New CHEOPS observing opportunities

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How to submit a GO proposal to CHEOPS ?

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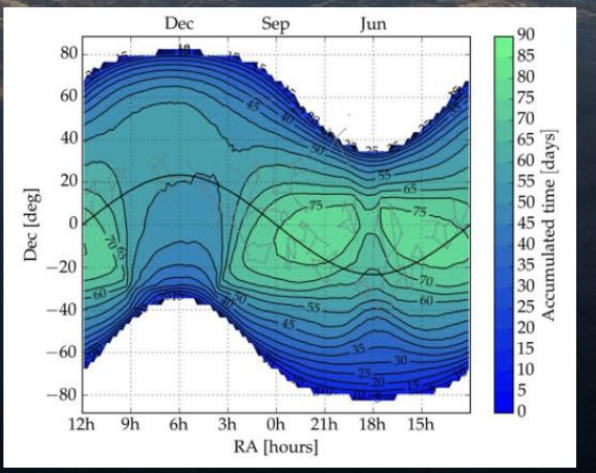
- **More time:** 30% science observing time dedicated to the GO Programme
- **Double anonymous** peer-review of proposals
- Zero-installation, **cloud-based** target visibility checker

Space-based ultra-high-precision photometry :

- 20 ppm in 6 hrs ($6 \leq V \leq 9$); 85 ppm in 3 hrs ($9 \leq V \leq 12$)
- ~70% of the sky observable



Target visibility map

Outline

- CHEOPS Mission – 5 years in orbit
- Spacecraft and instruments
- Science highlights
- What is in CHEOPS for you?
- Questions?

First ESA "S"- class Mission (CHaracterising ExOPlanet Satellite)

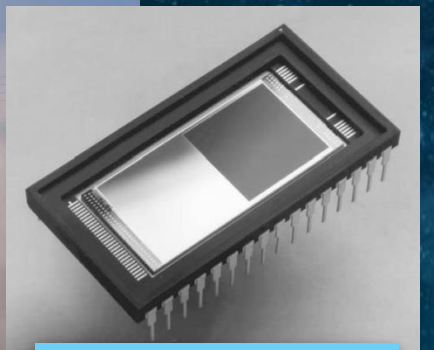
esa
European Space Agency
Agence spatiale européenne

with
Shared lead

Consortium
CHEOPS

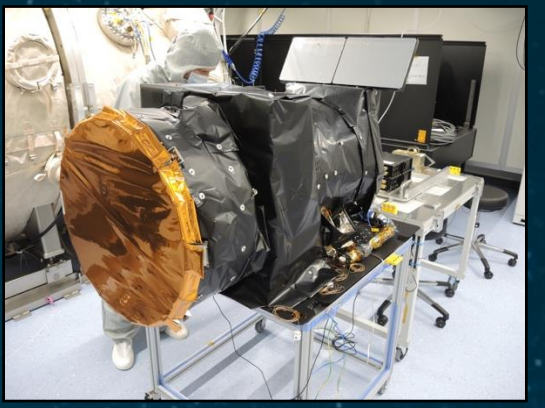
- Launching state
- Mission architect
- Launch services
- Platform procurement
- CCD procurement
- Space Debris Service
- Guest Observers (GO) programme


Soyuz-Fregat rocket


Frame-transfer CCD


Spacecraft platform

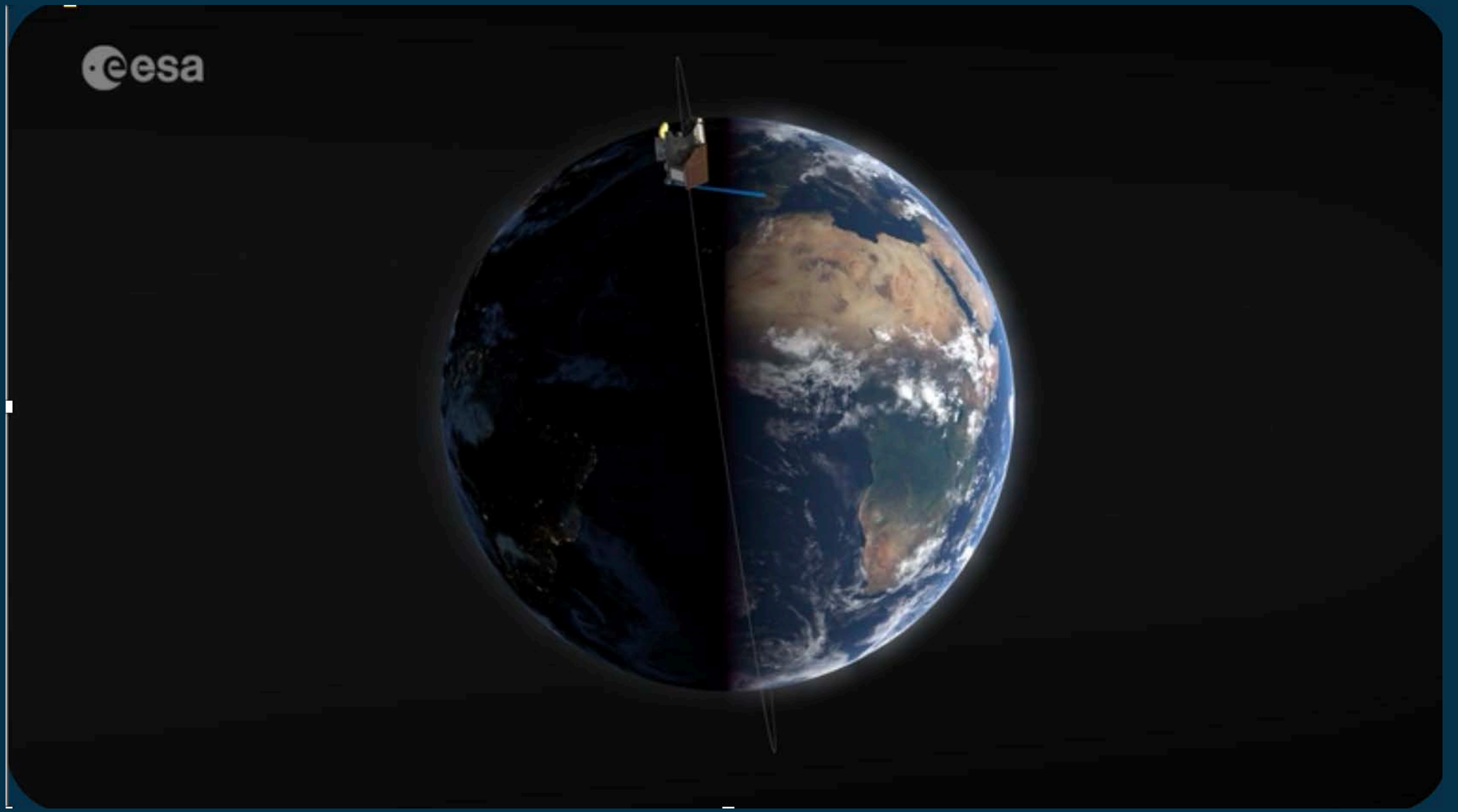
- Mission concept
- Instrument design, manufacture, calibration
- Spacecraft operations
- Science operations
- Guaranteed Time Observations (GTO) programme


