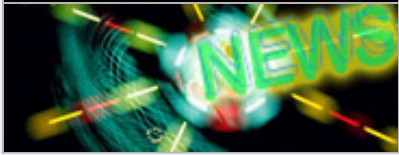




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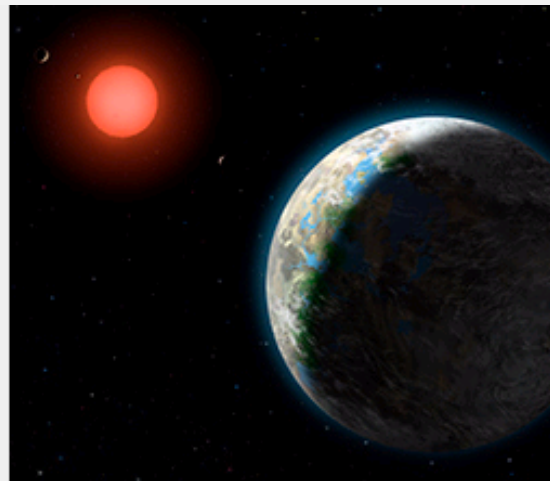
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Press Release 10-172

Newly Discovered Planet May First Truly Habitable Exoplanet

Discovery suggests our galaxy may be teeming with potentially habitable planets



This artist's conception shows the inner four planets of the Gliese 581 system and their host star.

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September 29, 2010

View a [webcast](#) with Steven Vogt and Paul Butler, the team that discovered the first potentially habitable exoplanet.

A team of planet hunters led by astronomers at the University of California, Santa Cruz (UC Santa Cruz), and the California Institute of Technology, and supported by the National Science Foundation (NSF) and NASA, has announced the discovery of an Earth-sized planet (three times the mass of Earth) orbiting a nearby star at a distance that places it squarely in the star's "habitable zone," where liquid water could exist on the planet's surface. If confirmed, this would be the most Earth-like exoplanet yet discovered and the first strong case for a potentially habitable one.

"This is clearly one of the most exciting areas of science today," said Ed Seidel, assistant director for NSF's Mathematical and Physical Sciences directorate. "If we do discover an Earth-like planet, it would perhaps be the most significant discovery of all time."

To astronomers, a "potentially habitable" planet is one that can sustain life, not necessarily one that humans would find a nice place to live. Habitability depends on many factors, but liquid water and an atmosphere are among the most important.

"Our findings offer a very compelling case for a potentially habitable planet," said Steven Vogt, professor of astronomy and astrophysics at UC Santa Cruz. "The fact that we were able to detect this planet so quickly and so nearby tells us that planets like this must be really common."

"With modern techniques, it is now possible to actually find planets for worlds that might be able to support life as we know it," added Seidel. "Just a few years back I wouldn't have believed this could have advanced so fast."

This discovery was the result of over a decade of observations on the W. M. Keck Observatory in Hawaii. "Advanced techniques combined with old-fashioned ground-based telescopes are helping to lead the exoplanet revolution," said Paul Butler of Carnegie Institution. "Our ability to find potentially habitable worlds is now limited only by our telescope time."

"One of the three main science objectives of the Astrophysics Decadal Survey released last month is 'New Worlds: Seeking nearby habitable planets,'" said the survey's Astronomy Division Director Jim Ulvestad. "It is very exciting to see that long-term scientific investments by NSF are paying off, and we expect continued discoveries in this area as nearby stars are searched for longer periods."

Vogt and Butler lead the Lick-Carnegie Exoplanet Survey team's new findings are reported in a paper to be published in the *Astrophysical Journal* and posted online today at [arXiv.org](#). It is also [linked](#) to this release. Coauthors include astronomy research scientist Eugenio Rivera of UC Santa Cruz; astronomer Nader Haghighipour of the University of Hawaii at Manoa; and research scientists Gregory Henry and Mark Williamson of Tennessee State University.

