

The hottest Jupiters transiting evolved stars

Samuel Grunblatt, Nicholas Saunders, and many others

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Flatiron Institute**



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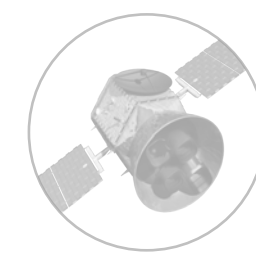
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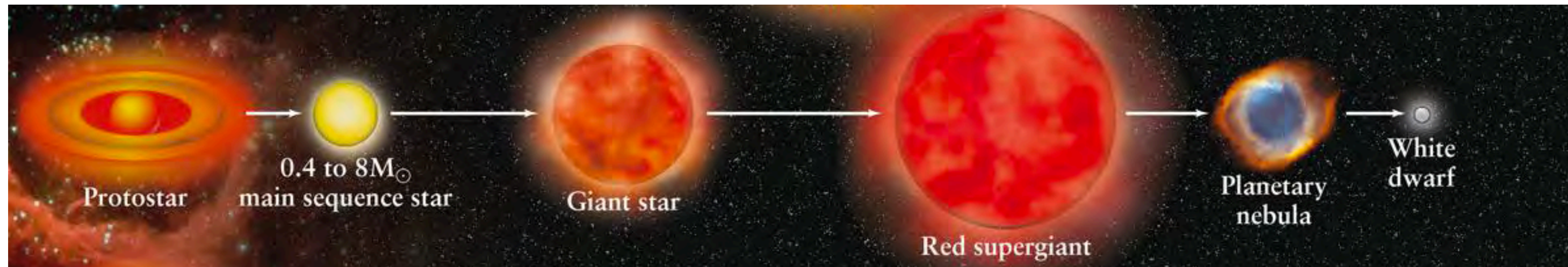


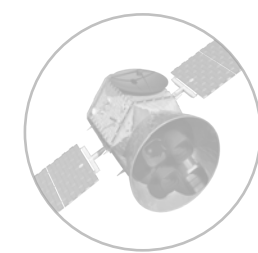
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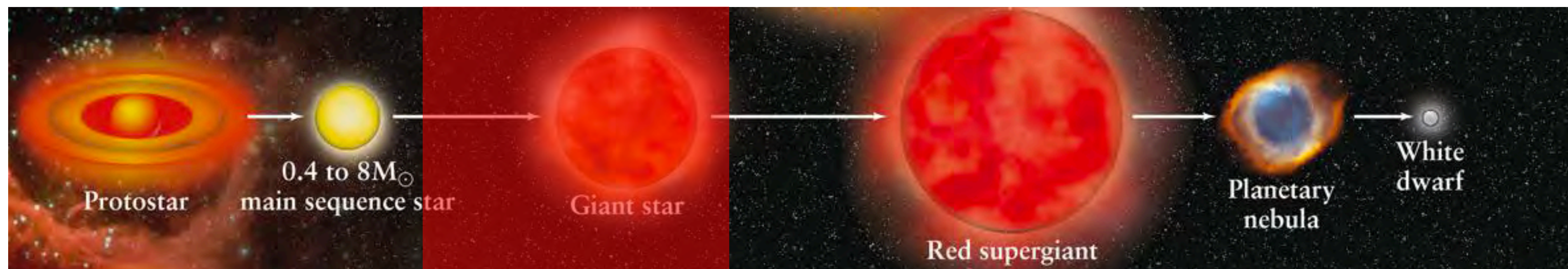


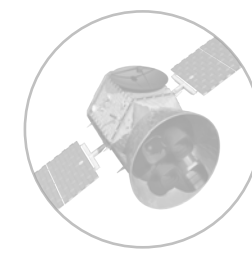
Stellar evolution in 30 seconds:



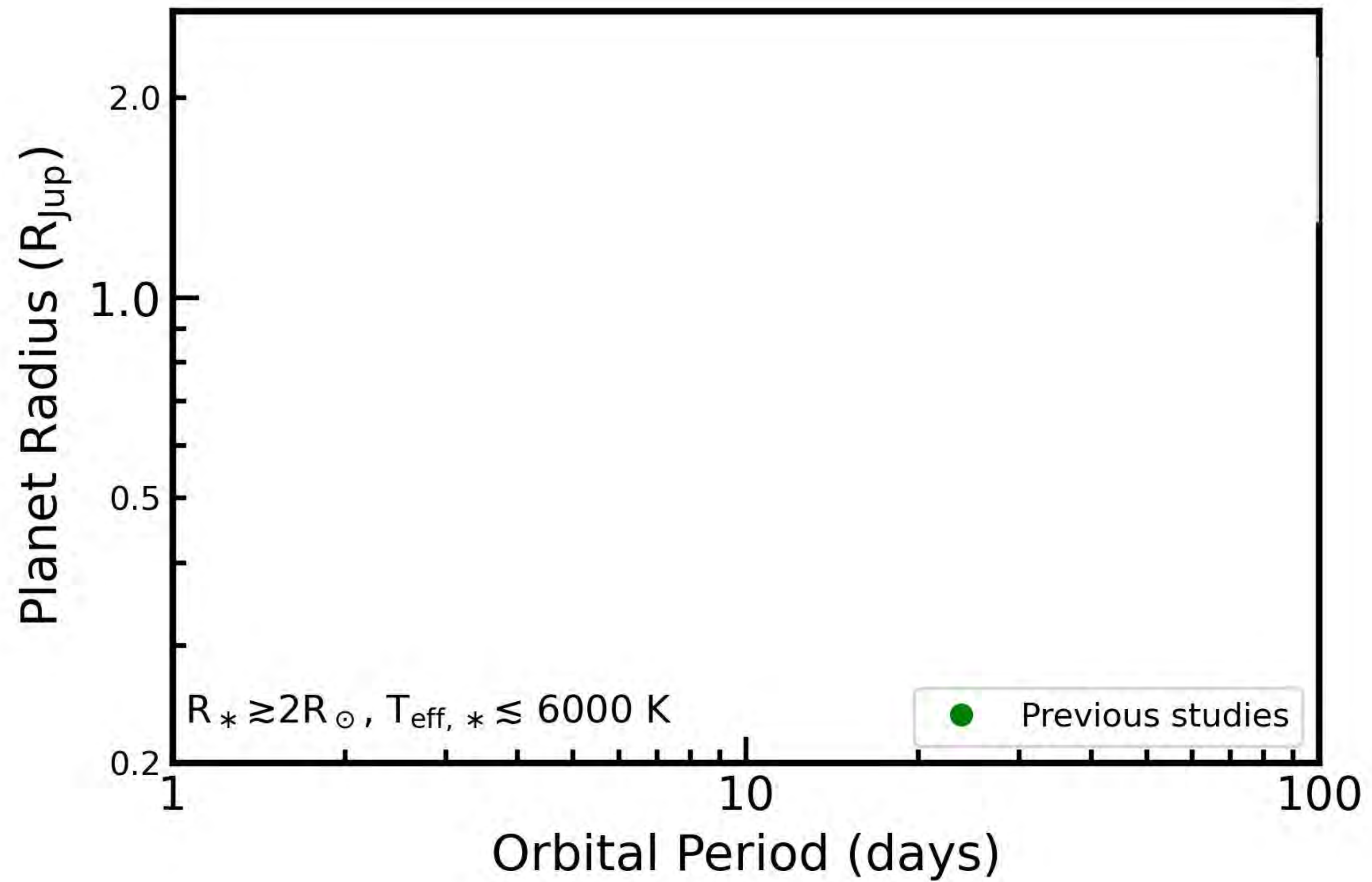


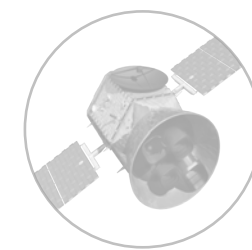
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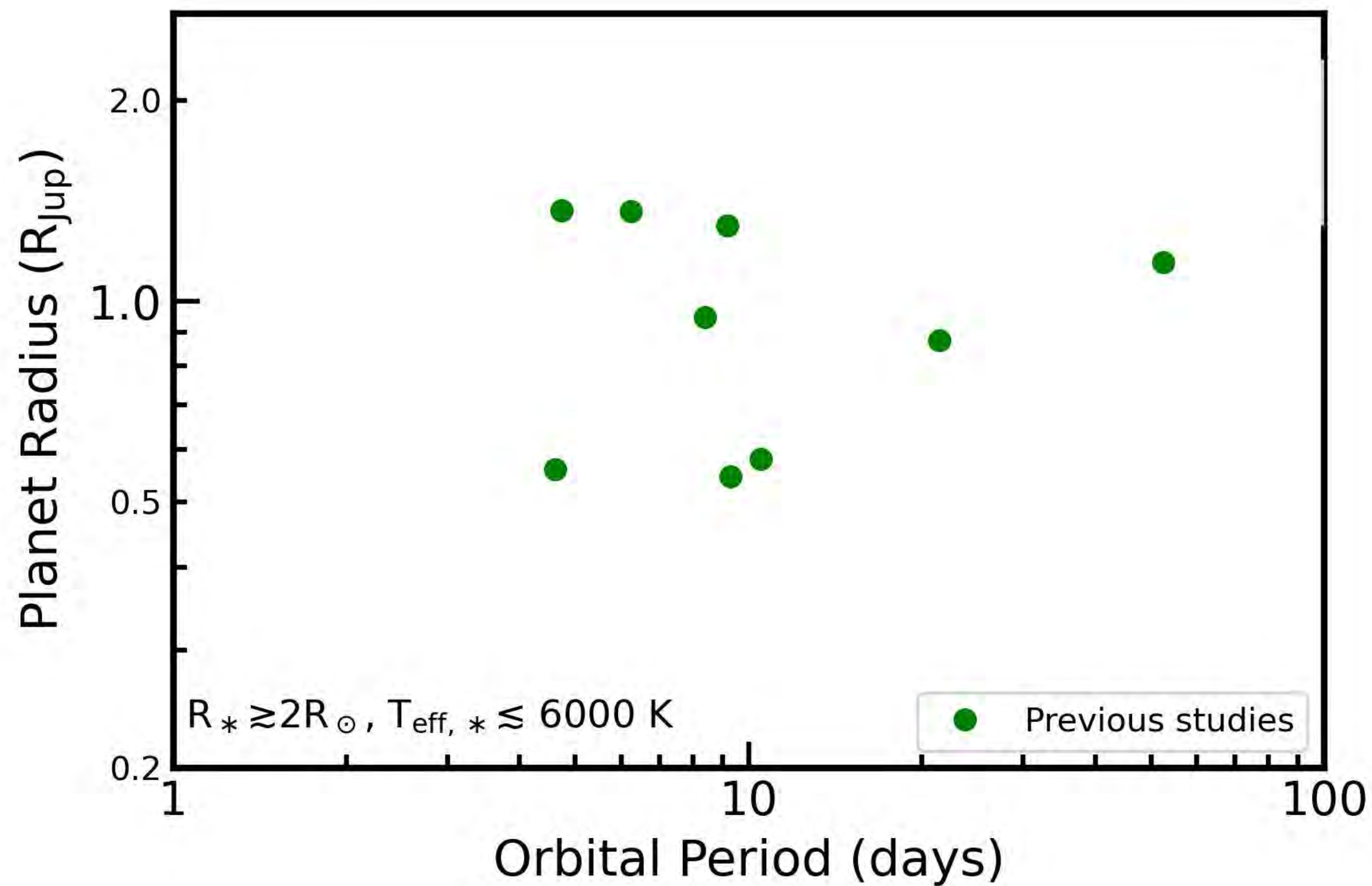


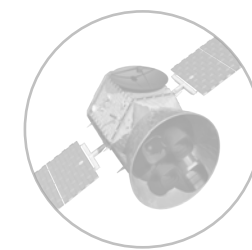
2013: no evidence for planets transiting evolved stars.