CHEOPS instrument

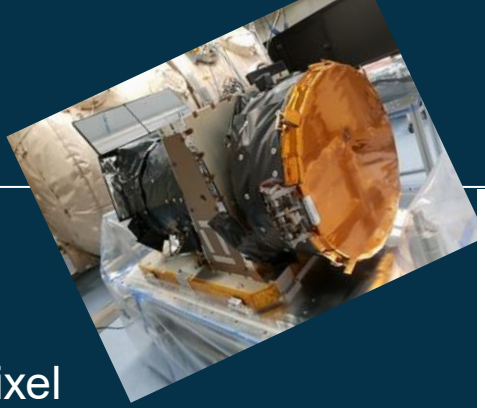
Ultrahigh-precision photometer for transit follow-up observations, phase-curves, and other science.

Photometric precision (stability) over 48 hr timescale: 20 ppm (6 hrs) for G-type star

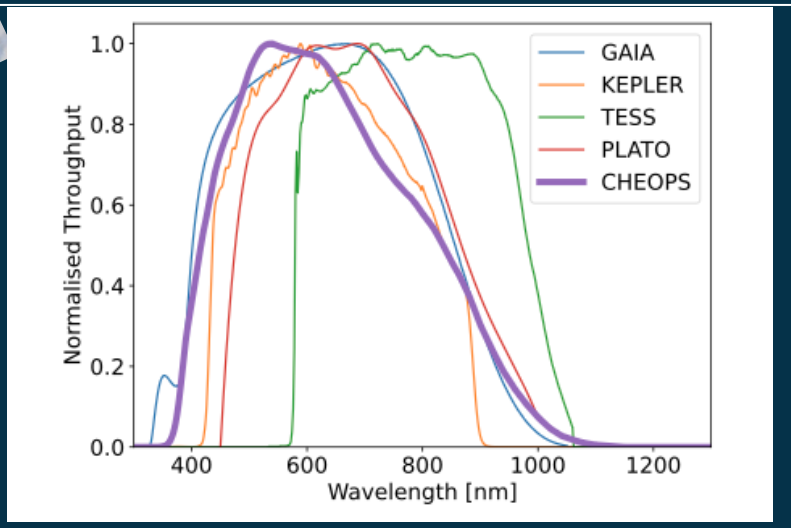
Orbit and Ground Stations

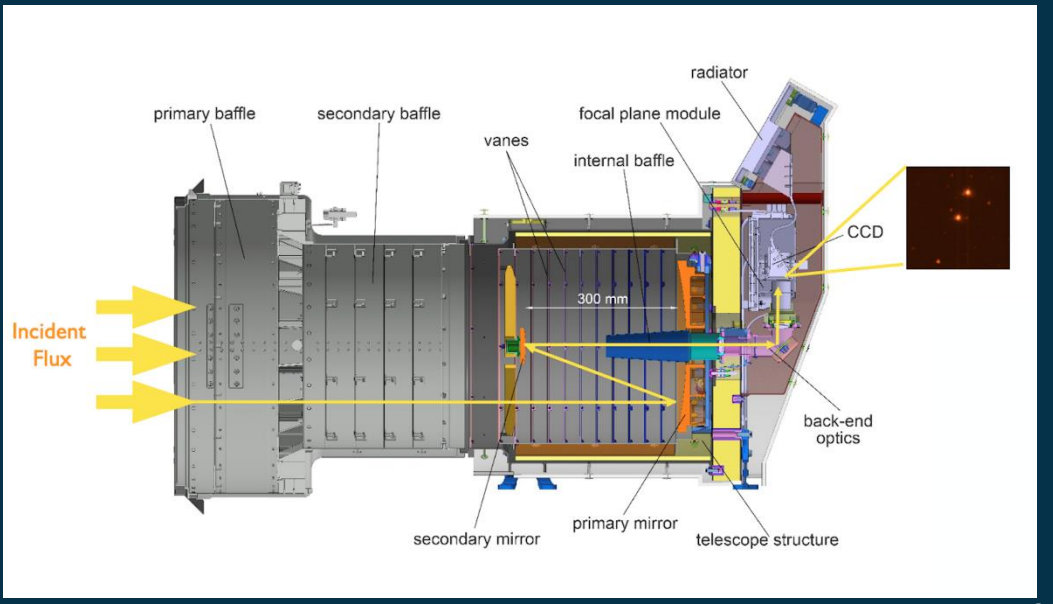


CHEOPS Instrument Overview



- Uses a single, frame-transfer, back-illuminated CCD detector from Teledyne with 1024 × 1024 pixels and a pixel pitch of 13 μm.
- CCD is mounted in the focal plane of a 32 cm diameter, f/8, on-axis Ritchey-Chrétien telescope.
- Passively cooled to 233 K, with a thermal stability of 10 mK.
- Stray light, primarily from the Earth, is minimized by baffling the telescope.
- Cleanliness and contamination requirements necessitate a light and dust-tight cover.
- The detector, support electronics, telescope, back-end optics, instrument computer, and thermal regulation hardware are collectively known as the CHEOPS Instrument System (CIS).





