# CHEOPS space telescope takes its first pictures

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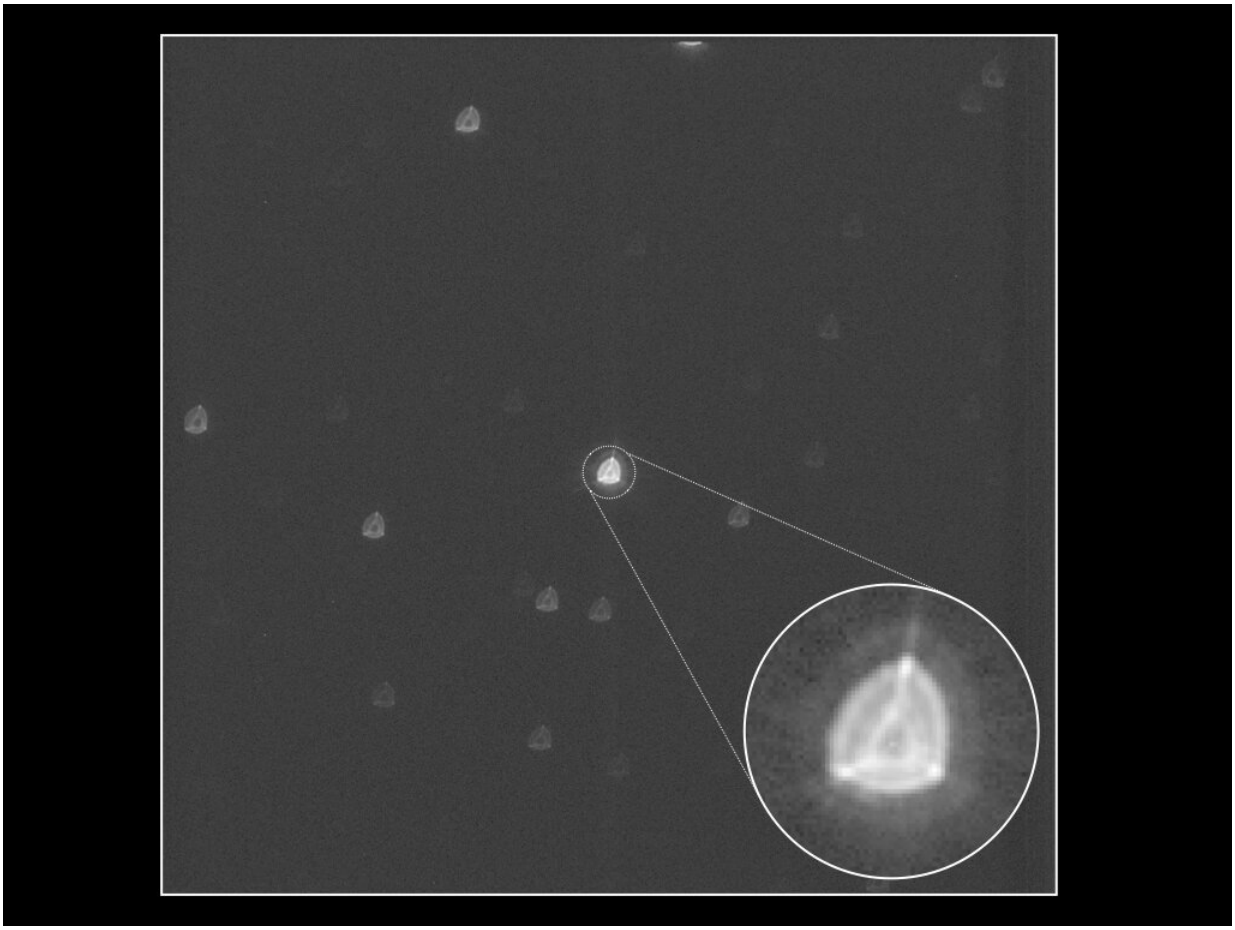

First image of the star chosen as target for CHEOPS after cover opening. The star, at the centre of the image, is located at a distance of 150 light-years from us, in the constellation of Cancer. The image is about 1000x1000 pixels in size, with each pixel representing a tiny angle of about 0.0003 degree (1 arcsecond) on the sky. The other, fainter stars in the image are in the background of the target. The inset in the lower right corner shows a region of about 100-pixels in

width, centered on the target star. The peculiar shape of the star in the image is due to the deliberate defocusing of CHEOPS optics. CHEOPS measures the star's brightness by adding up the light received in all pixels within a region centered on the star as illustrated by the circle in the picture. The defocusing spreads the light onto many pixels, which allows CHEOPS to reach best possible photometric precision. Credit: © ESA/Airbus/CHEOPS Mission Consortium

