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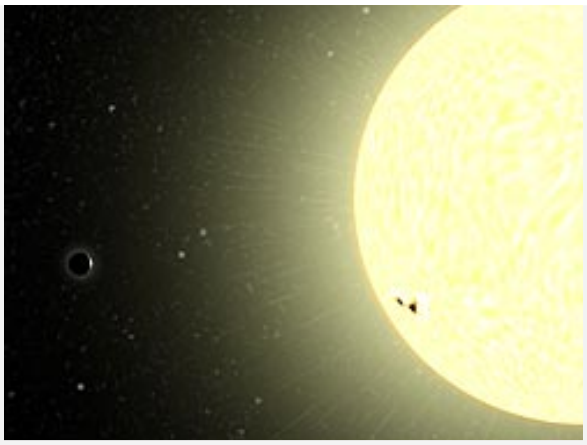
In early February 2009, the CoRoT satellite discovered the planet CoRoT-7b, measuring just two Earth radii in size. Following a series of elaborate and high-precision measurements conducted by the European Southern Observatory (ESO), it has now proven possible to determine the mass of this extra-solar planet. CoRoT-7b is five times heavier than our home planet and has approximately the same density. CoRoT-7b therefore definitively belongs to the class of what are known as 'Super Earths' – of which about a dozen are known – although this is the first time it has been possible to determine the density of one of them. Scientists from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) have a substantial role to play in this search for exoplanets using the CoRoT (**Co**nvection, **Ro**tation an Planetary **T**ransits) space telescope.

A truly fascinating subject for research

"The fact that we are able to determine both parameters for this Super Earth – radius and mass – makes this planet a highly interesting object for our research work", stated Prof. Heike Rauer, Project Manager of the German CoRoT contribution at the DLR Institute for Planetary Research in Berlin and also a professor at the Technical University (TU) in Berlin. Extra-solar planets, also referred to as exoplanets, orbit around stars other than our own Sun. Planet CoRoT-7b orbits its star in 20.4 hours. It has a light side, which always faces the star, and a perpetually dark side. The radiation from the star could be heating the light side of the planet to more than 2000 degrees Celsius, while the dark side remains at a deeply frozen temperature of minus 200 degrees Celsius. These properties make CoRoT-7b very different from most of the 370 or more exoplanets already discovered, which are most commonly giant balls of gas known as hot Jupiters.



Detailed photograph of CoRoT-7b

The CoRoT space telescope first started observing the star around which this planet orbits back in 2008. The regular dimming of light from the star caused by the planet passing between it and the space telescope was, however, masked by other phenomena, primarily 'starspots' occurring on the star. CoRoT-7 is an active star with starspots, phenomena broadly similar to the sunspots on our own Sun. Having said that, CoRoT-7 is a significantly more active star than our own Sun. Starspots are cooler regions on the surface of a star, which therefore appear to be darker, and these spots follow the rotation of the star. CoRoT-7 takes 23 days to rotate around its own central axis and exhibits fluctuations in brightness that perfectly match this period.

Research as a process

With the transit method, CoRoT has already discovered six objects. However, these CoRoT measurements do not by any means have the final say. They provide a list of possible candidates, the authenticity of which then need to be verified by a combination of subsequent and prior measurements. In the case of CoRoT-7b, measurements were made using a large number of ground-based telescopes. This has also made it possible to characterise the central star, CoRoT-7, in a precise manner. The star is 1.5 billion years old, making it about 3 billion years younger than our Sun, as well as slightly smaller and cooler. CoRoT-7b and its star are a mere 500 light years away from Earth.

Through an extensive series of time-consuming measurements using the HARPS spectrograph (High Accuracy Radial velocity Planet Searcher) on the 3.60-metre ESO telescope at La Silla (Chile), it proved possible to establish the precise mass of the planet using the radial velocity method. These same measurements have also firmed up suspicions about the existence of yet another exoplanet, CoRoT-7c. This orbits the star every 3 days and 17 hours and has at least eight times the mass of Earth. Viewed from Earth, this enormous planet never passes in front of its central star, so the transit method cannot be employed to verify its existence.

Animation: The CoRoT-7 system – overview and transit

About CoRoT

CoRoT was launched on 27 December 2006 from Baikonur Cosmodrome in Kazakhstan and is the first satellite mission to be tasked with searching for rocky – that is, Earth-like – planets outside our Solar System. CoRoT has on on-board telescope with an aperture of 27 centimetres and is in a polar orbit around Earth at an altitude of about 900 kilometres. The measuring technology on CoRoT is not only suited to the transit search for extra-solar planets; it can also be employed to verify and investigate stellar vibrations.

This mission is led by the French space agency (Centre National d'Etudes Spatiales; CNES) and includes researchers from ESA and other research institutes from Austria, Belgium, Brazil, Germany and Spain. The on-board software was developed and tested within a five-year period by the DLR Institute for Planetary Research in Berlin on behalf of the German government and with financial support from the DLR Space Agency. As well as the control of instruments and precision alignment of the satellite, the software also handles some of the data processing and transmission.

The total German contribution amounts to about five million euro. The German team also includes the Tautenburg Observatory in Thuringia and the Rhenish Institute for Environmental Research at the University of Cologne, both of which played a major role in data analysis work, simulation calculations and subsequent observations.

Related Contacts

Henning Krause
German Aerospace Center
Corporate Communications
Tel: +49 2203 601-2502
Fax: +49 2203 601-3249
E-Mail: henning.krause@dlr.de

Dr. Manfred Gaida
German Aerospace Center
Space Administration, Space Science
Tel: +49 228 447-417
Fax: +49 228 447-745
E-Mail: Manfred.Gaida@dlr.de

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