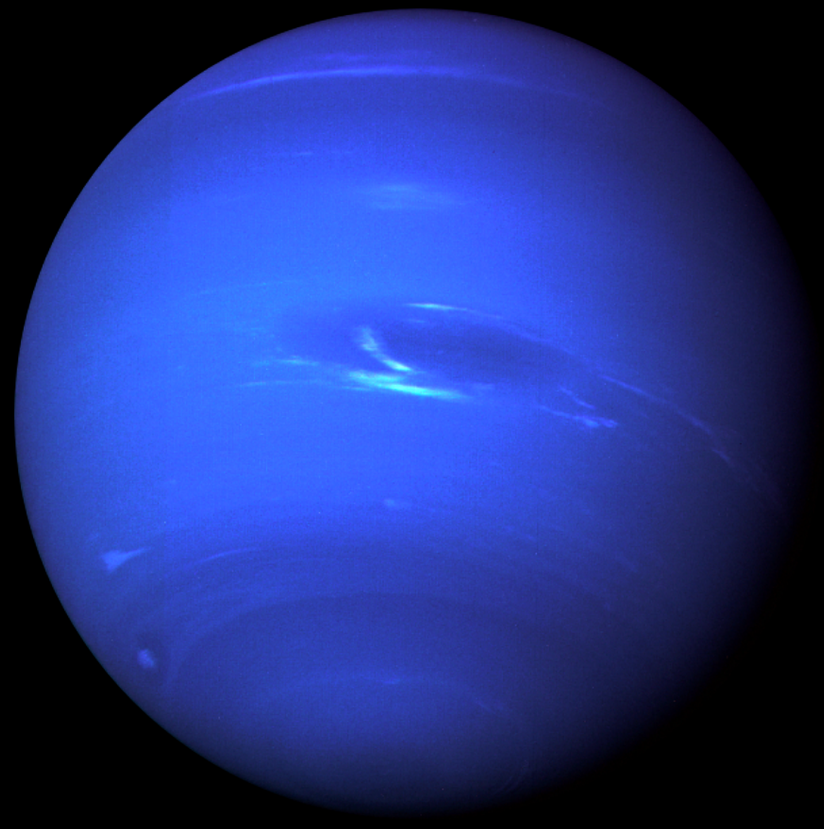
Exoplanets and SALT

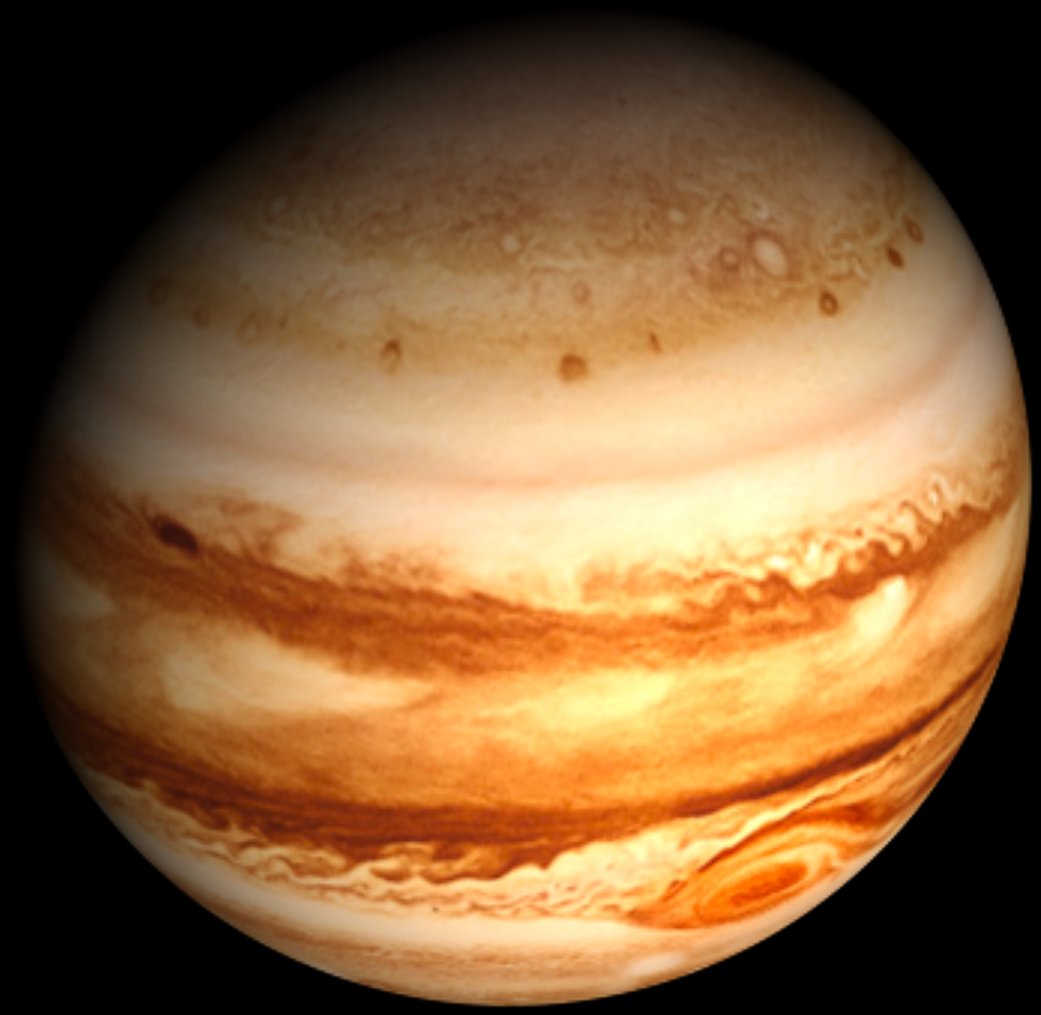
Elisabeth Newton
MIT — NSF Postdoctoral Fellow (now)
Dartmouth — Assistant Professor (January)

Elisabeth.R.Newton@Dartmouth.edu

How we find and study exoplanets

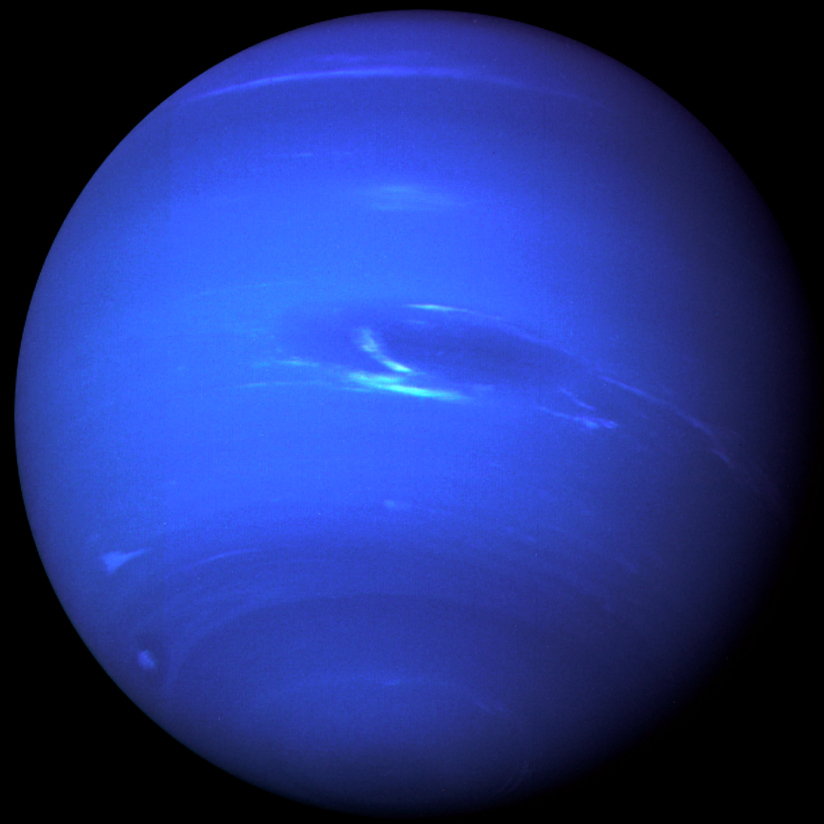
Updates from TESS, NASA's newest exoplanet mission





