Space eye with 34 telescopes will investigate one million stars (Update)

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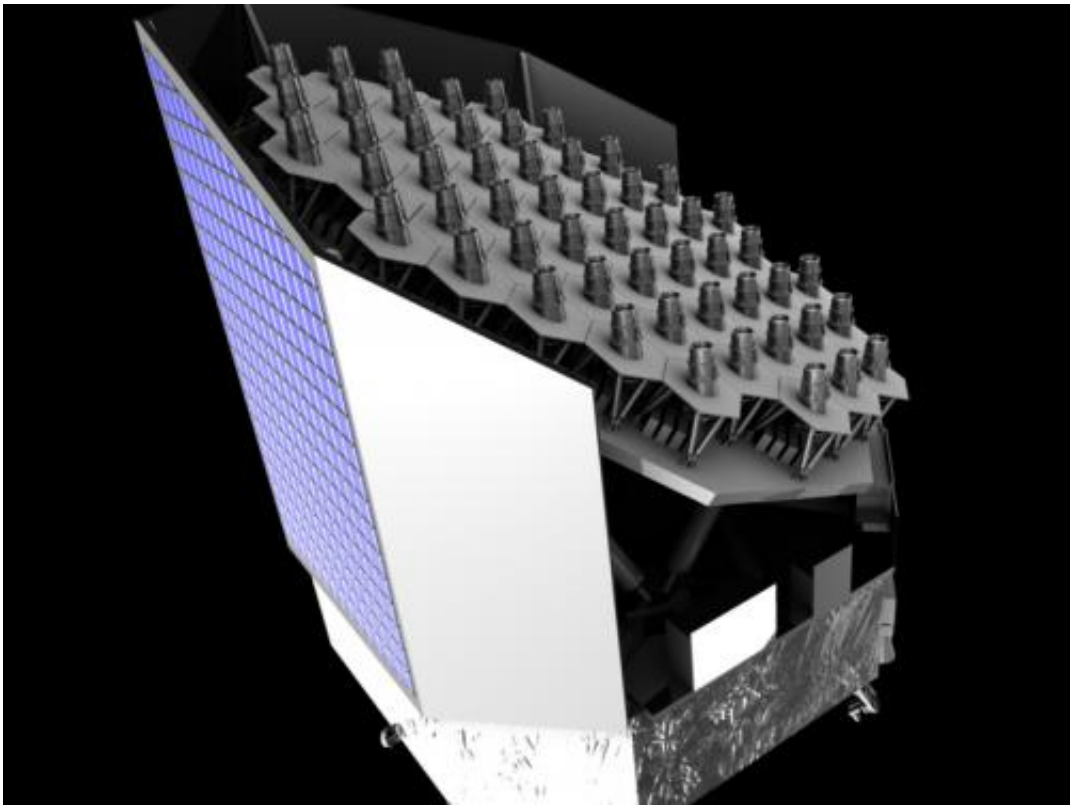

This is what the planet-hunter PLATO could look like. The image shows a concept presented by Thales Alenis Space. Credit: © ESA

The exploration of planets around stars other than the Sun, known as extrasolar planets or 'exoplanets', is one of the most exciting topics of 21st century science. One of the key goals of this research is to discover and learn the properties of Earth-like worlds in the Sun's neighbourhood.

ESA, the European Space Agency, will do this in preparing a new space mission named PLATO. The mission's launch is scheduled for 2024, and firm discoveries of Earth-like planets at Earth-like distances from stars similar to our Sun will be produced after three years of observational data have been collected. ESA's Science Programme Committee voted for PLATO at its regular meeting in Paris on 19th and 20th February, 2014, where it was one of five proposed space projects for a so-called "M" mission.

Not a single Earth-like exoplanet in a habitable zone around a star similar to our Sun has been found and characterized yet. PLATO will be a pioneer in finding new worlds for humanity to explore.

The PLATO Science consortium is led by Don Pollacco from the University of Warwick who comments "This is fantastic news for Europe, PLATO will allow the first systematic survey of nearby planets for indications from advanced life forms (as well as slime). A few years ago this would have been science fiction and now its coming to pass as science fact." The UK also has major roles in the instrument itself supplying the CCD sensors (e2V Technology and UCL), much of the image processing software (Cambridge) and Public Outreach (Open University).

The PLATO mission itself is led by Dr Heike Rauer at DLR, the German Aerospace Center. "PLATO will begin a completely new chapter in the exploration of extrasolar Planets" Dr Rauer confidently predicts. "We will find planets that orbit their star in the life-sustaining 'habitable' zone: planets where liquid water is expected, and where life as we know it can be maintained."

