ESA's first small-class mission

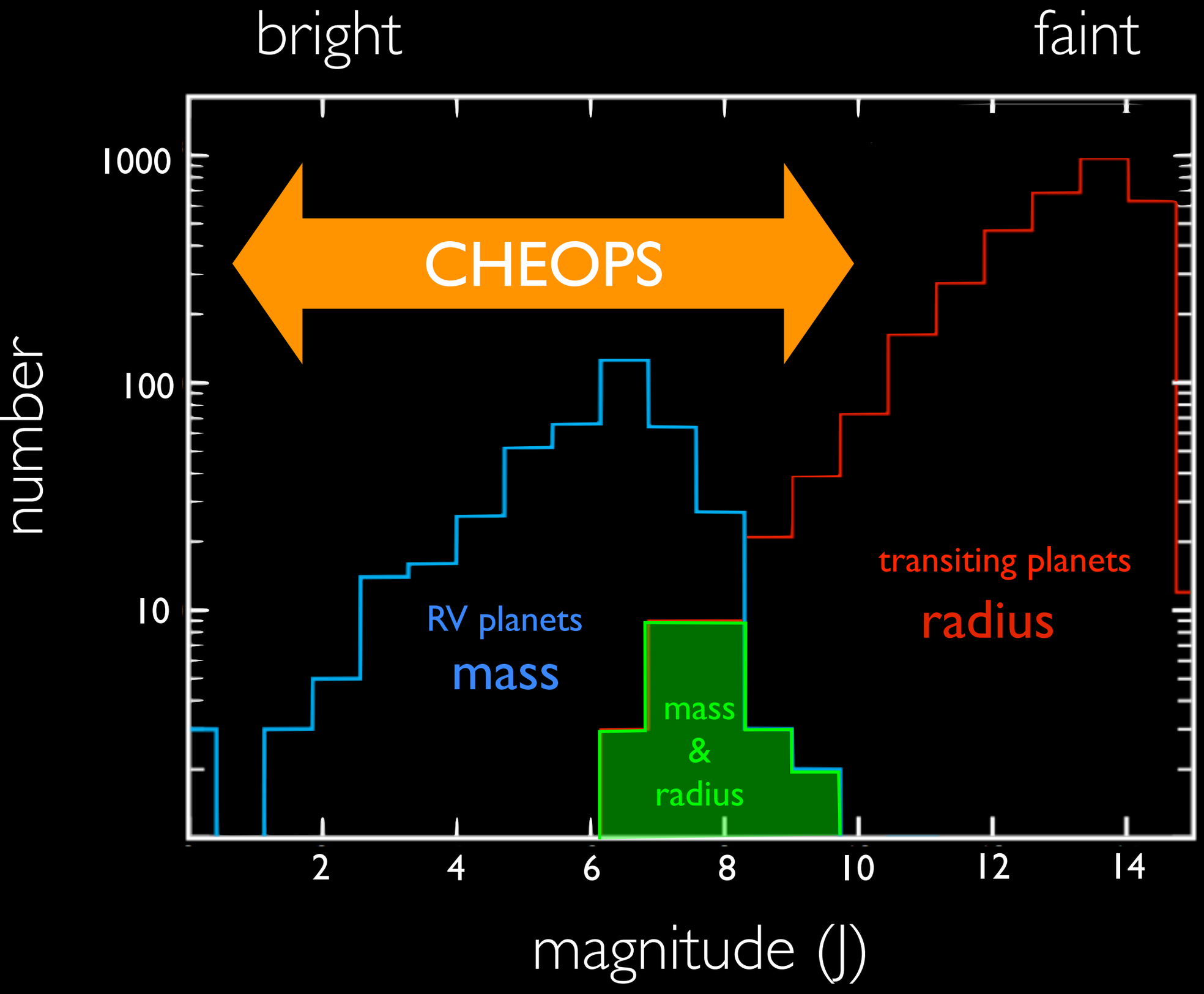
CHEOPS

CHaracterizing ExOPlanet Satellite

esa

ESA's small-class missions

- Science
  - excellent science in any area of space science
- Cost
  - total cost < 150 M€
  - cost to ESA: not to exceed 50 M€ (incl. launch)
- Schedule
  - developed and launched within 4 years


bright
faint
1000
100
10
number
CHEOPS
RV planets
mass
transiting planets
radius
mass
&
radius
2
4
6
8
10
12
14
magnitude (J)