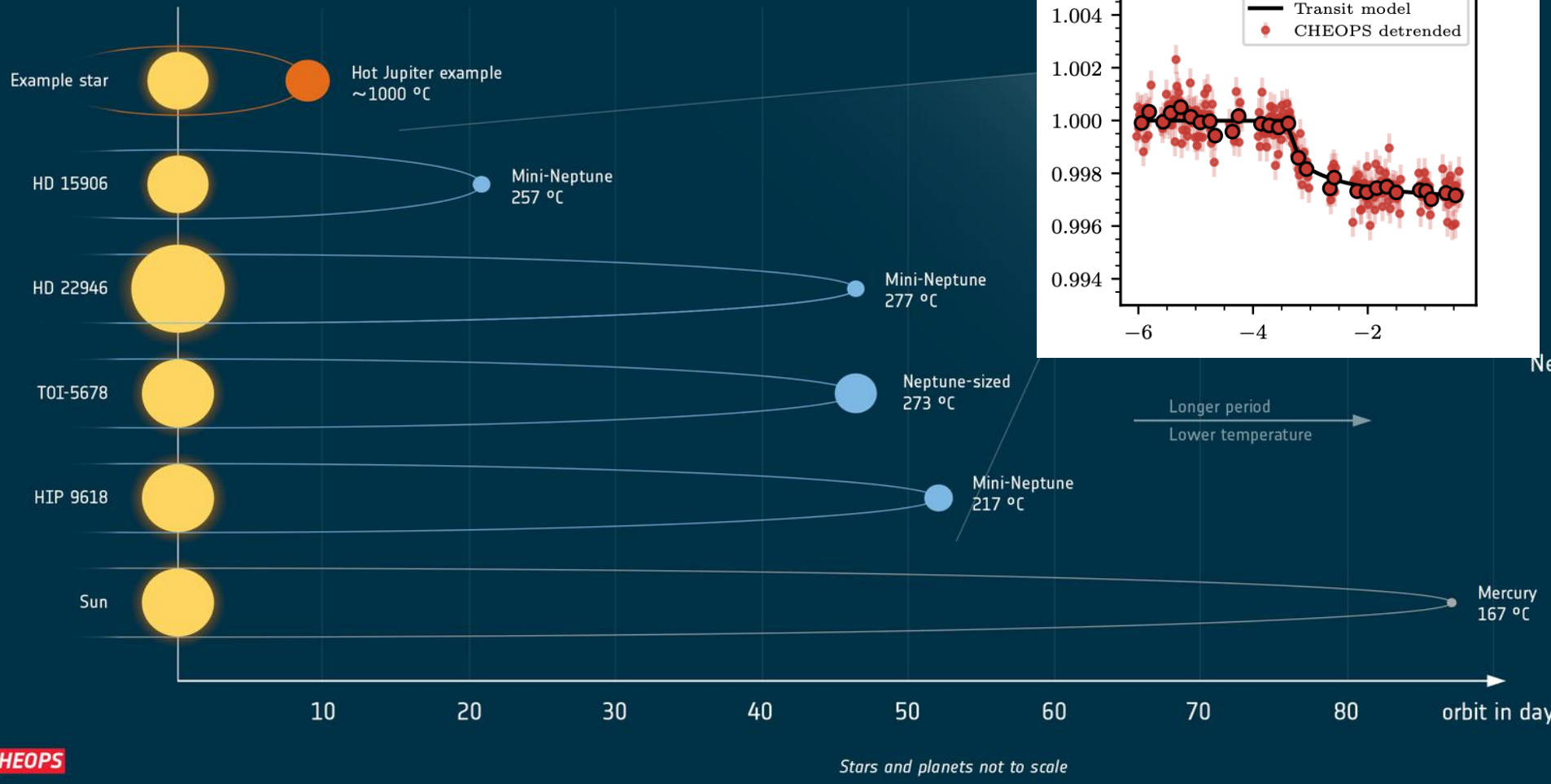
Fortier, A., et al.: A&A, 687, A302 (2024)

Science Highlights - 1

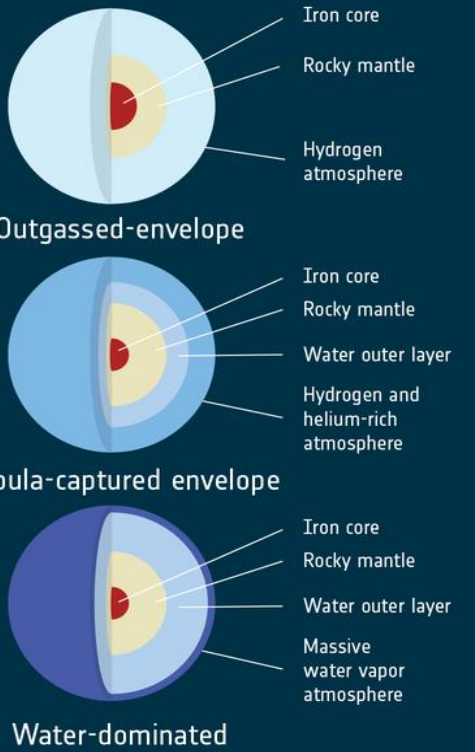
Garai et al., A&A 674 (2023), Osborn et al. MNRAS 523 (2023), Tuson et al. MNRAS 523 (2023), Ulmer-Moll A&A 674 (2023)

CHEOPS EXPLORES MYSTERIOUS WARM MINI-NEPTUNES

ESA's Cheops confirmed the existence of four warm exoplanets with sizes between Earth and Neptune, orbiting their stars closer than Mercury our Sun. These so-called mini-Neptunes are unlike any planet in our Solar System and provide a 'missing link' that is not yet understood. Mini-Neptunes are among the most common types of planets known, and astronomers are starting to find more and more orbiting bright stars.



Internal structure possibilities of mini-Neptunes

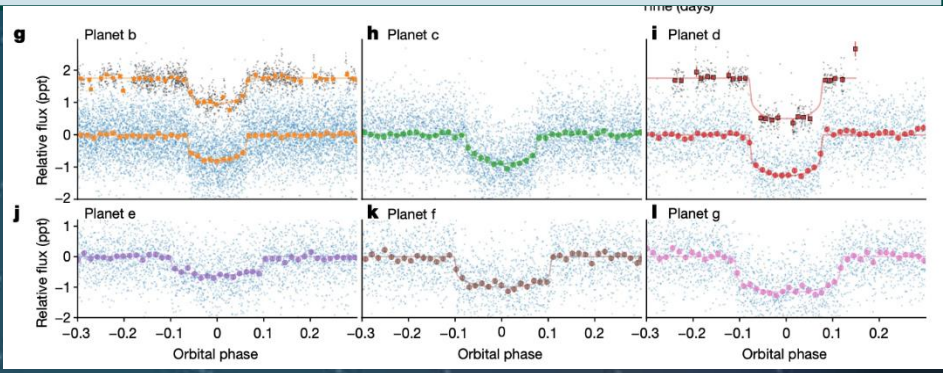


#CHEOPS

→ THE EUROPEAN SPACE AGENCY

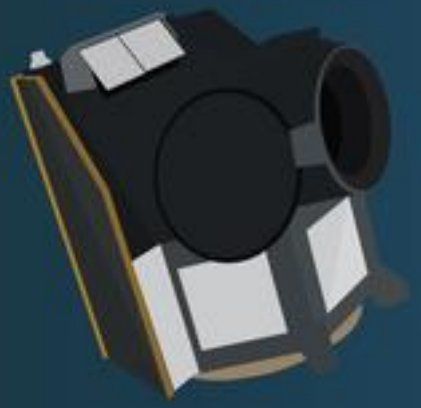
Science Highlights - 2

Luque, R. et al., Nature 623, 932–937 (2023), and others



ESA'S CHEOPS HELPS UNLOCK RARE SIX-PLANET SYSTEM

An uncommon family of **six exoplanets** has been unlocked with the help of **ESA's Cheops mission.**



The six planets orbit their **central star HD 110067** in a harmonic rhythm with planets aligning every few orbits.

