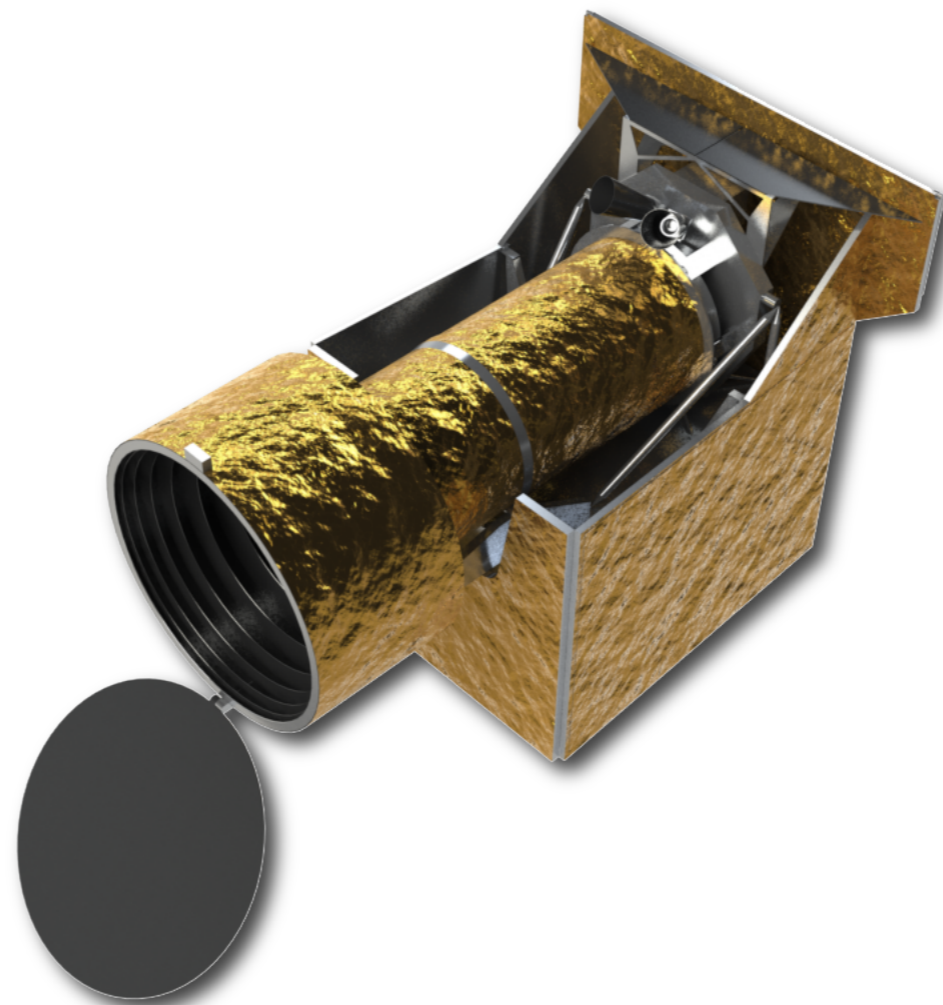


CHEOPS

Characterizing Exoplanet Satellite



Didier Queloz
UNIVERSITÉ
DE GENÈVE

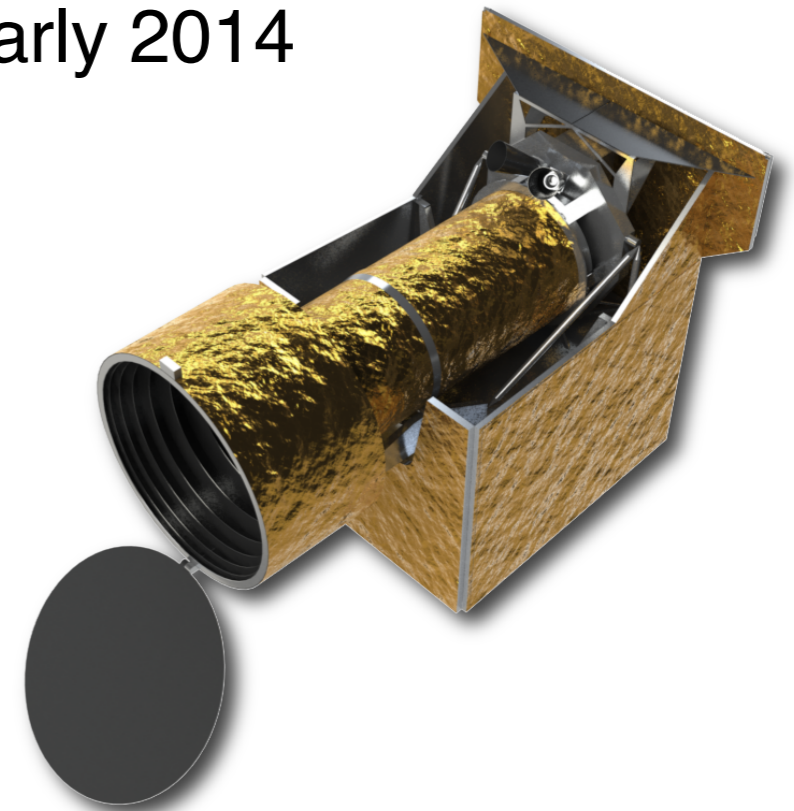
 **esa**'s first small-class mission



CHEOPS

In short...

- ◆ ESA's next exoplanet mission (2017), adoption early 2014
- ◆ **Follow-up known planetary systems**
- ◆ ~ 90 M€ from ESA, CH, & ESA member states
- ◆ **∅30-cm telescope** on Sun-synchronous orbit
- ◆ **Detect transits down to Earth-size planets**
- ◆ **High cadence (1 min) 450-950nm broad photometry**
- ◆ **9th Vmag star: 20 ppm in 6h, 12th Vmag: 85ppm in 3.5h**



