

Exoplanet hunters find rich planetary systems

The time when isolated extrasolar planets were discovered is over, with the detection of two entire systems of six and possibly even seven planets orbiting nearby stars. These recent discoveries by two competing groups are opening a new era in exoplanet searches, in particular with the possible discovery of an Earth-sized planet within the habitable zone of one of the two systems.

More than 450 exoplanets have been detected since the discovery, 15 years ago, of 51 Peg b, the first extrasolar planet found around a normal star. The number of new detections per year is still rising and could surpass 100 new planets for 2010. Measurements of stellar radial-velocity remain the prime detection method, but detection via planetary transits is catching up rapidly since the launch of the French-European satellite for Convection, Rotation and planetary Transits (CoRoT) in 2006, and the NASA Kepler mission in 2009. As the occurrence of a planet transiting in front of the disc of its parent star is rare, these discoveries are made by looking at hundreds of thousands of relatively distant stars. Radial-velocity searches, by contrast, focus on hundreds of nearby stars and aim to detect the wobbling of the star that is induced by the gravity pull of the orbiting planet.

The exoplanets discovered first were gas giants akin to Jupiter and Saturn. A significant step forward was achieved in 2004 with the detection of Uranus- and Neptune-sized planets (*CERN Courier* October 2004 p19). A subsequent milestone was the detection of two planets, with sizes only slightly greater



Artist's impression of the planetary system around the Sun-like star HD 10180. (Courtesy ESO.)

than that of Earth, orbiting Gliese 581 (*CERN Courier* June 2007 p12). The claim that at least one of them was in the habitable zone of this low-mass star made this stellar system a popular place to study, but subsequent investigations suggested that one of the planets is most likely too hot and the other too cool to keep water liquid on its surface.

Now, Gliese 581 is again in the headlines with the possible discovery of a new, even smaller planet that is located in between the two already found and thus at the appropriate distance from the star to sustain life. Together with another newly detected object at longer periods, the small planet – with a mass of 3 to 4 times the mass of the Earth – would bring to six the number of planets in this system, which is only 20 light-years away.

The presence of the two new planets has been derived from a study led by Steven Vogt of the Lick Observatory of the University of California. His team combined

122 radial-velocity measurements by the High-Resolution Echelle Spectrometer (HIRES) of the Keck 10 m telescope on Mauna Kea, Hawaii, with 119 previously published measurements by the High Accuracy Radial-velocity Planet Searcher (HARPS) mounted on the 3.6 m telescope of the European Southern Observatory at La Silla, Chile. Although the HIRES measurements are less accurate than the HARPS ones, the combination of the two datasets improves the statistics.

The group using HARPS gained attention a month earlier with the detection of a rich stellar system of up to seven planets orbiting the solar-type star HD 10180, 130 light-years away. This study, led by Christophe Lovis of the Observatory of the University of Geneva, clearly detects five Neptune-like planets and there is good evidence for a heavier planet orbiting further out, as well as for an Earth-sized planet close to the star.

Although the existence of the new planets is still to be more firmly confirmed in both exoplanetary systems, these new studies show that they can be highly populated by low-mass planets and suggest that potentially habitable planets might be relatively common. According to Vogt, they could be present around a few tens of per cent of stars in the solar neighbourhood.

Further reading:

S S Vogt *et al.* 2010 *ApJ*, in press, arXiv:1009.5733.

C Lovis *et al.* 2010 *A&A*, in press.

Picture of the month



Tom Lowe from the US won the Royal Observatory's Astronomy Photographer of the Year competition with this artistic image of the Milky Way. Entitled "Blazing Bristlecone", the image beautifully juxtaposes the arch of the Milky Way from deep space with that of the dead tree on Earth. According to Marek Kukula, one of the judges, the jury was "blown away by the quality of all of the almost 500 entries this year". The public astronomer at the Royal Observatory Greenwich adds about the winning picture: "The bristlecone pines that you see in the foreground are some of the oldest living things on Earth, but yet they are dwarfed by the light shining behind them that has been travelling for almost 30 000 years. It is just a beautiful concept." (Courtesy Tom Lowe.)