Planet b completes **six orbits** while planet g does **one**

6:1

Planet e completes **four orbits** while planet f does **three**

3:2 3:2 3:2 4:3 4:3

Planet c completes **three orbits** while planet d does **two**

Orbital period predicted and confirmed by Cheops

All planets are smaller than Neptune and have large atmospheres

*Star and planets not to scale

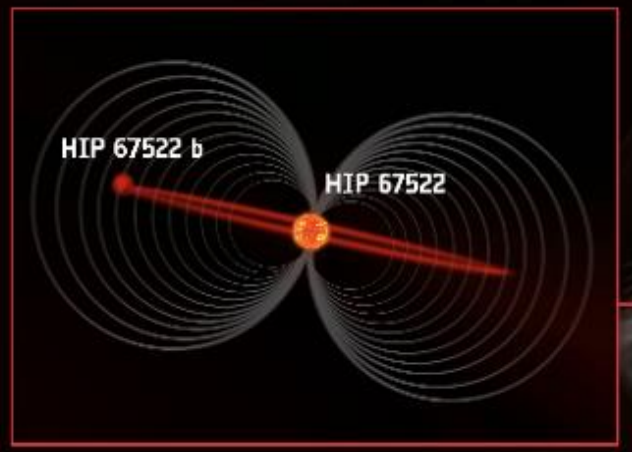
#CHEOPS

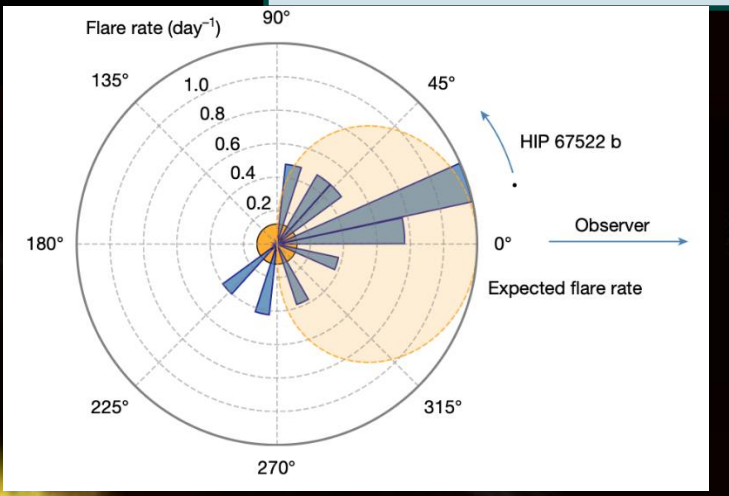
Science Highlights – 3:
Close-in planet induces flares on its host star

Ilin, E. et al., Nature 643, 645–648 (2025)

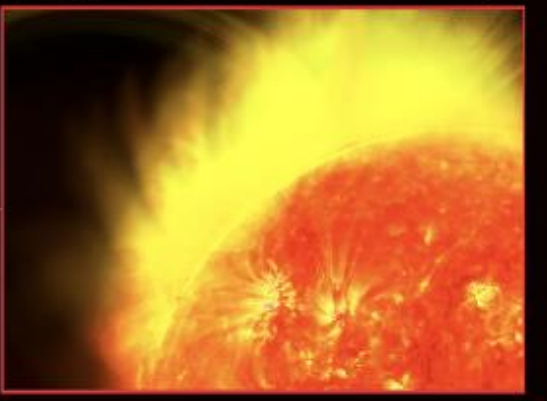
esa

01.
HIP 67522 b orbits close to its host star HIP 67522, inside the star's large and powerful magnetic field



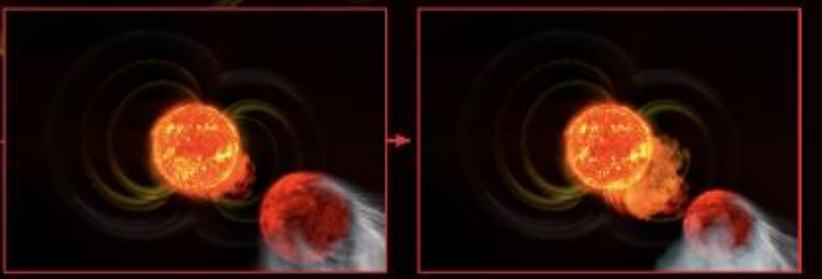


03.
Where the waves meet the star's surface, they trigger the release of a flare of light



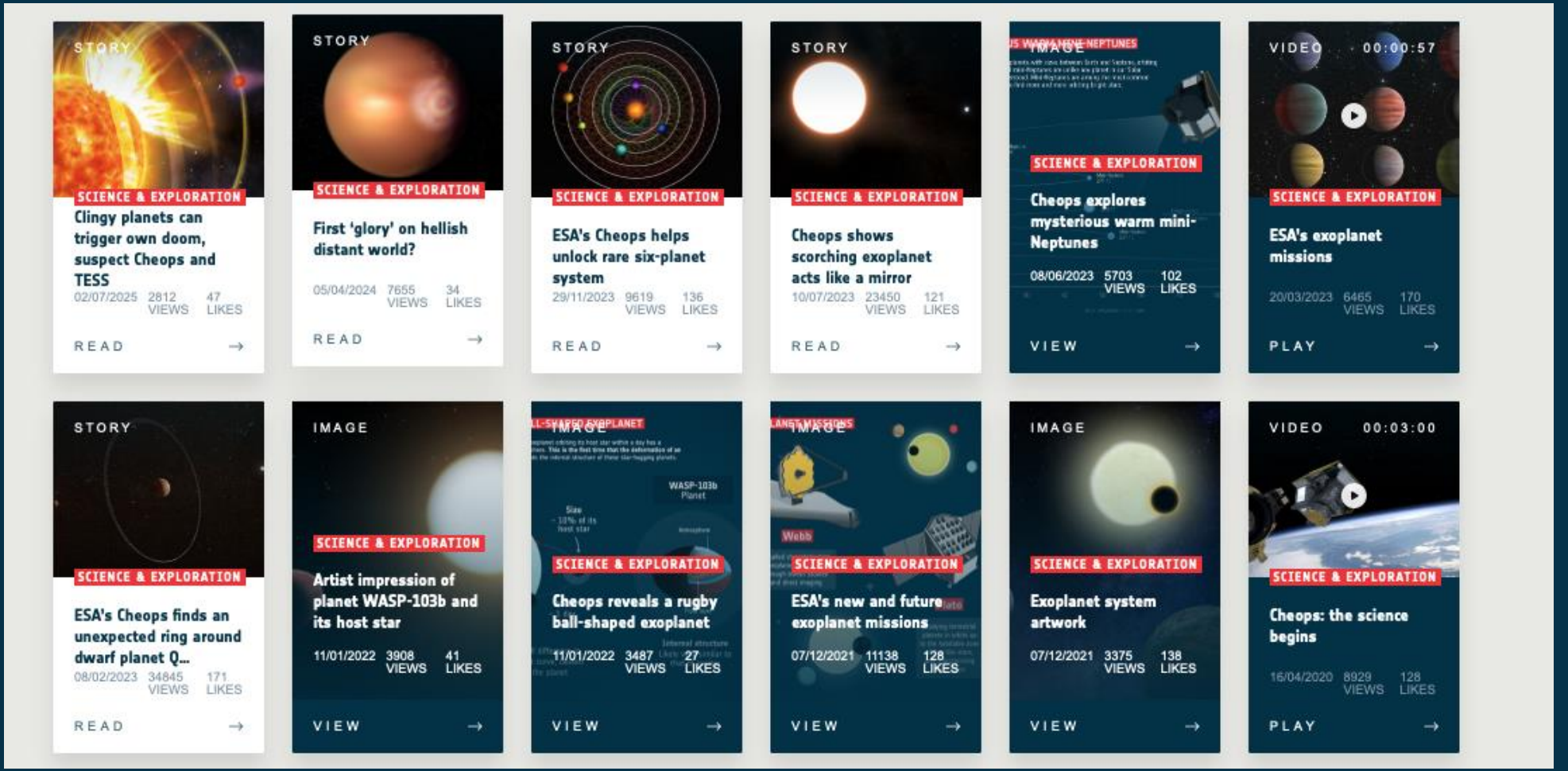
02.
The planet stores magnetic energy as it orbits the star, and sends this back as waves along the star's magnetic field lines