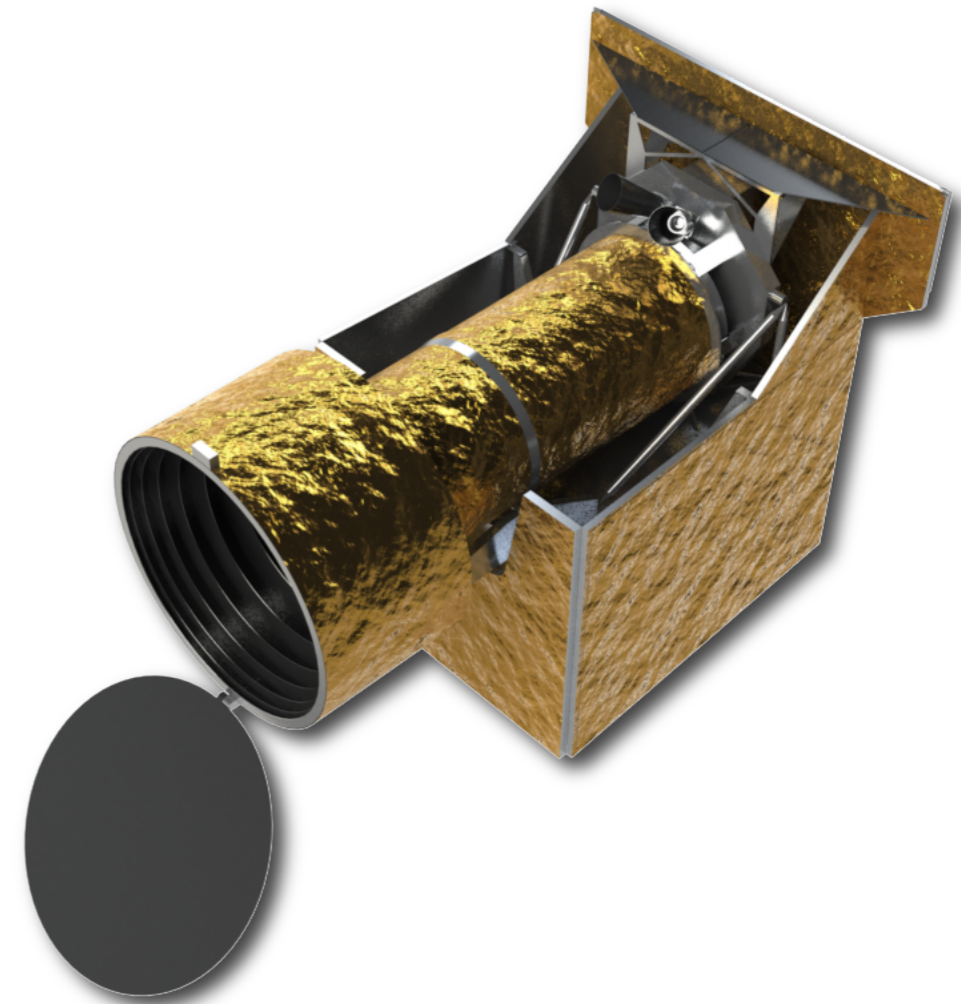
 **esa**'s first small-class mission



CHEOPS

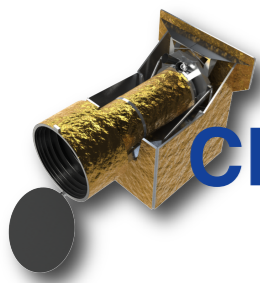
Science objectives

1. Mass-radius relation determination
2. Identification of planets with atmospheres
3. Constraints on planet origins
4. Energy transport in hot-Jupiter atmospheres
5. Targets for future spectroscopic facilities
6. Variability studies for astronomical sources

