ESO/M. Kornmesser

Radial Velocity tells us about mass

Earth based instruments use the radial velocity method to determine the mass of a planet of a solar system far away. Because of the laws of gravity, a planet orbiting around its star will slightly attract the latter, thus making the star « wobble » around. The amplitude of the star's wobble is directly proportional to the mass of the orbiting planet: the heavier the planet, the larger the movement of the central star. This movement can be measured from Earth. The world's most accurate spectrograph using this method is HARPS. It is mounted in the light path of a 3.6 meter diameter telescope in La Silla, Chile and was built under the leadership of the University of Geneva. It will deliver a significant number of low mass exoplanets as observing targets for CHEOPS.

Transit method tells us about diameter

When an exoplanet orbiting around its star « transits » it appears from far away as a small disc moving in front of its star, thus making it less bright. The size of the eclipsing planet determines the amount of the decrease of light. If Earth wanders in front of the Sun, a far-away observer would measure a decrease of sunlight of about one ten-thousandth. The instrument on CHEOPS is able to measure such fine variations of the brightness. Thanks to these data, scientists can deduce the diameter of planets in distant solar systems.

Partner institutions in eleven European countries contribute to the realisation of the space mission CHEOPS under co-leadership between Switzerland and the European Space Agency (ESA).

For Switzerland

Scientific institutions: CSH University of Bern, University of Geneva, Swiss Space Center, EPF Lausanne.

Industrial partners: Almatech/Connova, Pfeiffer Vakuum AG, P&P Software, RUAG Space, and other partners.

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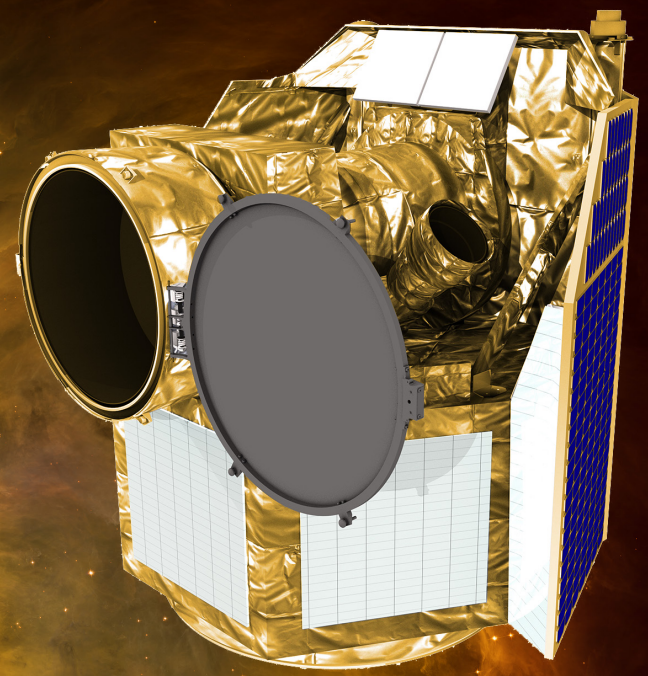
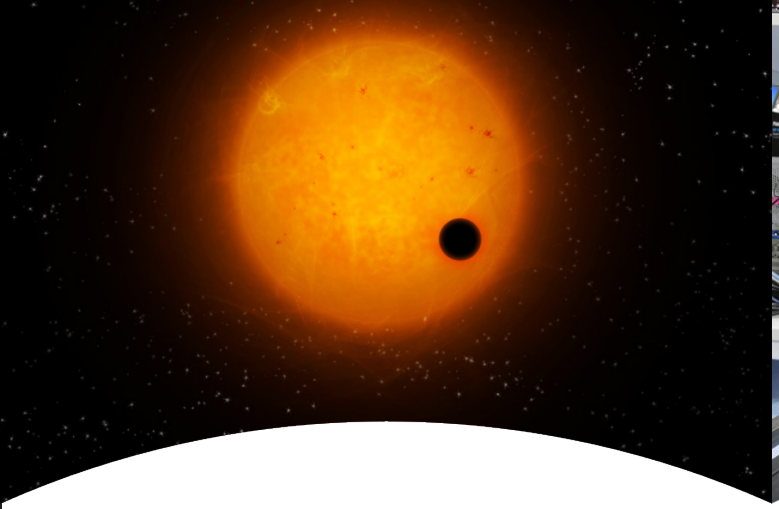
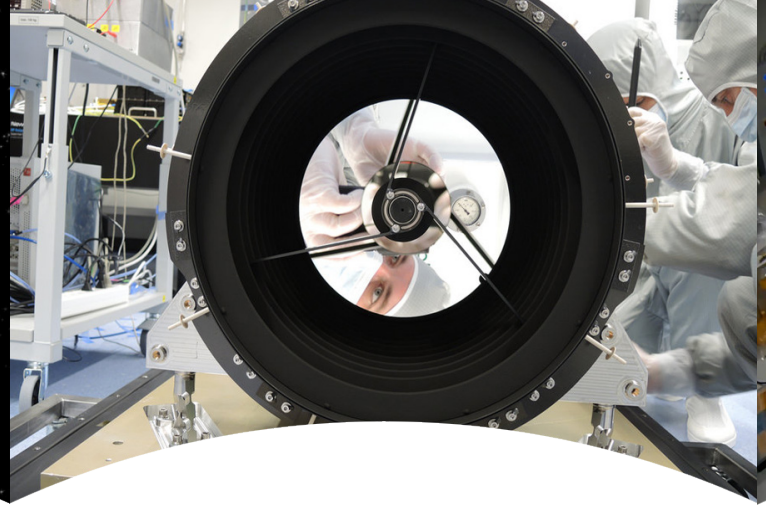


