**Cheops: The Hunt for Exoplanets**

**WEBCOPY**

A powerful space telescope, due for launch from Europe’s spaceport in French Guiana on 17 December 2019, will give scientists a new insight into the nature of planets outside our solar system.

Cheops [Pron: K-ops] – Characterising ExOPlanet Satellite – will study known exoplanets that are orbiting bright stars.

More than 4000 exoplanets have been discovered and Cheops will be targeting planets between the size of Earth and Neptune, to find out more about their composition, internal structure and whether they might be able to support life.

The Cheops mission is a partnership between ESA and Switzerland with additional contributions from Austria, Belgium, France, Germany, Hungary, Italy, Portugal, Spain, Sweden and the UK.

This film examines the nature of exoplanets, the challenge of exoplanet exploration and features the Cheops Science Operations Centre in Geneva.

**A-ROLL**

**Picture**

**Script**

**10:00:10**

Animated fly-through of Hubble ultra-deep-field – real - image (ESA, NASA)

From: https://hubblesite.org/video/718/news/58-hubble-ultra-deep-field

**10:00:19**

Gaia Galaxy image (ESA)

**10:00:24**

Exoplanet sunrise animation

Thanks to space telescopes like the international Hubble mission, we know there are some two trillion galaxies in the observable universe…

….and hundreds of billions of stars in our galaxy alone…

Now technology is revealing planets orbiting many of these stars and we’re beginning to understand what they’re like…

**10:00:32**

Ext shots Geneva observatory

In 1995, Michel Mayor [PRON: MYER] and Didier Queloz [PRON: KEL-OZ] from the Geneva Observatory co-discovered the first ever exoplanet orbiting a Sun-like star.

This year, they won the Nobel Prize in Physics for their work…

**10:00:46**

Didier Queloz, Chair, Cheops Science Team

**10:01:07**

C/A of transiting star animation (not the graph one)

*I was using a technique called radial velocity which is observing a star and looking for any change of speed in the star. Since then the field has exploded and as you may know there are really now thousands of exoplanets. There are lots of planets known to be transiting, which means the planet goes right in front of the star, and that’s this technique that we’re using for the Cheops mission.*

**10:01:14**

Exoplanet solar system animation (ESA, ESO)

Thanks to ground-based observations and planet hunting missions, such as Corot [PRON: COR-O] and Kepler, more than 4000 Exoplanets have now been discovered. They range from small rocky planets to gas giants larger than Jupiter.

Cheops will be targeting known planets between the size of Earth and the icy giant Neptune, which has four times our planet’s radius.

The mission will probe the nature of these exoplanets and begin to answer questions such as whether any of these alien worlds could support life.

**10:01:47**

Willy Benz, Cheops Principal Investigator, University of Bern

*Cheops’ aim is to measure the size of already known exoplanets. It’s not a discovery mission. It’s really aimed at precisely measuring the size and once we have size and possibly the mass we can derive the mean density and from then we know a little bit what the planet is made of.*

**10:02:07**

Computers and GVs Science Operations Centre

Data from the orbiting space telescope will be processed in banks of computers at the Geneva Observatory…home to the Cheops Science Operations Centre, where scientists will also decide which exoplanets to target.

**10:02:21**

Matthias Beck, Cheops Ground Segment Manager

*We’re sending the observation programme to the Mission Operations Centre in Madrid where then the information is uplinked to the actual instrument. The instrument is configured to observe the star and then the telemetry, the data is downlinked to the Mission Operations Centre and right away forwarded to us here in Geneva where we can do the data processing, archive the data and then provide it to the scientists all over Europe and to the world.*

**10:02:49**

Cheops in orbit animation

**10:02:57**

Into…Exoplanet animations, ending with Earth-like planet

By making repeated observations of several hundred planets, Cheops will provide an important insight into the inner structure of exoplanets, how they form and evolve…and whether any are even a little like the Earth.