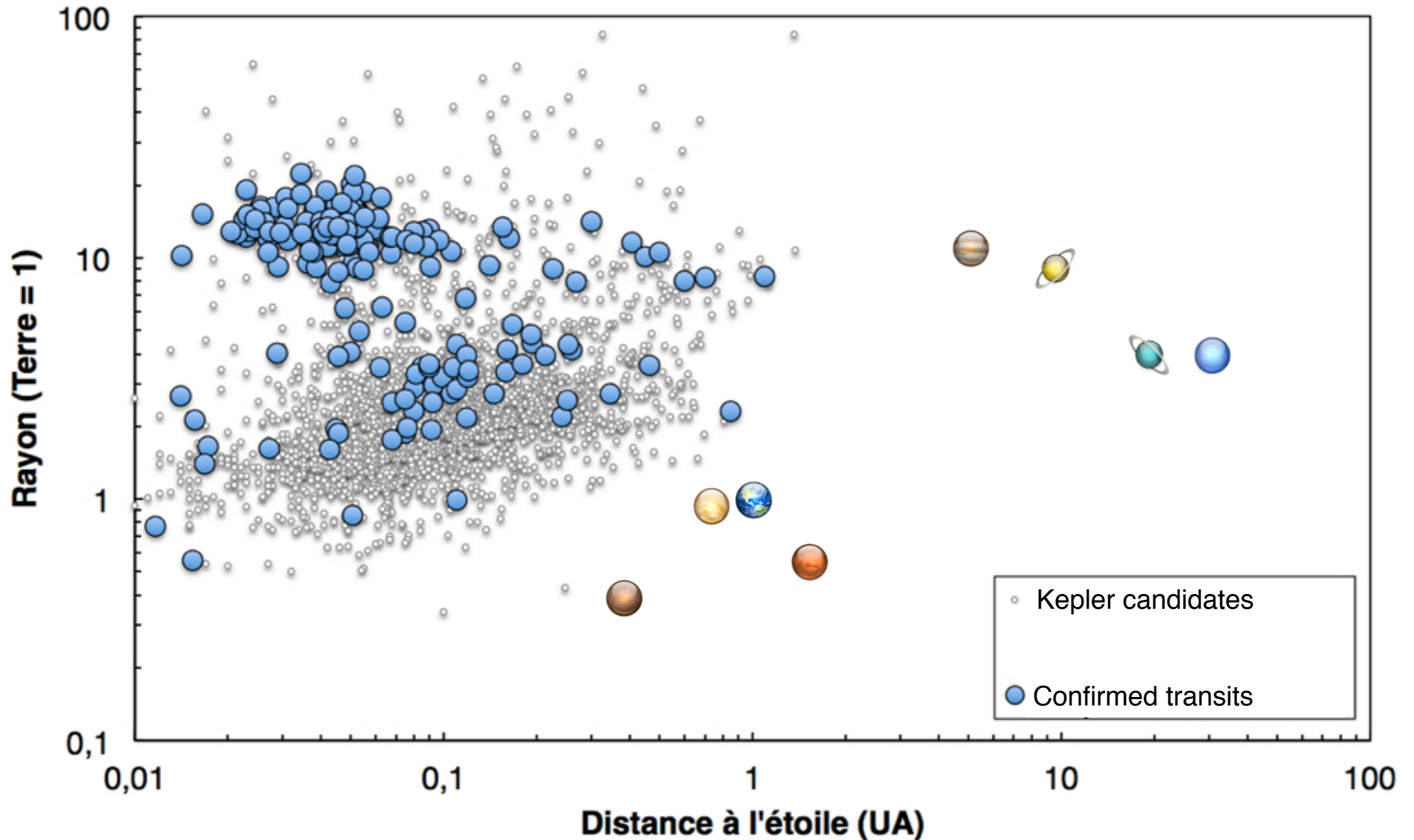


 **esa**'s first small-class mission

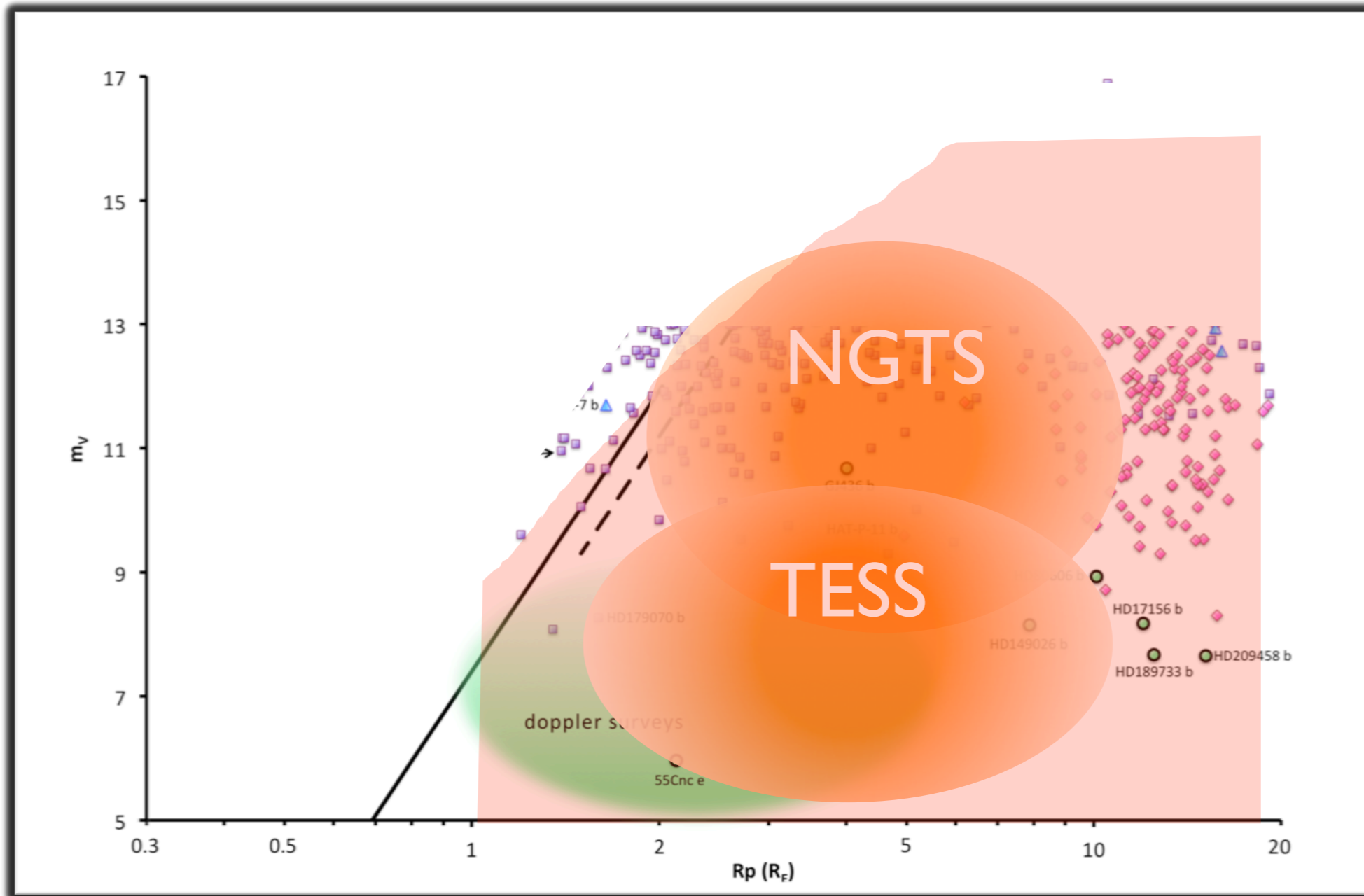


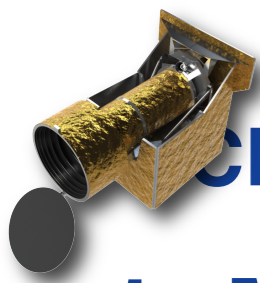


Thousands of candidates

