

Astronomers discover Earth-sized planet in the habitable zone

A rocky planet only five times the mass of the Earth was discovered around the nearby low-mass star Gliese 581. This is the most Earth-like planet known to date and furthermore its orbit is at the “warm” edge of the habitable zone around that star, thus allowing speculation that this planet could harbour life.

The quest for detecting new planets orbiting other stars than the Sun is boosted by the huge impact that this research field has on the general public (*CERN Courier* October 2004 p19). During one week, the Observatory of the University of Geneva was overwhelmed with phone calls from all over the world concerning the discovery and its implications for life in the universe. This mass interest was beyond the expectations of the discovery team led by Stéphane Udry, which simply published its findings in a specialized, rather than an interdisciplinary, scientific journal.

The faint star Gliese 581 is only 20 light-years away and is thus among the 100 closest stars. It is one of some 100 “M dwarf” stars monitored by the High Accuracy Radial-velocity Planet Searcher (HARPS) mounted on the 3.6m telescope of the European Southern Observatory (ESO) at La Silla, Chile. This high-precision spectrometer previously found a Neptune-mass planet around Gliese 581, but with more observations and refined analysis the astronomers discovered two additional planets by detecting the wobbling that their



Artist's impression of the three-planet system around the red dwarf Gliese 581. Liquid water could flow on the surface of the planet in the foreground, which is five times the mass of the Earth. (Courtesy ESO.)

gravitational pull exerts on the star. The two new planets have masses of five and eight times the mass of the Earth and orbit the red dwarf star every 13 and 84 days, respectively. Although these planets are much closer to Gliese 581 than the Earth is to the Sun, they are located approximately at the warm and cold edges of the habitable zone of such a low-luminosity star. Among the more than 200 extra-solar planets detected so far, some others have been found to be in the habitable zone of their parent star, but they were all bigger gaseous planets.

Apart from very exotic low-mass planets orbiting pulsars, the new planet of only five

times the mass of the Earth is the lightest extra-solar planet found to date. With a diameter estimated to exceed that of the Earth by only 50% and being in or just at the boundary of the habitable zone makes it the prime subject of interest. According to Udry, the surface temperature of the planet depends on the highly uncertain composition and thickness of its atmosphere. Nevertheless, an equilibrium temperature between -3°C and $+40^{\circ}\text{C}$ was estimated for a Venus-like and an Earth-like albedo, respectively. It is therefore likely that water could be liquid on the surface of this planet, although the strength of the greenhouse effect remains an important unknown.

The existence of liquid water and the possibility of life on this planet cannot be probed directly at the moment and we can only consider it as the best known candidate for future space-mission projects, like NASA's Terrestrial Planet Finder and ESA's Darwin, to search for the signature of water and oxygen in its atmosphere. However, the relatively old and quiet star Gliese 581 has already become one of the most famous stars in the universe and currently focuses all hopes to find a nearby Earth twin.

Further reading

S Udry *et al.* 2007 *Astron. and Astroph.*, in press. See <http://arxiv.org/abs/0704.3841>.

Picture of the month



To celebrate the 17th anniversary of the NASA/ESA Hubble Space Telescope a breathtaking panoramic view of the inner part of the Carina Nebula was released. The detail on this tiny portion of the full mosaic of 48 frames taken by the Advanced Camera for Surveys (ACS) allows one to imagine what the complete high-resolution image (29 566 pixels $\times$ 14 321 pixels) would look like! The Carina Nebula – previously pictured in infrared by Spitzer (*CERN Courier* July/August 2005 p10) – harbours some of the most massive stars in our galaxy. Their intense ultraviolet radiation erodes the dust column shown in this image. What is special here compared with other such “pillars of creation” (*CERN Courier* June 2005 p12 and March 2007 p11) is the double-jet of gas being launched by a newly forming star hidden inside the tip of the dust column. (Courtesy NASA; ESA; N Smith, University of California, Berkeley; and the Hubble Heritage Team, STScI/AURA.)

Calling Captain Vacuum! You have to stop Dr. NoVac! He's sabotaging the outer space turbo-vacuum pump plant.

Mission possible, Commander! Dr. NoVac will soon have taken his last breath. I have what it takes to save all the vacuum! I'm always ready, willing and able when the Void needs me!

Later, at the outer space vacuum plant.

Ha ha, I've defeated the vacuum! Air for my empire!

That scoundrel wants to repeal the laws of nature and seize power. You've got to cut off his air!

May the Void be with you!

This will keep the air outside, Dr. NoVac ... and keep the vacuum where it's needed!

Gasp ... Captain Vacuum?!

Dr. NoVac drifts vacuumized in space; the Captain is victorious. Now he sets about stabilizing the vacuum in outer space. His special vacuum belt has everything he needs to get the plant running again.

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