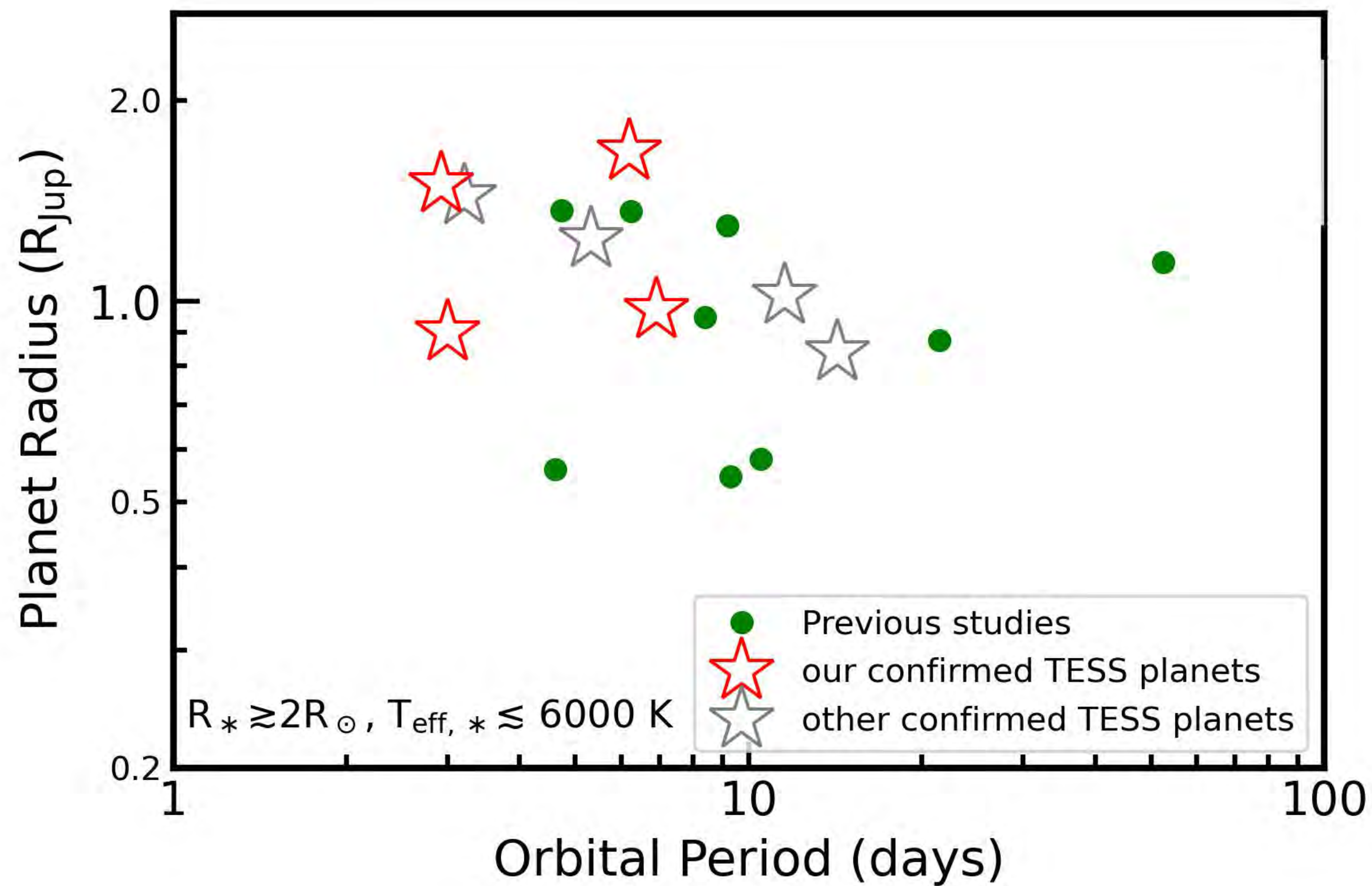


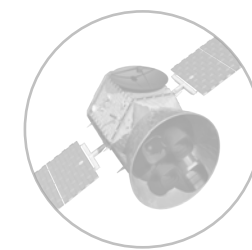
2018: transiting planet surveys show planets transiting evolved stars exist.



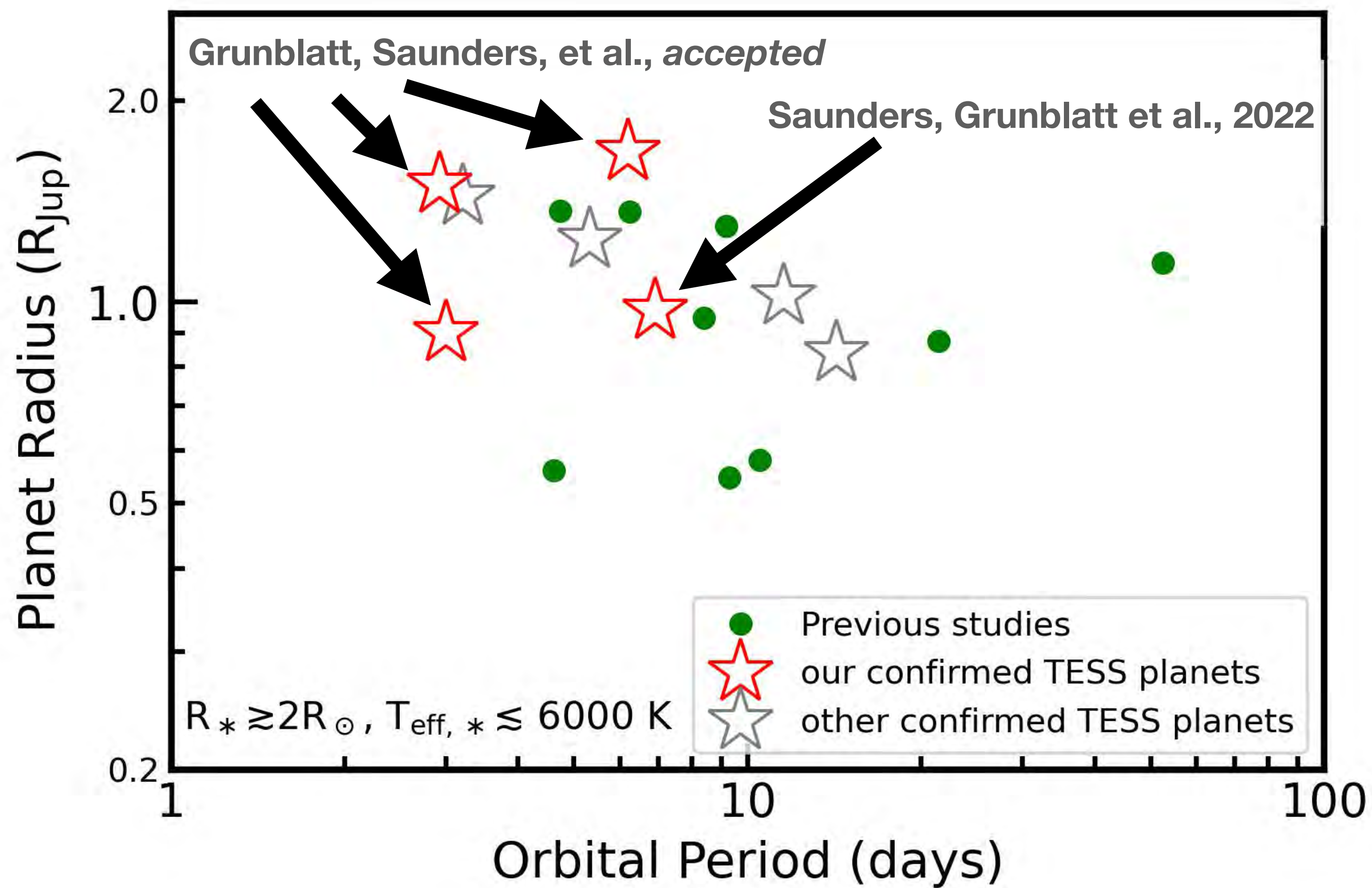


2022: TESS discoveries reveal the hottest planets orbiting evolved stars.



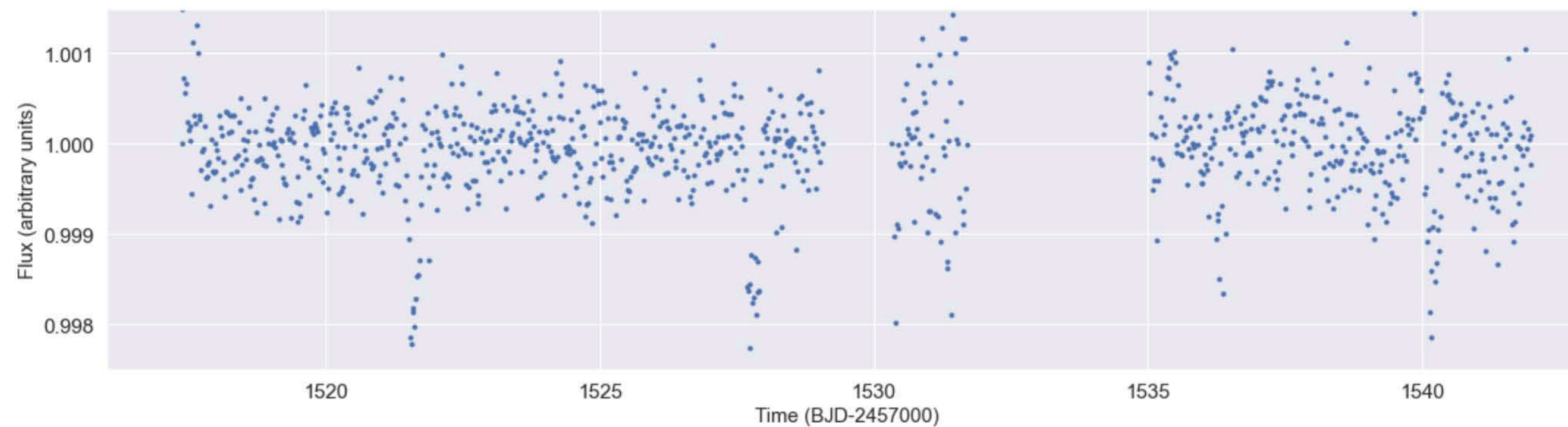
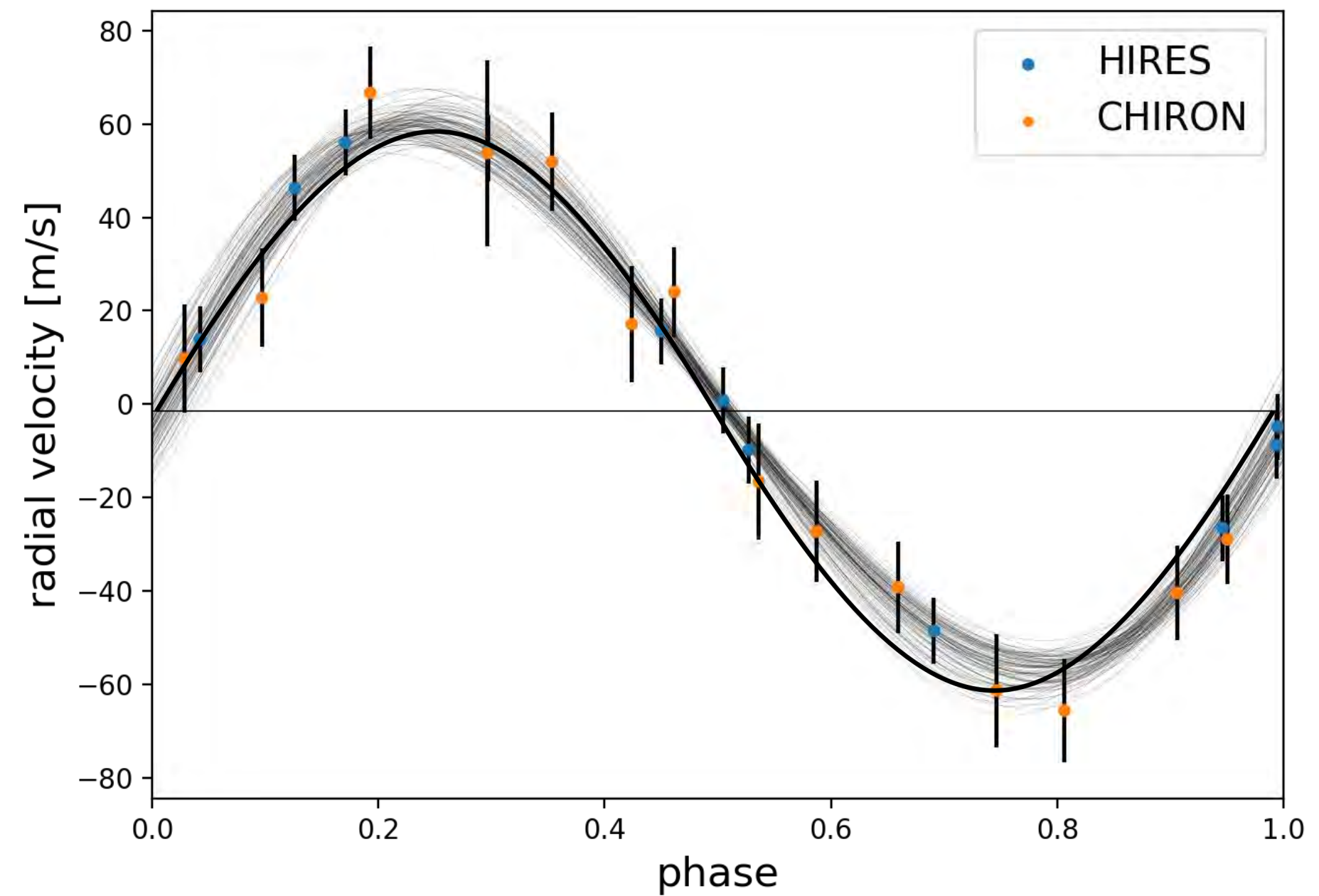
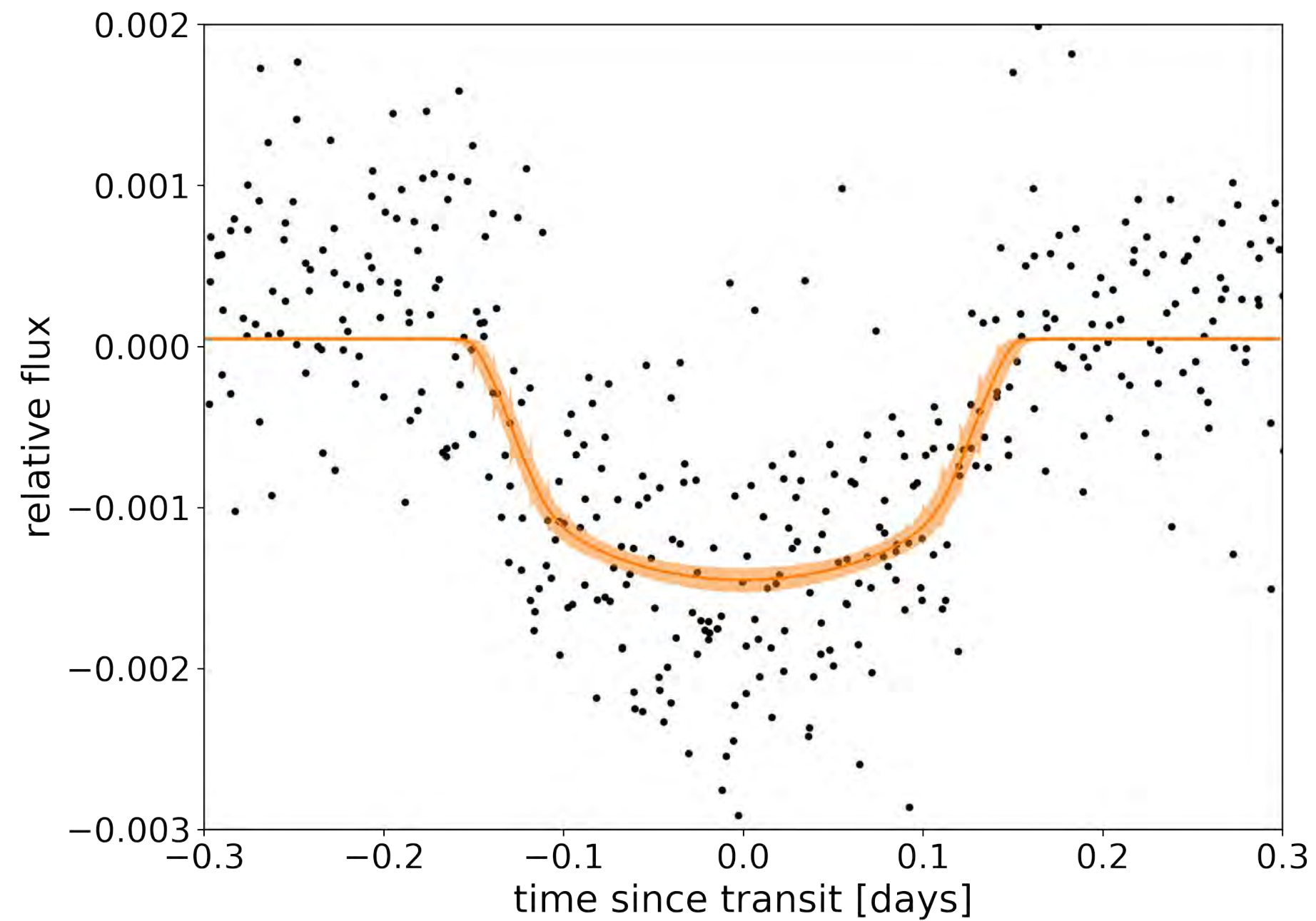