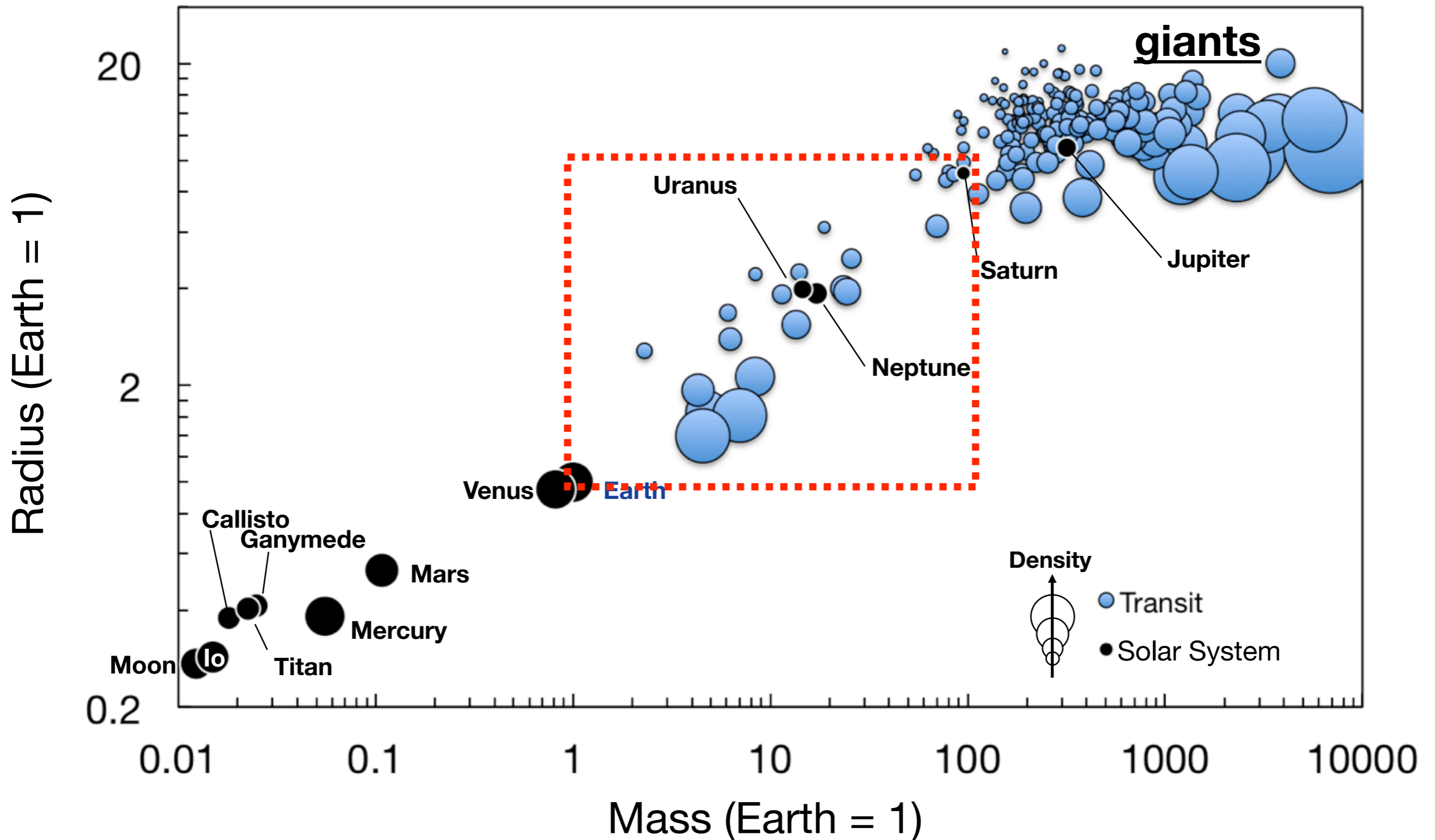


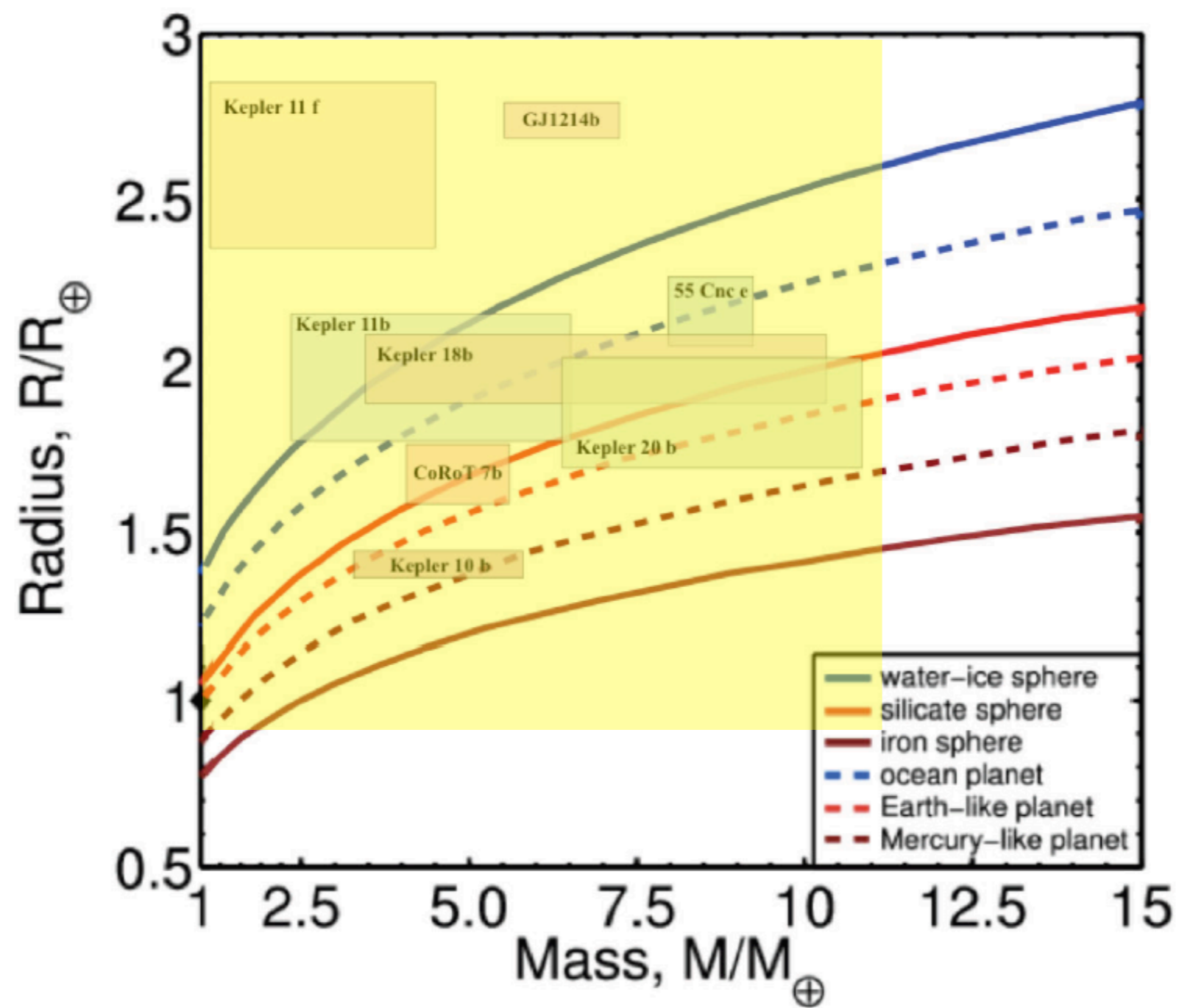
Bright targets only matters

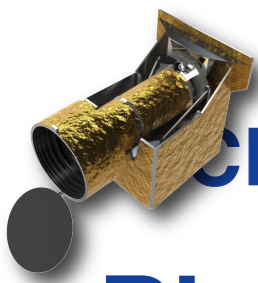