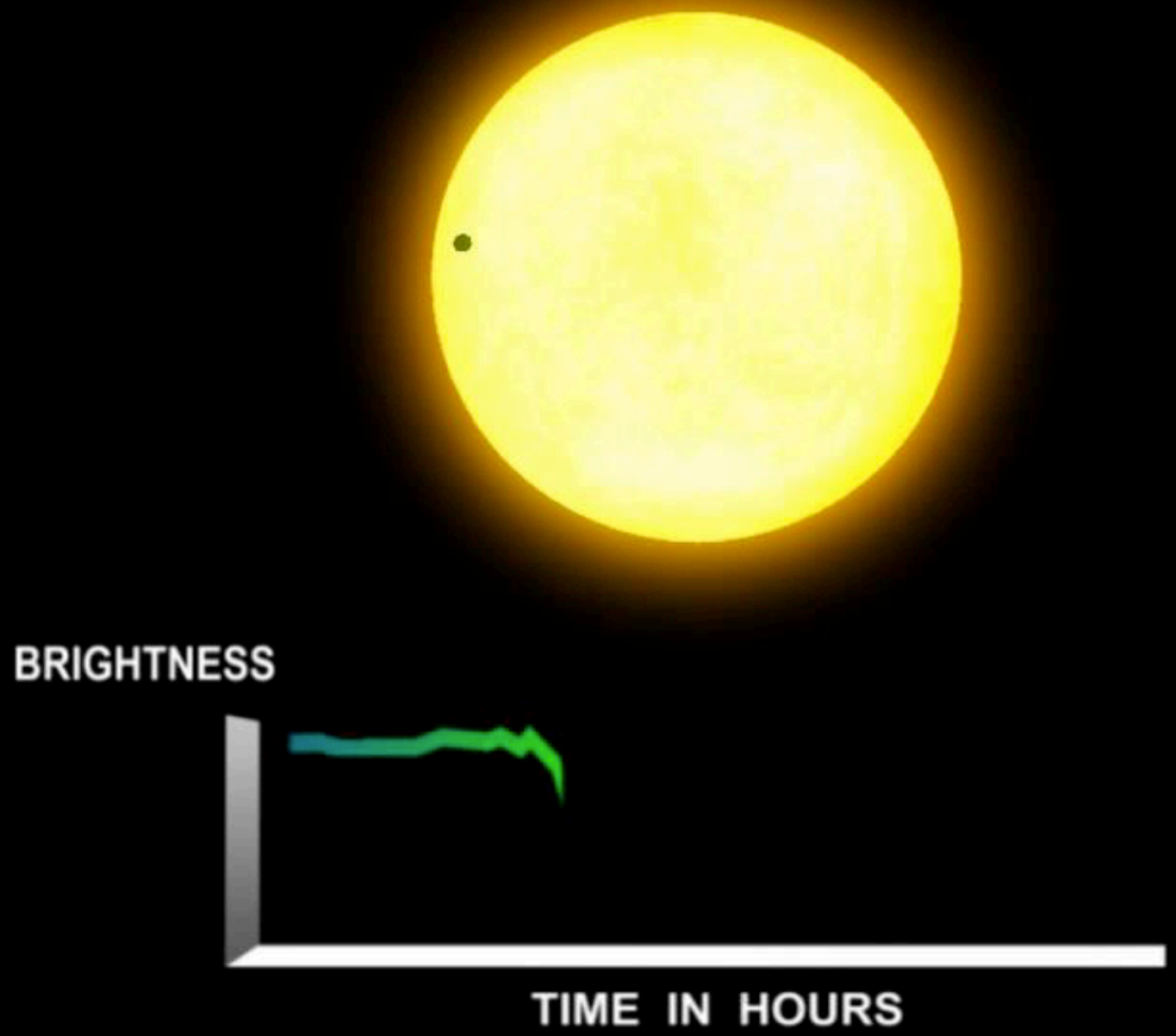
The role of SALT in measuring exoplanet masses