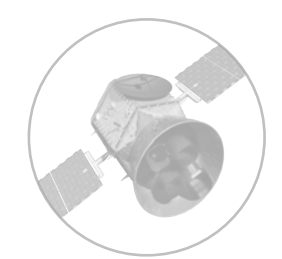
2022: TESS discoveries reveal the hottest planets orbiting evolved stars.



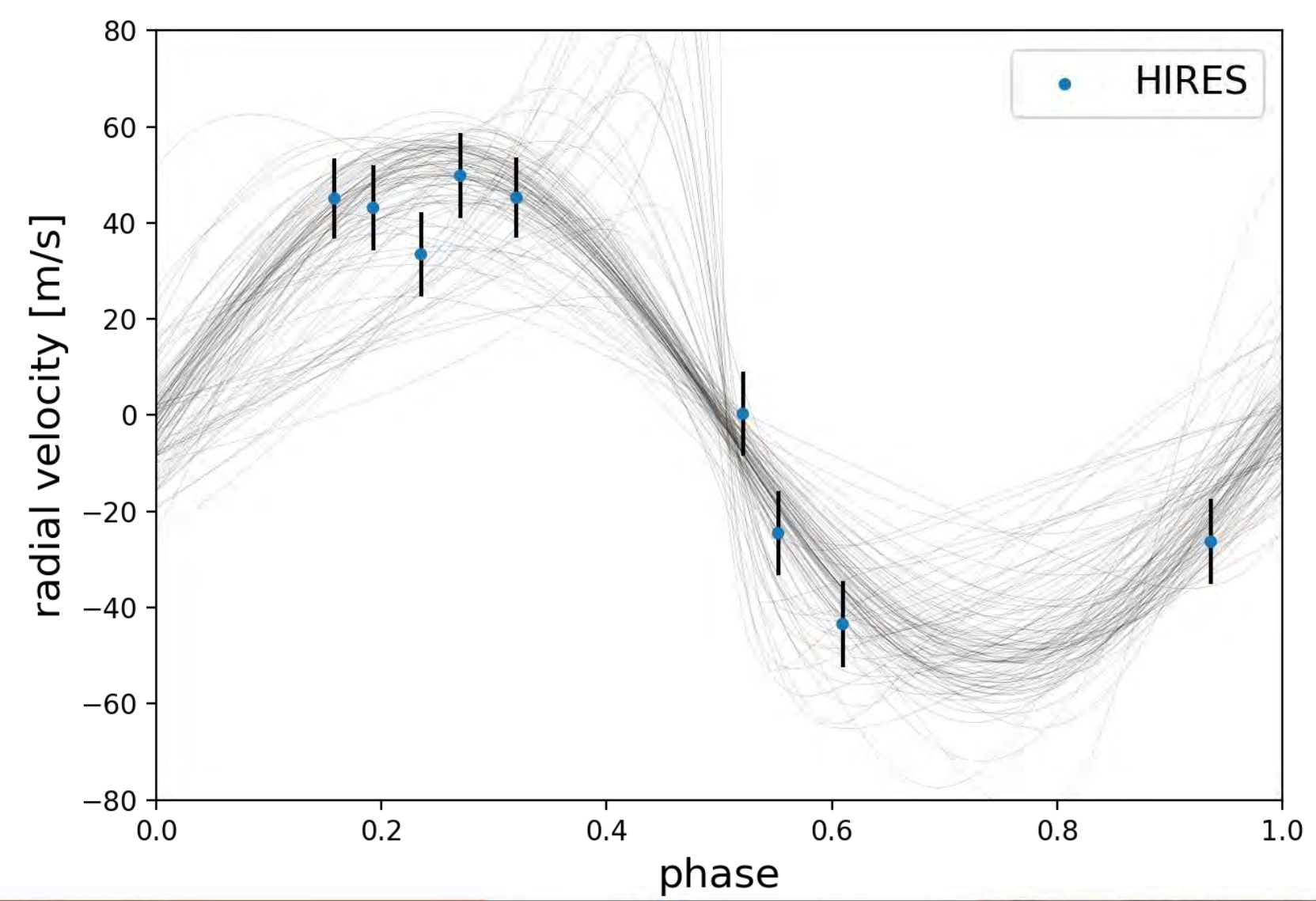
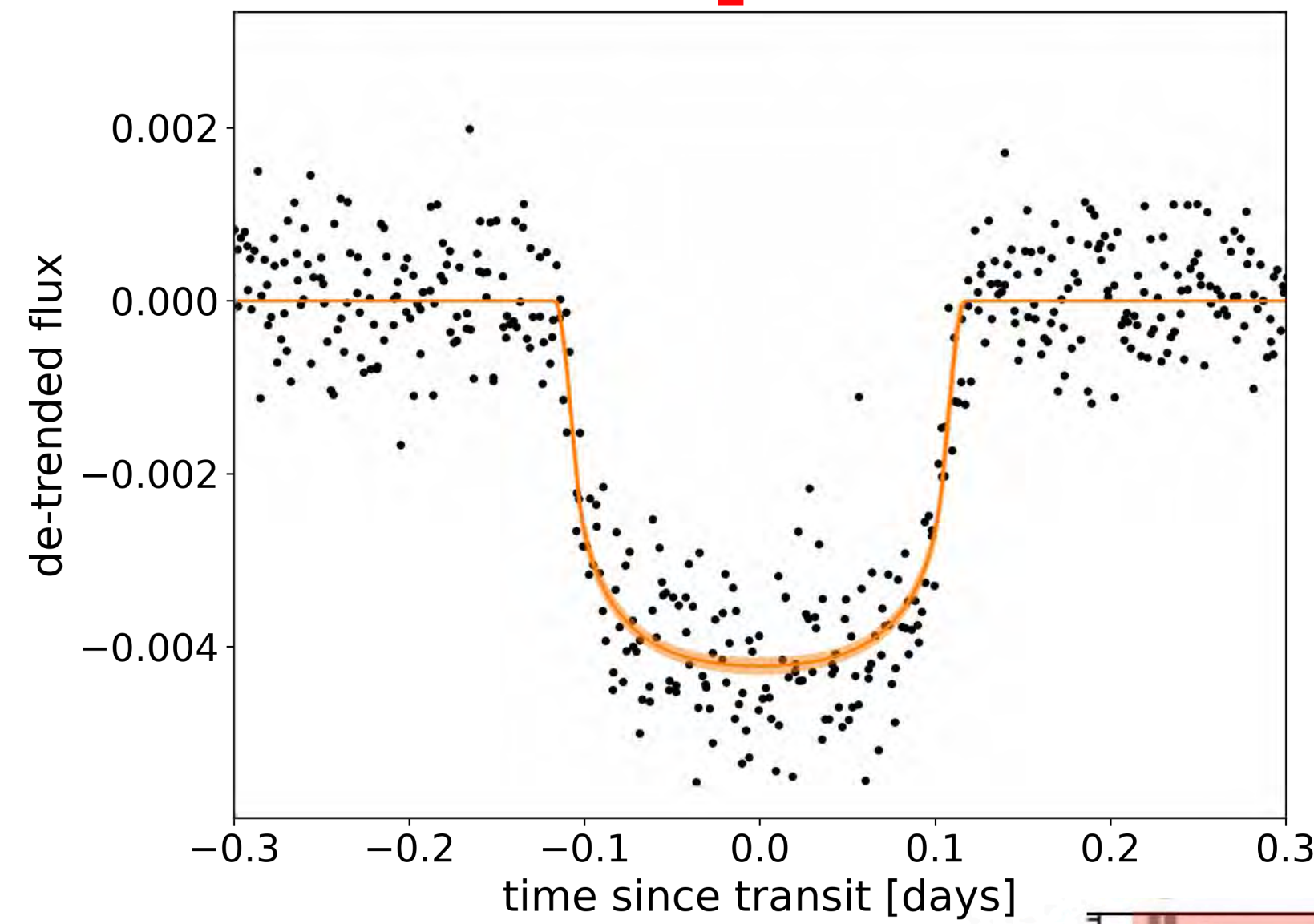
TOI-2669b confirmed with only **~25 days of TESS data!**

Possibly eccentric despite its short period—
continuing a pattern in evolved systems (Grunblatt+ 2018)?