1. Mass-radius relation determination





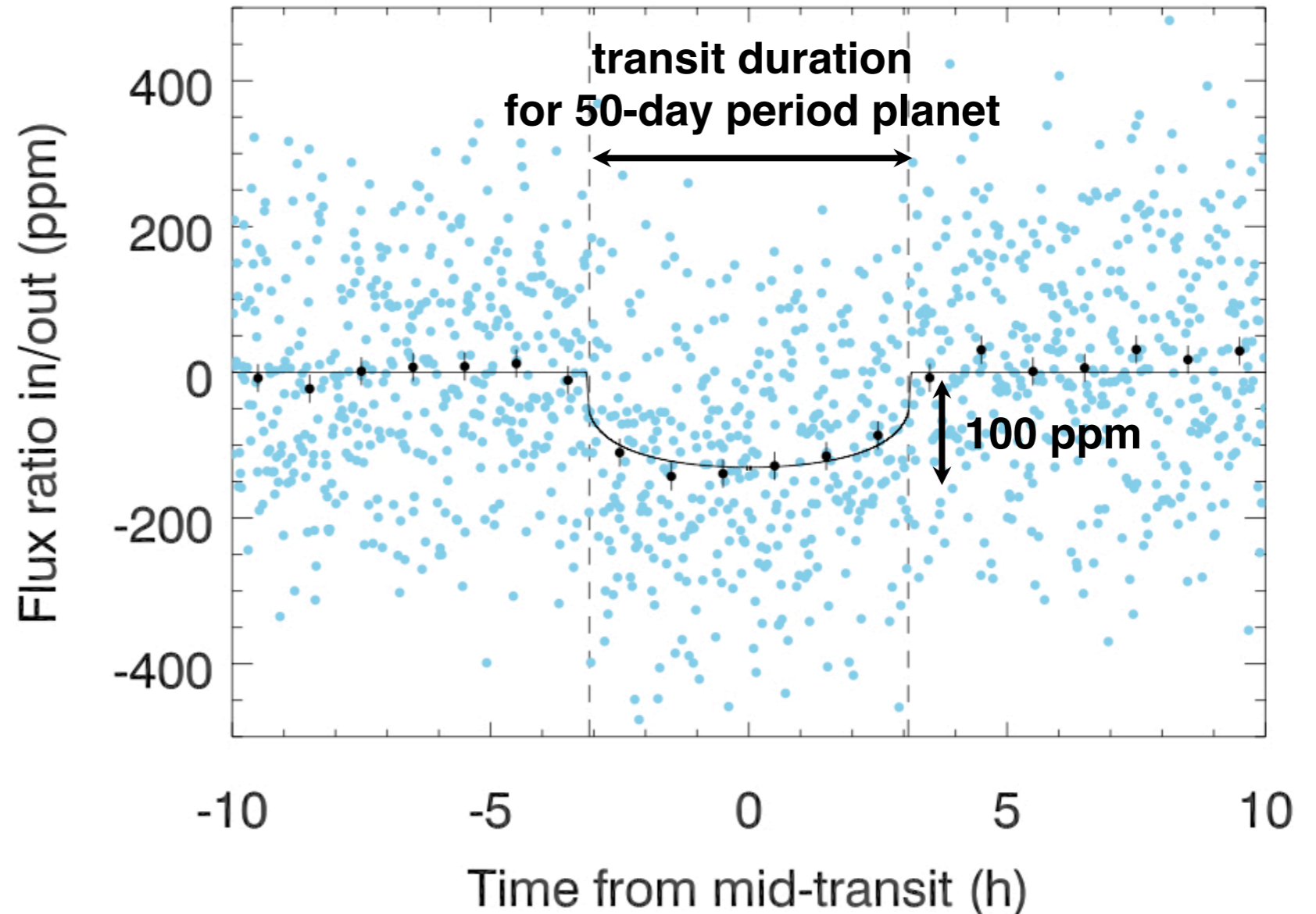
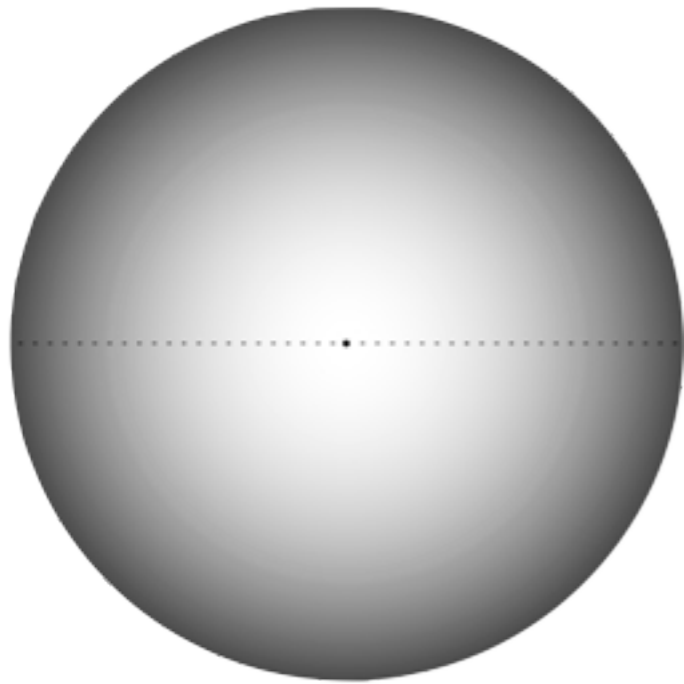


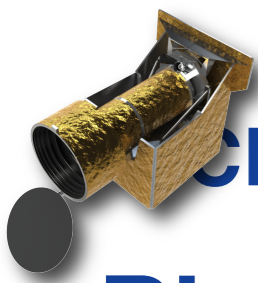
Photometric precision (1)