The paper reports the discovery of two new planets orbiting nearby red dwarf star Gliese 581. This brings the total number of known planets around this star to six, the most yet discovered in a planetary system other than our own solar system. In our solar system, the planets around Gliese 581 have nearly circular orbits.

The most interesting of the two new planets is Gliese 581c, with a mass three to four times that of the Earth and an orbital period of just under 37 days. Its mass indicates that it is probably a rocky planet with a definite surface, and that it has enough surface gravity to hold on to an atmosphere, according to Vogt.

Gliese 581, located 20 light years away from Earth in the constellation Libra, has a somewhat checkered history of habitable-planet claims. Two previously detected planets in the system lie at the edges of the habitable zone, one on the hot side (planet c) and one on the cold side (planet d). Many astronomers still think planet d may be habitable if it has a thick atmosphere with a strong greenhouse effect to warm it, but others are skeptical. The newly discovered planet g, however, lies right in the middle of the habitable zone.

"We had planets on both sides of the habitable zone--one too hot and one too cold--and now we have one in the middle, right," Vogt said.

The planet is tidally locked to the star, meaning that it always faces the star and basking in perpetual daylight.

the side facing away from the star is in perpetual darkness. The effect of this is to stabilize the planet's surface climate according to Vogt. The most habitable zone on the planet's surface would be the line between shadow and light (the "terminator"), with surface temperatures decreasing toward the dark side and increasing toward the light side.

"Any emerging life forms would have a wide range of climates to choose from and to evolve around, depending on their longitude," Vogt said.

The researchers estimate that the average surface temperature of the planet is between -24 and 10 degrees Fahrenheit (-12 degrees Celsius). Actual temperatures would range from blazing hot on the side facing the star to freezing cold on the dark side.

If Gliese 581g has a rocky composition similar to Earth, its diameter would be about 1.2 to 1.4 times that of Earth, and its surface gravity would be about the same or slightly less than Earth's, so that a person could easily walk upright or run, Vogt said.

The new findings are based on 11 years of observations of Gliese 581 using the HIRES spectrometer (designed and built at the Keck I Telescope at the W. M. Keck Observatory). The spectrometer allows precise measurements of the star's radial velocity (its motion along the line of sight from Earth). The presence of planets orbiting the star causes periodic changes in the radial velocity of the host star. Multiple planets induce complex wobbles in the star's motion, and astronomers use sophisticated techniques to detect planets and determine their orbits and masses.

"It's really hard to detect a planet like this," Vogt said. "At the time we measure the radial velocity, that's an even bigger challenge. It took more than 200 observations with a precision of about 1.6 meters per second to detect the planet."

To get that many radial velocity measurements (238 in total), Vogt's team combined their HIRES observations with data from another group led by the Geneva Observatory (HARPS, the High Accuracy Radial velocity Planet Search project).

In addition to the radial velocity observations, Henry and Williamson made precise night-to-night brightness measurements of the star with one of Tennessee State University's robotic telescopes. "Our brightness measurements verify that the radial velocity variations are caused by an orbiting planet and not by any process within the star," Henry said.

The researchers also explored the implications of their discovery with respect to the number of stars that are likely to have at least one potentially habitable planet. Given the relatively small number of stars that have been carefully monitored by planet hunters, this discovery has come surprisingly soon.

"If these are rare, we shouldn't have found one so close to us so nearby," Vogt said. "The number of systems with habitable planets is probably on the order of 10 or 20 in our galaxy, and when you multiply that by the hundreds of billions of stars in the Milky Way, that's a large number. There could be billions of these systems in our galaxy."

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UC, Santa Cruz News: www.ucsc.edu/news_events

Carnegie Institution of Science: <http://carnegiescience.edu>

Ground-based Astronomy at NSF:

<http://www.nsf.gov/eyesonthesky>

The Lick-Carnegie Exoplanet Survey (PDF):

<http://www.nsf.gov/news/longurl.cfm?id=206>