04.
These flares blast away the planet's wispy atmosphere, causing it to shrink every year



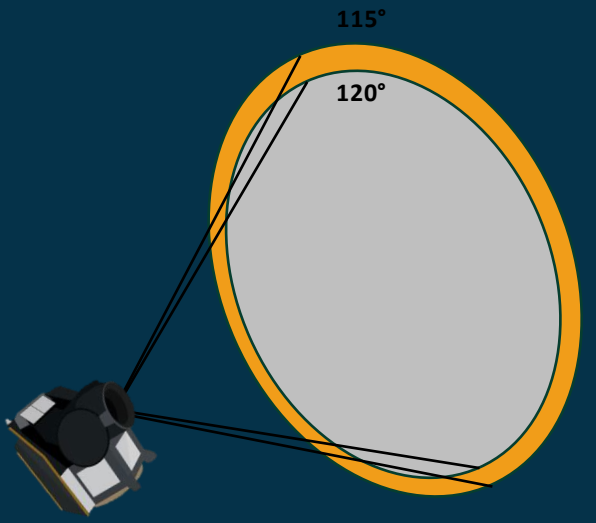
More science @

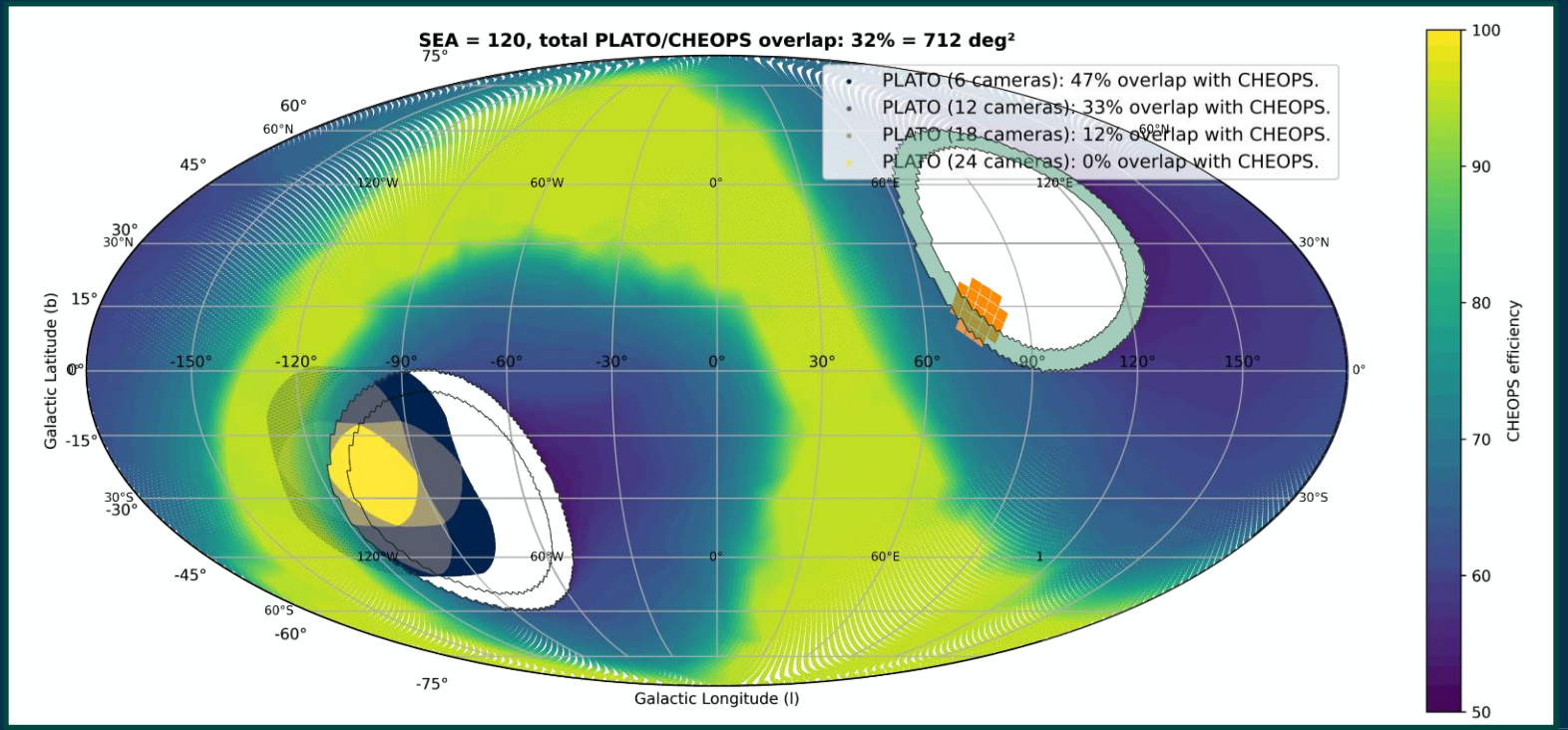
https://www.esa.int/Science_Exploration/Space_Science/Cheops



Changes in operations set up – over 75% of sky coverage

- The Sun Exclusion Angle (**SEA**) reduced from 120° to **115°**
- The satellite's operational performance remains intact
- **+ 450 more** exoplanets and exoplanetary candidates
- **+ 227'000 more** stars
- Increased visibility window for old targets





- Overlap with the Kepler field increased: 17% → 50%
- Overlap with the PLATO field increased: 32% → 47%
- 114 new PLATO targets → broader synergy possibilities