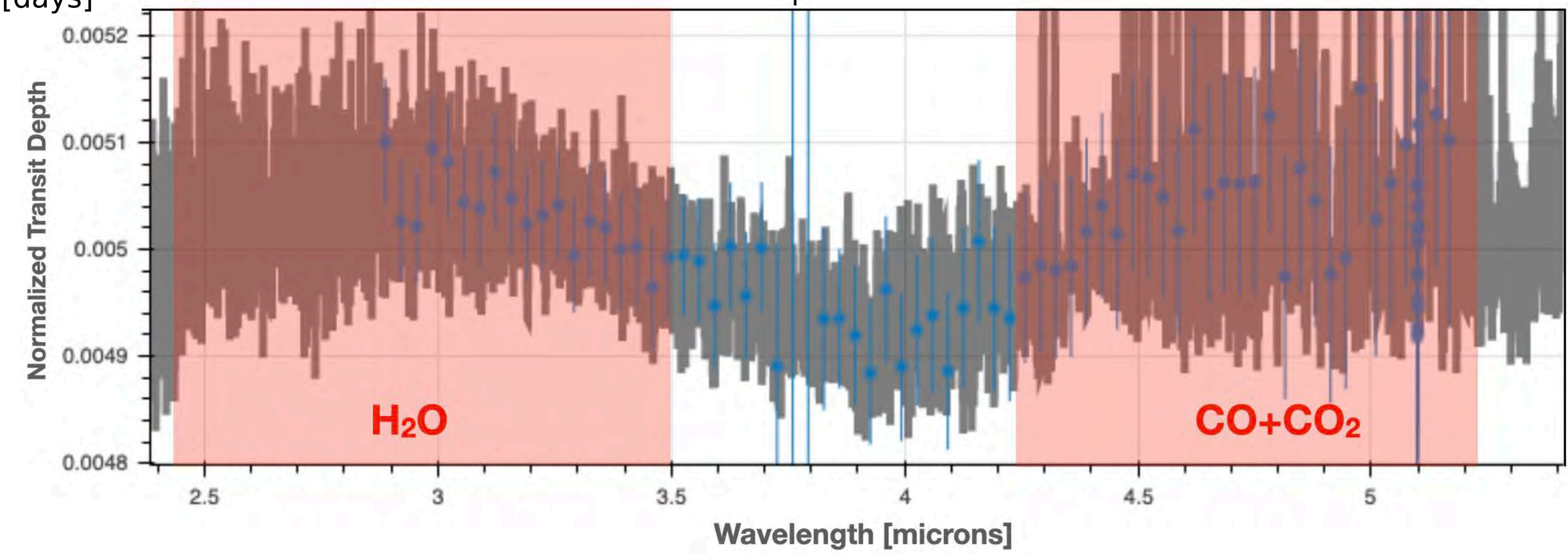




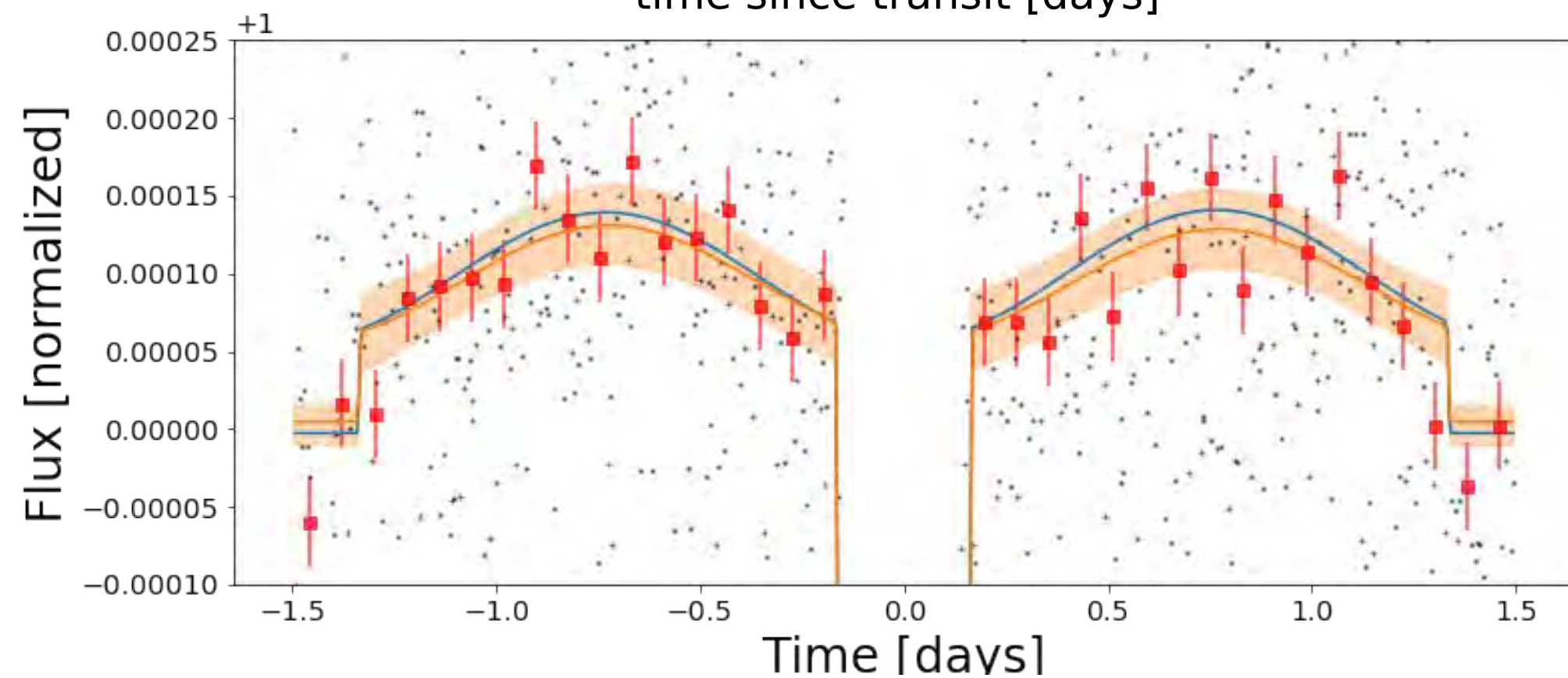
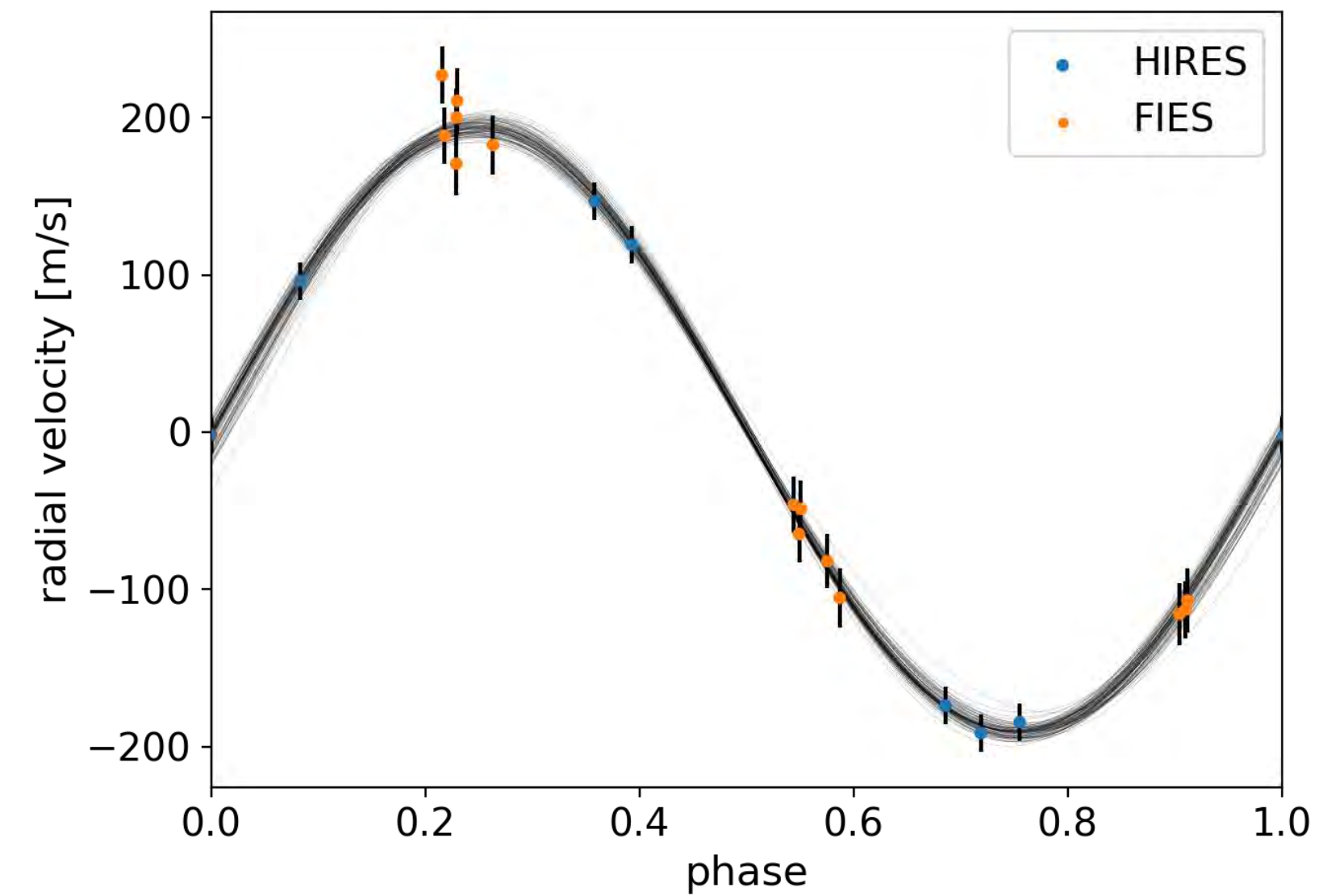
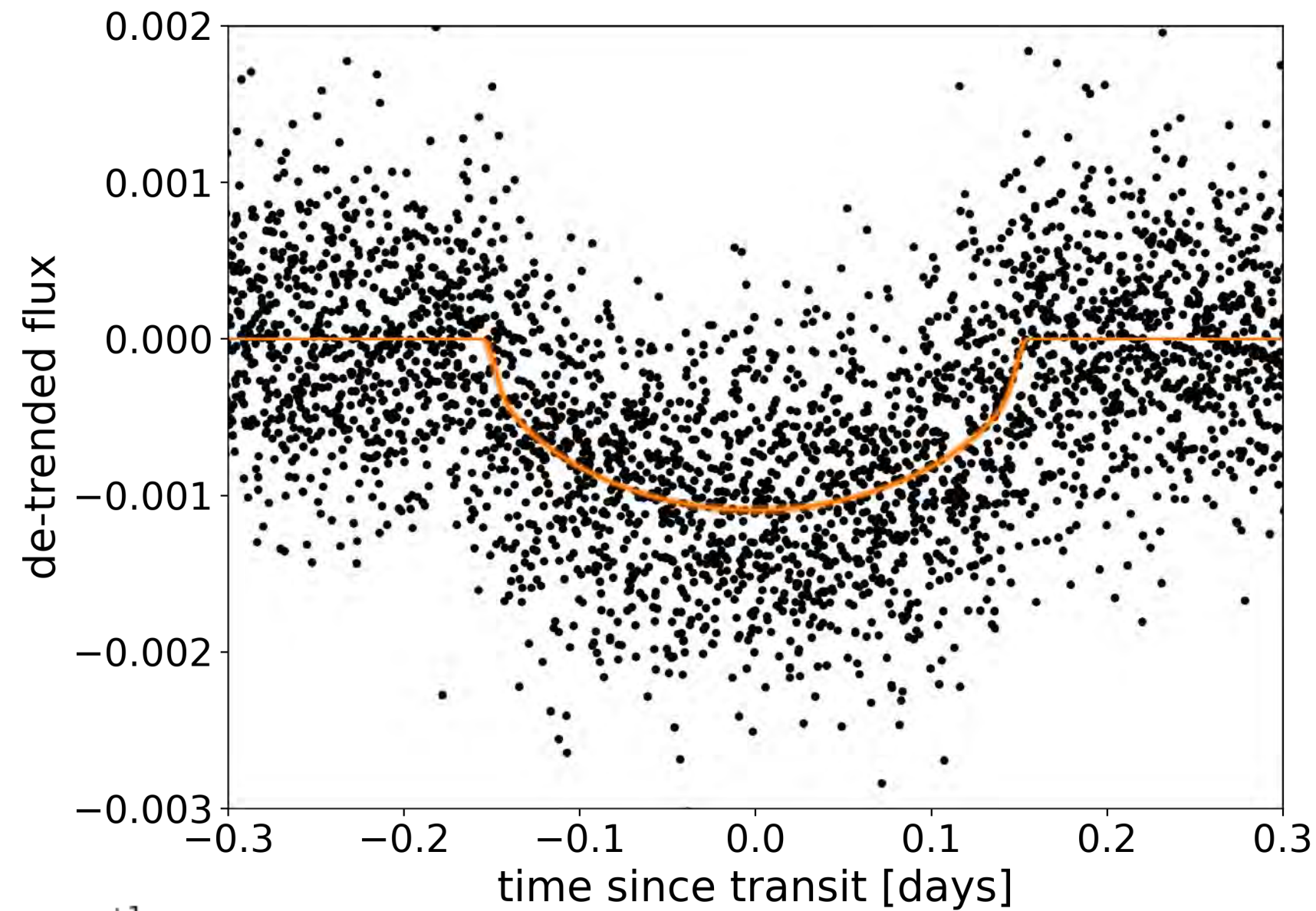
TOI-4329b is the **best evolved planet for atmospheric characterization.**



JWST observations could detect water or CO₂ in the planet's atmosphere, informing planetary migration models.