Detecting transits of Earth-size planets

around G5 dwarfs of $V < 9$

➔ 20 ppm in 6h of integration





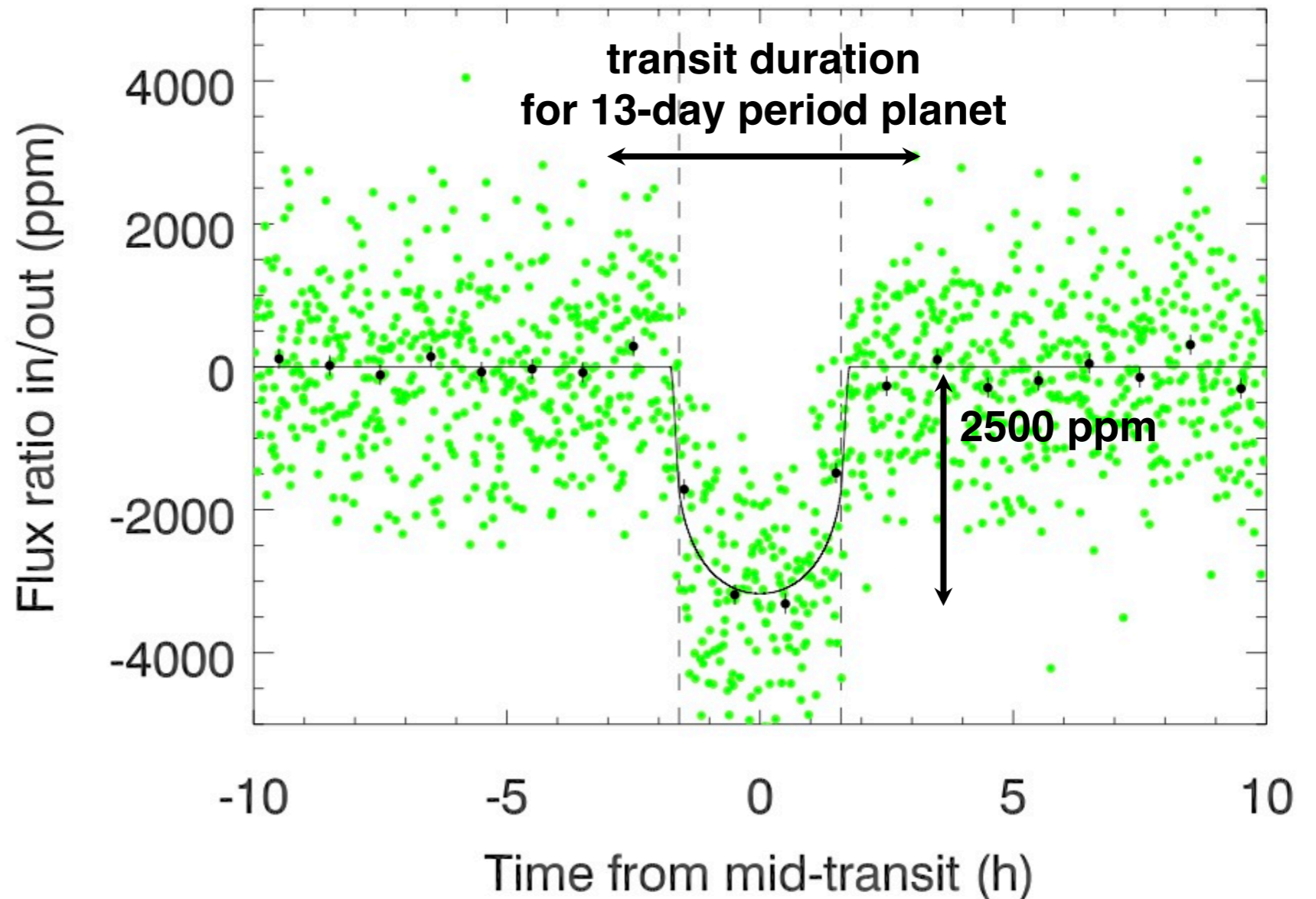
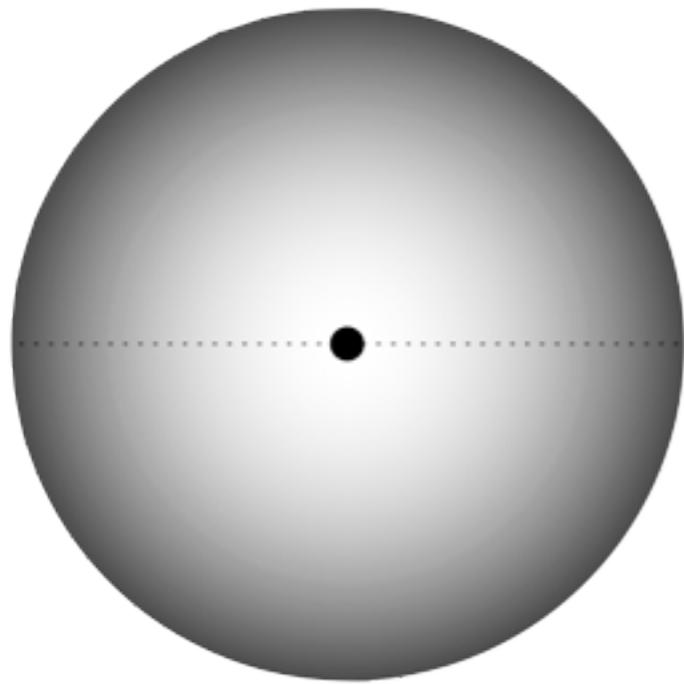
CHEOPS—Science requirements

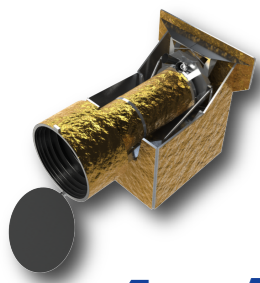
Photometric precision (2)