Key targets: bright stars

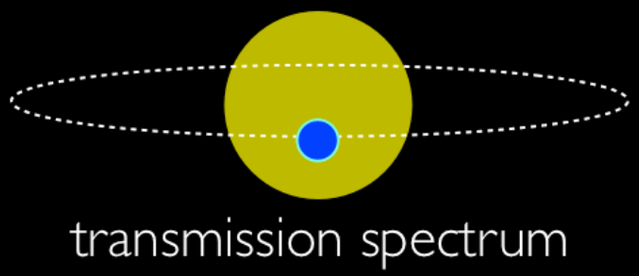
Interior

radial velocity measurements → mass

transit measurements → radius

mass + radius → mean density → constraint on structure

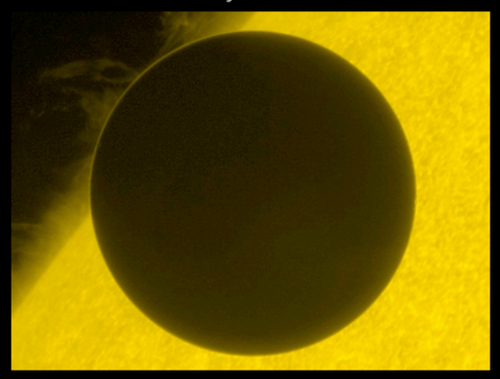
atmosphere

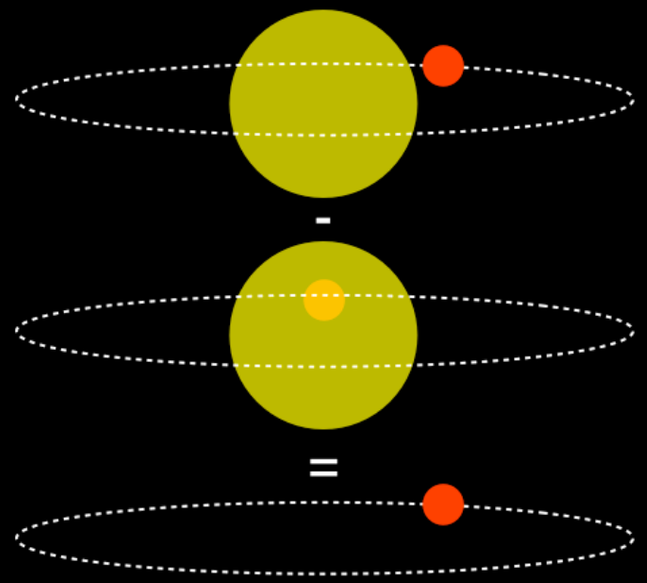


transmission spectrum

Venus transit

Hinode June 5, 2012





thermal emission spectrum

Characterization of planets

Science objectives

1. Mass-radius relation of planets
2. Identification of planets with atmospheres
3. Constraints on planet migration paths
4. Energy transport in hot-Jupiter atmospheres
5. Targets for future spectroscopic facilities
6. 20% open time (selection through ESA)

A mission of innovation

- **Programmatic**

  First small mission in ESA's Science Programme
  - first for the Agency
  - first for the Member States

- **Scientific**

  First exoplanet follow-up mission

A mission of challenges

Financial

- 50 M€ from ESA (cost cap)
  - 10% of a M-mission!
  - ESA procured elements
    - launch
    - plateform
    - CCD

- ~ 50 M€ from Member States
  - MS procured elements:
    - payload (telescope)
    - ground segment (SOC, MOC)

A mission of challenges

Schedule

call issued	March 3, 2012
proposal due	June 15, 2012
mission selection	October 19, 2012
mission adoption	February 2014
launch	2017
nominal lifetime	3.5 years

Decision processes (Agency and Member States) not really ready for such a fast pace!

