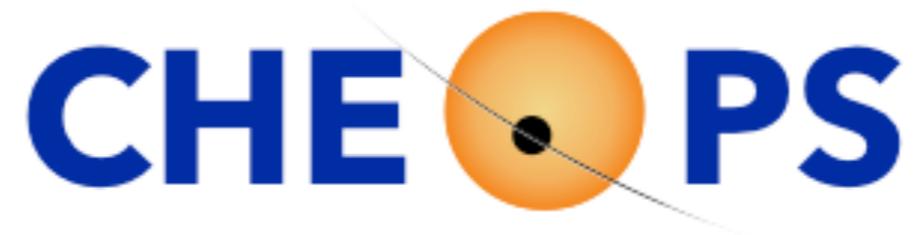


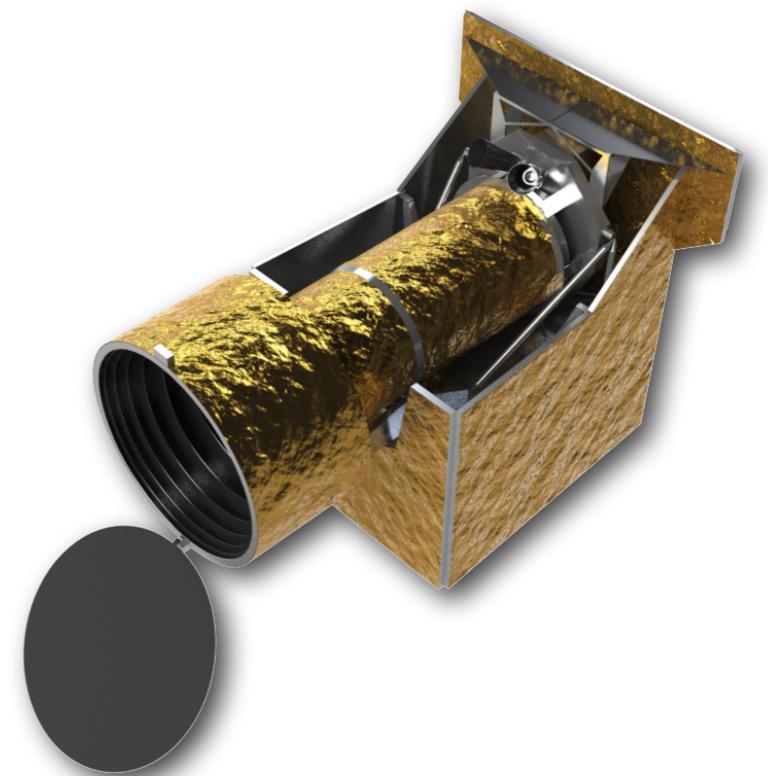
Science Operations

Mathias Beck for the CHEOPS consortium



CHaracterizing ExOPlanet Satellite

 **esa**'s first small-class mission



ESA's S-mission requirements

- **Science**

- Top-rated science in any area of space science
- Revolutionized our understanding of how planets form

- **Cost**

- Total cost < 150 M€
- **ESA cost < 50 M€ (fixed)**



~ 90 M€

- 
- Platform
 - Detector
 - Launch

- **Schedule**

- Developed and launched within **4 years**

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Challenges!

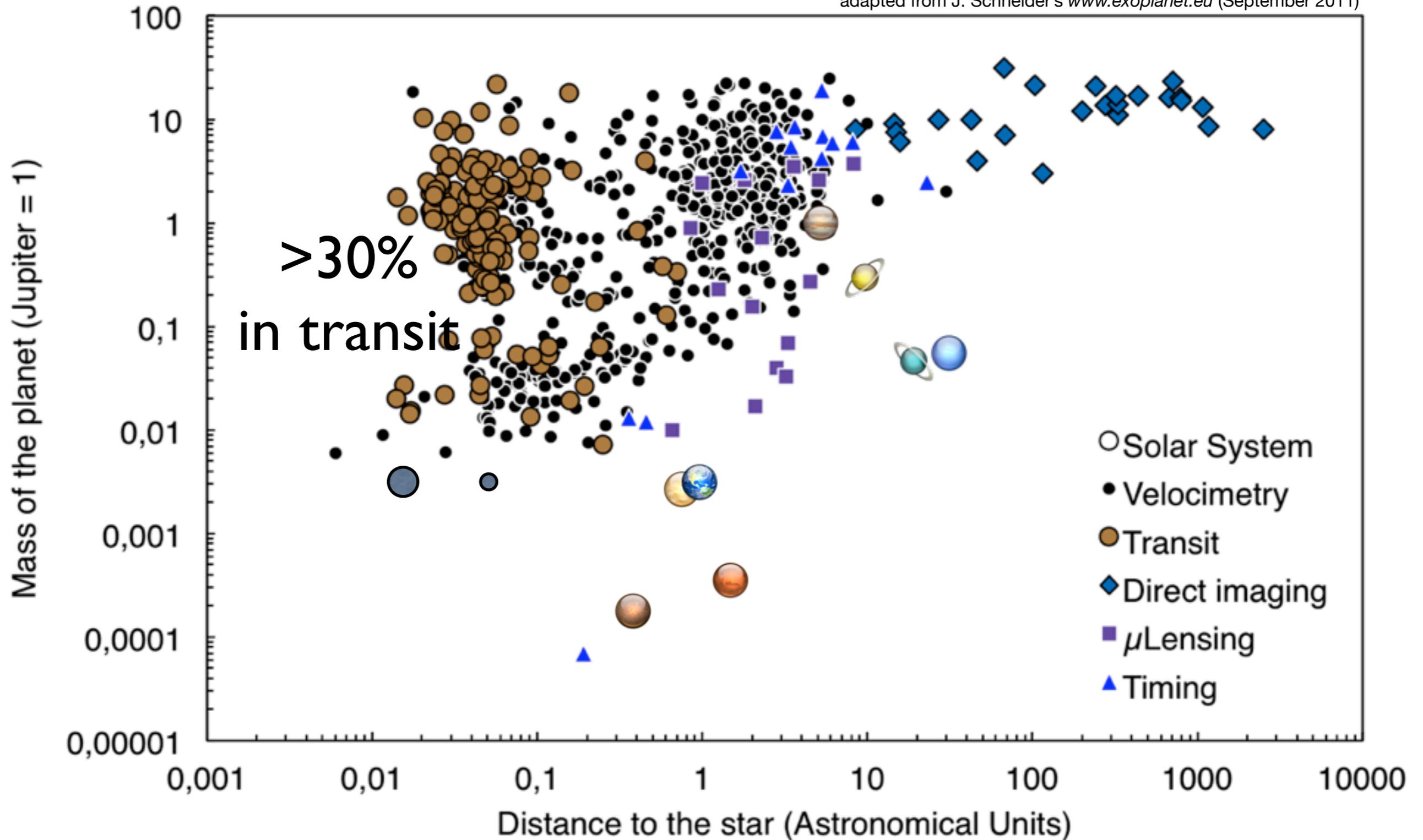
Tight costs & schedule
Top-level of responsibility for UniGE + **Switzerland**

Science Objectives

- Mass-radius relation determination
- Identification of planets with atmospheres
- Constraints on planet migration paths
- Energy transport in hot-Jupiter atmospheres
- Targets for future spectroscopic facilities
- Variability studies for astronomical sources