First of an ESA Exoplanet Trilogy

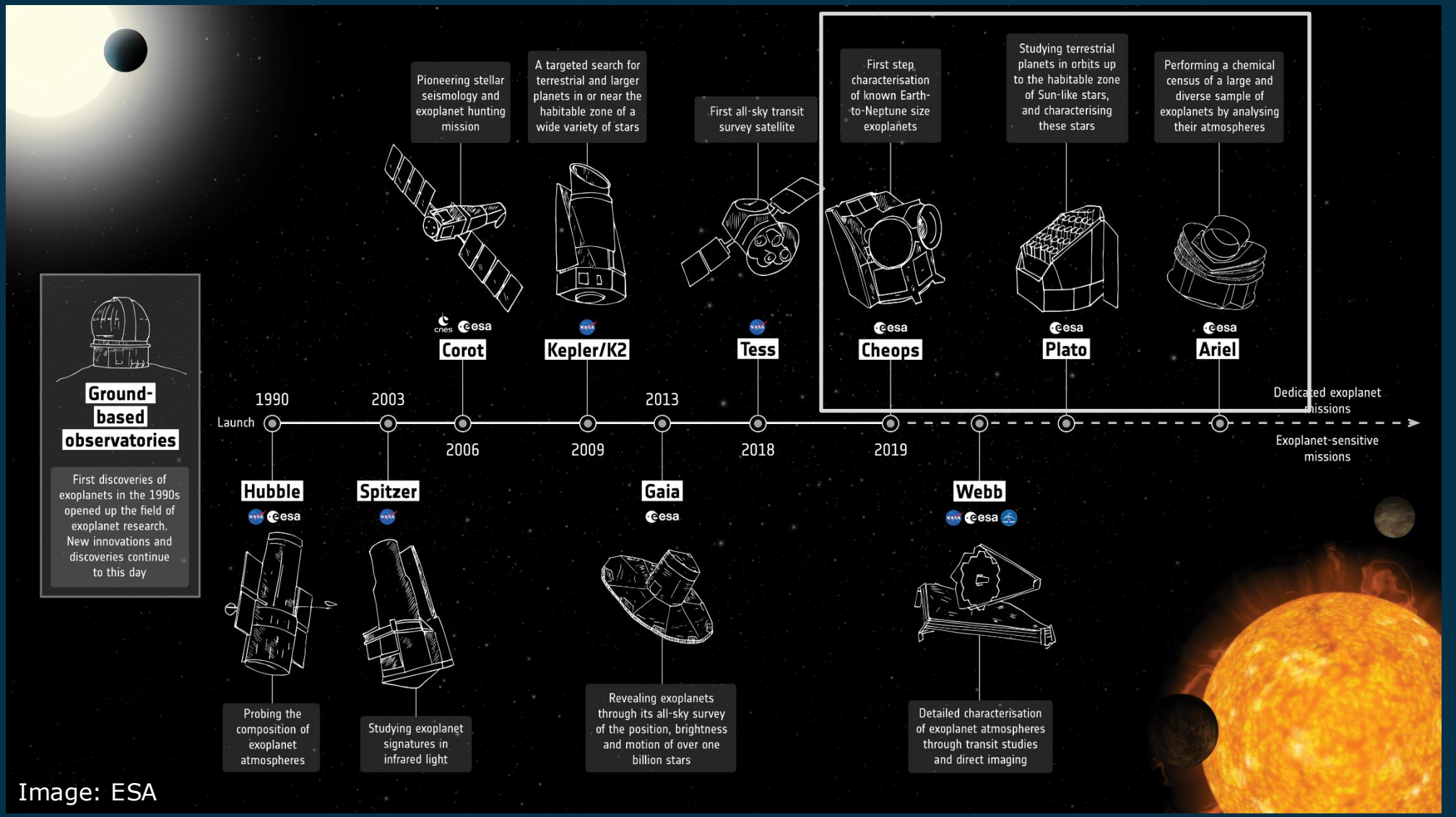
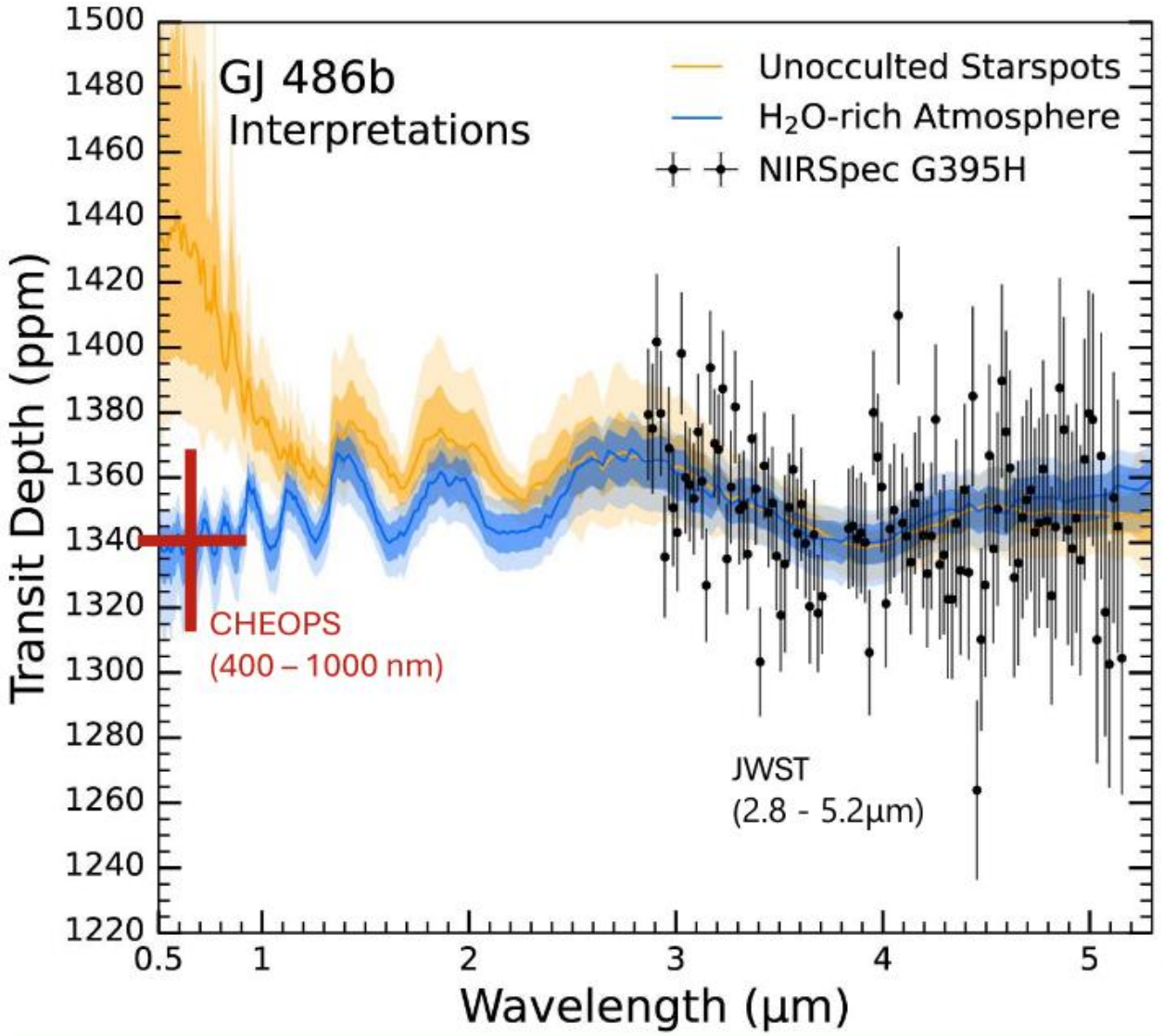