The bulk properties of an exoplanet

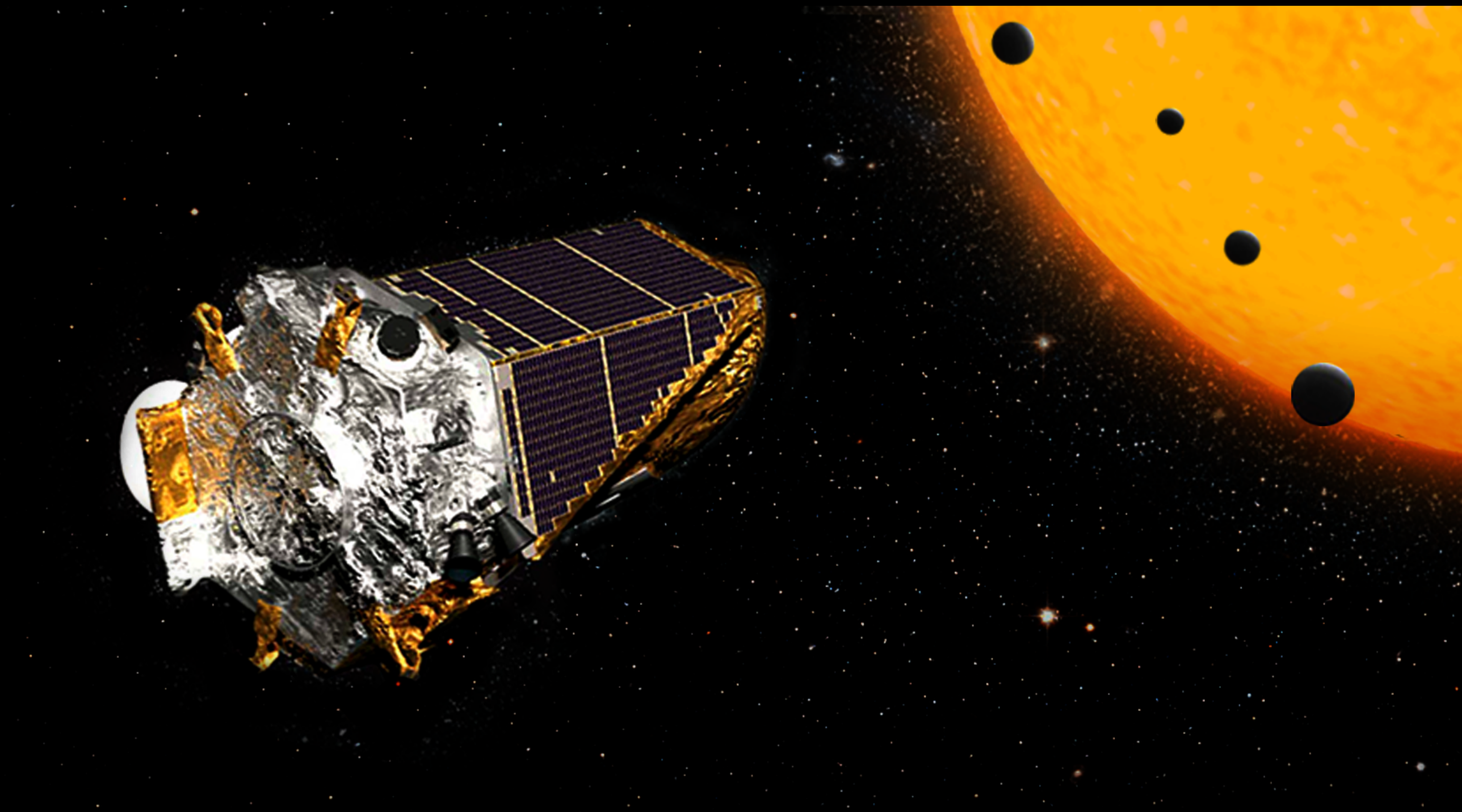


Radius: the transit method
Mass: the radial velocity technique

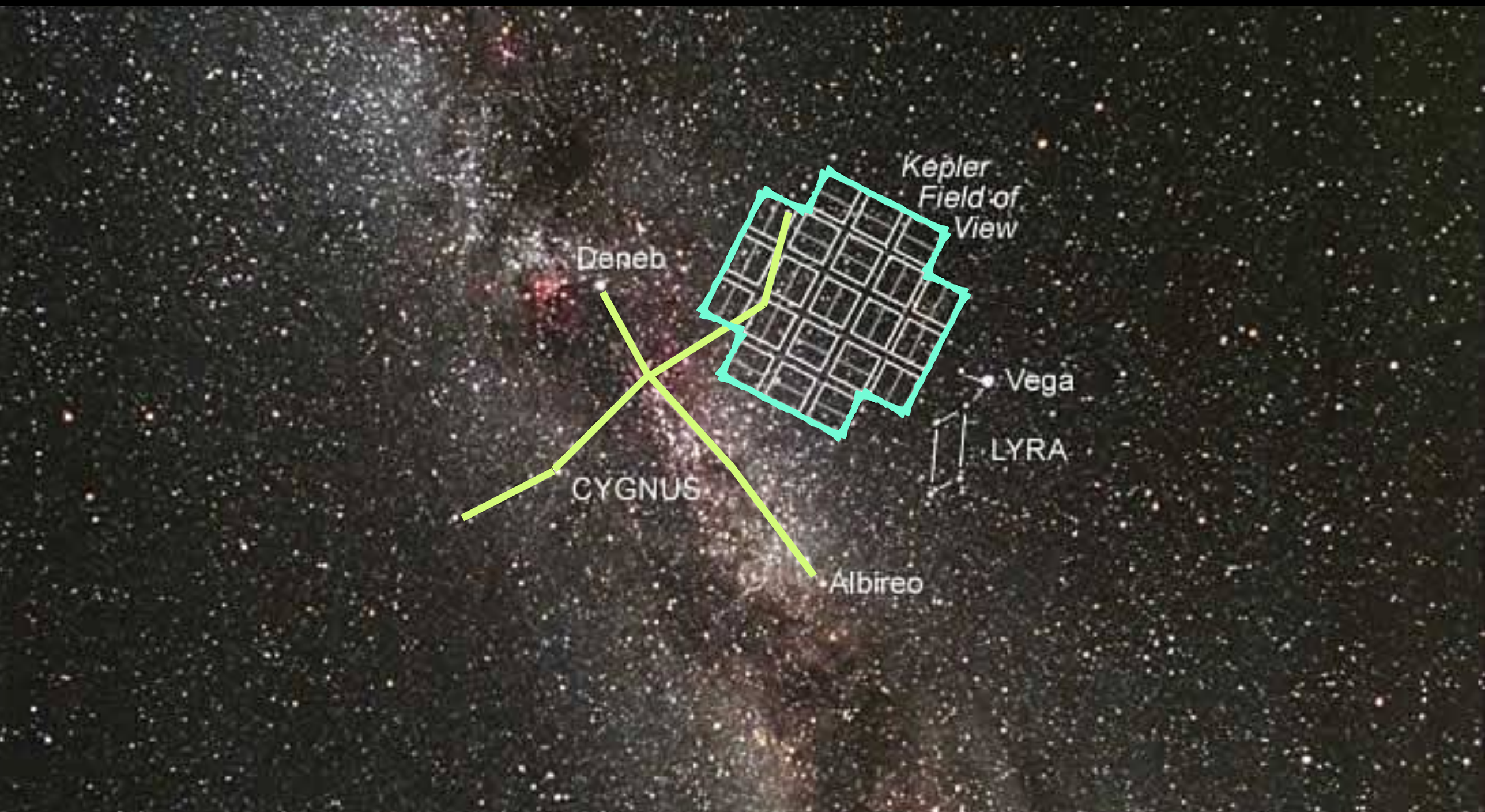
Measuring planets' radii



Thousands of planets can be detected transit surveys



The *Kepler* mission's approach: one patch of sky for 4 years



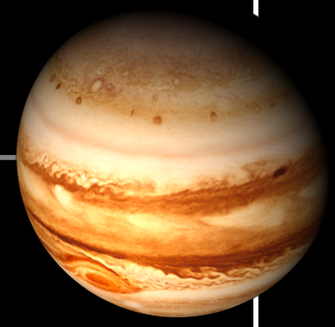
15

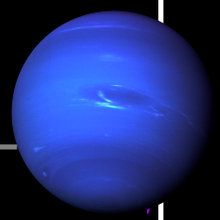
10

5

0

Planet radius (Earth radii)





0.1

1

10

Orbital Period (days)

Slide c.f. Jenn Burt
NASA Exoplanet Archive
11/13/2018

Kepler's planets

Planet radius (Earth radii)