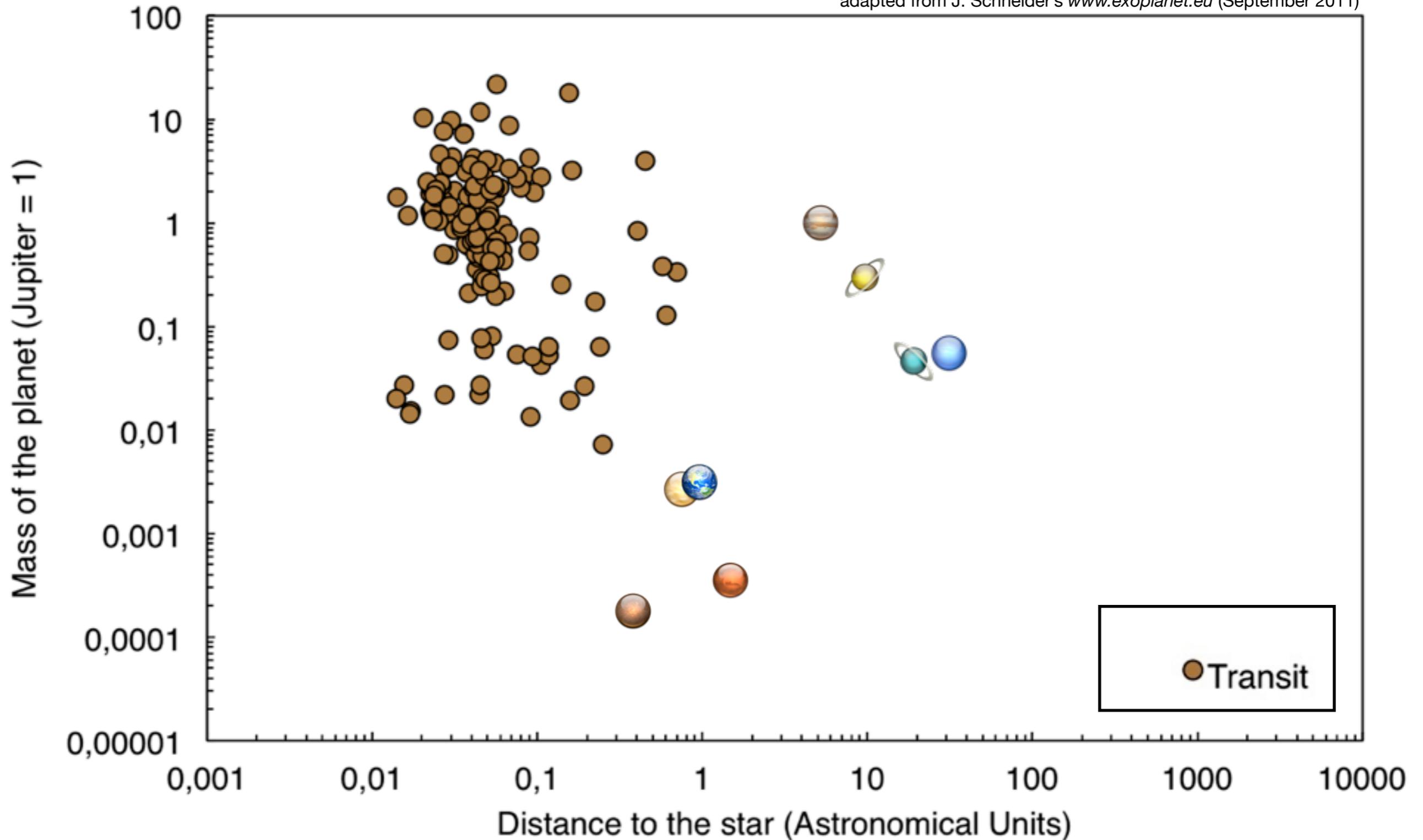
Science context

adapted from J. Schneider's www.exoplanet.eu (September 2011)