**B-ROLL**

**10:03:09:24**

**Didier Queloz, Chair Cheops Science Team, University of Geneva (English)**

*Well, my life has been absolutely organized – my professional life – around exoplanets. because I had the chance to find the first one orbiting a star in ’95, and in these days I was using a technique called radial velocity which is observing a star and looking for any change of speed in the star. Since then the field has exploded and as you may know there are really now thousands of exoplanets. There are lots of planets known to be transiting, which means the planet goes right in front of the star, and that’s this technique that we’re using for the Cheops mission*

*Detecting a planet is very difficult and you have to rely on tricks using the star and in the case of a transiting planet what happens is the planet goes in front of the star so you get the shadow effect, it means the size of the planet and of course the period of the planet. When you go for the radial velocity you’ve got mass of the planet because what the planet does is changing the speed of the stars. Well, you can combine the two together and for some system having a transiting planet and you do also radial velocity in this case your get the mass, you get the size and then you can compute the density, or the bulk density, that tells you about the nature of the planet - if it’s a planet like Jupiter or if it’s a planet like the Earth*

*Well the science programme started two, three years ago. It’s a big amount of work to establish a programme because Cheops is dedicated mission to do follow-up so there’s a lot of targets. We have more than 100 targets that we are going to observe. These targets need to be carefully selected. So most of the work is done right now. So two weeks before the launch practically the mood is more to just hope that the launch will go well. The programme is ready to go. What were are very eager to know right now is we have a lot of simulations, we have a lot of detail about the potential of the missions, where we we’re really hoping to open the hood of the telescope and to start seeing the star with this telescope and then matching the expectation we have for the science programme with the reality. So it’s really crossed fingers for the launch right now.*

**10:05:42:18**

**Didier Queloz, Chair Cheops Science Team, University of Geneva (French)**

 • Why CHEOPS is different from other exoplanet missions (in French).

 • Receiving data from CHEOPS after the launch (in French).

**10:08:46:05**

**Willy Benz, Principal Investigator, Cheops, University of Bern (English)**

*This is the whole challenge of astronomy. Targets are way too far, we cannot go for most of them, so all we have are telescopes to look at. So what Cheops will be doing is to look at the moment in time when planet passes in front of the star. It transits, one calls it, and when the planet goes, passes in front of star it will dim a little bit the light from the star because it casts a shadow and we actually see this shadow. And the amount of light, the decrease in light is minute. It’s very, very tiny, 0.01% for an Earth-like planet passing in front of a Sun-like star and these kinds of measurements you can only do from space to begin with. But then, from the decrease in light, you can infer how big the planet is compared to the star because it just hides a part of the surface and you can compute which fraction of the surface is being hidden by the passing planet and that gives you then the size of the planet. All this without going there, all this without seeing the planet, we just see the shadow.*

*The first thing we will do is to open the cover of Cheops and this opening will be a delicate moment because if the cover doesn’t open then we will see dark skies for the rest of the mission but anyway, and then slowly we’ll turn on. So this commissioning phase as it’s called at the very beginning will last about two months and the idea is during these two months idea to check one by one all the functions of the satellite and at the same time verify that we are capable of measuring what we want to measure within the requirements we set to ourselves to address the science we want to address.*

*Cheops is a follow-up mission. It’s not a discovery mission so Cheops is not looking at 100 thousands of stars with the idea to detect more planets. Cheops is looking at one star at a time. We need to know that star has a planet. We need to know when this planet passes in front of the star and at that moment we point Cheops there and measure with precision the depth of the light diminishing because of the passing of the planet and that is the measurement of the size. This is the first one and only one transit mission that does it that way.*

**10:11:44:13**

**Willy Benz, Pincipal Investigator, Cheops, University of Bern (French)**

 • How Cheops is different to existing exoplanet missions (in French).

 • What Cheops will tell us about known exoplanets (in French).

 • The types of exoplanets of interest

**10:15:04:11**

**Matthias Beck, Cheops Ground Segment Manager, University of Geneva (English)**

*So here in Geneva we are sort of the heart of the mission. We have the scientists proposing targets, stars with planets, then we’re cooking up the observation programme, we’re sending the observation programme to the Mission Operations Centre in Madrid where then the information is uplinked to the actual instrument. The instrument is configured to observe the star and then the telemetry, the data is downlinked to the Mission Operations Centre and right away forwarded to us here in Geneva where we then can do the data processing, archive the data and then provide it to the scientists all over Europe and to the world.*

**10:15:56:22**

**Matthias Beck, Cheops Ground Segment Manager, University of Geneva (German)**

 • The role of the CHEOPS Science Operations Centre at the Geneva Observatory, Switzerland (in German).

 • The computing power required for the Science Operations Centre at the Geneva Observatory for the CHEOPS mission (in German).

 • The operations before and after launch (in German).

**10:18:55:18**

**Geneva Observatory, exterior GVs**

**10:20:31:01**

**Cheops Science Operations Centre GVs, Geneva Observatory**

**10:21:17:10**

**Exoplanet animations (ESA and ESO)**

**10:23:17:13**

**New Exoplanet Animations - December 2019**

**10:25:07:03**

**[ENDS]**