15

10

5

0

0.1

1

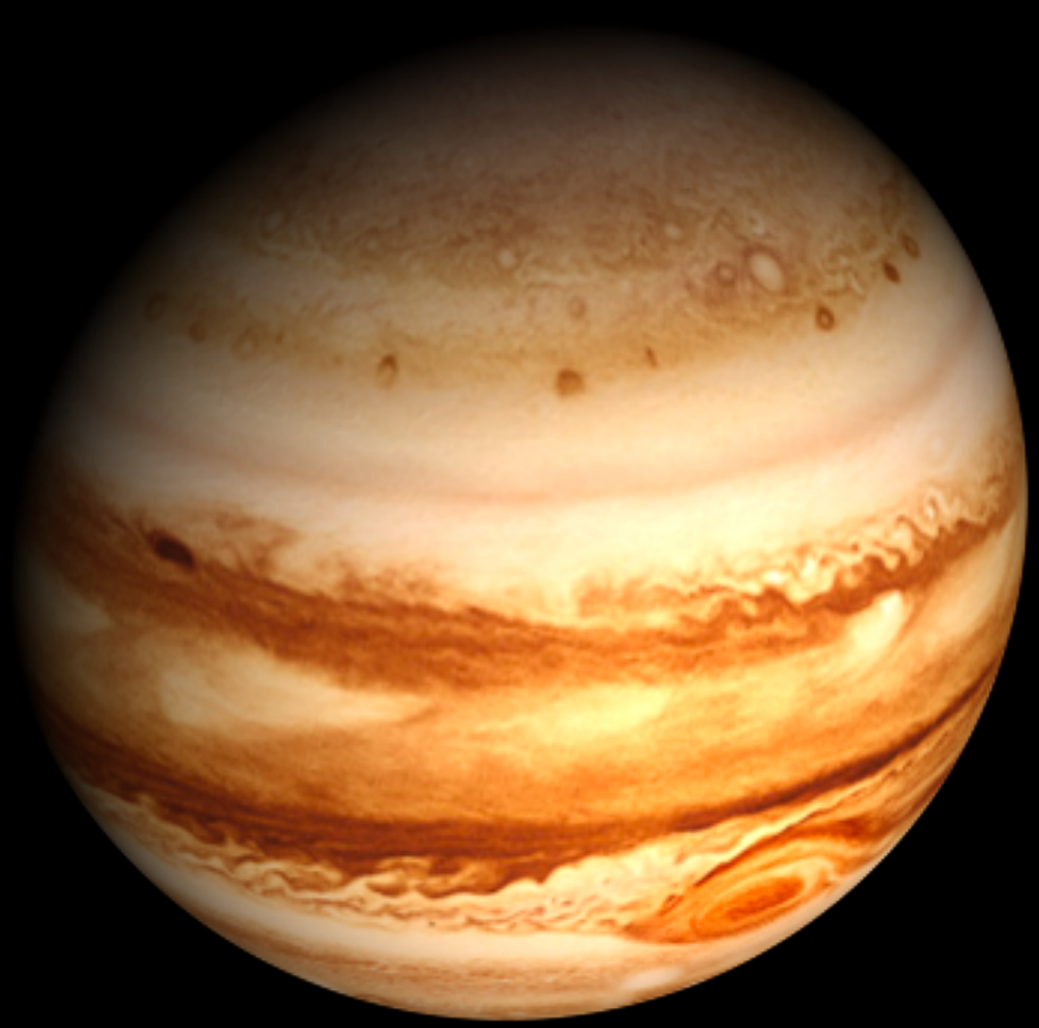
10

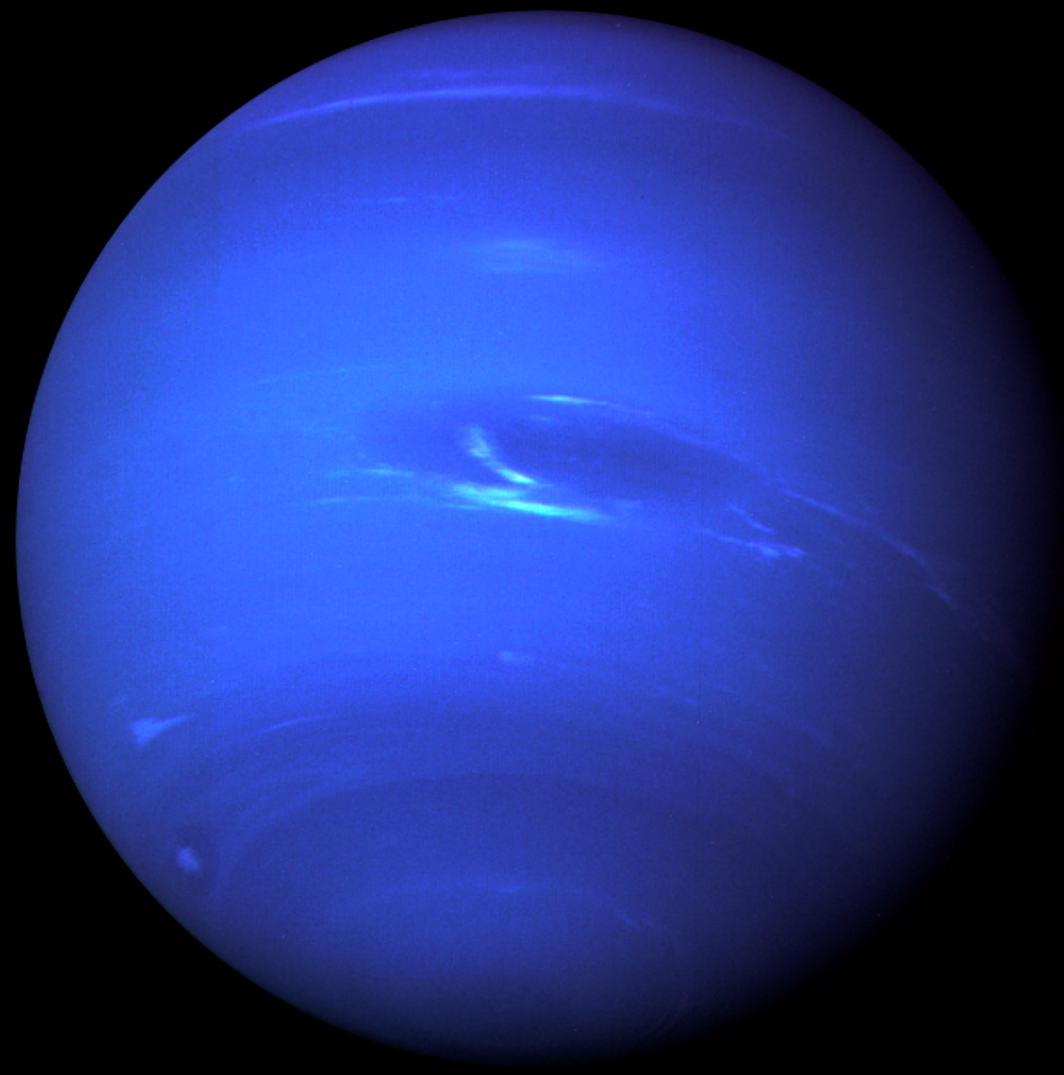
100

Orbital Period (days)

NASA Exoplanet Archive
11/13/2018

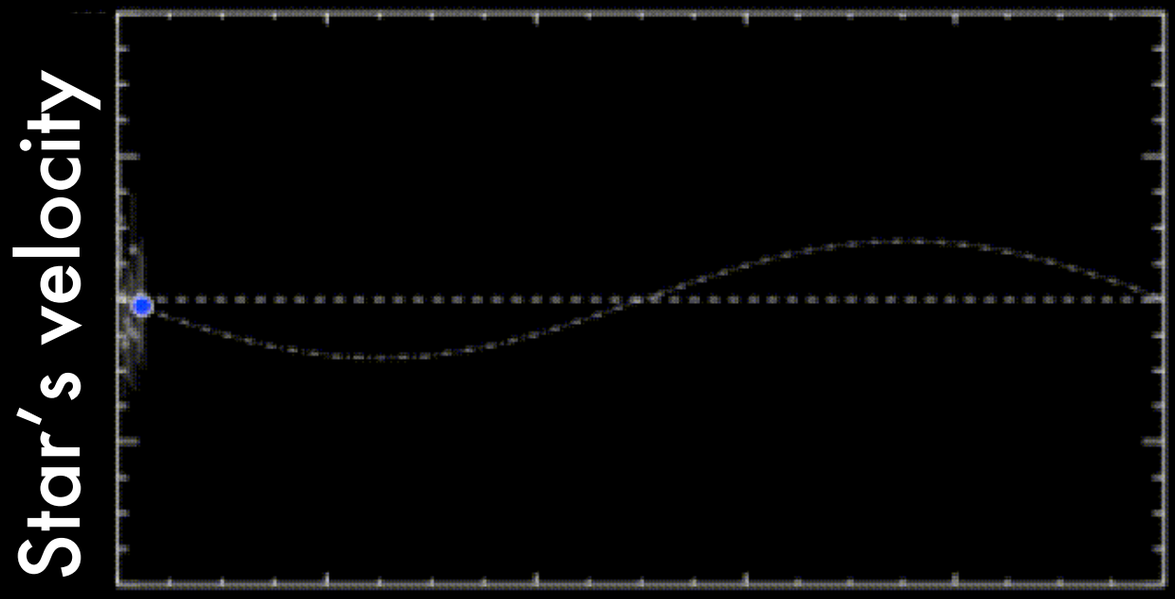
Radius + Mass gives insight into *composition*

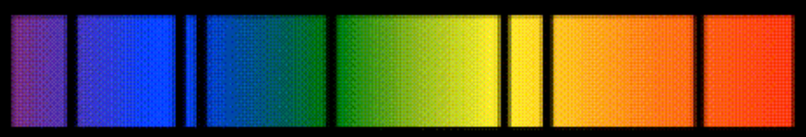




Measuring planets' masses

The Doppler wobble





Slide: Sam Halverson

Kepler's planets

Planet radius (Earth radii)

15

10

5

0

0.1

1

10

100

Orbital Period (days)

NASA Exoplanet Archive
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Planets with
masses and radii

Planet mass (Earth masses)

100

10

1

0.1

1

10

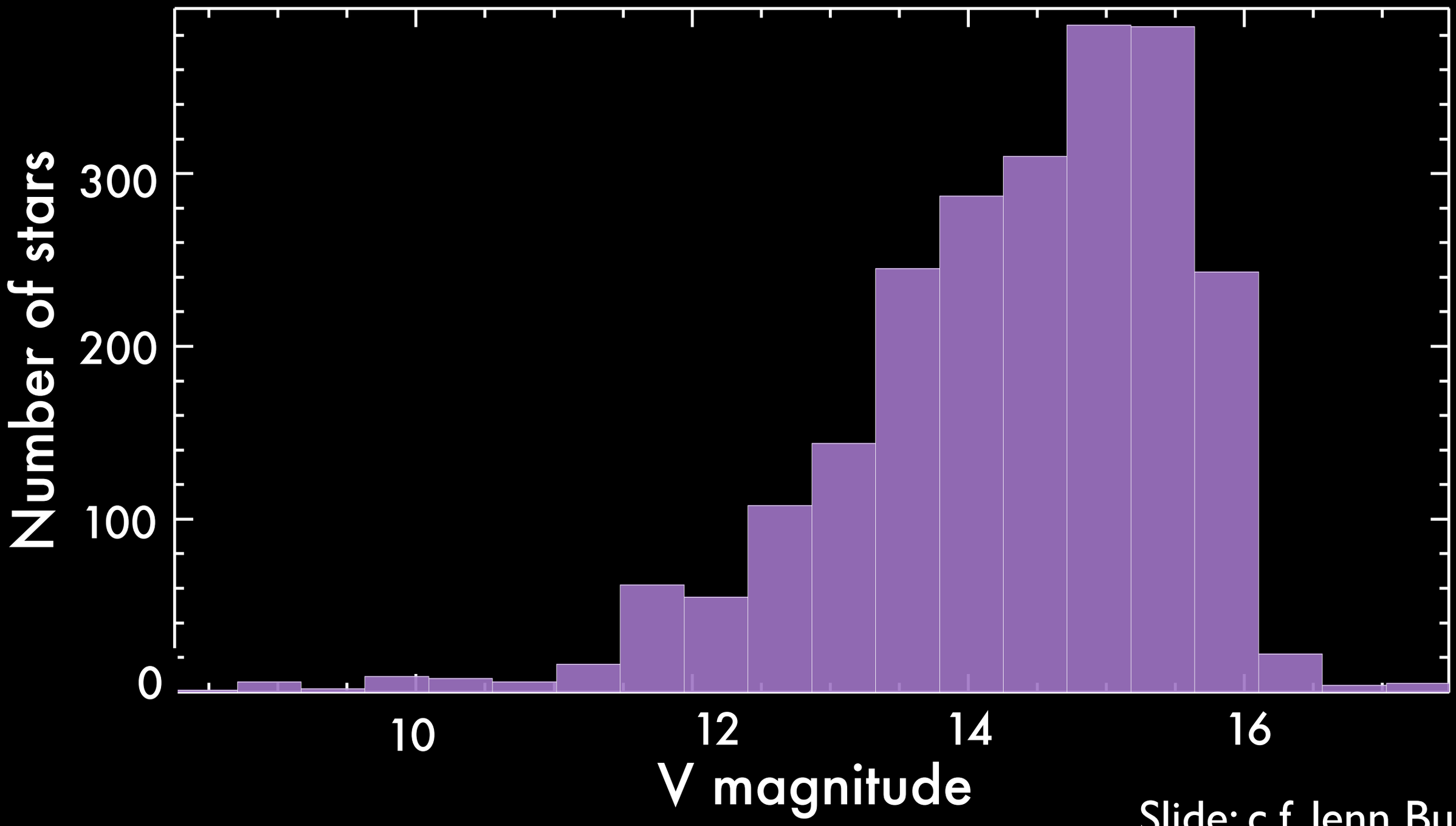
100

Orbital Period (days)