A mission of challenges

Organisation

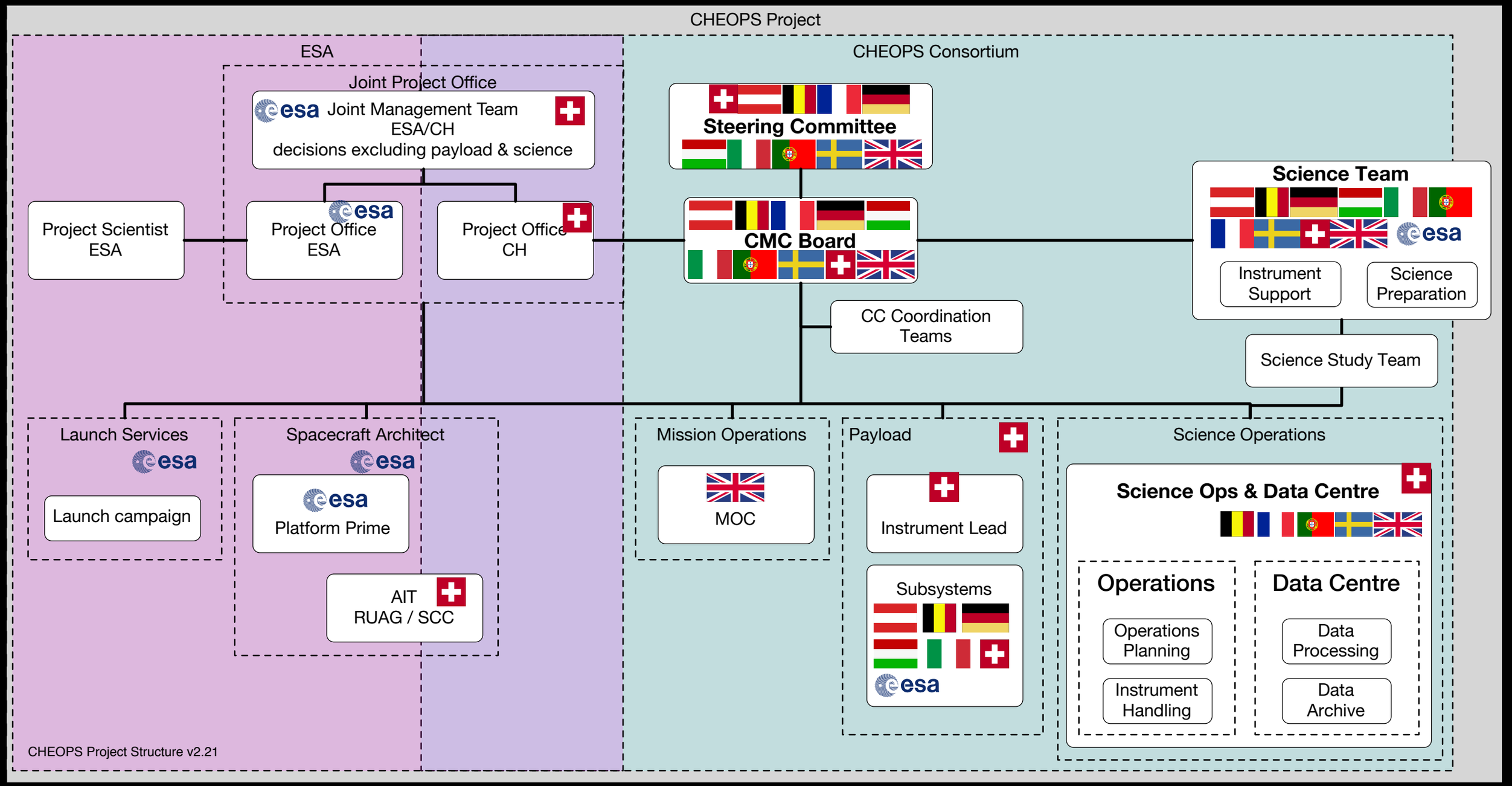
- *10 countries*
- *19 entities*

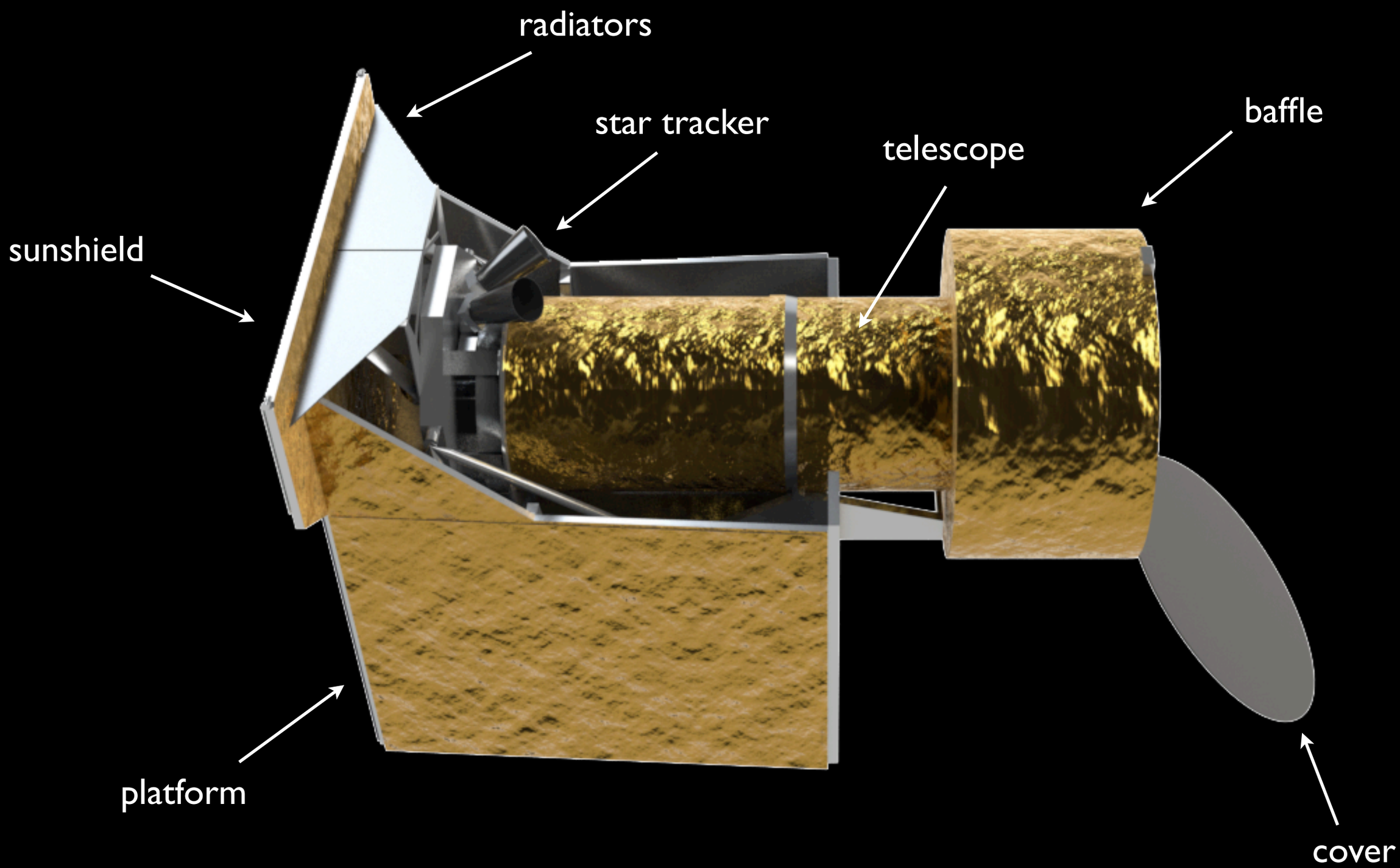
small mission with a large organisation!