Image: ESA

Science Case

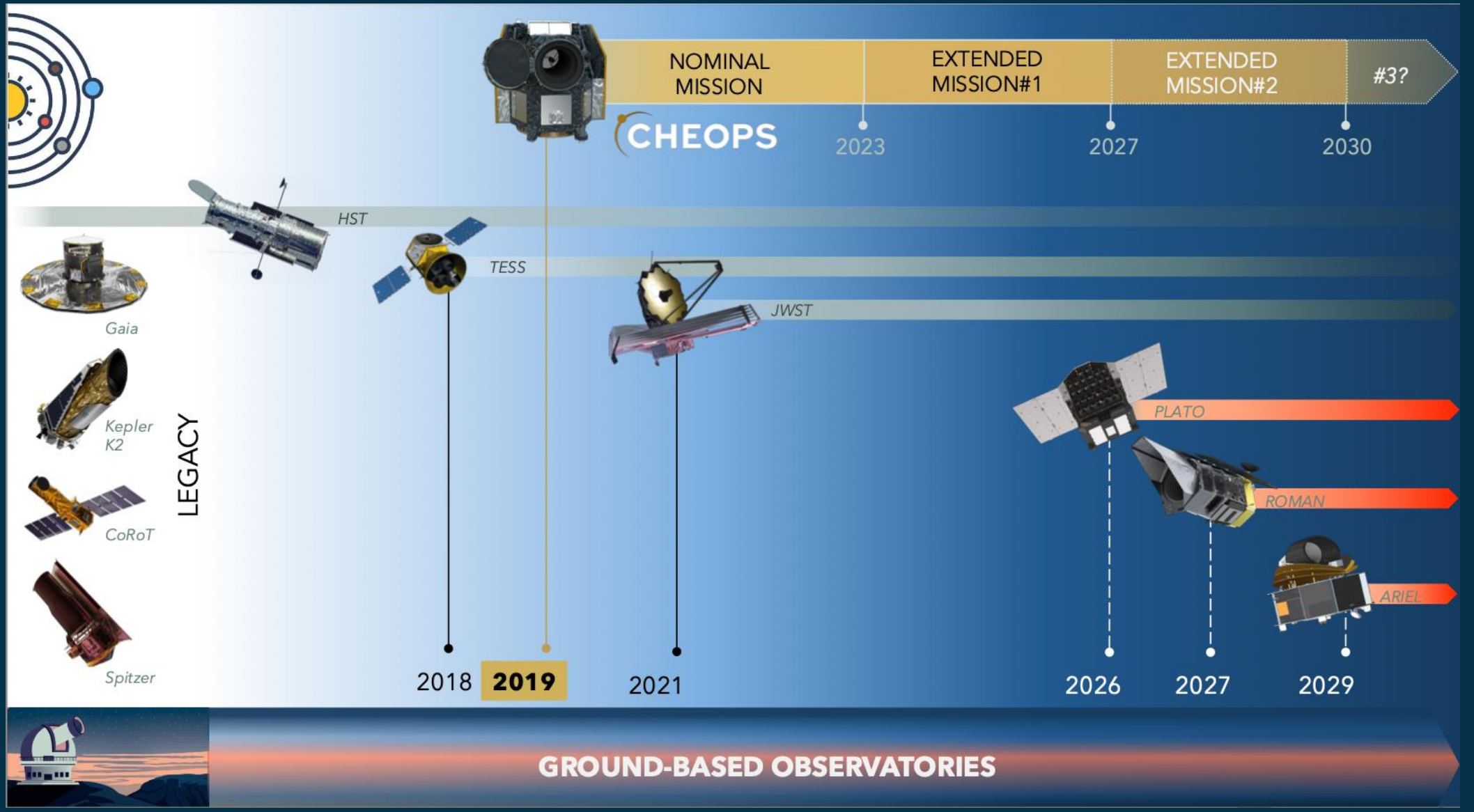


Simultaneous observations:

- Example of super-Earth GJ 486b studied with JWST
- High-profile science (NASA media release, worldwide coverage)
- Simultaneous CHEOPS observations could have broken this degeneracy and given the full picture
- CHEOPS will help HST and JWST to reach full potential

Moran et al. 2023, ApJL, Volume 948, Issue 1, doi: 10.3847/2041-8213/accb9c
https://www.nasa.gov/universe/webb-finds-water-vapor-but-from-a-rocky-planet-or-its-star/

Crucial Synergistic Role in the Present & Future



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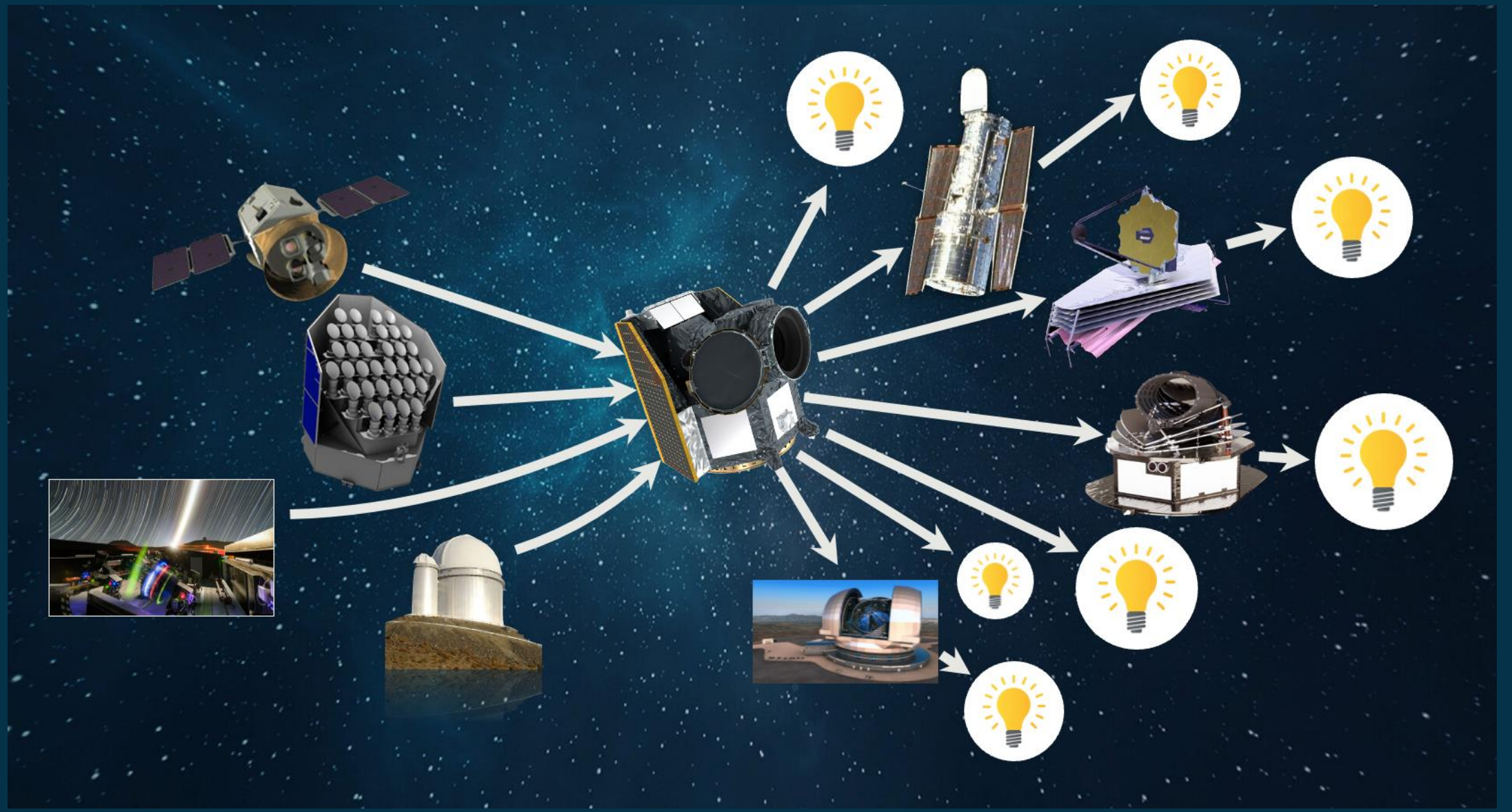