NASA Exoplanet Archive
11/13/2018

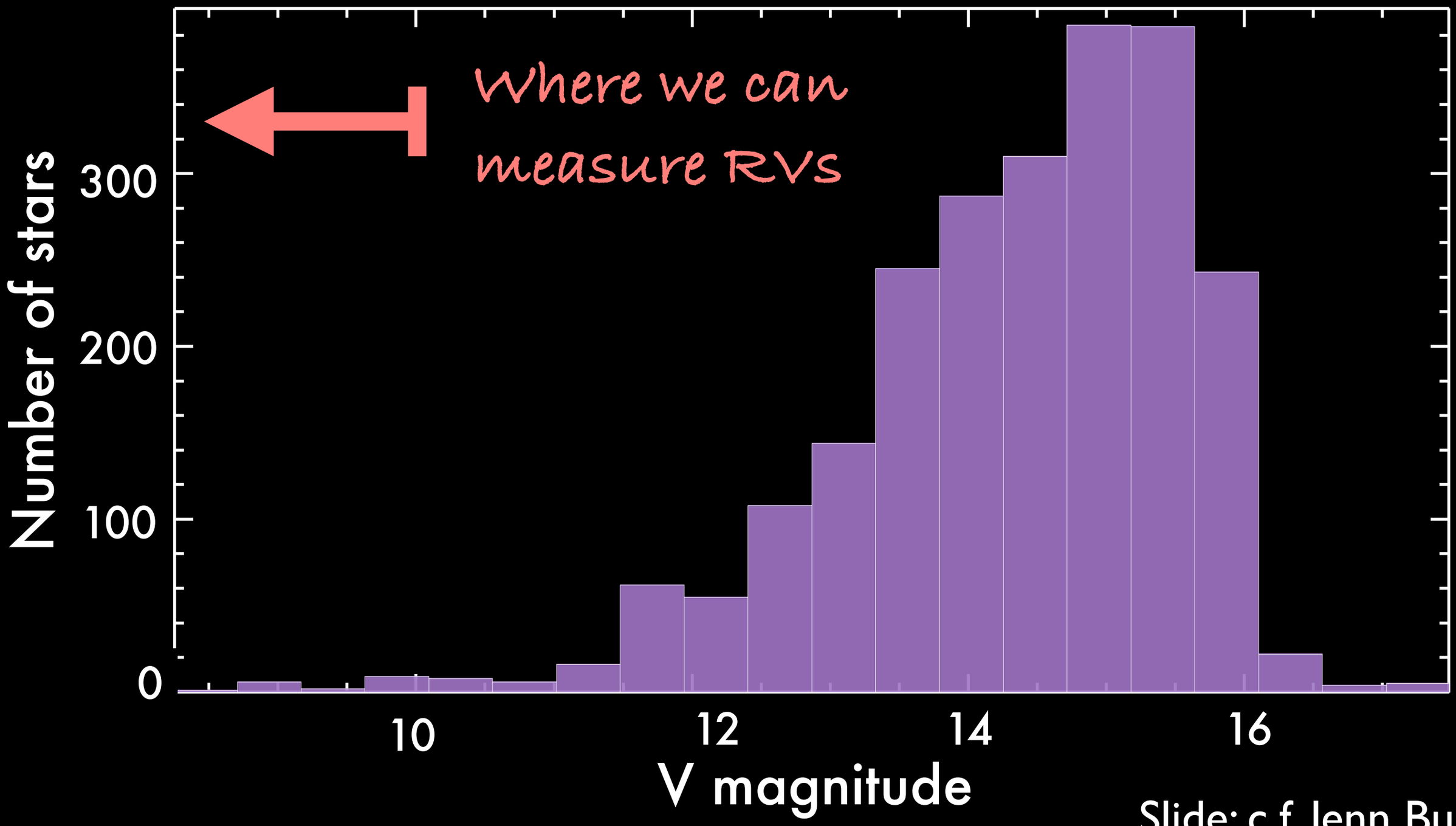
To measure planet masses,
the stars need to be bright