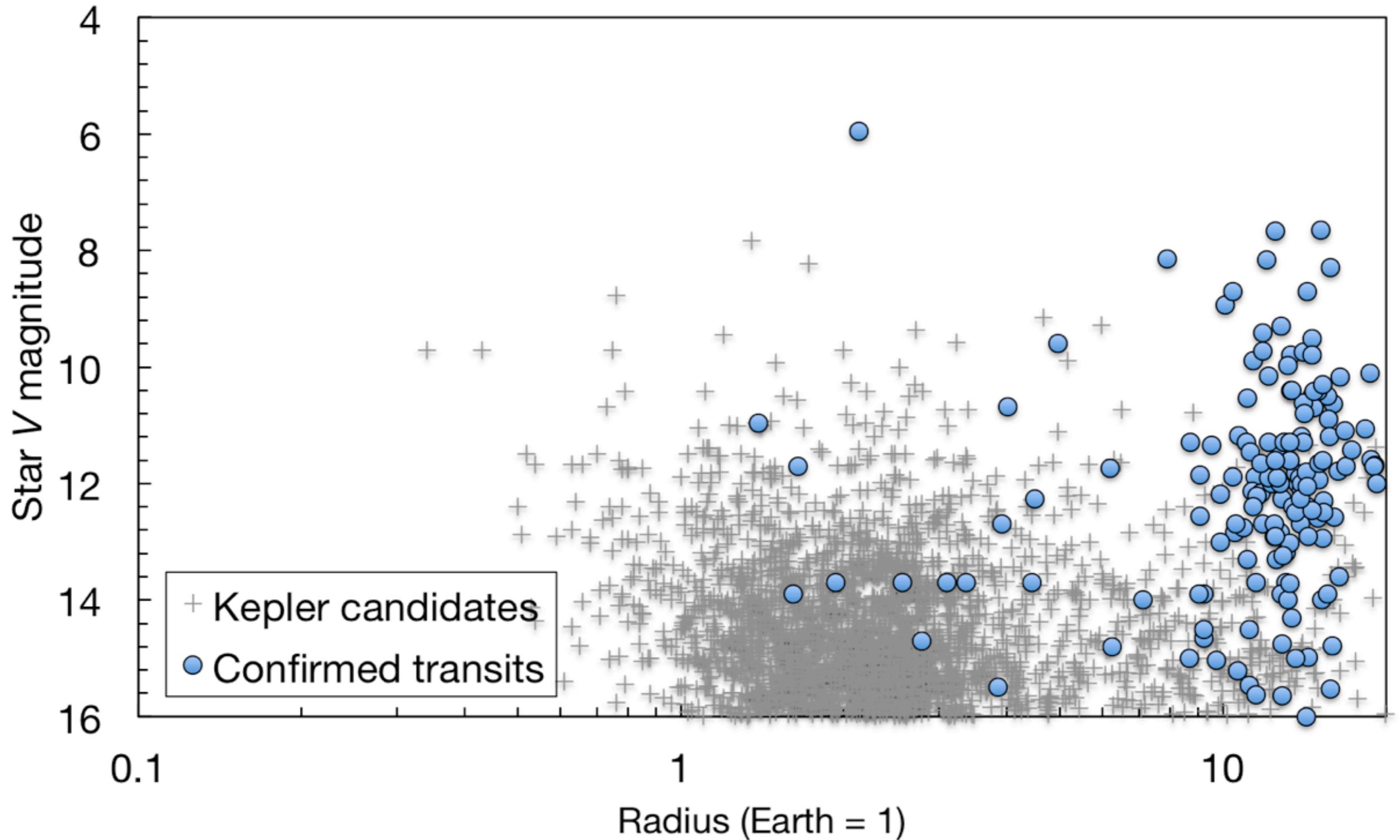


Science context

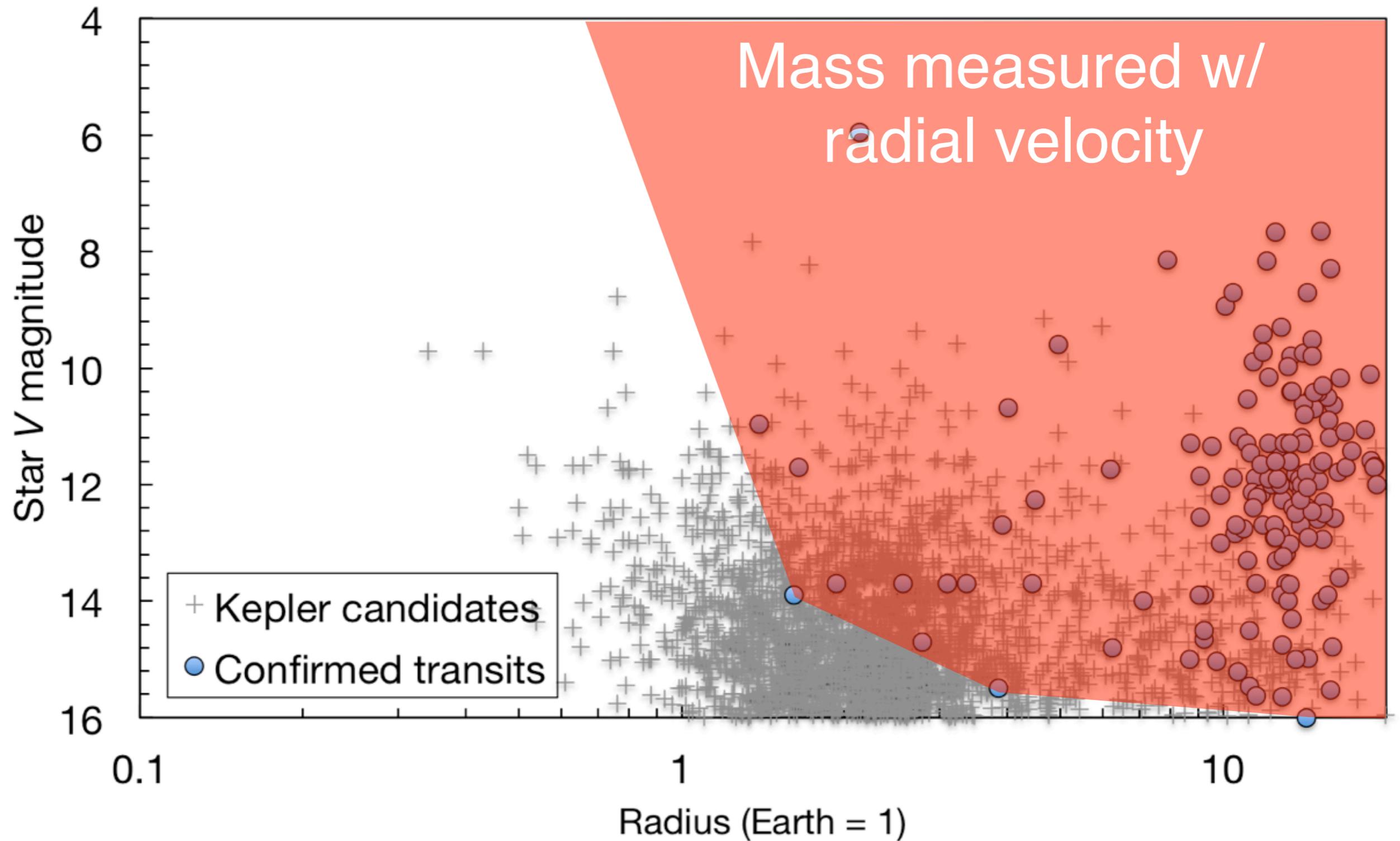
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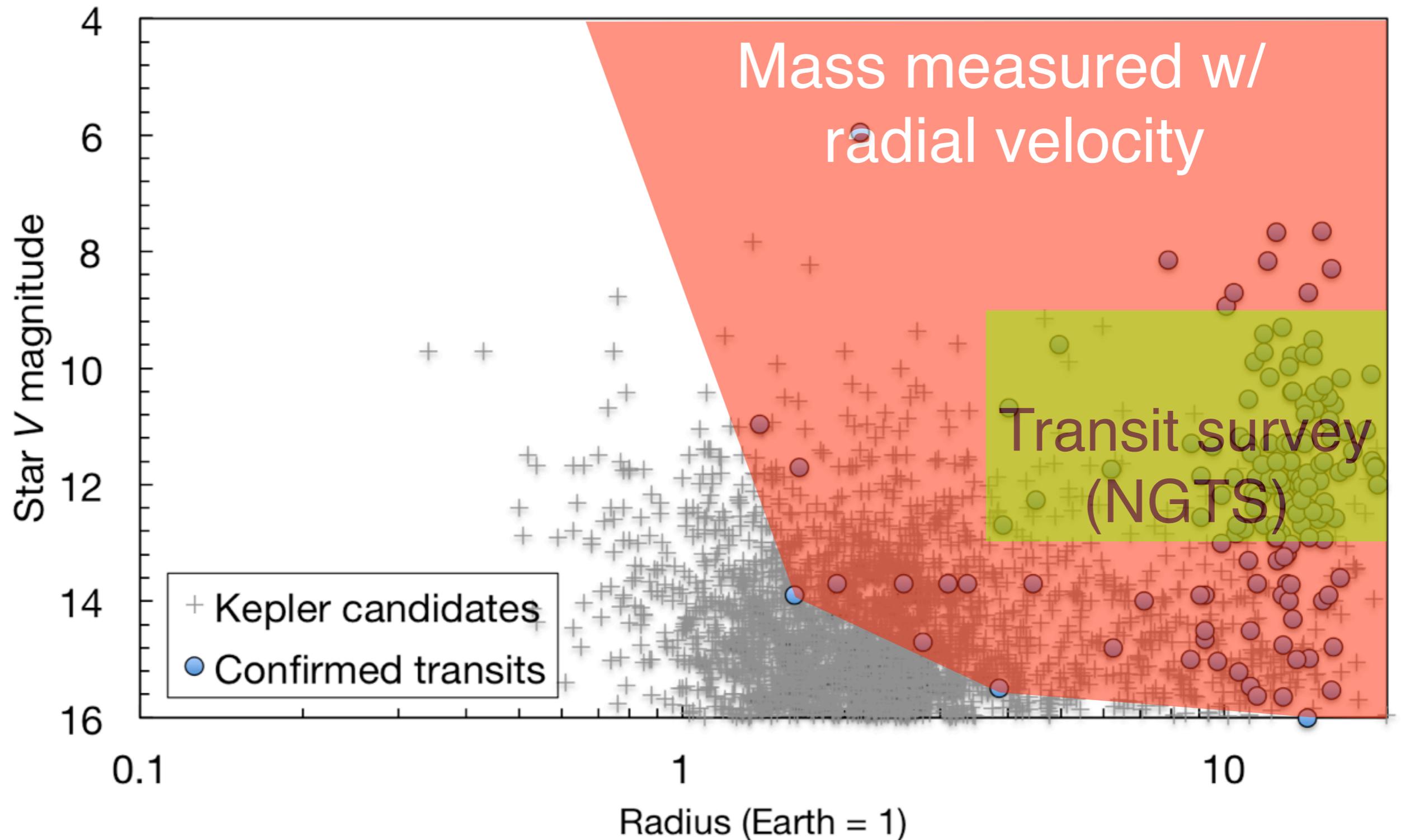
Science context