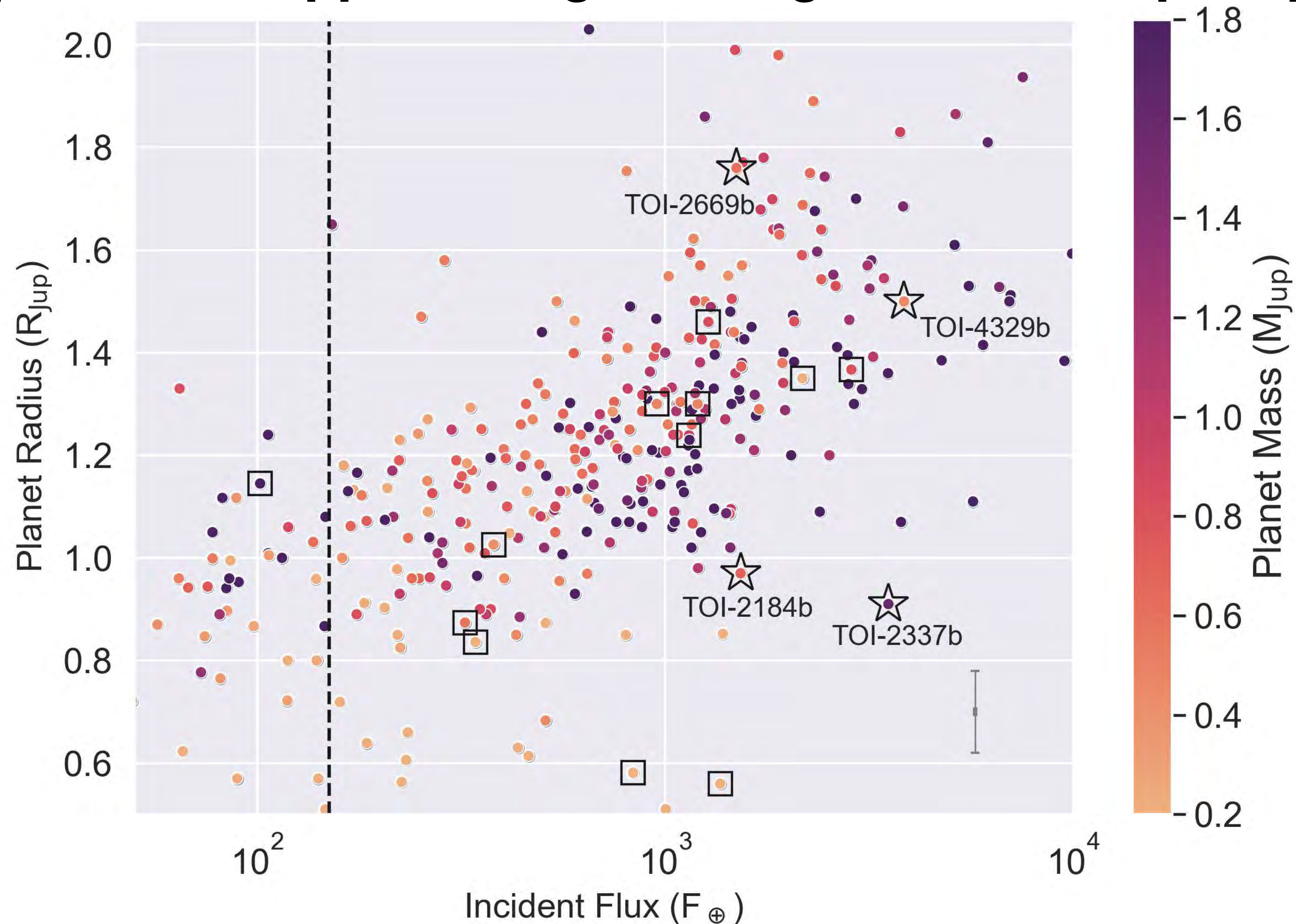
TOI-2337b is a **very high density planet** given its temperature and orbital period.



Variations in the out-of-transit light curve suggest additional star-planet interaction.

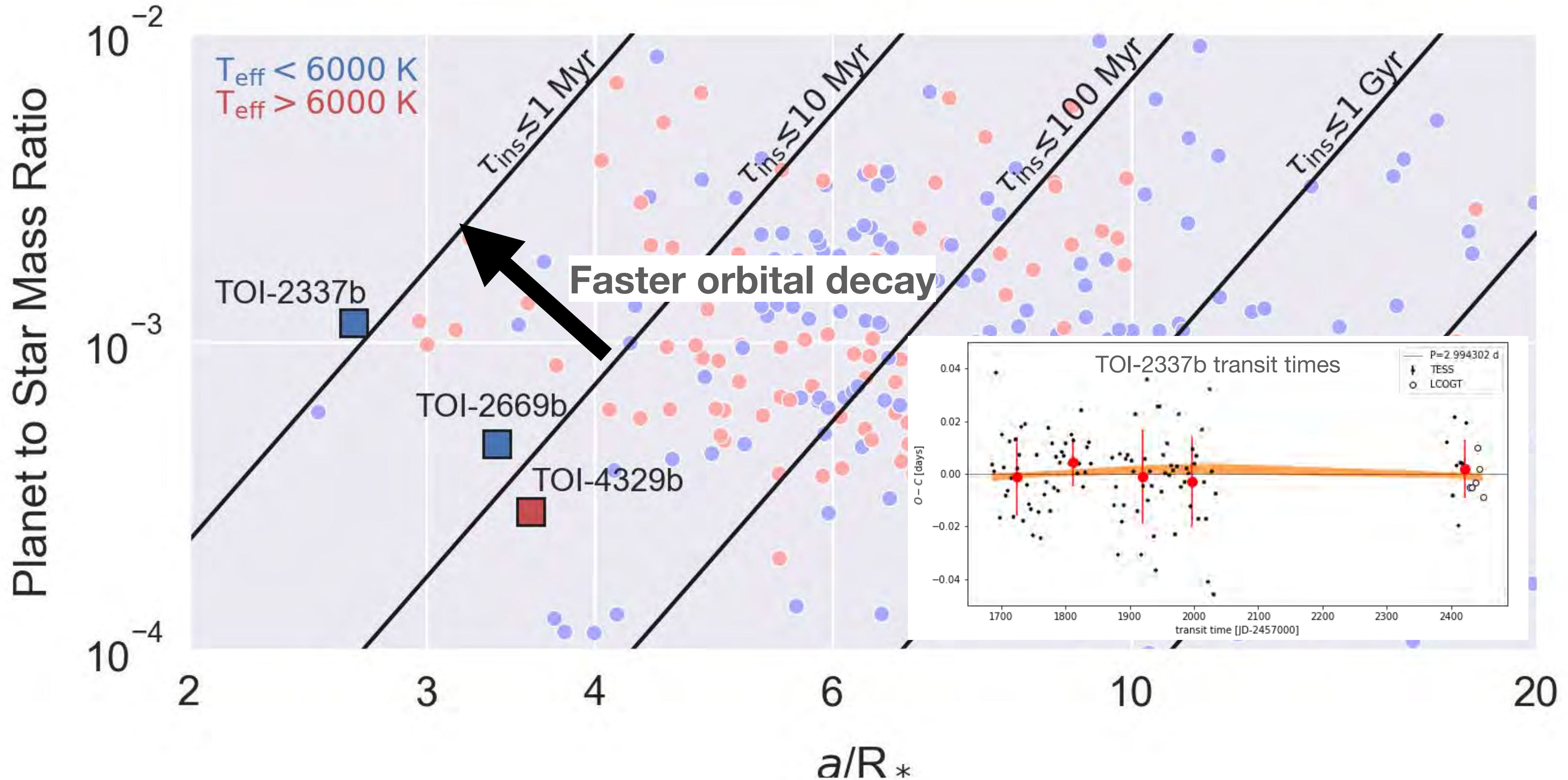
Evolved hot Jupiters may be under-inflated.

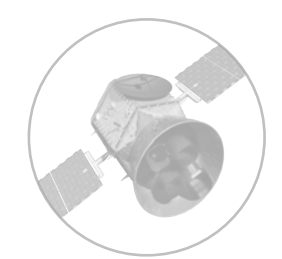
Overall spread also appears larger than general hot Jupiter population.



Orbital decay of evolved systems?

Not yet detectable, but continued TESS observations will test models.