The tension was high: In front of a large screen at the house near Madrid where members of the Consortium participating in the commissioning of the satellite live, as well as at the other institutes involved in CHEOPS, the team waited for the first images from the space telescope. "The first images that were about to appear on the screen were crucial for us to be able to determine if the telescope's optics had survived the rocket launch in good shape," explains Willy Benz, Professor of Astrophysics at the University of Bern and Principal Investigator of the CHEOPS mission. "When the first images of a field of stars appeared on the screen, it was immediately clear to everyone that we did indeed have a working telescope," says Benz happily. Now the remaining question is how well it is working.

## First images even better than expected

Preliminary analysis has shown that the images from CHEOPS are even better than expected. However, better for CHEOPS does not mean sharper as the telescope has been deliberately defocused. This is because spreading the light over many pixels ensures that the spacecraft's jitter and the pixel-to-pixel variations are smoothed out, allowing for better photometric precision.

"The good news is that the actual blurred images received are smoother and more symmetrical than what we expected from measurements

performed in the laboratory," says Benz. High precision is necessary for CHEOPS to observe small changes in the brightness of stars outside our solar system caused by the transit of an exoplanet in front of the star. Since these changes in brightness are proportional to the surface of the transit planet, CHEOPS will be able to measure the size of the planets. "These initial promising analyses are a great relief and also a boost for the team," continues Benz.

## Further functional tests to follow

How well CHEOPS is working will be tested further over the next two months. "We will analyze many more images in detail to determine the exact level of accuracy that can be achieved by CHEOPS in the different aspects of the science program," says David Ehrenreich, CHEOPS project scientist at the University of Geneva. "The results so far bode well," said Ehrenreich.

## CHEOPS—in search of potential habitable planets

The CHEOPS mission is the first of the ESA's newly created "S-class missions" (small class missions with an agency budget under 50 million) and is dedicated to characterizing exoplanets' transits. "CHEOPS" (CHaracterising ExOPlanet Satellite) will make highly accurate measurements of stars and monitor small changes in their brightness that are caused by a planet transiting in front of the star.

CHEOPS was developed as part of a partnership between the European Space Agency (ESA) and Switzerland. Under the leadership of the University of Bern and ESA, a consortium of more than a hundred scientists and engineers from eleven European states was involved in constructing the satellite over five years.

CHEOPS began its journey into space on Wednesday, December 18, 2019 on board a Soyuz Fregat rocket from the European spaceport in Kourou, French Guiana. Since then, it has been orbiting the Earth on a polar orbit in roughly an hour and a half at an altitude of 700 kilometers following the terminator. The Swiss Confederation participates in the CHEOPS telescope within the PRODEX program (PROgramme de Développement d'EXpériences scientifiques) of the European Space Agency ESA. Through this program, national contributions for science missions can be developed and built by project teams from research and industry. This transfer of knowledge and technology between science and industry ultimately also gives Switzerland a structural competitive advantage as a business location—and enables technologies, processes and products to flow into other markets and thus generate added value for our economy.

## Bernese space exploration: With the world's elite since the first moon landing

When the second man, "Buzz" Aldrin, stepped out of the lunar module on July 21, 1969, the first task he did was to set up the Bernese Solar Wind Composition experiment (SWC) also known as the "solar sail" by planting it in the ground of the moon, even before the American flag. This experiment, which was planned and the results analyzed by Prof. Dr. Johannes Geiss and his team from the Physics Institute of the University of Bern, was the first great highlight in the history of Bernese space exploration

Ever since Bernese space exploration has been among the world's elite. The numbers are impressive: 25 times were instruments flown into the upper atmosphere and ionosphere using rockets (1967-1993), nine times into the stratosphere with balloon flights (1991-2008), over 30 instruments were flown on space probes, and with CHEOPS the

University of Bern shares responsibility with ESA for a whole mission.

The successful work of the Department of Space Research and Planetary Sciences (WP) from the Physics Institute of the University of Bern was consolidated by the foundation of a university competence center, the Center for Space and Habitability (CSH). The Swiss National Fund also awarded the University of Bern the National Center of Competence in Research (NCCR) PlanetS, which it manages together with the University of Geneva.

Provided by University of Bern