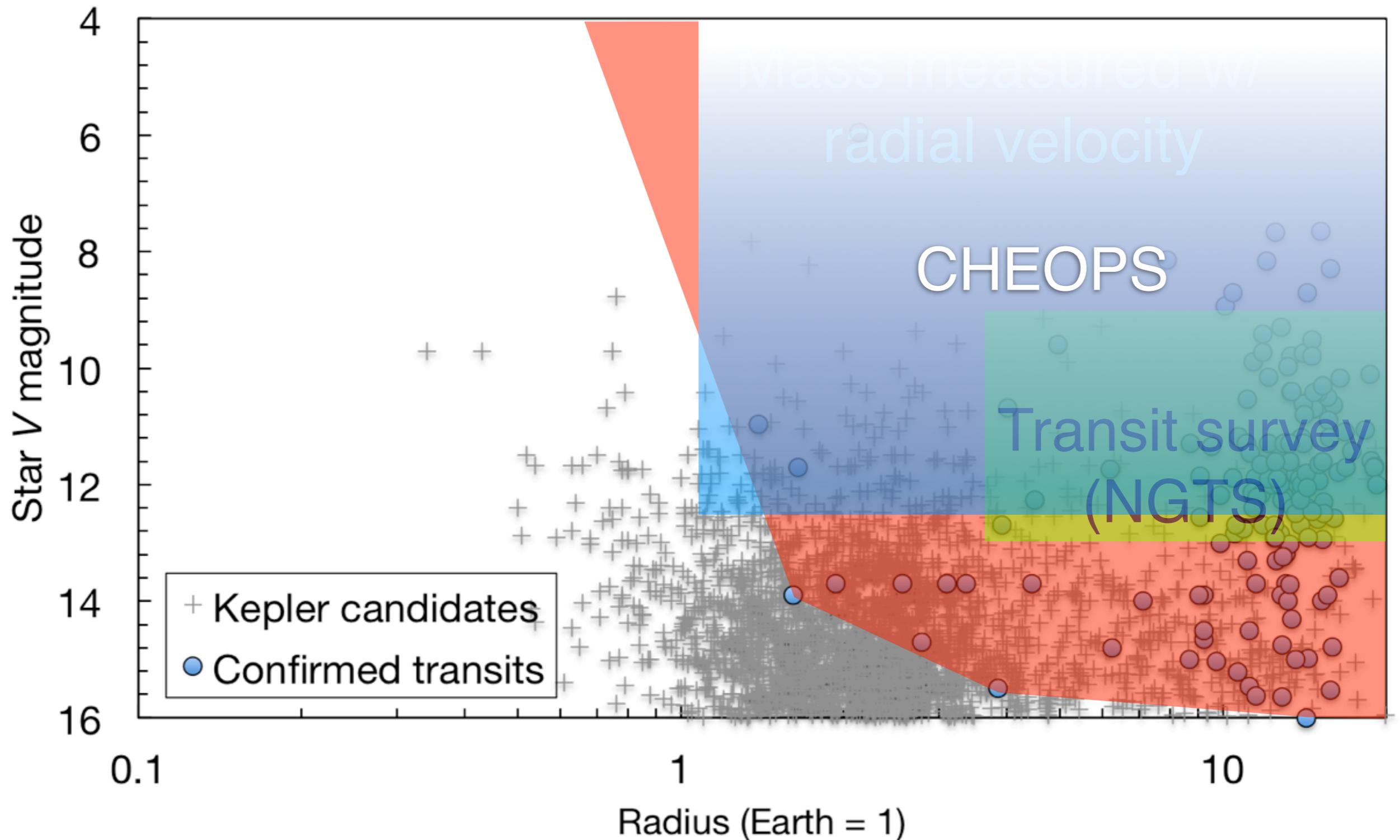
Science context



Science context



Science context



Science Objectives

6. Variability studies for astronomical sources

20% open time
for the community
for ancillary science

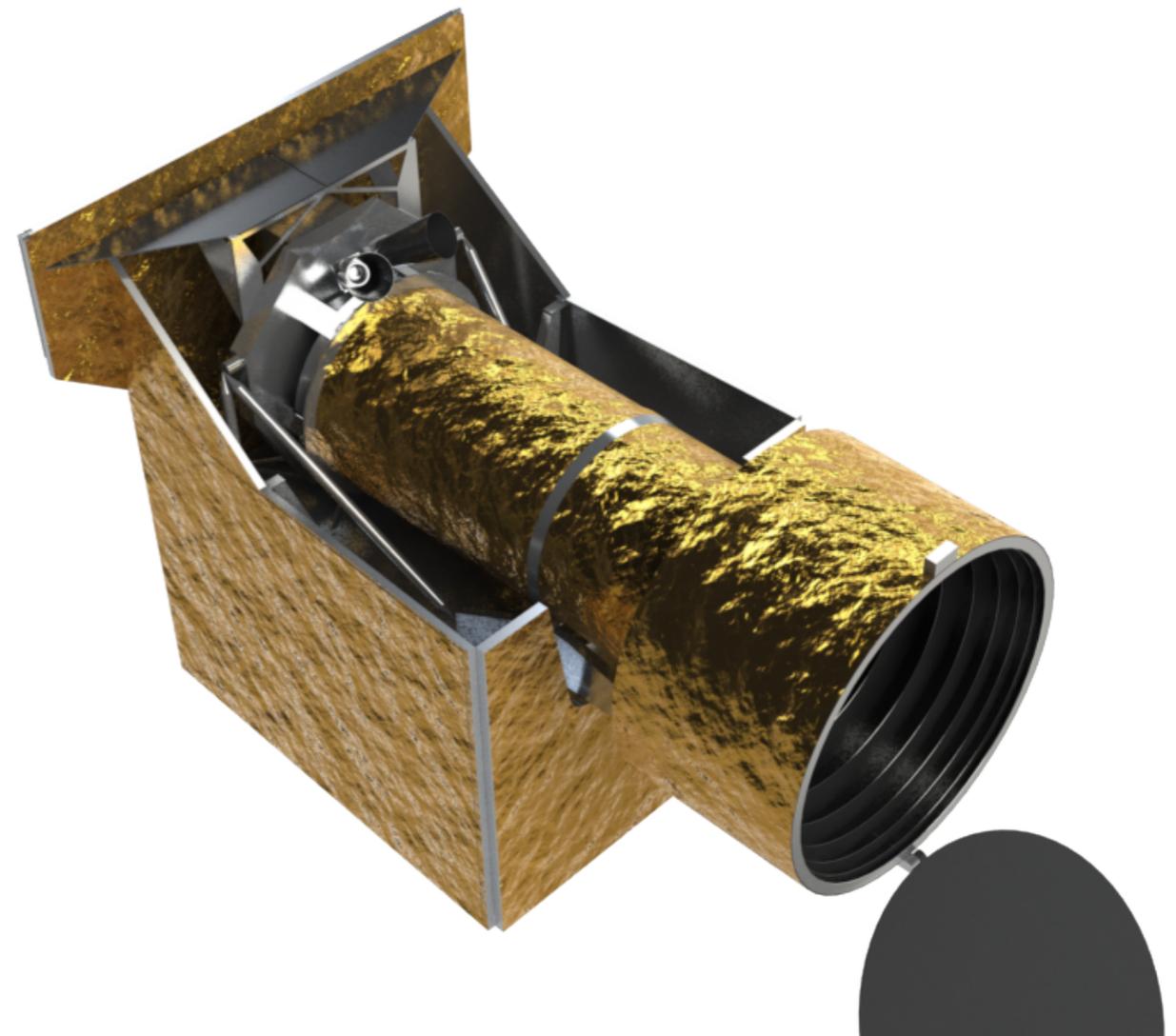
Science requirements

Mission duration

Search for transits of Doppler planets		
~175 targets	1–2 transit(s)	~750 days
Characterization of transits detected from the ground		
~100 targets	1–10 transit(s)	~200 days
Phase curves of hot Jupiters in reflected light		
~5 targets	3 orbits	~80 days
	Overheads	~20 days
	CHEOPS Mission Consortium	~1050 days
	Open time	~250 days
	Mission duration	3.5 years

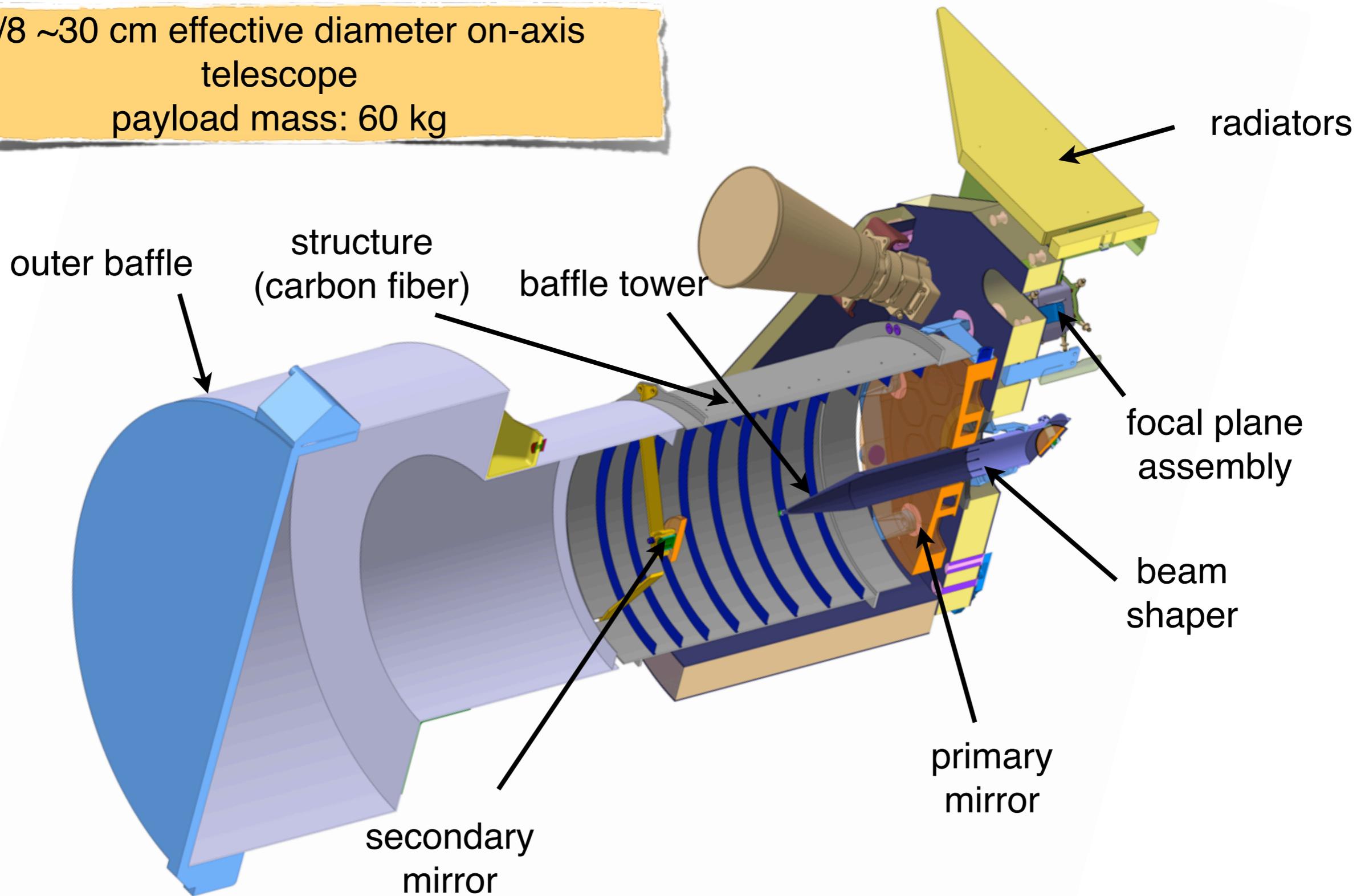
Platform

- Attitude Control
 - 3-axis stabilized S/C - one side facing Earth
 - pointing accuracy < 8 arc sec rms for 10h
- Instrument Power
 - 50 W continuous power,
 - 70 W peak
- Data rate
 - 1 Gbit/day downlink
- Total mass with payload
 - 200 kg



Payload

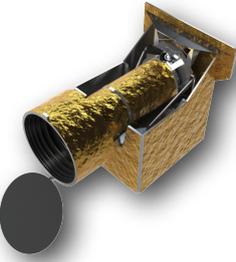
F/8 ~30 cm effective diameter on-axis telescope
payload mass: 60 kg



A brief history

2011–2012	Swiss study for a small satellite mission: CHEOPS
March 2012	ESA call for small (S) mission proposals
Oct. 2012	CHEOPS selected as the only candidate (out of 26)
Oct.–Dec. 2012	Concurrent design facility study at ESA /ESTEC
June 2013	Instrument preliminary requirements review successful
Jul. 13–Feb. 14	Industrial competition for providing spacecraft platform
Oct. 2013	Instrument system requirements review Ground Segment requirements review
Feb. 2014	Formal adoption of the mission by ESA
End 2017	Launch

CHEOPS in Europe



Country	Institutes
 Switzerland	University of Bern (project lead) University of Geneva Swiss Space Center (EPFL) ETH Zürich
 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
 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 University of Cambridge