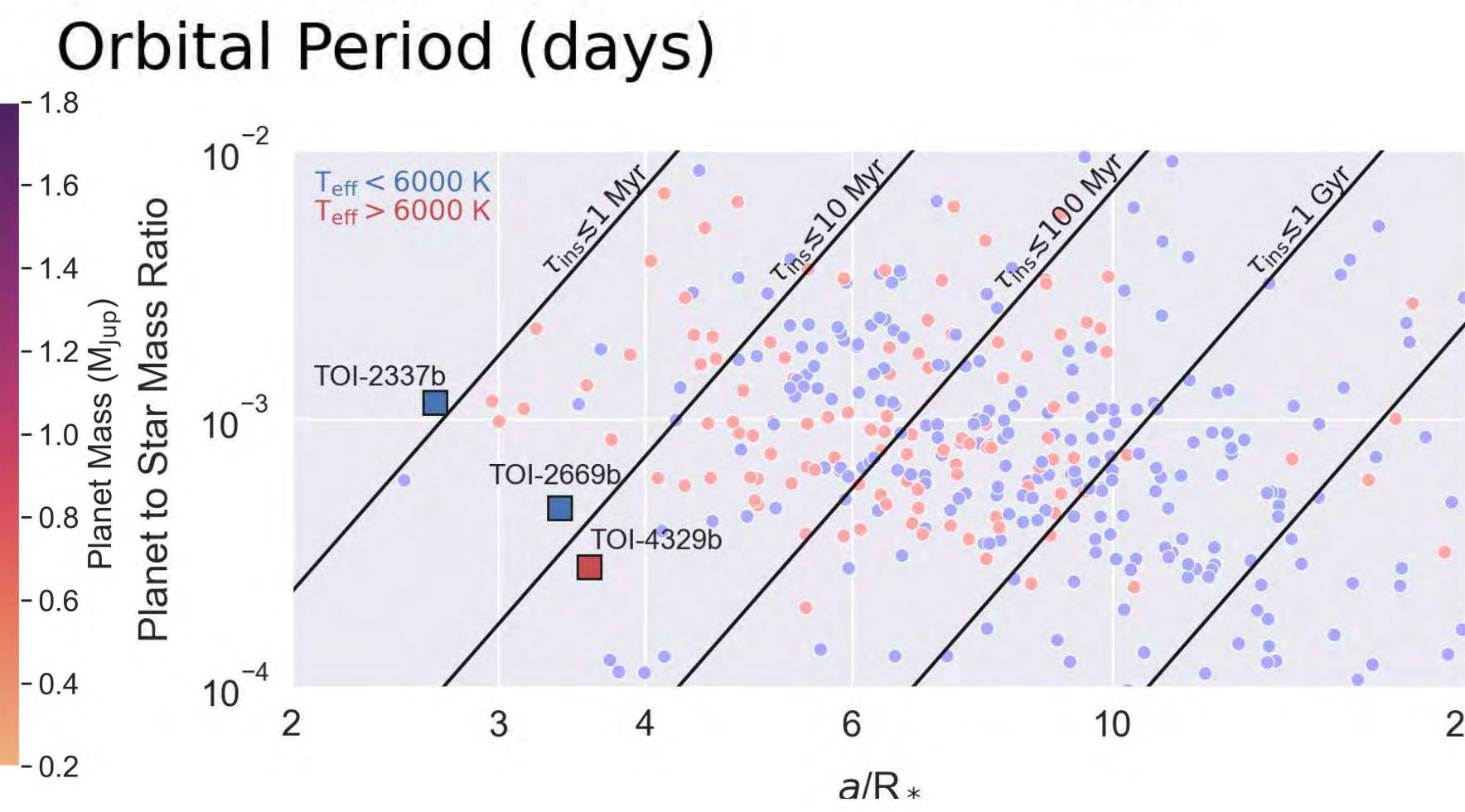
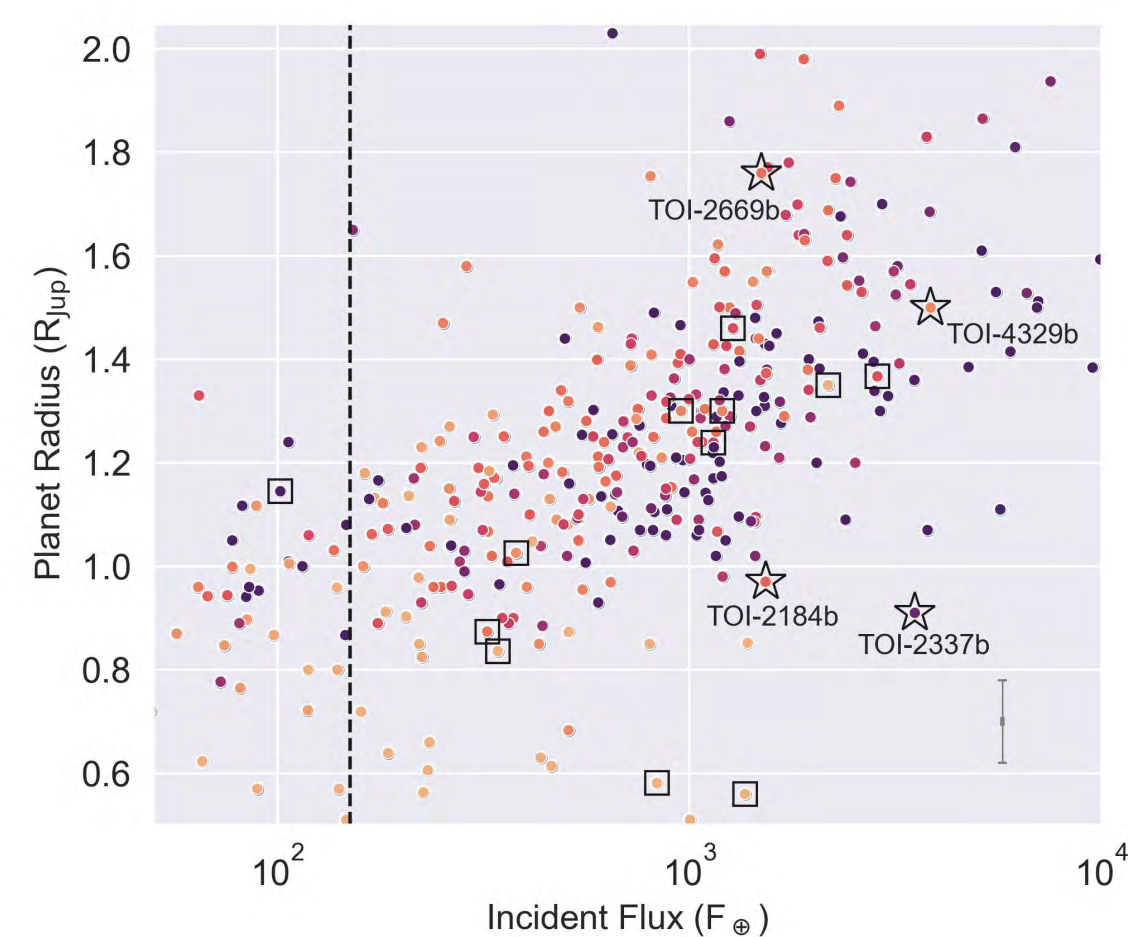
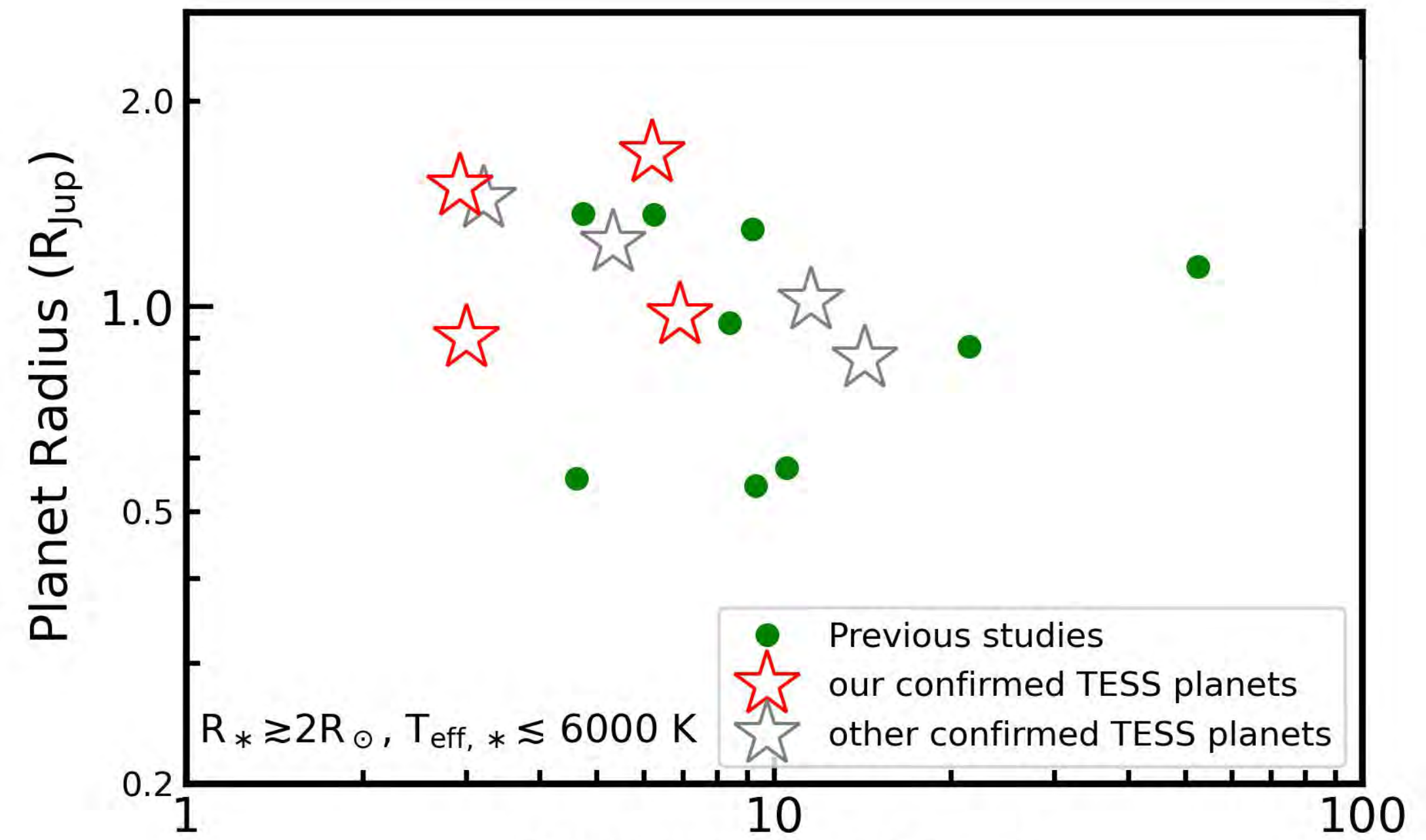


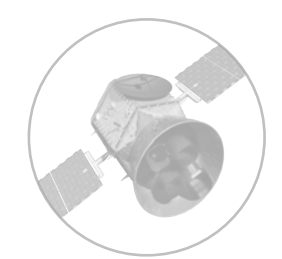
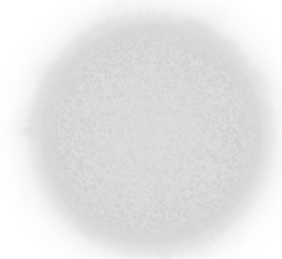


TESS “Giants Transiting Giants” reveal mysteries of planet evolution.

- TESS is revolutionizing our understanding of planets transiting evolved stars, right now!
- Evolved hot Jupiters are inflated, but possibly less than similar temperature main sequence planets — related to unique origins?
- Tighter constraints on planetary orbital decay, planetary system architecture and atmospheric properties possible soon!

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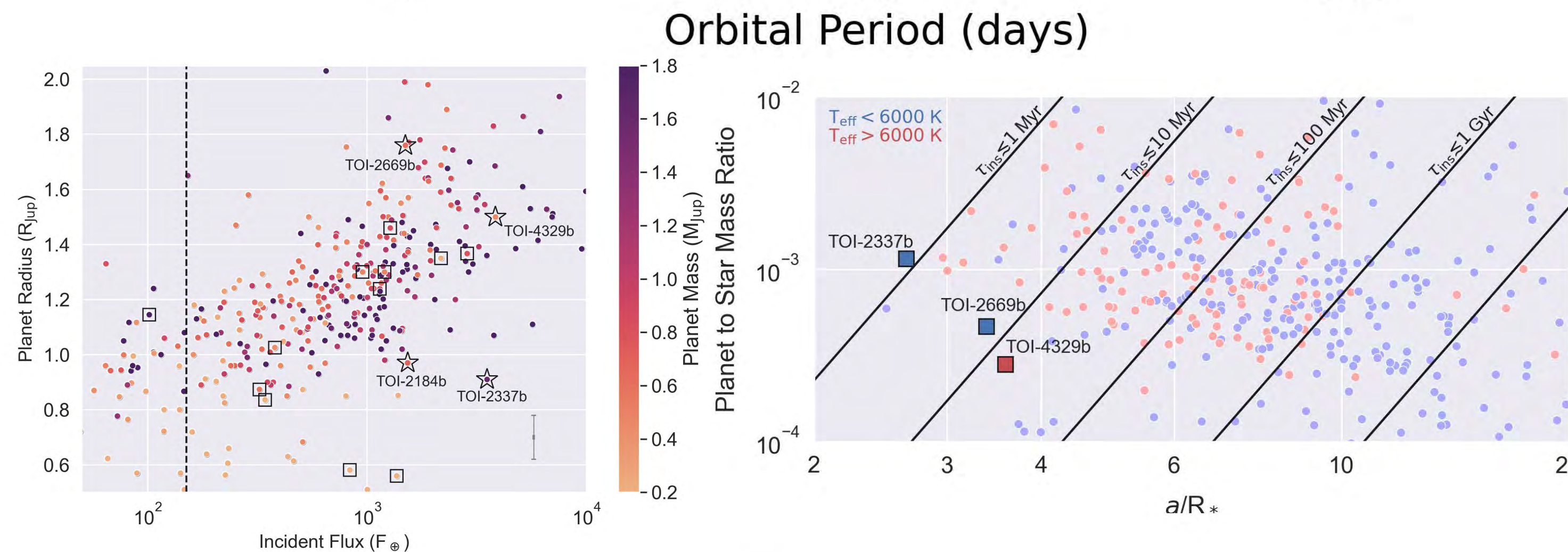
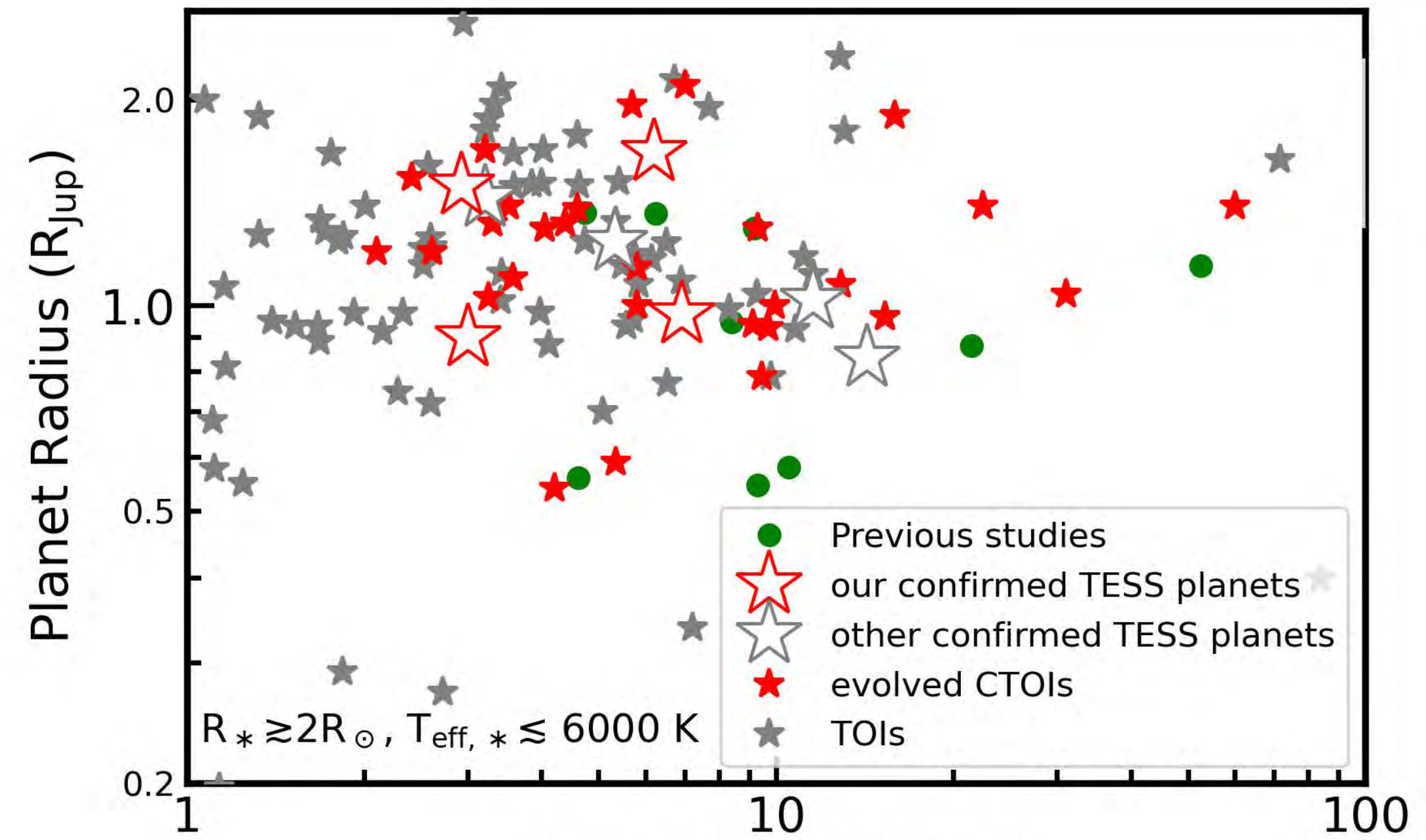