Kepler's stars weren't bright

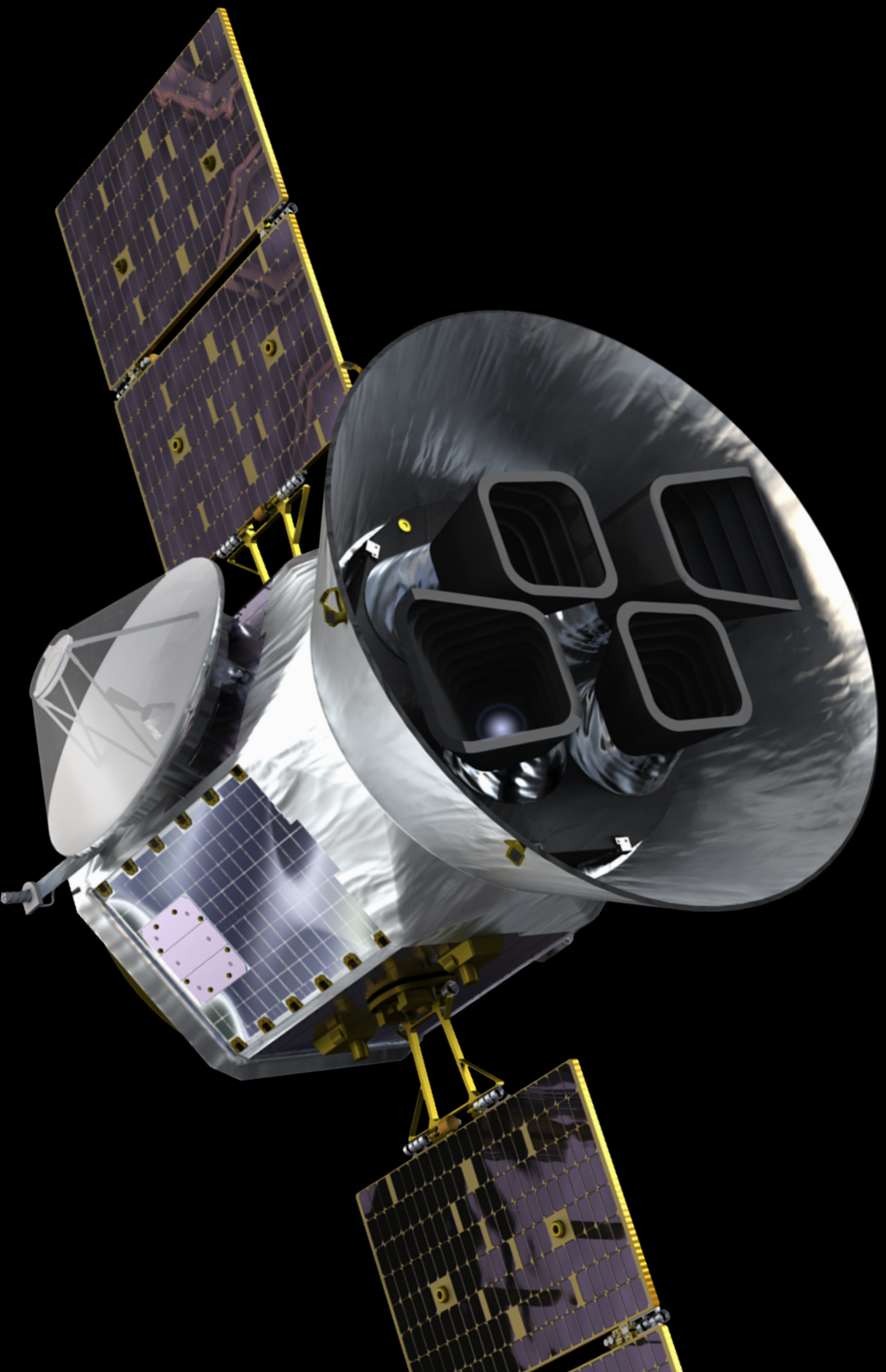


Slide: c.f. Jenn Burt
NASA Exoplanet Archive
11/28/2017

Kepler's stars weren't bright



Slide: c.f. Jenn Burt
NASA Exoplanet Archive
11/28/2017



TESS

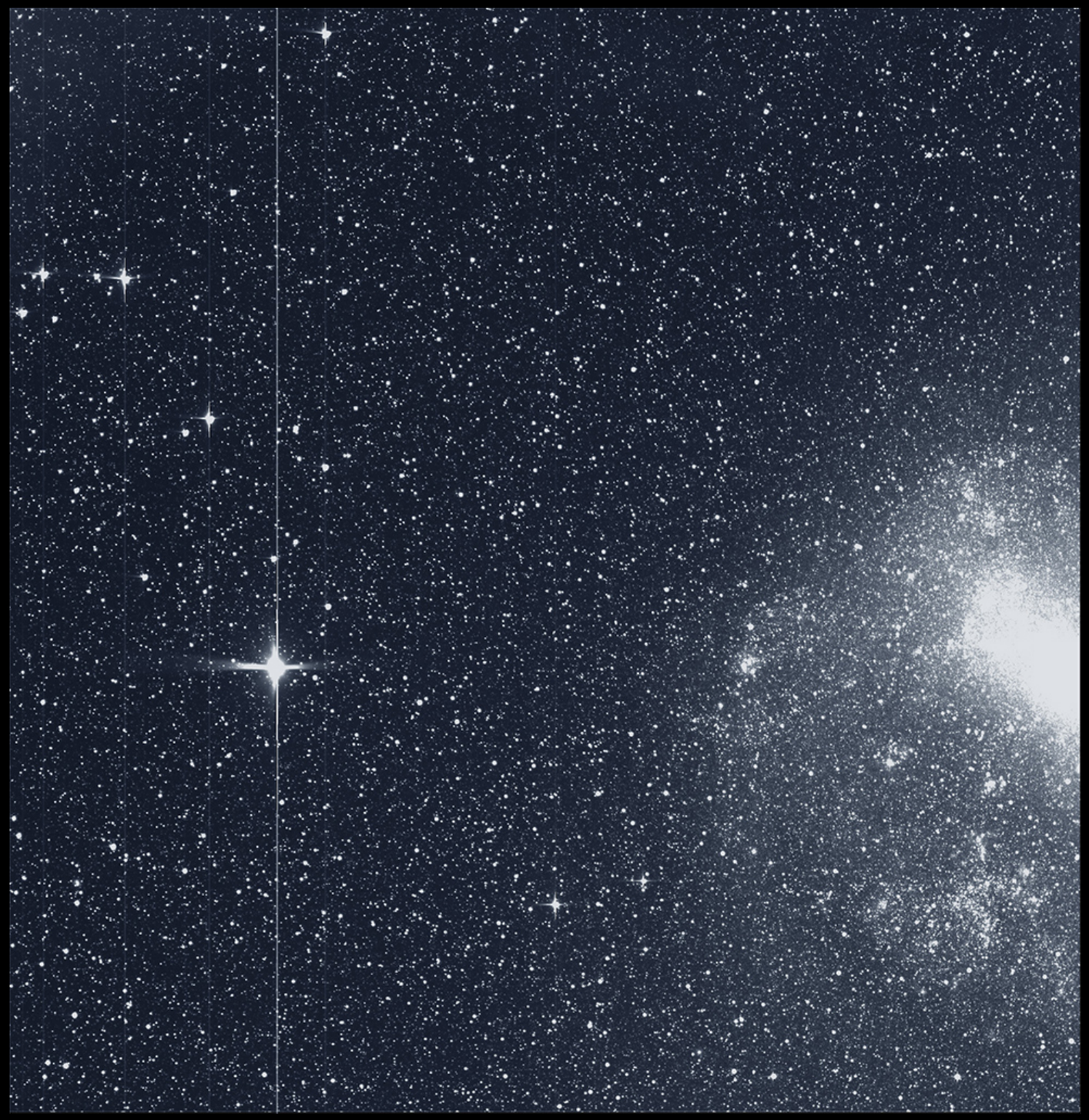
Transiting Exoplanet Survey Satellite

MIT · NASA Goddard · CfA · Orbital ATK · STScI

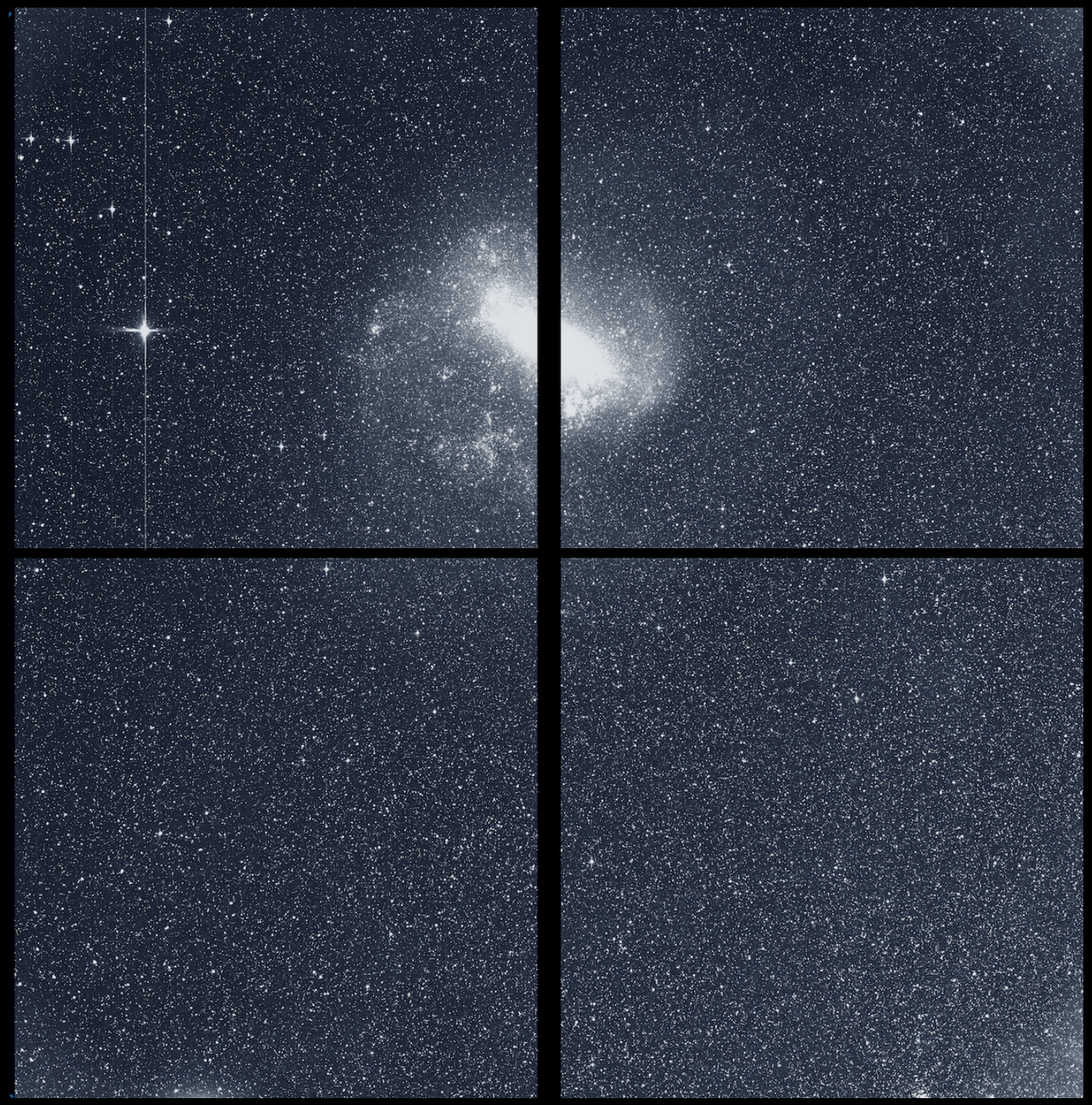
Kepler Search Space:
3000 light-years
0.25% of the sky