Consortium

☆ Consortium member

★ SOC member

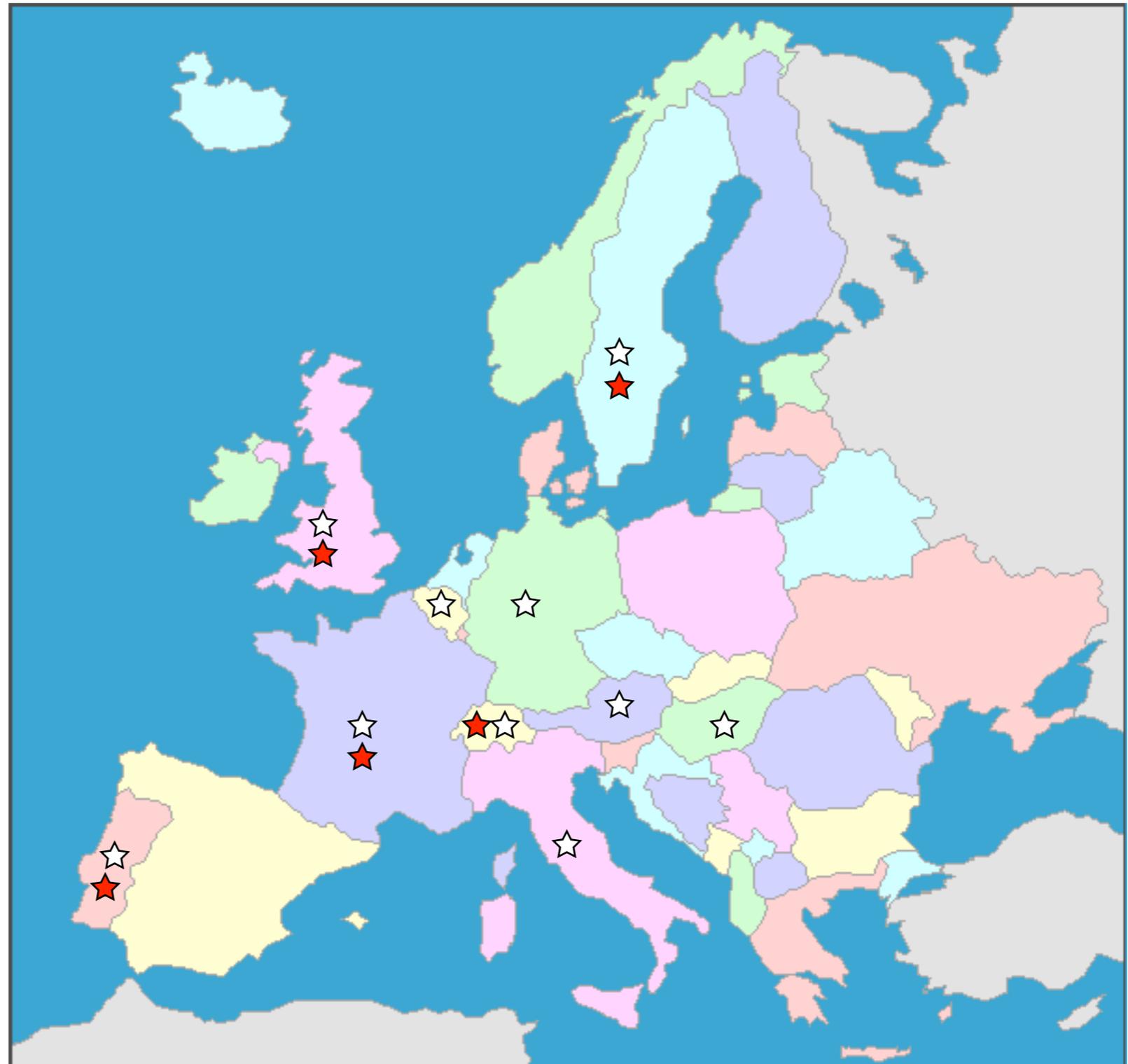
CH: UGE, SSCE

FR: LAM

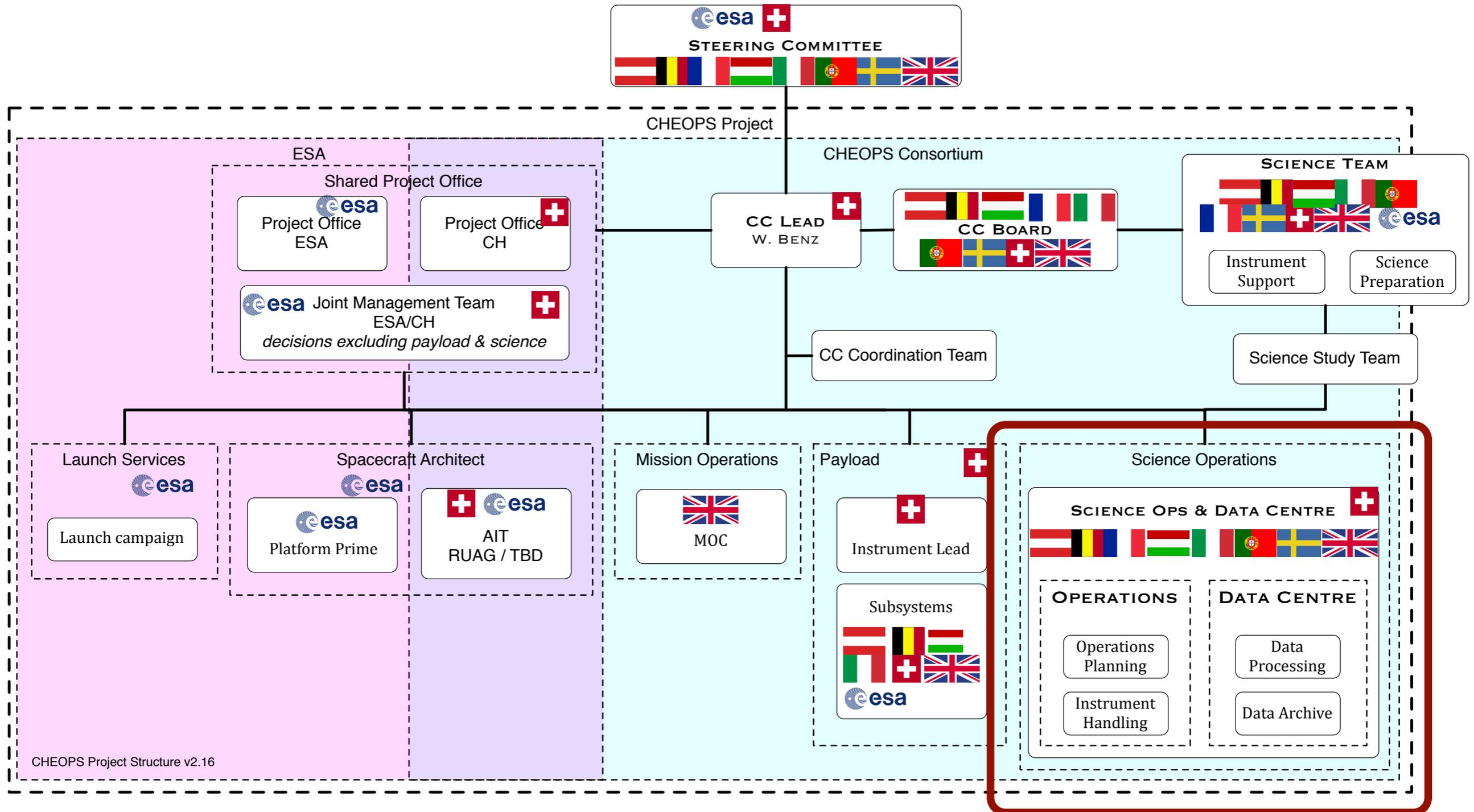
PT: CAUP, DEIM

SE: UST

UK: UCAM



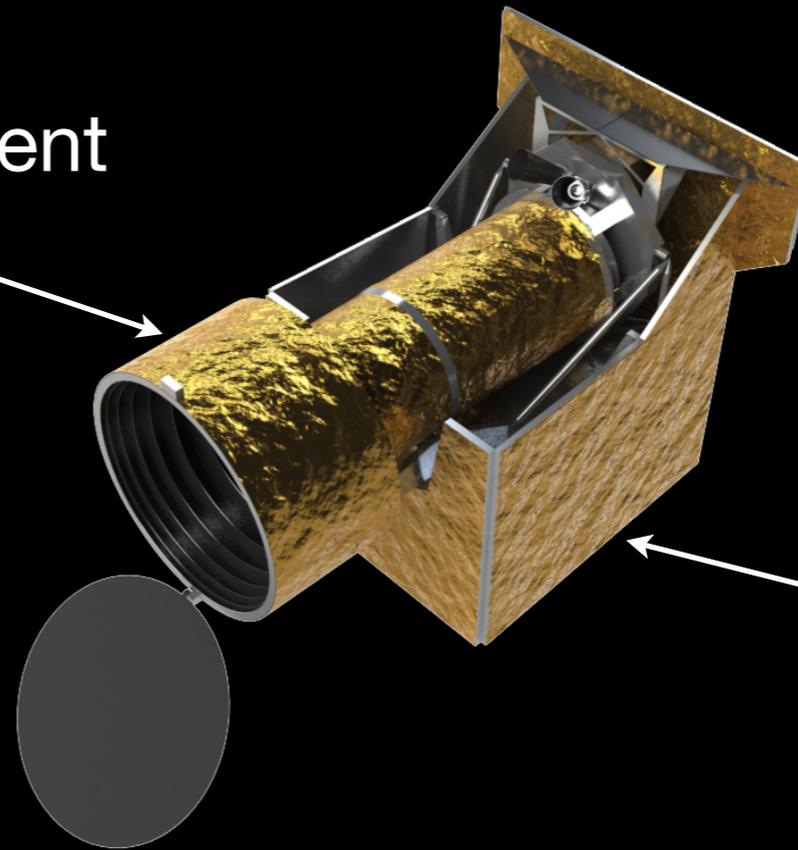
Consortium



CHEOPS spacecraft



Payload: the instrument
(a telescope)