Characterizing transits of Neptune-size planets

around K dwarfs of $V < 12$

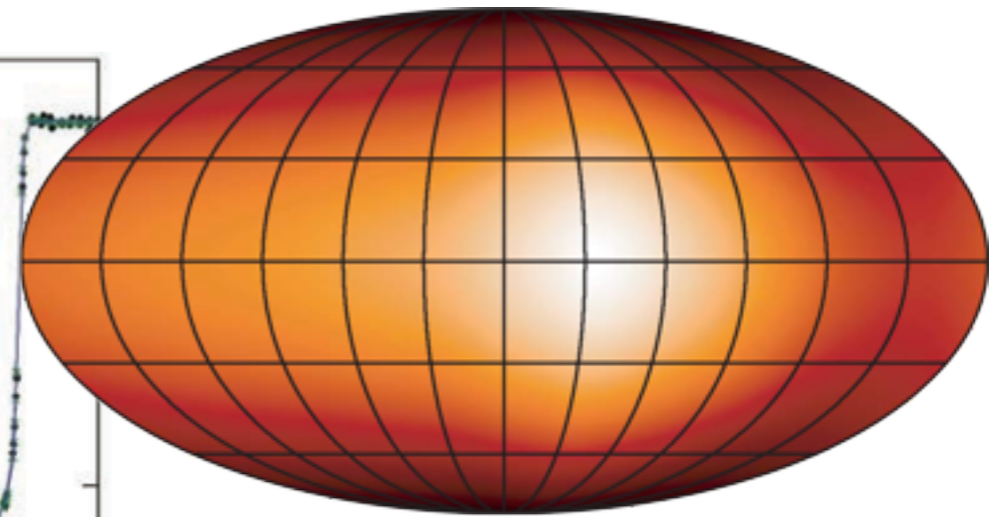
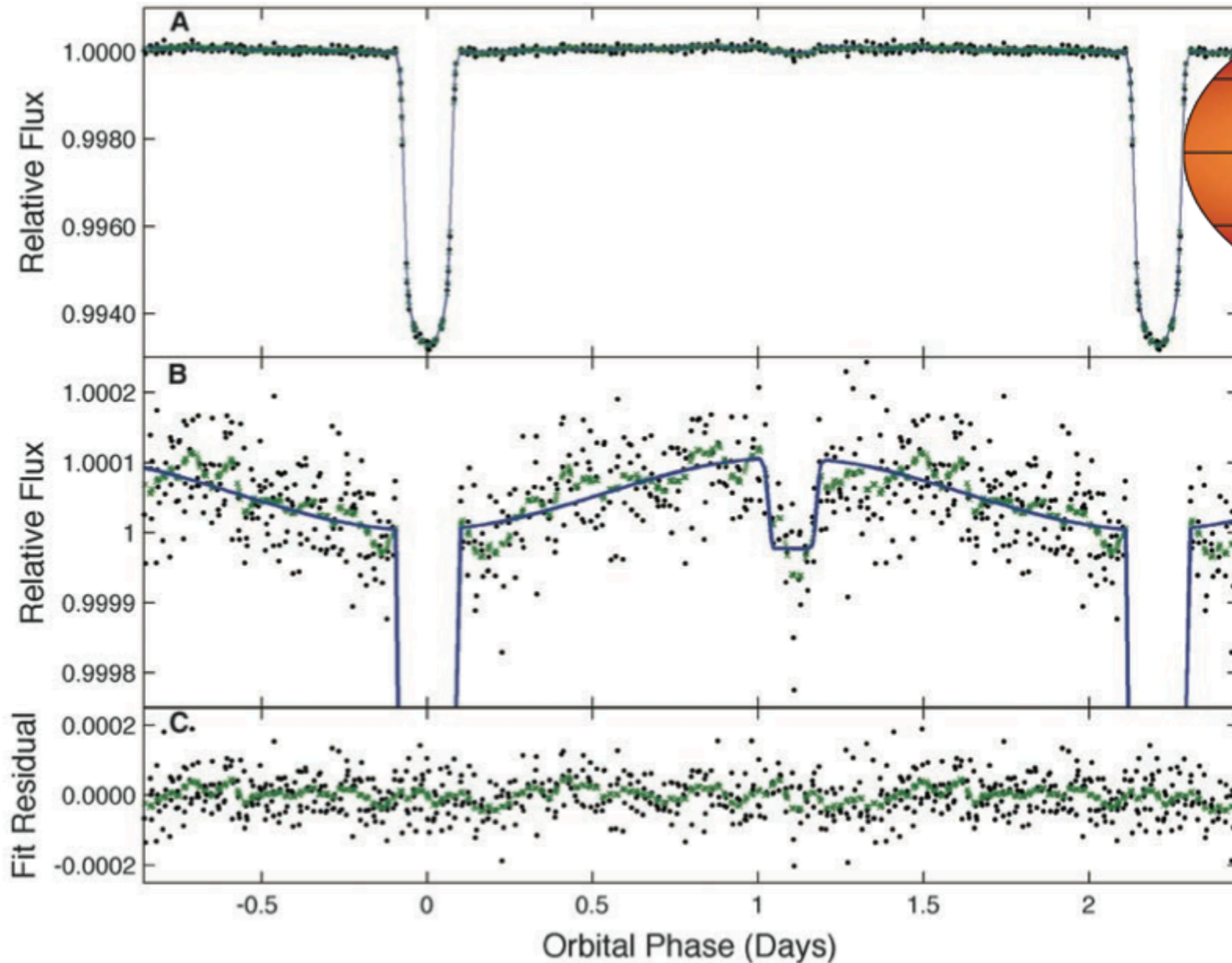
➔ 85 ppm in 3h of integration





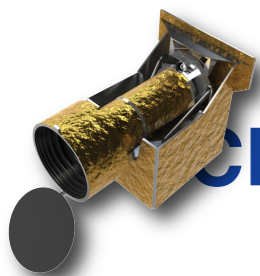
CHEOPS—Science objectives

4. Albedo and Energy transport in hot Jupiters



Brightness map of a hot Jupiter
Knutson et al. 2007

Optical phase curve of a V=10.5 mag star (HAT-P-7) by *Kepler*
Borucki et al. 2007



