systems.

A paper on the new findings was accepted for publication in the *Astrophysical Journal* and is available online.

More information: Color difference makes a difference: four planet candidates around tau Ceti. *arXiv*. arxiv.org/abs/1708.02051

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