Country	Institutes
CH	University of Bern (project lead) University of Geneva Swiss Space Center (EPFL) ETH-Z
Austria	Institut für Weltraumforschung, Graz
Belgium	Centre Spatial de Liège Université de Liège
France	Laboratoire d'astrophysique de Marseille
Germany	DLR Institute for Planetary Research DLR Institute for Optical Sensor Systems
Hungary	Konkoly Observatory
Italy	Osservatorio Astrofisico di Catania – INAF Osservatorio Astronomico di Padova - INAF Università di Padova
Portugal	Centro de Astrofisica da Universidade do Porto Deimos Engenharia
Sweden	Onsala Space Observatory, Chalmers University University of Stockholm
UK	University of Warwick

Payload Ground segment

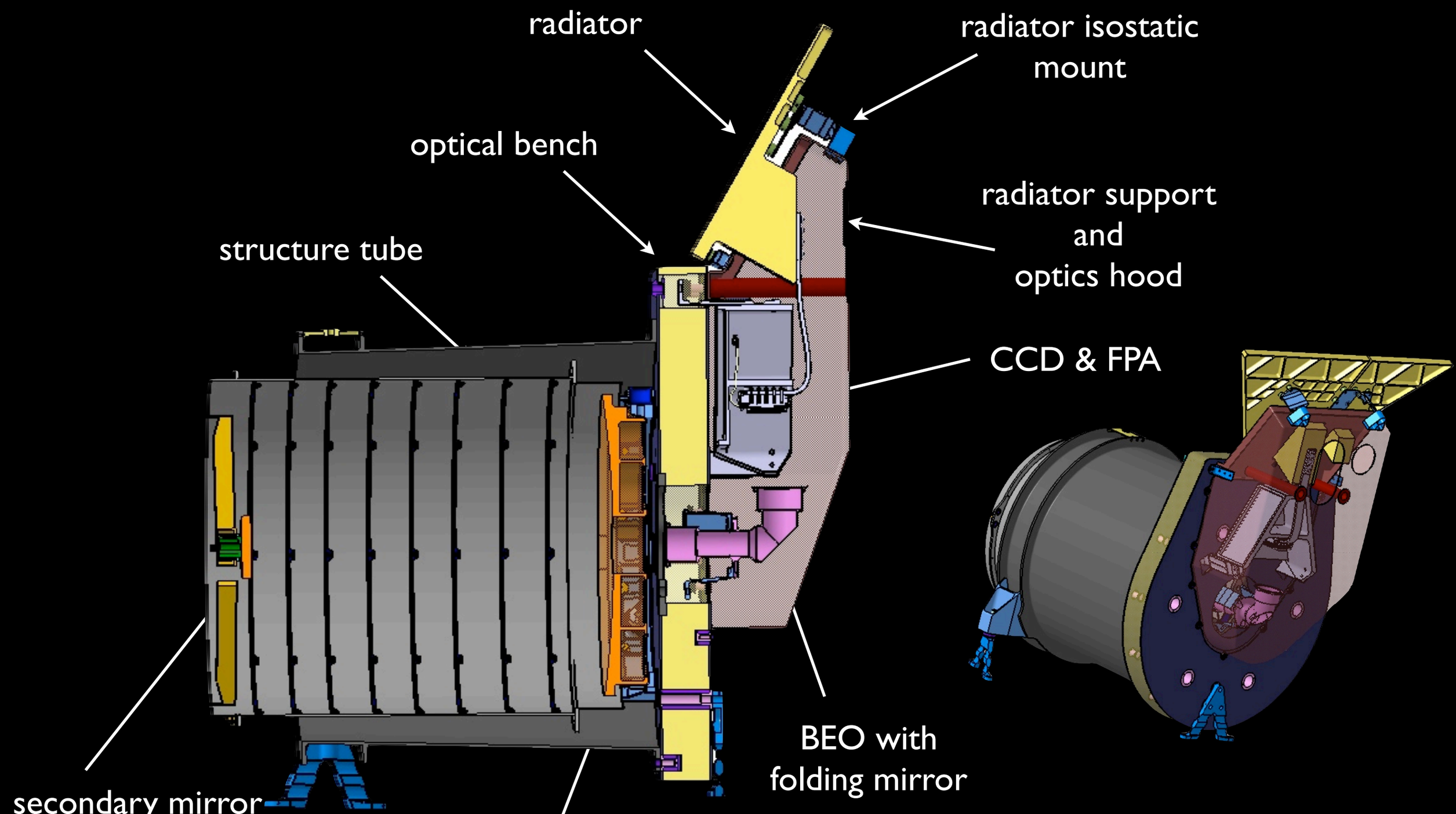
CHEOPS Organisation





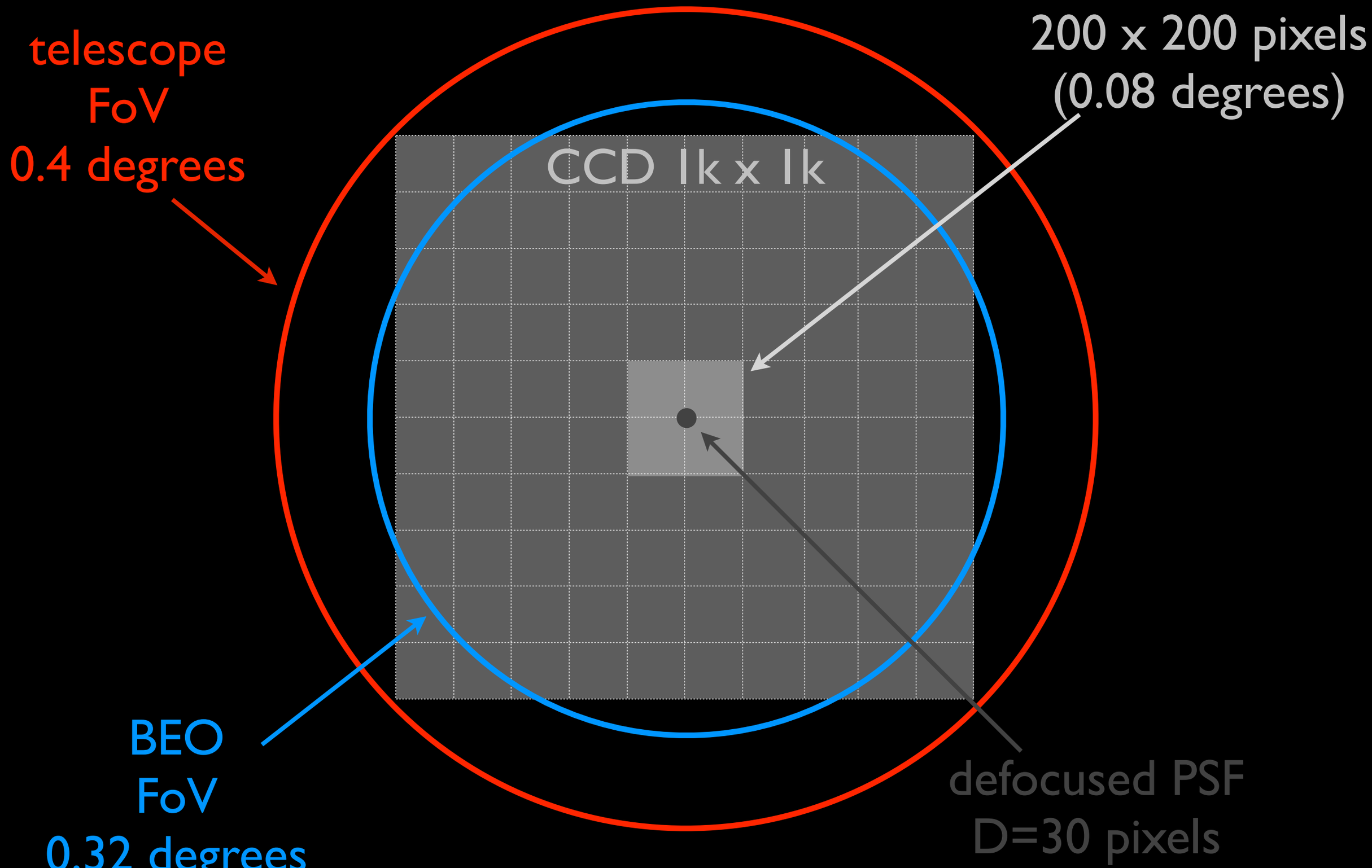
Total weight: 250 kg
Total length: 1.3m

CHEOPS instrument system



Diameter of telescope: 32 cm
Total weight: 60 kg

Pointing: 8” rms jitter



What is special about CHEOPS ?