CHEOPS—Synergies

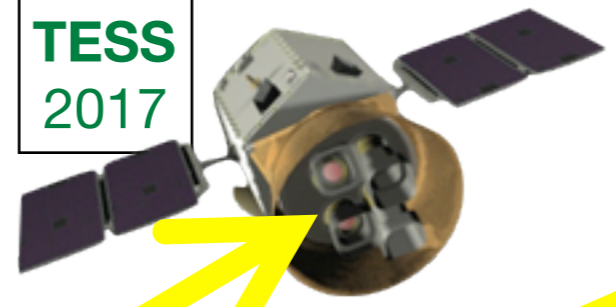
CoRoT
Kepler



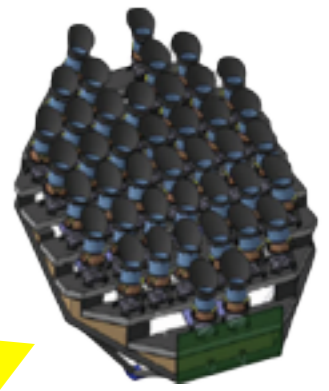
NGTS
2014

CHEOPS
2017

TESS
2017



PLATO 2.0
2022



HARPS
HARPS-N
SOPHIE

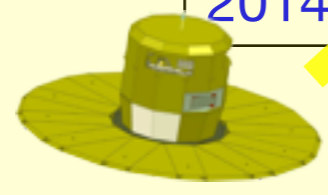
Today



“Warm”
Spitzer

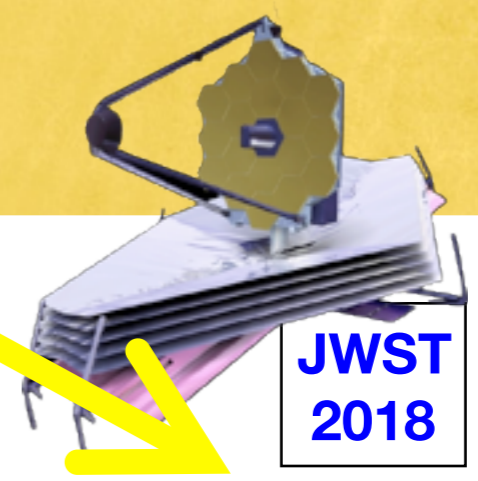
HST

GAIA
2014



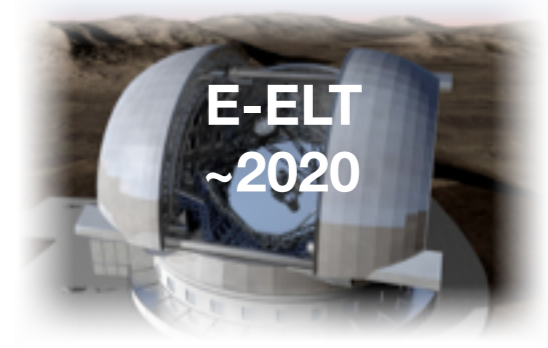
VLT

CRIRES, FORS,
FLAMES, K-MOS

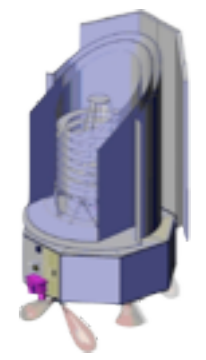


JWST
2018

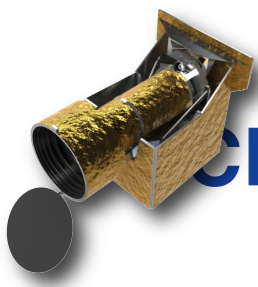
ESA
L-mission
2028/34
?



E-ELT
~2020



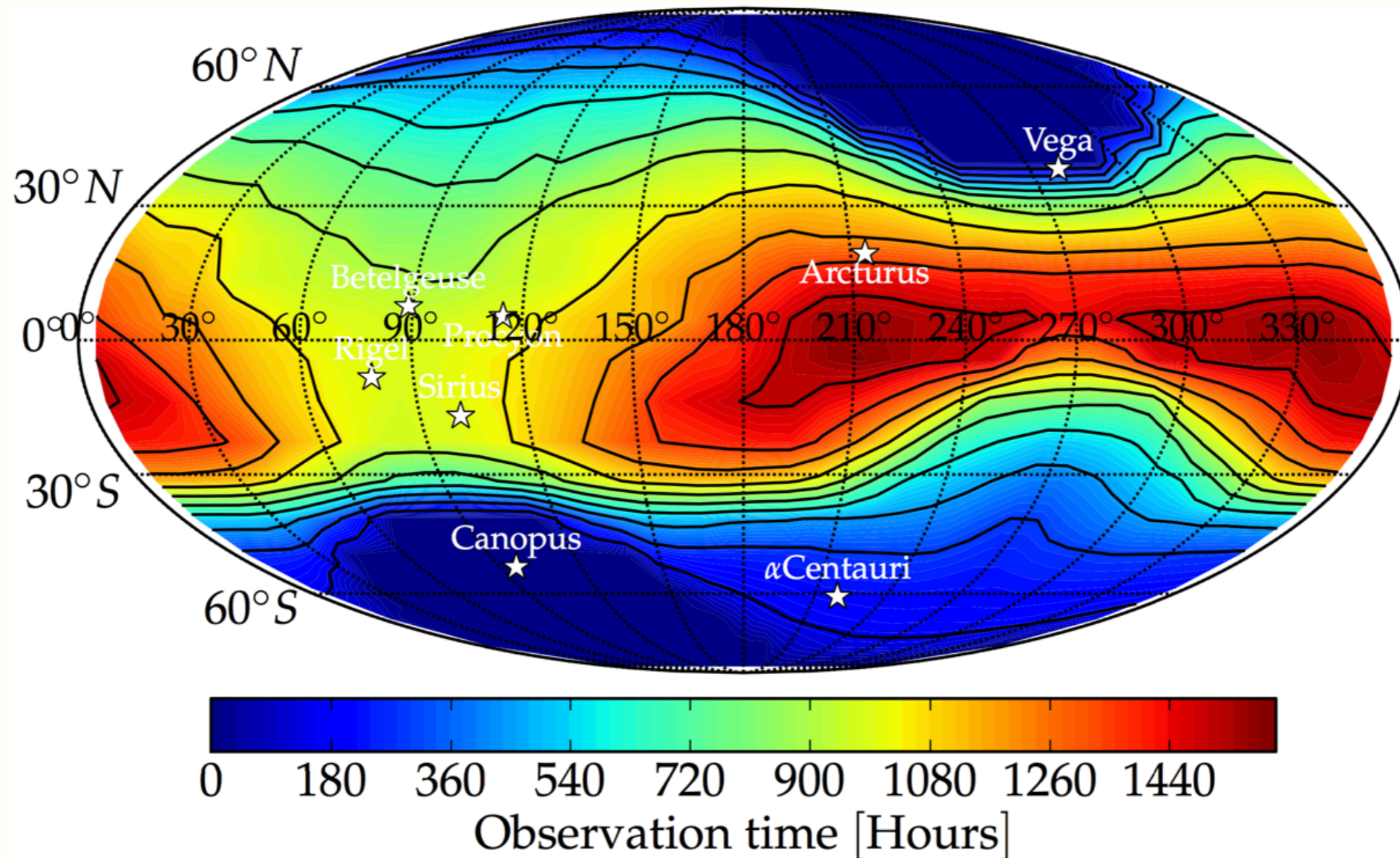
EChO
2022

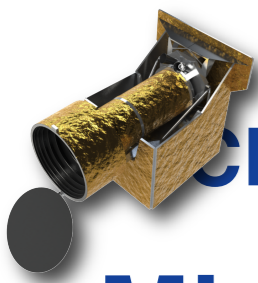


CHEOPS—Science requirements

Detecting transits of Earth-size planets

- ➔ 50% of sky accessible for 50 days per yr and per target with <50% interruption per orbit





CHEOPS—Science requirements

Mission duration

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