Platform

+industry



UNIVERSITÉ
DE GENÈVE

CHEOPS ground segment

Ground
station

Mission operation center

Science operation center

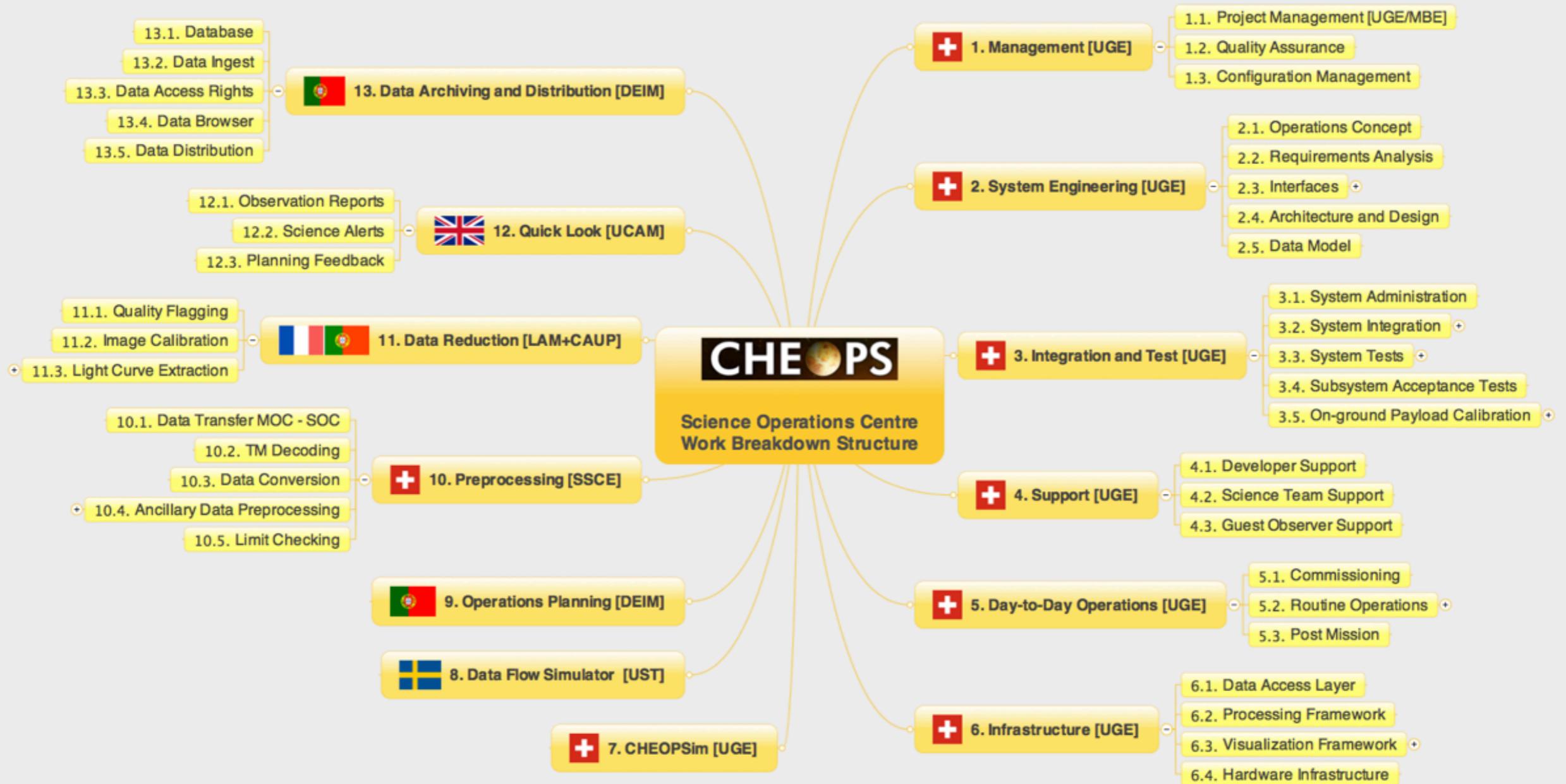


+ scientists

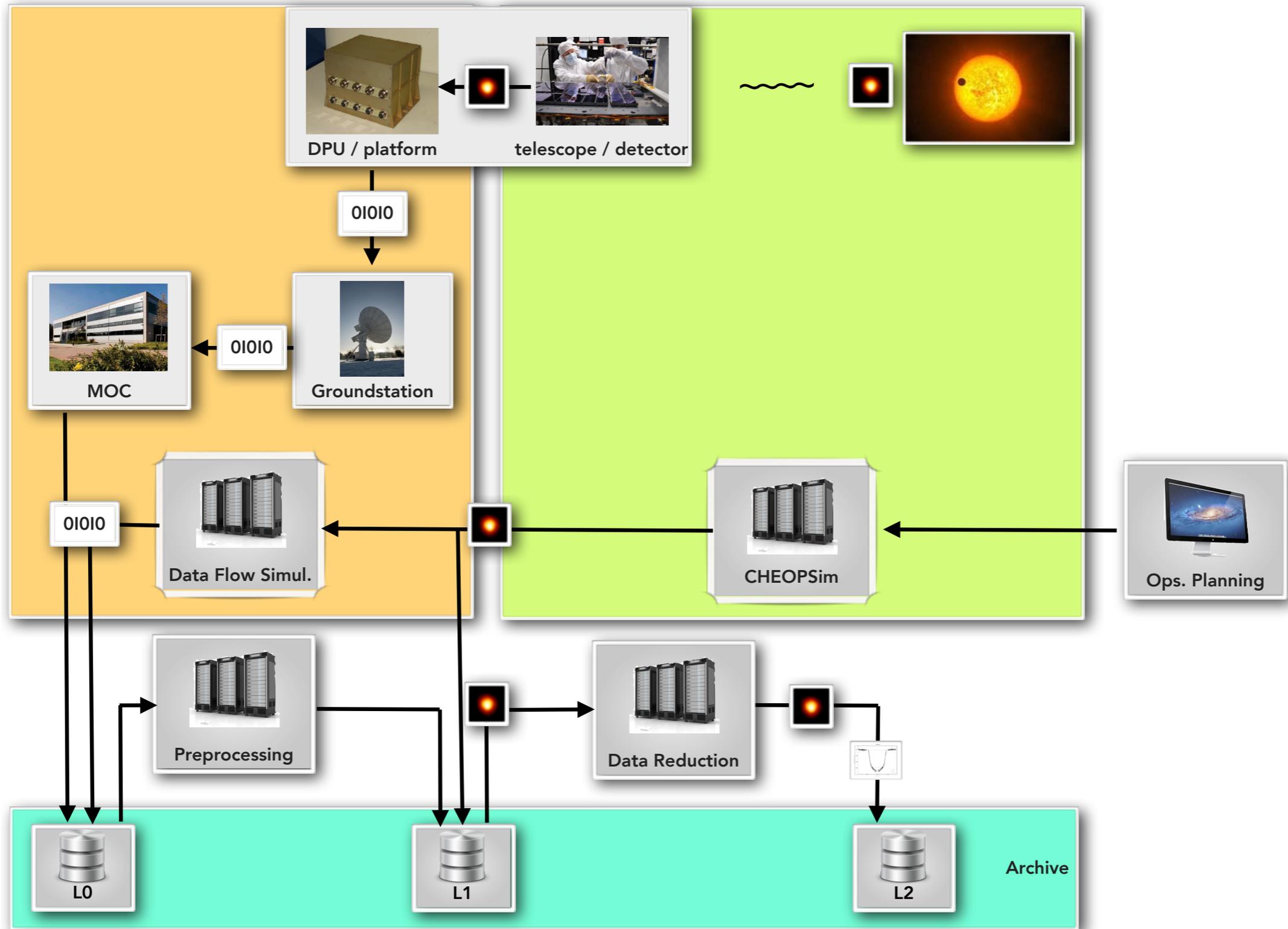
CHEOPS SOC responsibilities

- Mission management after commissioning
- Support to Science Team and GO
- Science Operations Planning
- Science Instrument Handling
- Science Data Processing
- Mission Data Archiving and Distribution

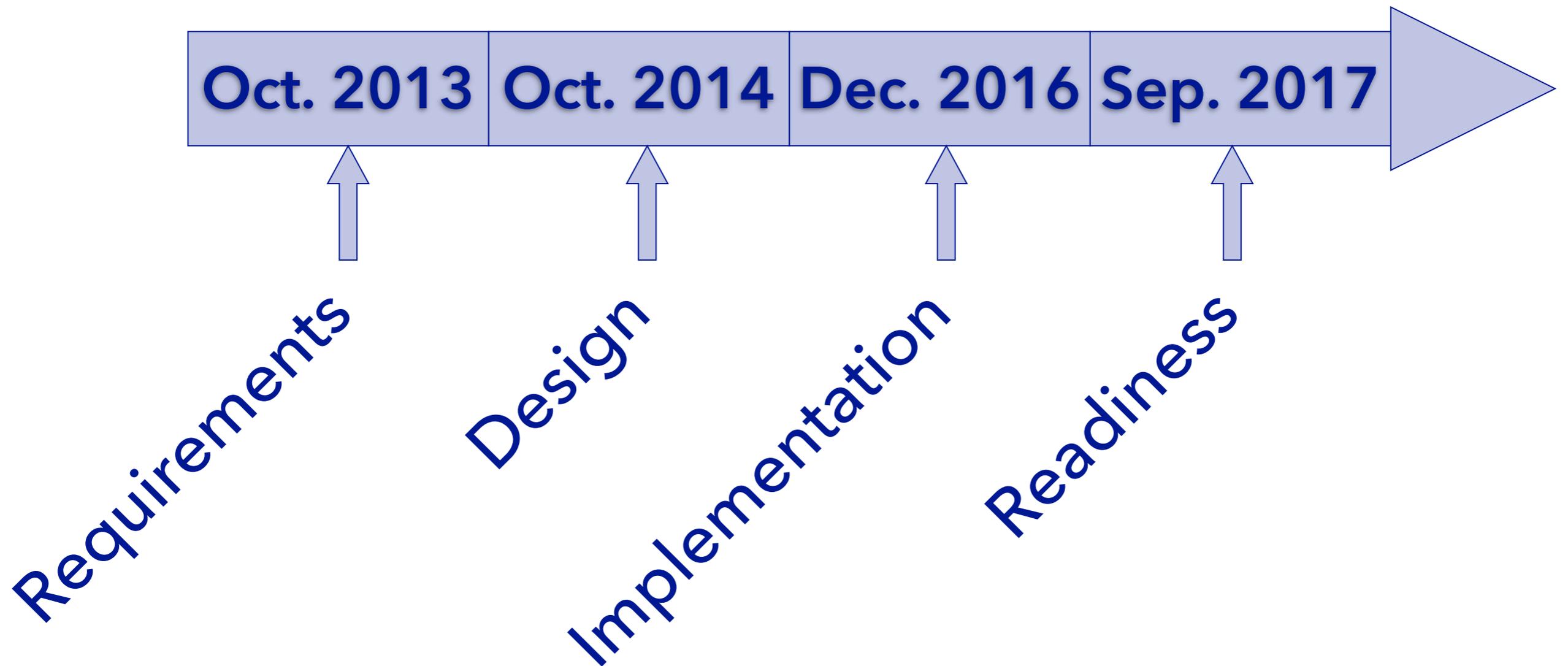
Work breakdown



Data Flow



Schedule



Mission summary

Name	CHEOPS - CHaracterizing ExOPlanet Satellite
Primary science goal	Measure the radius of planets transiting bright stars to 10% accuracy
Targets	Known exoplanet host stars with a V-magnitude < 12.5 anywhere on the sky
Wavelength	Visible range : 400 to 1100 nm
Telescope	707 cm ² effective aperture reflective on-axis telescope
Orbit	LEO sun-synchronous, LTAN 6am, 620-800 km
Lifetime	3.5 years
Type	ESA S-class