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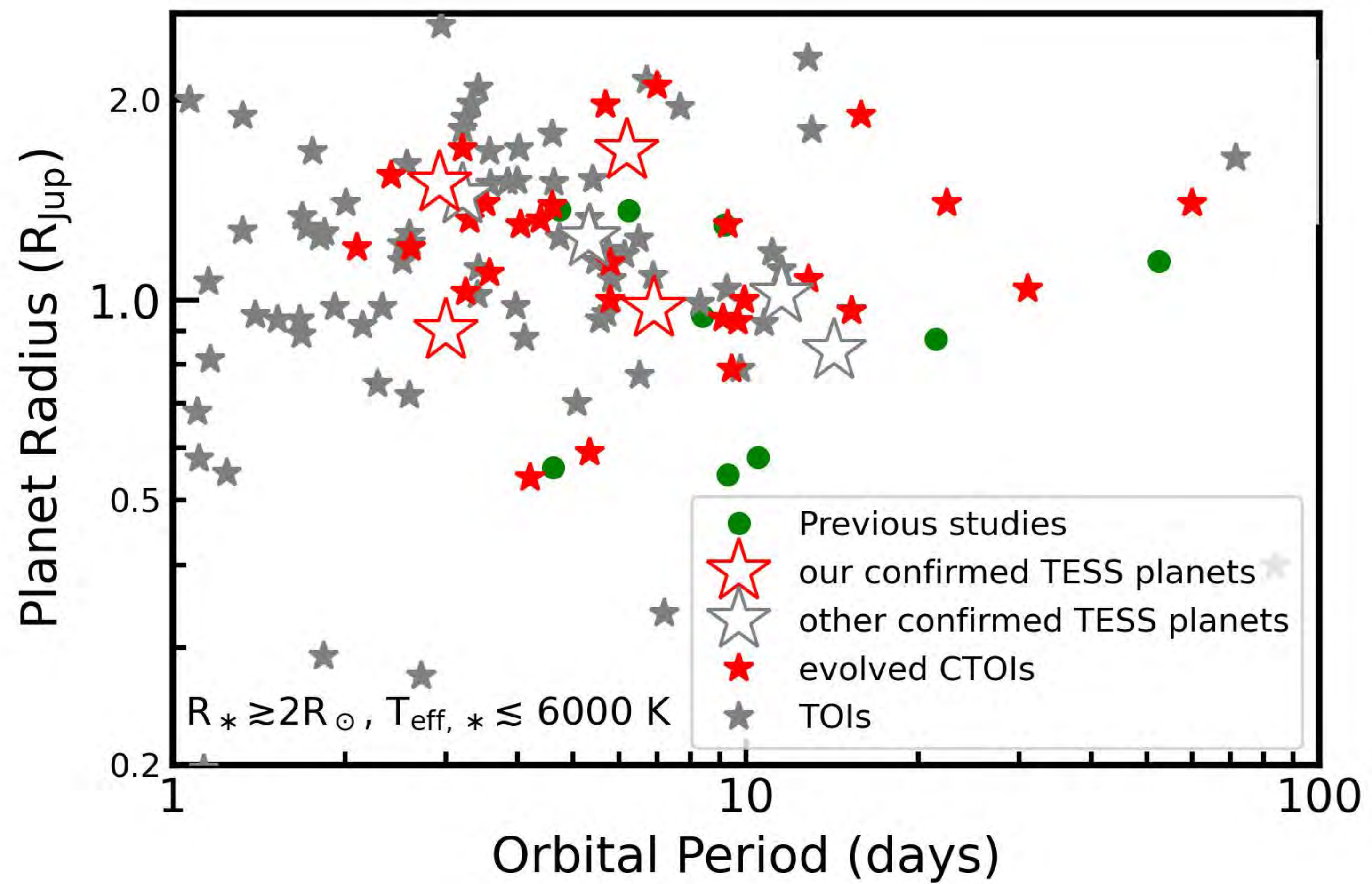
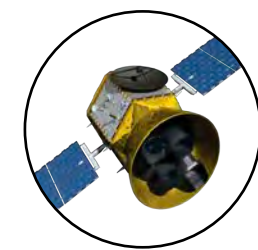
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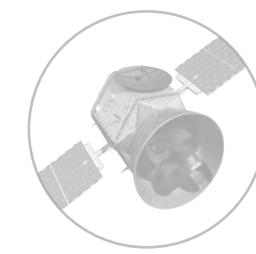
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Questions?

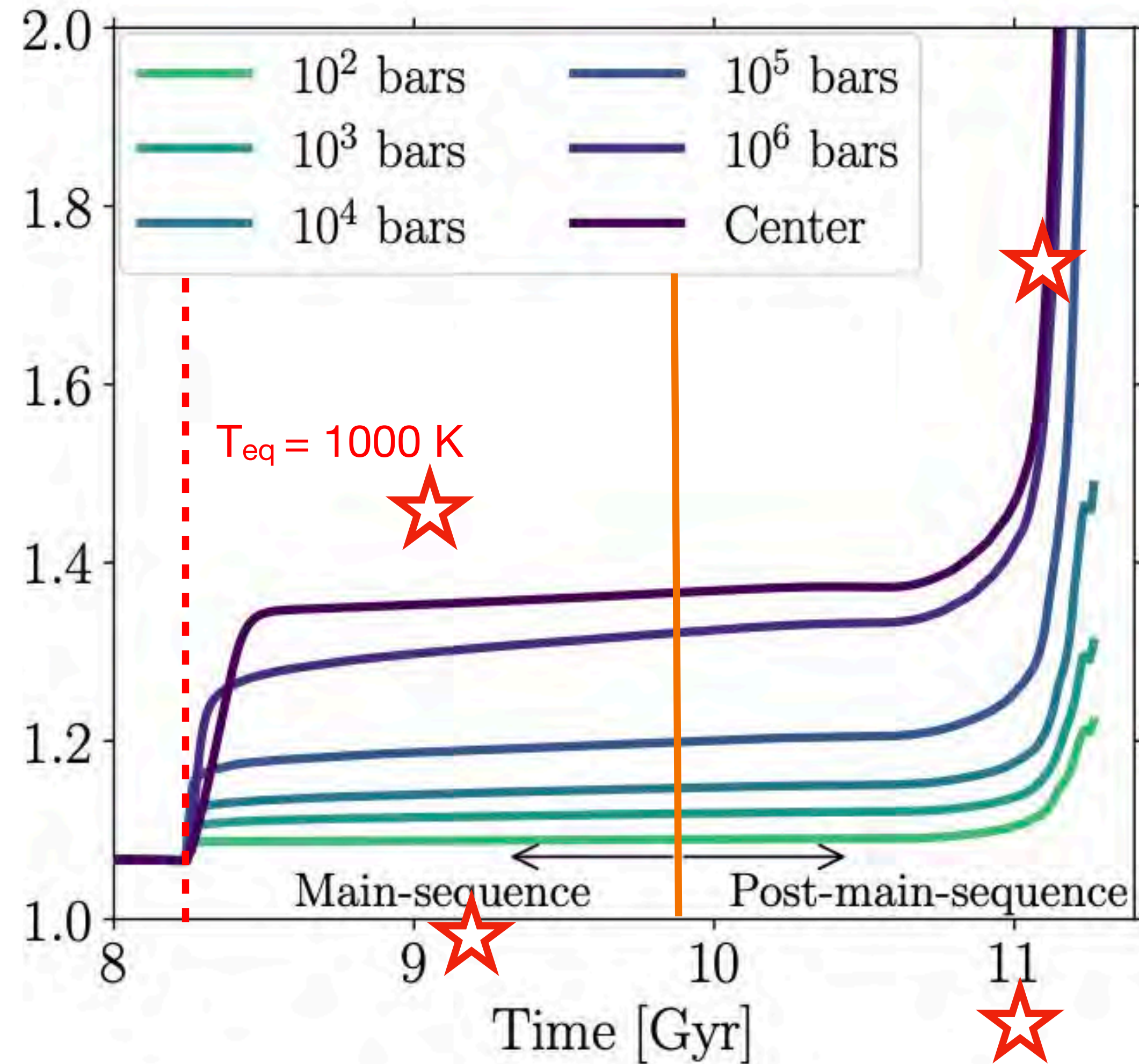
Extra Slides





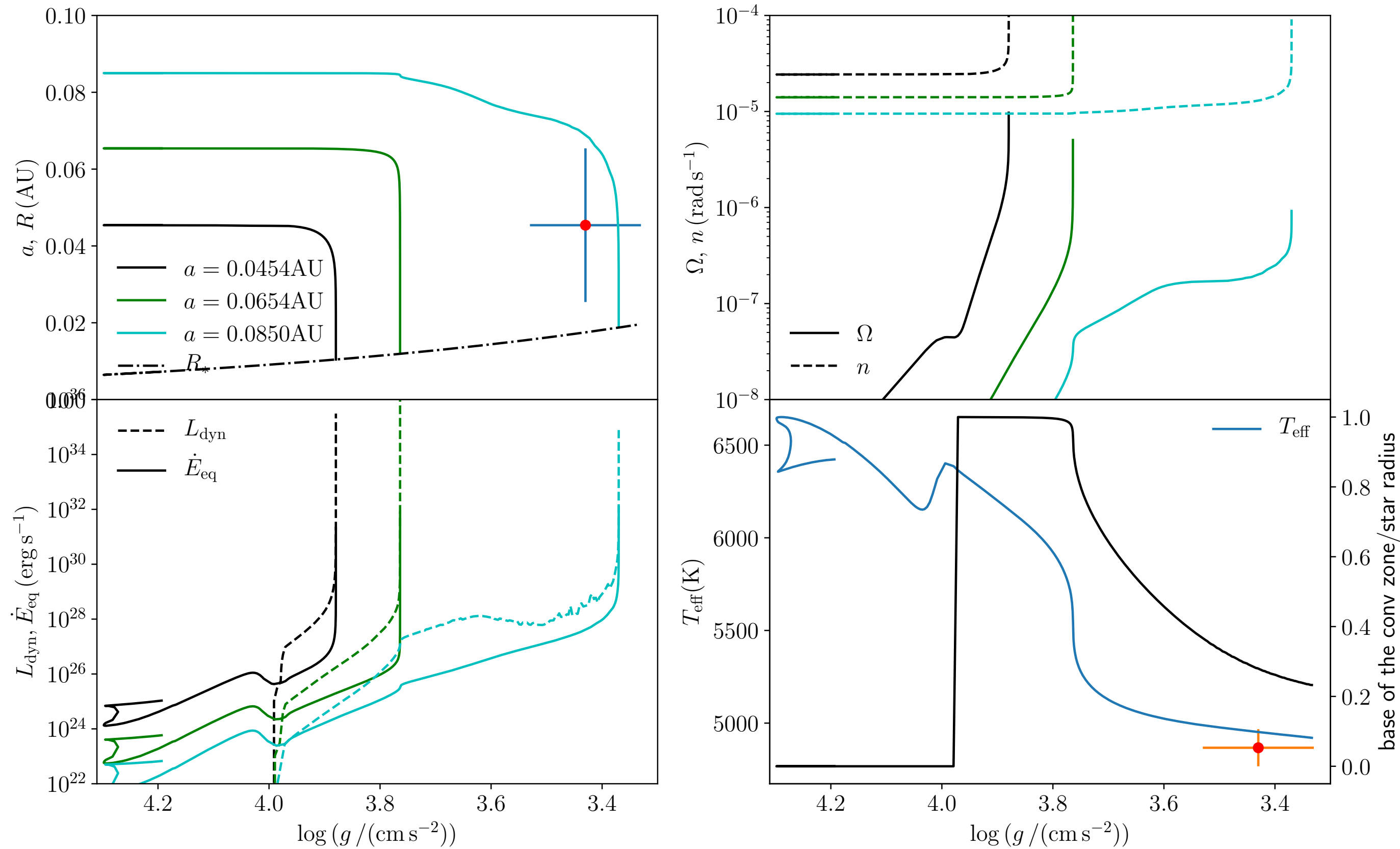
the new planets

Lack of inflation due to subgiant evolutionary state?
Could test depth of heating in evolved systems.