TESS Search Space:
300 light-years
85% of the sky

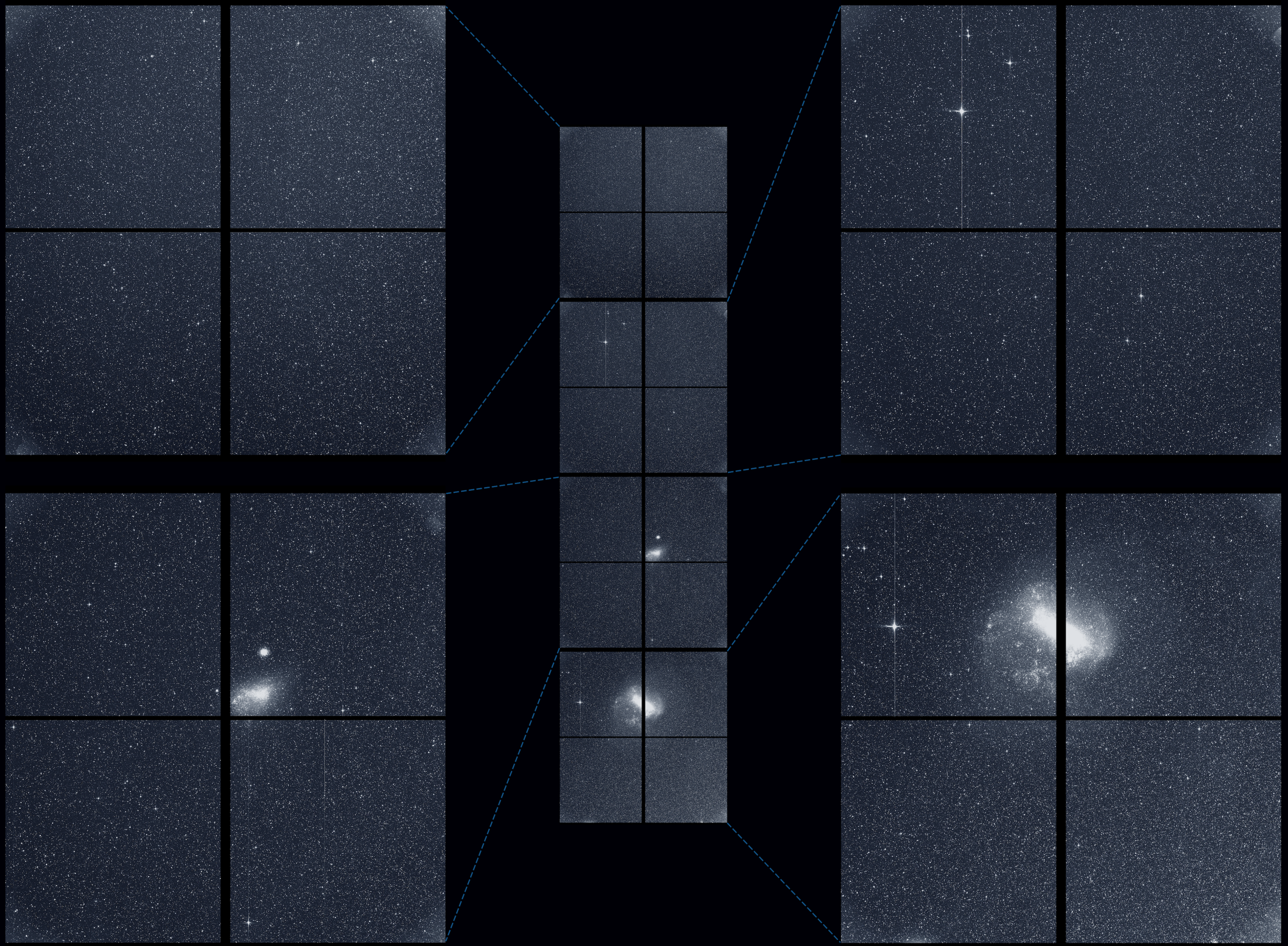
Slide: Tom Barclay



TESS observes a large area at once



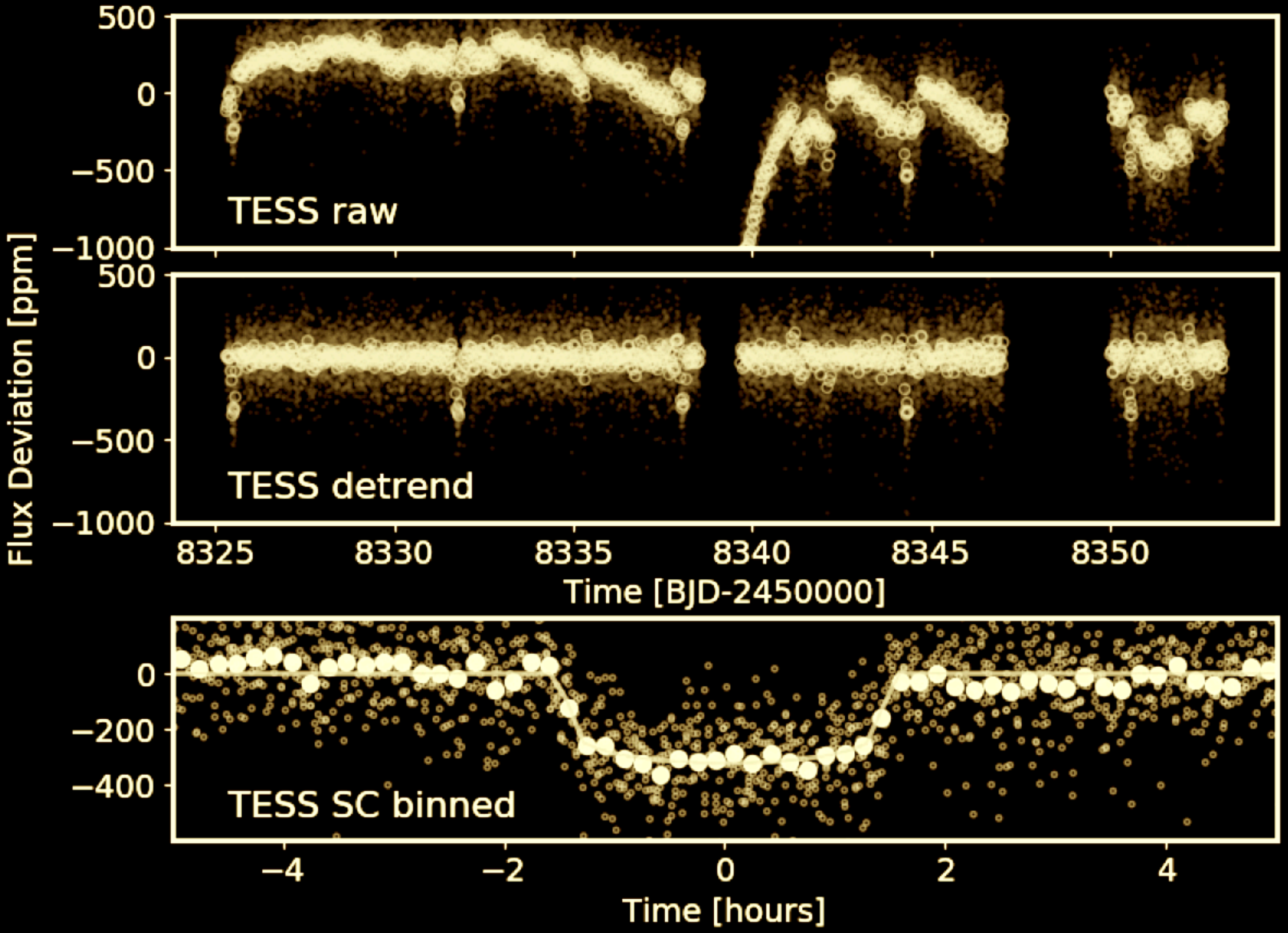
TESS observes a large area at once



TESS observes in 27 day “sectors”