PLATO will measure the sizes, masses, and ages of the planetary systems it finds, so detailed comparisons with our own Solar System can be made. "In the last 20 years more than one thousand exoplanets have

been discovered, with quite a few multi-planetary systems among them", Rauer explains. "But almost all of these systems differ significantly from our Solar System in their properties, because they are the easiest-to-find examples. PLATO firmly will establish whether systems like our own Solar System, and planets like our own Earth are common in the Galaxy."

PLATO, is an acronym for PLanetary Transits and Oscillations of Stars. PLATO will find planets through the periodic dimming of the detected starlight caused by a planet orbiting in front of the star, blocking PLATO's view of a fraction of the starlight. PLATO will also measure tiny changes in detected starlight caused by small vibrations in the host stars, performing so-called astroseismology. Just as in seismology of the Earth, these vibrations reveal the interior structure of the vibrating body. Astroseismology allows us to learn the age of the vibrating star and the planets orbiting around it.

A new type of space telescope

PLATO is a completely new type of space telescope: it will use an array of telescopes rather than a single lens or mirror. PLATO will use top quality cameras, and will have the advantage of observing continuously from space, without the interruption of sunrise, or the blurring caused by the Earth's atmosphere. This will allow PLATO to discover planets smaller than Earth, and planets at distances from their host stars similar to the Earth-Sun distance. So far, only a few small exoplanets are known at star-planet distances comparable to or greater than Earth's. Unlike previous missions, PLATO will focus on these planets, which are expected to resemble our own Solar System planets.

Europe will take on a leading role in the search for extrasolar planets

PLATO is a lively and vigorous European collaboration – many European research institutions and hundreds of European researchers are working together, with scientists from all over the world completing the team. The catalogue of potentially habitable planets provided by PLATO will be the basis for follow-up measurements to confirm discoveries of new planets, using the European Southern Observatory's European Extremely Large Telescope (E-ELT), or the next generation of large space telescopes, like the James Webb Space Telescope. With PLATO, Europe will be leading the search for habitable exoplanets.

So far only a few exoplanets have had their mass, radius and age determined precisely. This is needed to properly describe a planet. "The observation of planets in many different states of their evolution will give us clues for the past and the future of our own planetary system", Dr Rauer remarked. "By no means do we know all about the youth of our Solar System."

Pioneering work in the search for a candidate "second Solar System"

Only a measurement of both the radius and the mass of a planet allows us to distinguish between a "mini-Neptune" with a high gas content, but a low density – like the two outermost planets in the Solar System – or a rocky planet with an iron core, like the Earth. Without this information the habitability of a planet cannot be determined. Some known extrasolar planets are "super-Earths" with sizes and masses somewhat larger than the Earth's. These two fundamental parameters are not known with sufficient precision for most exoplanets.

Key facts:

During its six year long planned mission, PLATO will observe one

million stars, leading to the likely discovery and characterisation of thousands of new planets circling other stars. PLATO will scan and observe about half the sky, including the brightest and nearest stars.

PLATO consists of an array of 34 individual telescopes mounted on an observing platform in the space probe. The satellite will be positioned at one of the so-called Lagrangian Points , where the gravitational pull of the Sun and the Earth cancel each other out so the satellite will stay at a fixed position in space. Each of the 34 telescopes has an aperture of 12 centimetres.

The individual telescopes can be combined in many different modes and bundled together, leading to unprecedented capabilities to simultaneously observe both bright and dim objects.

PLATO will be equipped with the largest camera-system sensor ever flown in space, comprising 136 charge-coupled devices (CCDs) that have a combined area of 0.9 square metres.

The accuracy of PLATO's astroseismological measurements will be higher than with previous planet-searching programmes, allowing for a better characterisation of the stars, particularly those stellar-planetary configurations similar to our Solar System.

The scientific objective is based on previous successful projects, like the French-European space telescope CoRoT or NASA's Kepler mission. It will also take into account the mission concepts that are currently under preparation which will "fill the gap" between now and PLATO's launch in 2024 – NASA's Kepler-2, and TESS missions and ESA's ChEOPS mission.

Dr Heike Rauer from DLR's Institute of Planetary Research in Berlin is a professor for astrophysics at Berlin's Technical University. Rauer is

leading the international consortium that will provide the payload and perform all scientific investigations with the data.

Provided by University of Warwick