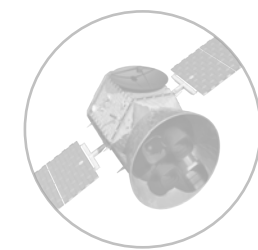


Komacek+ (2020)

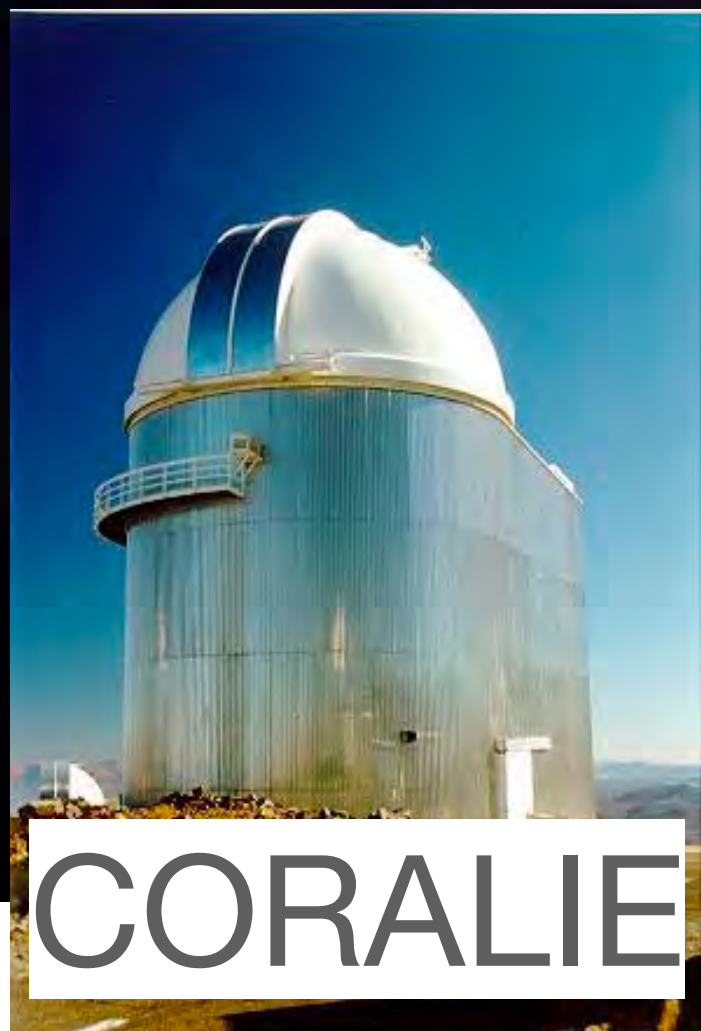
Constraints on star/planet system evolution



$$Q'_\star = 9P\dot{P}^{-1} \frac{M_p}{M_\star} \left(\frac{R_\star}{a} \right)^5 \left(\omega_\star - \frac{2\pi}{P} \right)$$



A global RV effort,
led by Keck/HIRES.



CORALIE



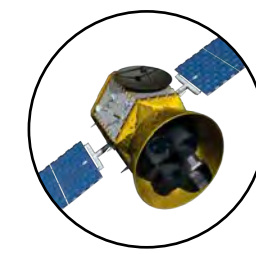
FIES



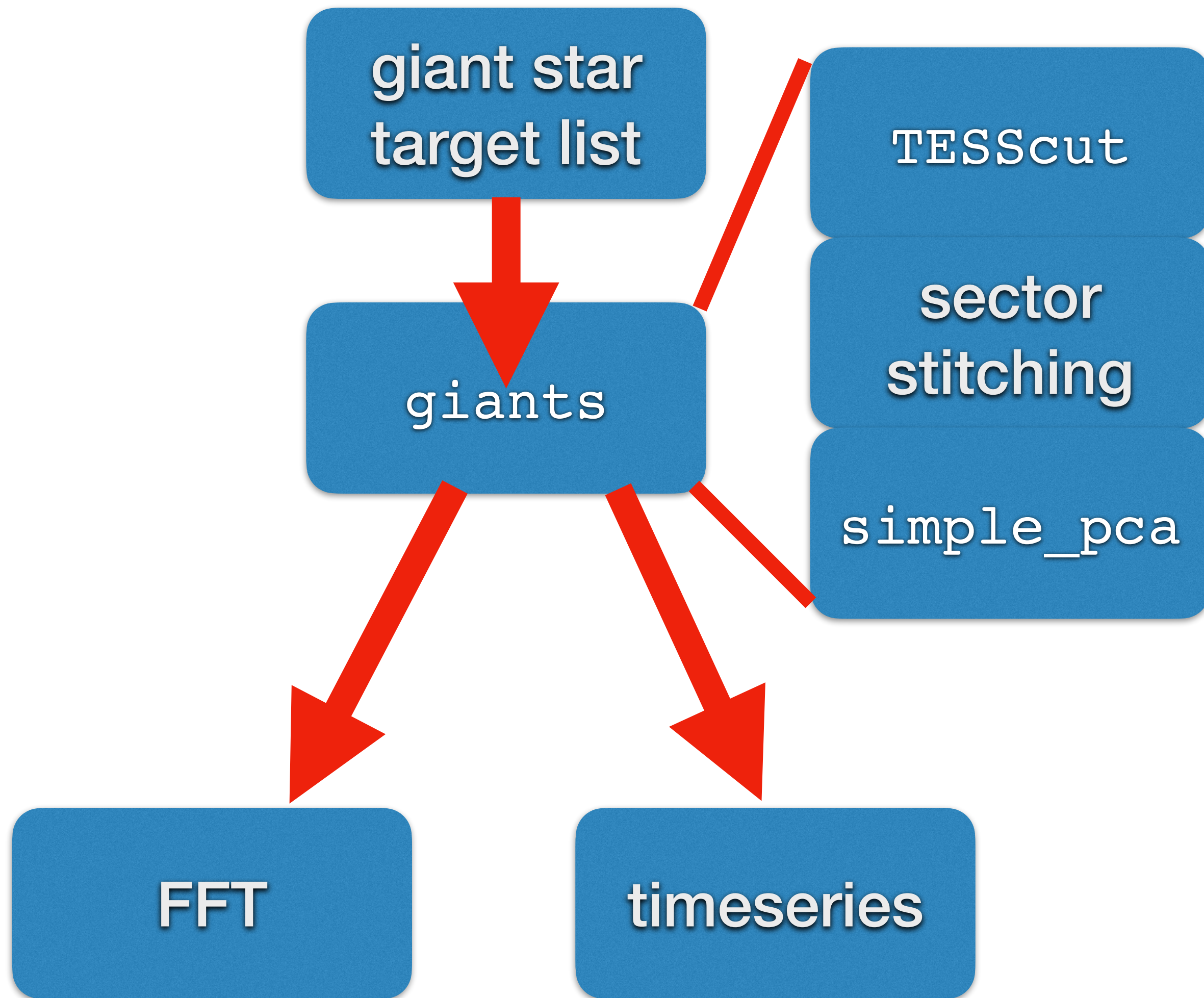
SALT



CHIRON



Turning target lists into data products

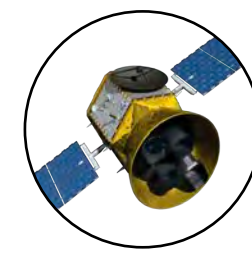


Nick Saunders

<https://github.com/nksaunders/giants>

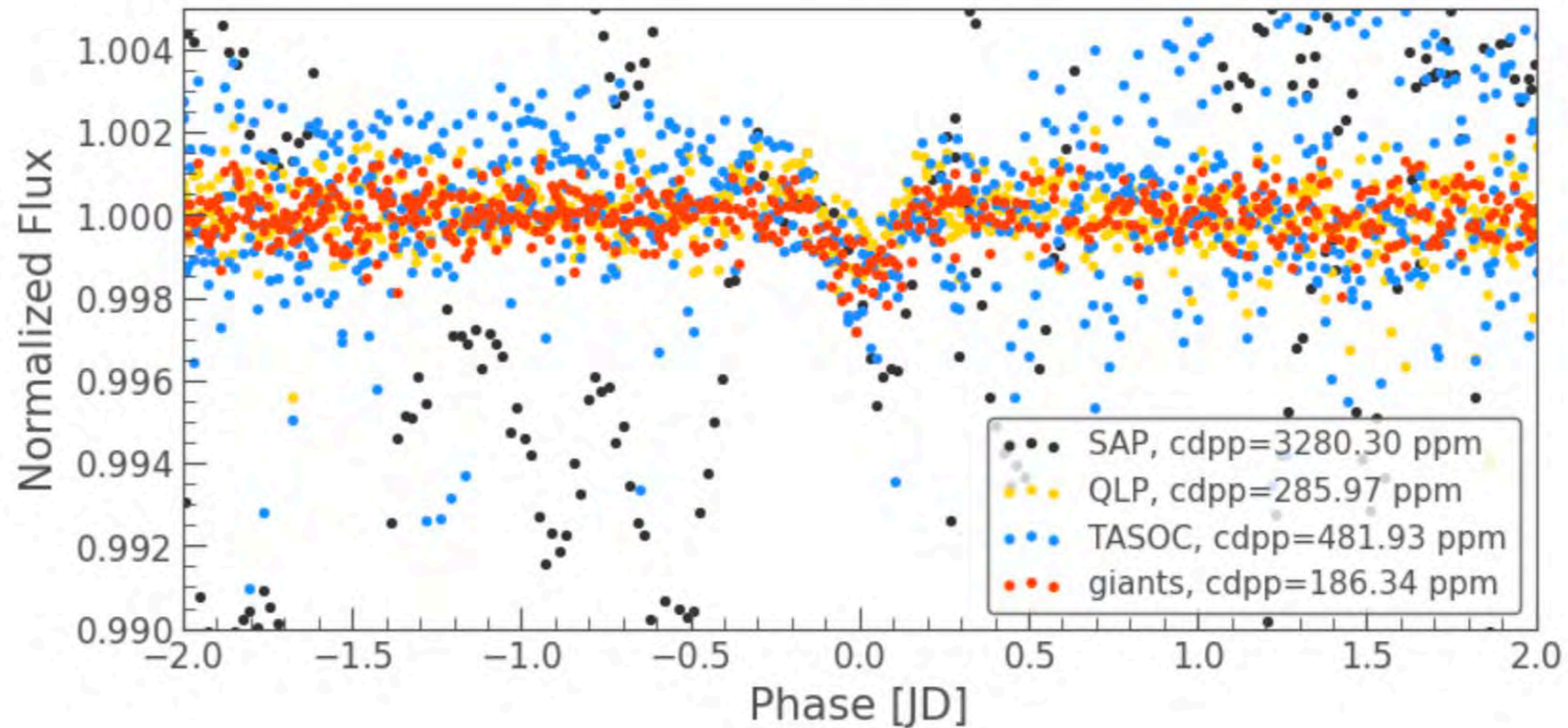
@nksaunders

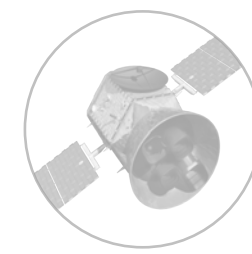




The giants pipeline is finding planets with low SNR transits.

single sector, folded light curve





Asteroseismology of TESS evolved planet hosts: only tentative detection so far, better with higher cadence data

TOI-2669