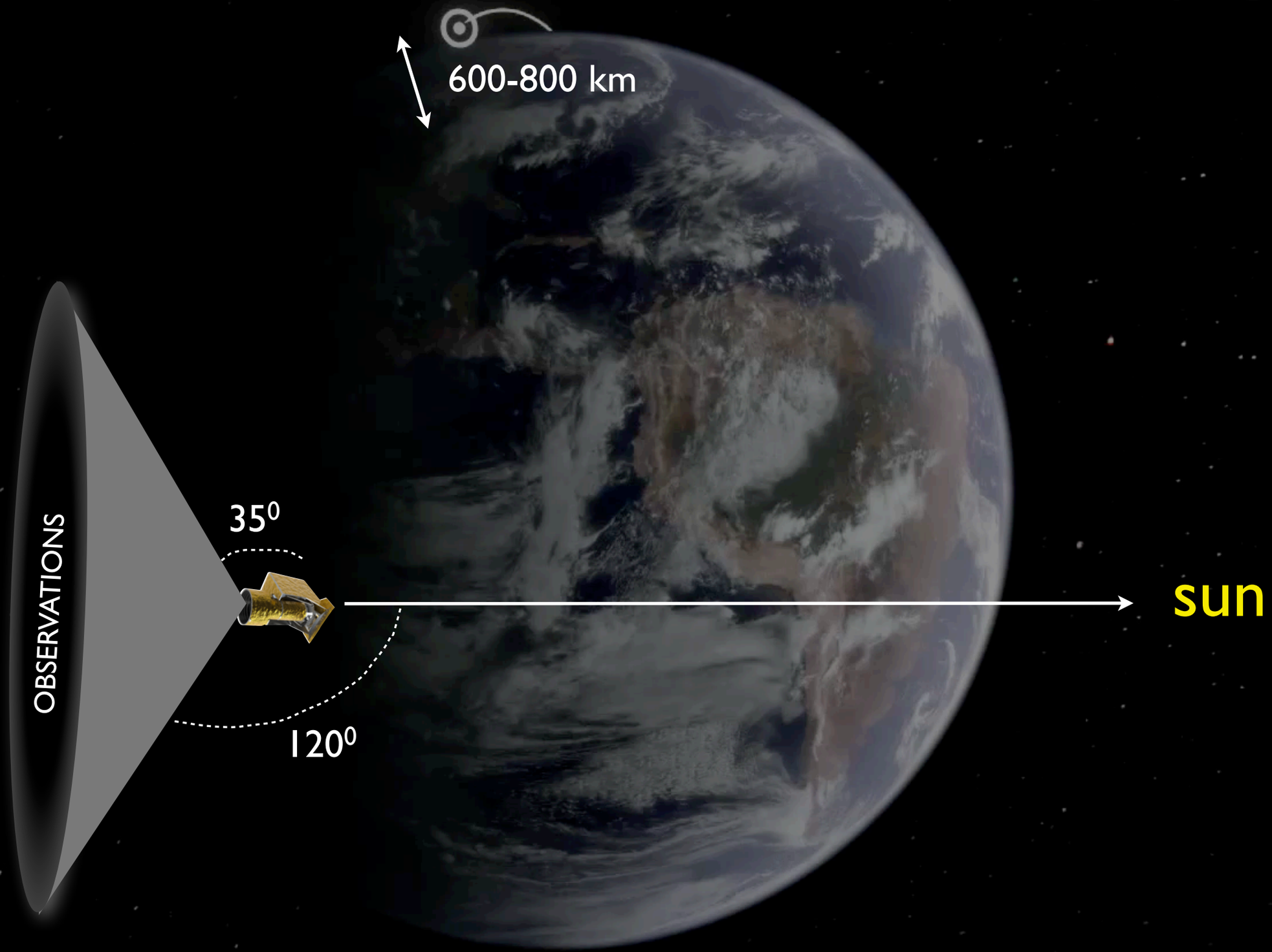
CHEOPS is a photometric observatory
looking at one object at a time

- it will measure highly accurate signals
  - 20 ppm accuracy over 6 hours for G-type stars with $m_V < 9$
  - 85 ppm accuracy over 3 hours for K-type stars with $m_V < 12$

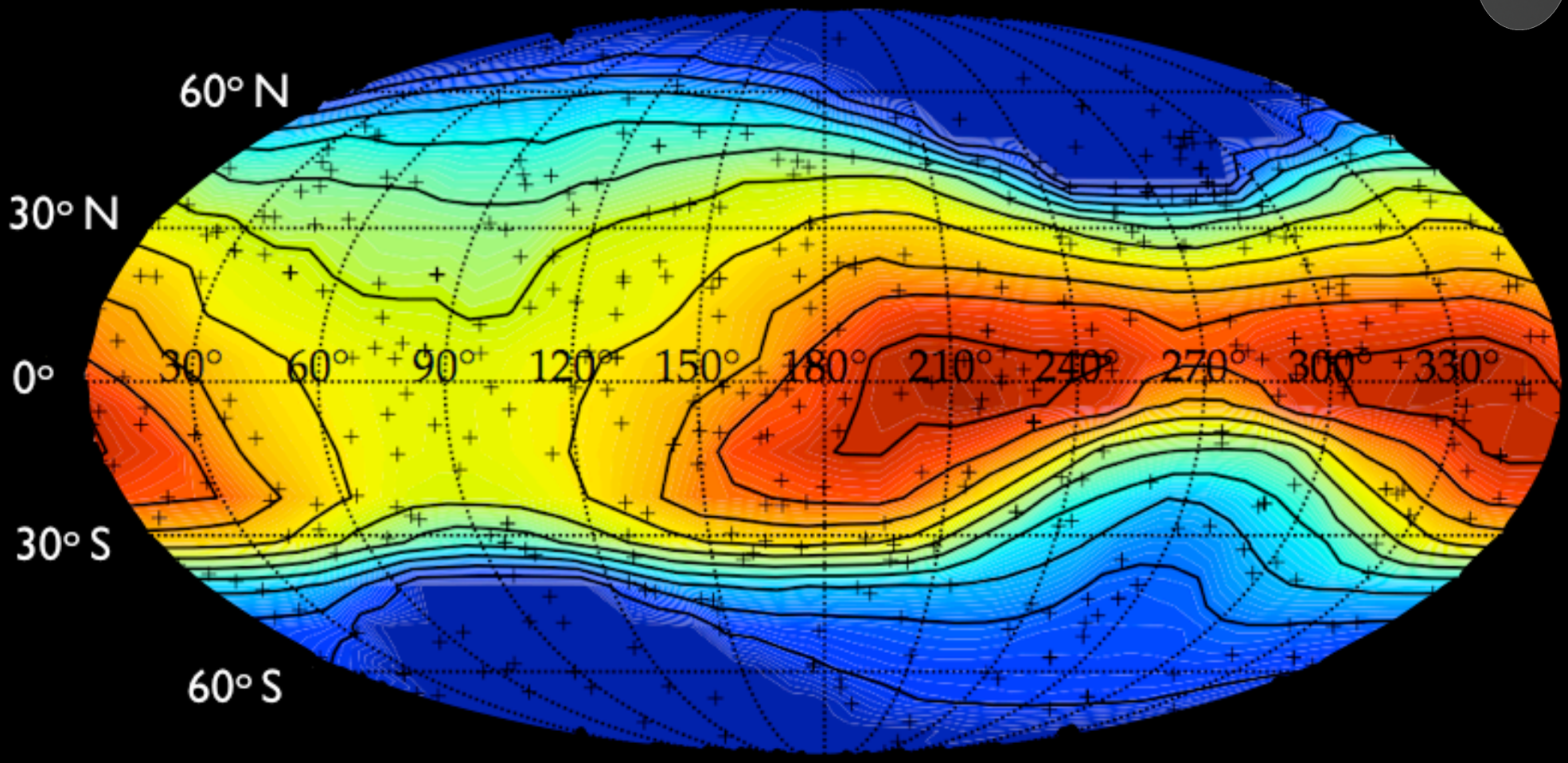
- it can point at any location over more than 50% of the sky
  - can choose the best targets for transit search
  - can improve radius measurements
  - can confirm transiting planets on larger orbits
  - can search for additional planets