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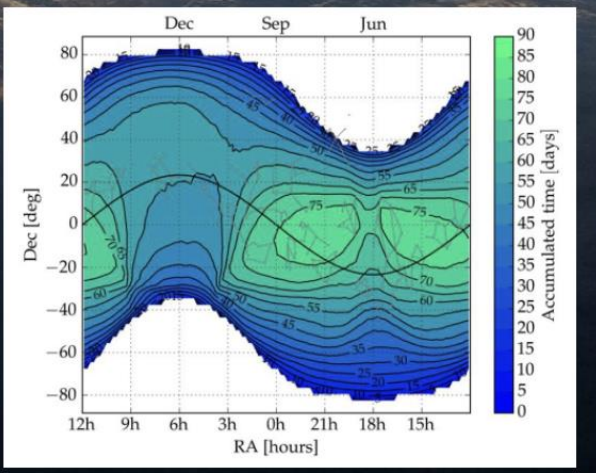
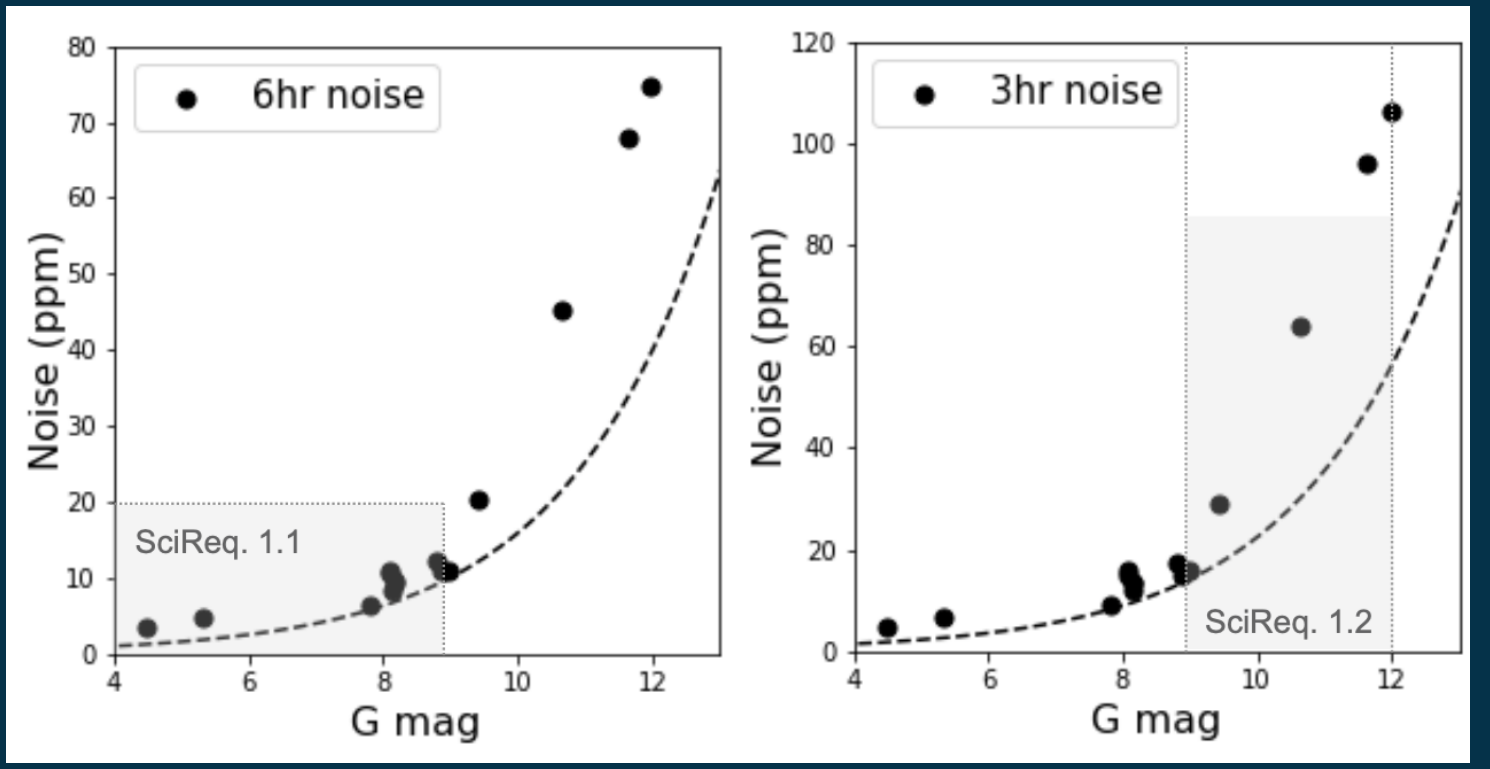


Target visibility map

Thanks for your attention!
Any questions?

In-flight performance remains high

- Ageing as expected: hot pixels, charge transfer inefficiency, and sensitivity decrease
- Well identified by Monitoring & Characterisation programme
- In line with scientific requirements for targets with Gmag<11.5; new public pipeline addresses Gmag>11.5
- Modelling of systematics is key for high quality of science data (e.g., via Data Reduction Pipeline)



Fortier et al. (2024, A&A, doi:10.1051/0004-6361/202348576)