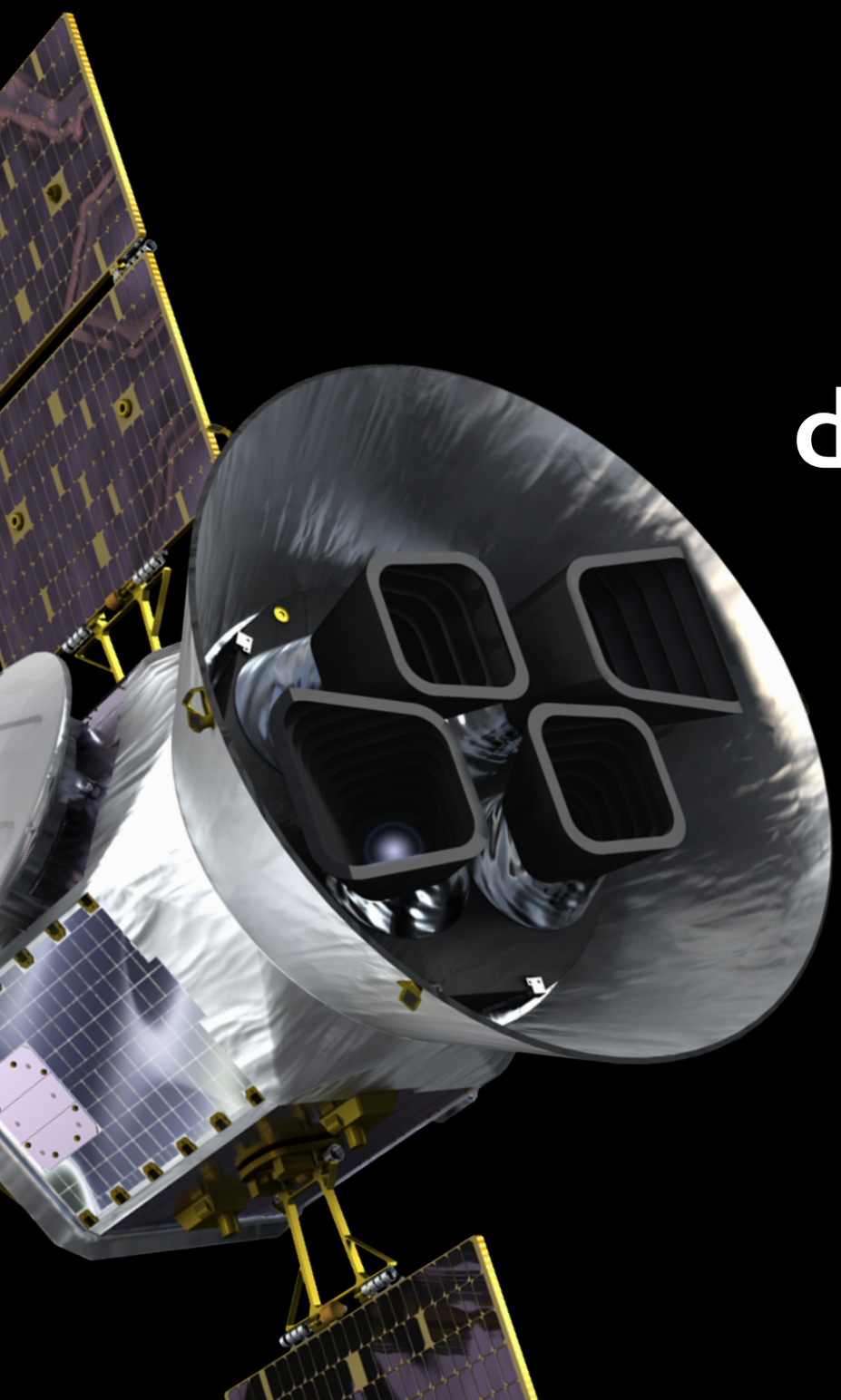
April 18th

The MIT-TESS team is releasing alerts on planet candidates to facilitate early science



Huang, Burt, Vanderburg et al. arXiv:1809.05967

TESS gives us radii. Let's get the masses with SALT/HRS!



Alerts are here, and more are on the way

Public release of available data is expected early 2019.

The question I'd like to address:
How do planets evolve?

Planet radius (Earth radii)

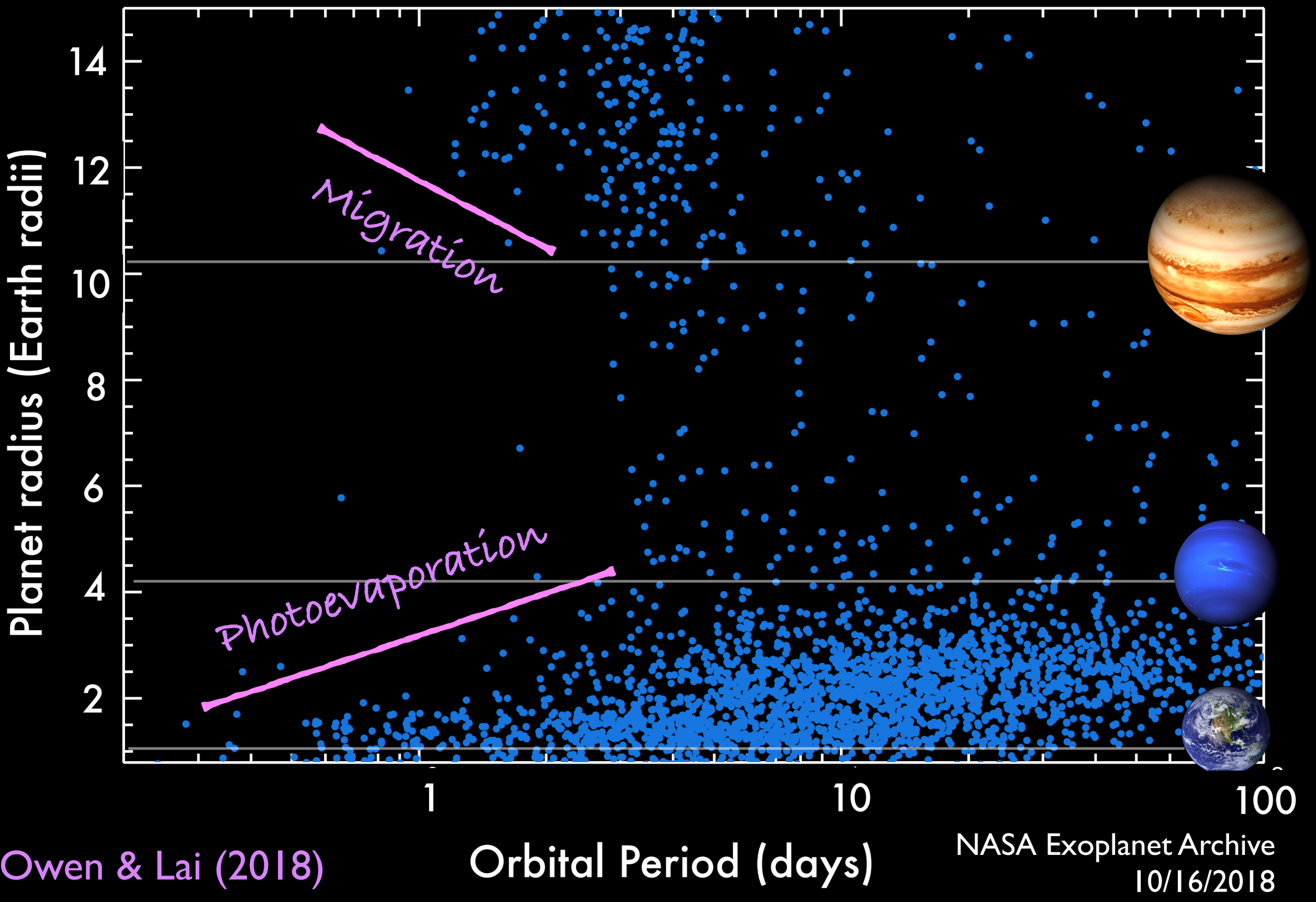
14
12
10
8
6
4
2

1
10
100

Orbital Period (days)

NASA Exoplanet Archive
10/16/2018

14
12
10
8
6
4
2
Planet radius (Earth radii)
The "sub-Jovian desert"
1
10
100
Orbital Period (days)
Szabó & Kiss (2011)
NASA Exoplanet Archive
10/16/2018



Owen & Lai (2018)

NASA Exoplanet Archive
10/16/2018

Image: Mark Garlick/University of Warwick
for the exoplanet GI 436b

How is the population of exoplanets shaped by atmospheric evaporation?

Evaporating planets?

Planet radius (Earth radii)

14
12
10
8
6
4
2

1
10
100

Orbital Period (days)

Owen & Lai (2018)

NASA Exoplanet Archive
10/16/2018

TESS is finding new exoplanets around bright stars

We can measure their masses with SALT

Photo: Janus Brink