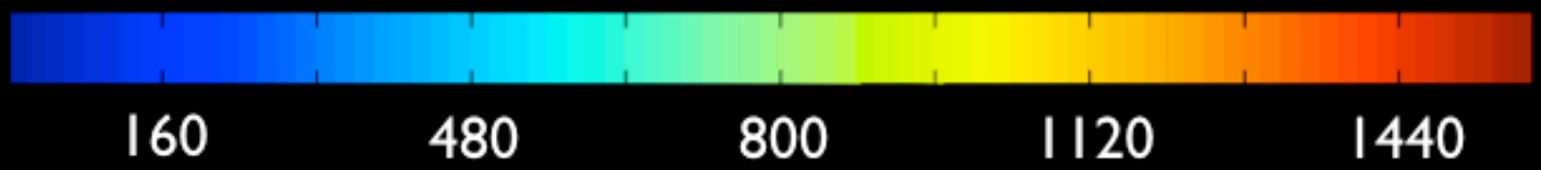
CHEOPS is complementary to all other transit missions

The orbit



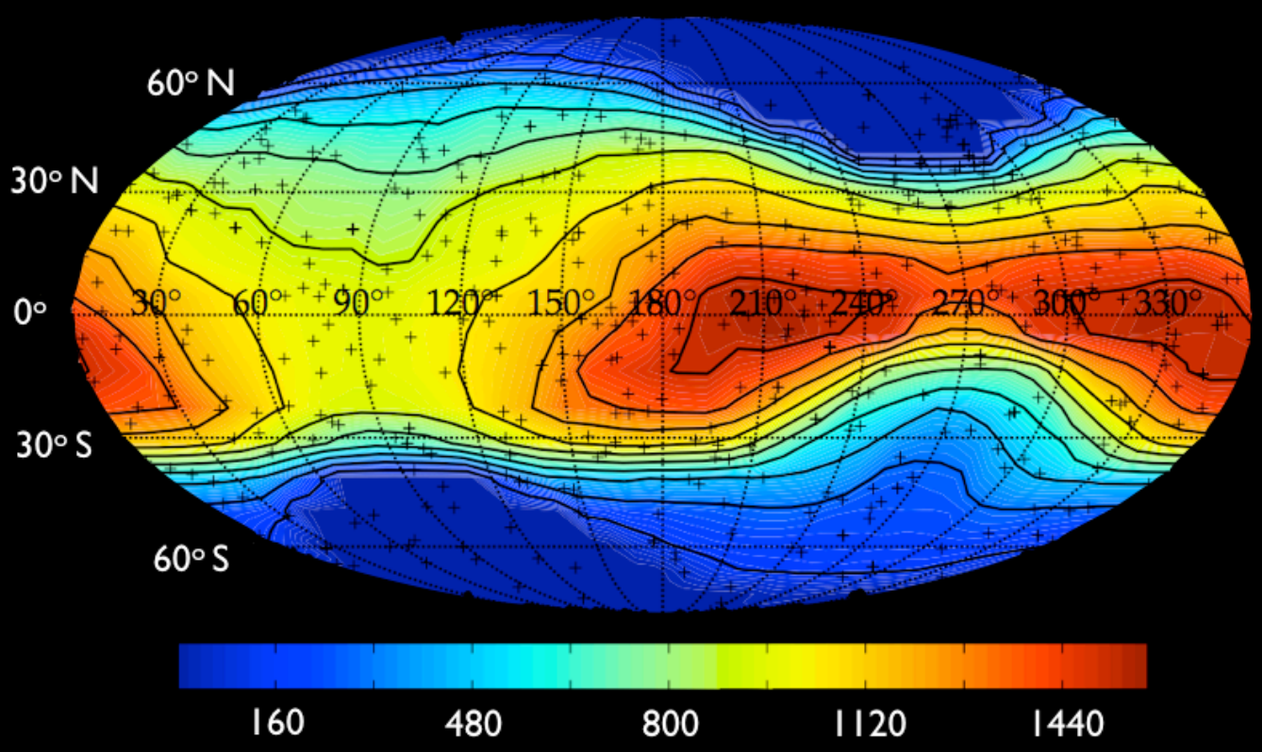
The CHEOPS sky

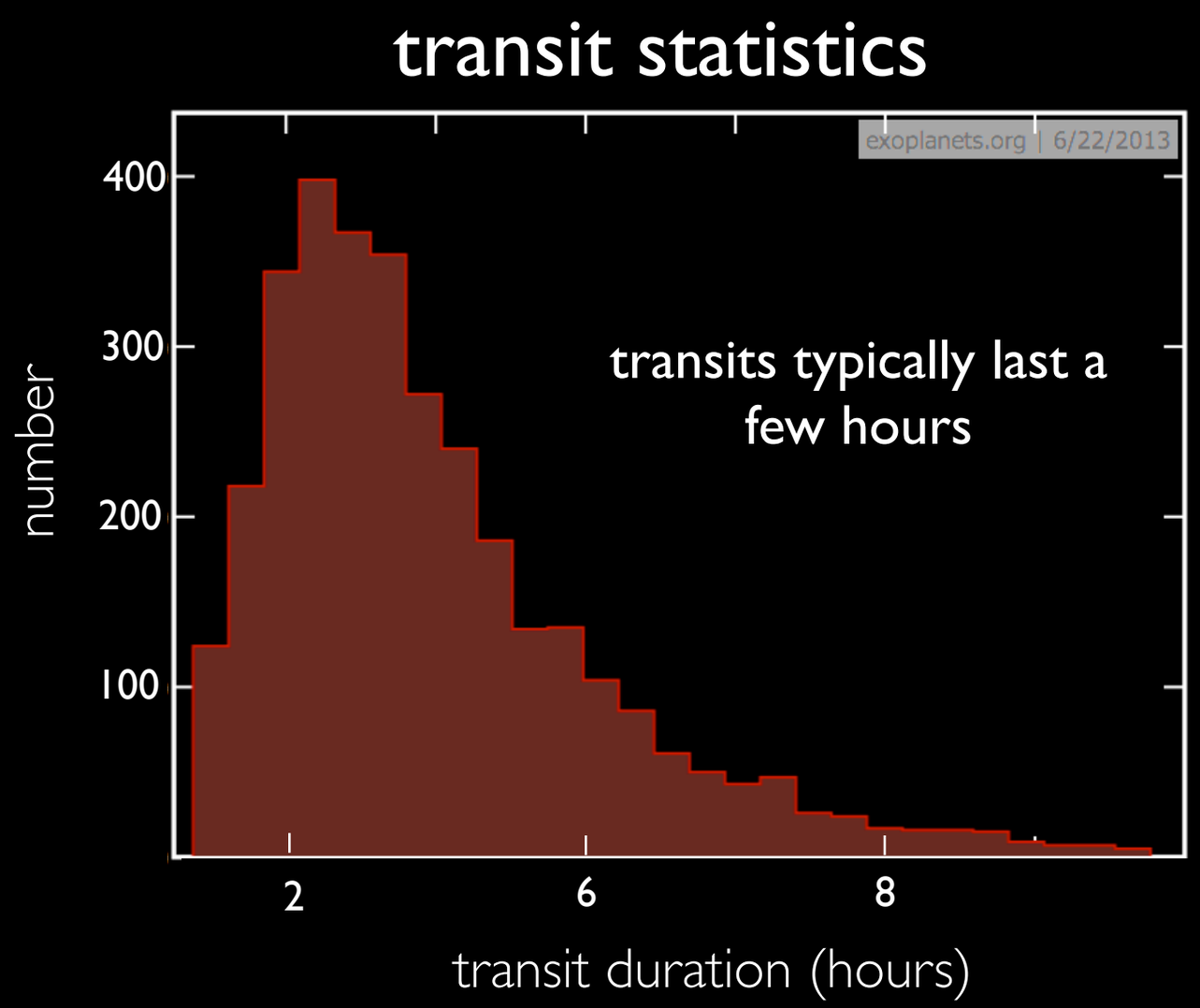




Observing time / year (hours)

The follow-up machine





Knowing when to look at a star makes CHEOPS extremely efficient

Summary

- CHEOPS is the first S-mission selected in ESA's Science Programme

- CHEOPS is a small mission!
    - there are limits to what one can do within the available budget!

- CHEOPS is a follow-up mission
    - different from all other transit missions
    - allows to choose specific targets
        → *pick the most interesting objects*