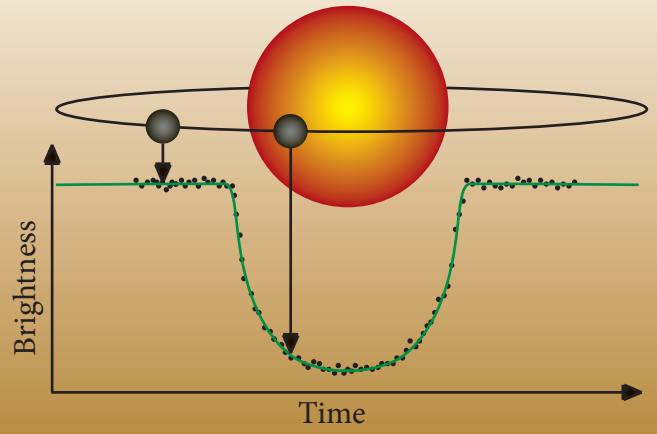
CHEOPS
CHARACTERISING EXOPLANET SATELLITE





In the footsteps of a second Earth

The discovery of the first planet orbiting a Sun-like star far away was made by Michel Mayor and Didier Queloz at the University of Geneva in 1995. The two Swiss astronomers detected the so-called exoplanet by measuring the radial velocity of the star (see description). It was a gas giant similar to Jupiter, but circled its star 51 Pegasi in only 4 days. In the following two decades, researchers discovered thousands of exoplanets and more sensitive methods allowed the detection of increasingly smaller objects. Now scientists are aiming at further investigating their physical and chemical properties.



Switzerland taking the lead

This is the goal of CHEOPS **(CHaracterising ExOPlanet Satellite)**, a space mission co-led by Switzerland. The launch of this 280-kilogram heavy satellite is scheduled during the first half of 2019. Then CHEOPS will be shot into an Earth orbit of about 700 kilometres. Once installed, it will point its 32 centimetres wide and 1.5 meters long telescope to over 700 bright stars that are known to host exoplanets. CHEOPS will use the transit method (see infographic) to determine the exoplanets' diameters.

Together with the mass of the planets, measurable by the radial velocity method, the researchers will be able to derive the density of these bodies. These data will provide clues about their physical and chemical nature and will allow the distinction between gas, icy, and rocky worlds.

CHEOPS is able to investigate exoplanets of various sizes including small ones with Earth-like diameters. Being able to characterise these will shed light onto the story of how planets like Earth form and evolve. The knowledge gained will be the key to future research and the most interesting exoplanets will be selected as targets for the next generation of instruments. They will be aimed at analysing the atmospheres and habitability of these distant worlds.

A network of professional partners

The main responsibility for the CHEOPS project lies with the Swiss researchers and the ESA (European Space Agency). Under the lead of Professor Willy Benz at the Center for Space and Habitability (CSH) of the University of Bern, the planning and the realisation of the mission is carried out. The Swiss industry provides the basic telescope structure, mounts, and other important components. The CSH team integrates and tests the telescope. International partners across Europe are providing additional elements. The satellite platform is built in Spain and the Swiss company RUAG Space performs tests on the fully integrated satellite in Switzerland.

The search for exoplanets in the habitable zone of a star, where life as we know it could be sustained, has evolved into a major topic in astronomy. CHEOPS will help select and characterise those systems most interesting for future studies and for the search of life.