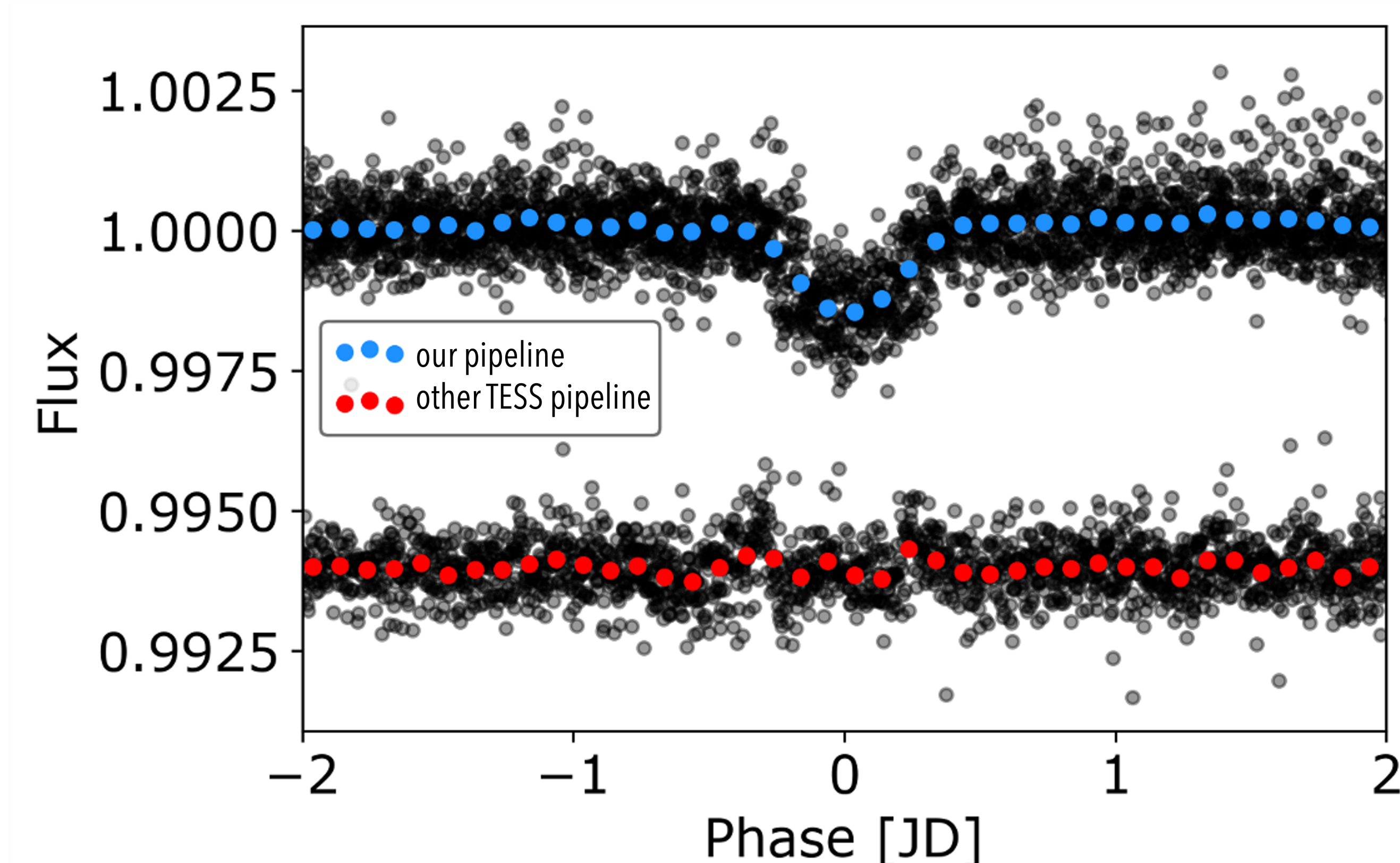


NICHOLAS SAUNDERS^{1,2,3},
Samuel Grunblatt³, Daniel Huber²

NO PLANET LEFT BEHIND: A Search for Giant Planets Orbiting Giant Stars with TESS

¹NSF Graduate Research Fellow
²Institute for Astronomy, University of Hawaii
³American Museum of Natural History

THE GIANTS PIPELINE



The giants pipeline removes systematic noise from TESS observations using local pixel-level regression.

Our pipeline preserves long-duration transits, which can be removed by other pipelines.

When searching for planets around stars with large radii or long-period transiting planets, it is vital to preserve long-duration transits.

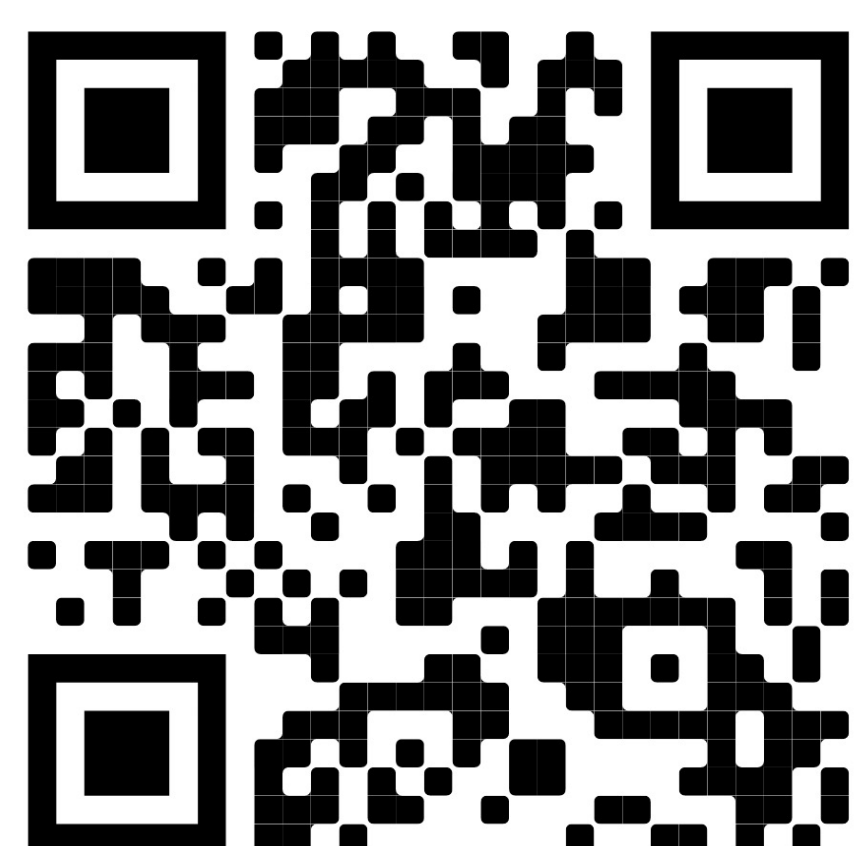
To install the giants pipeline:

```
git clone https://github.com/nksaunders/giants.git
cd giants
pip install .
```

The following code snippet can be used to produce a de-trended light curve and perform a Box-Least Squares transit search:

```
import giants
target = giants.Target(ticid=176956893)
target.fetch_and_clean_data()
target.create_summary_plot()
```

FIND THE OPEN-SOURCE
GIANTS PIPELINE HERE →

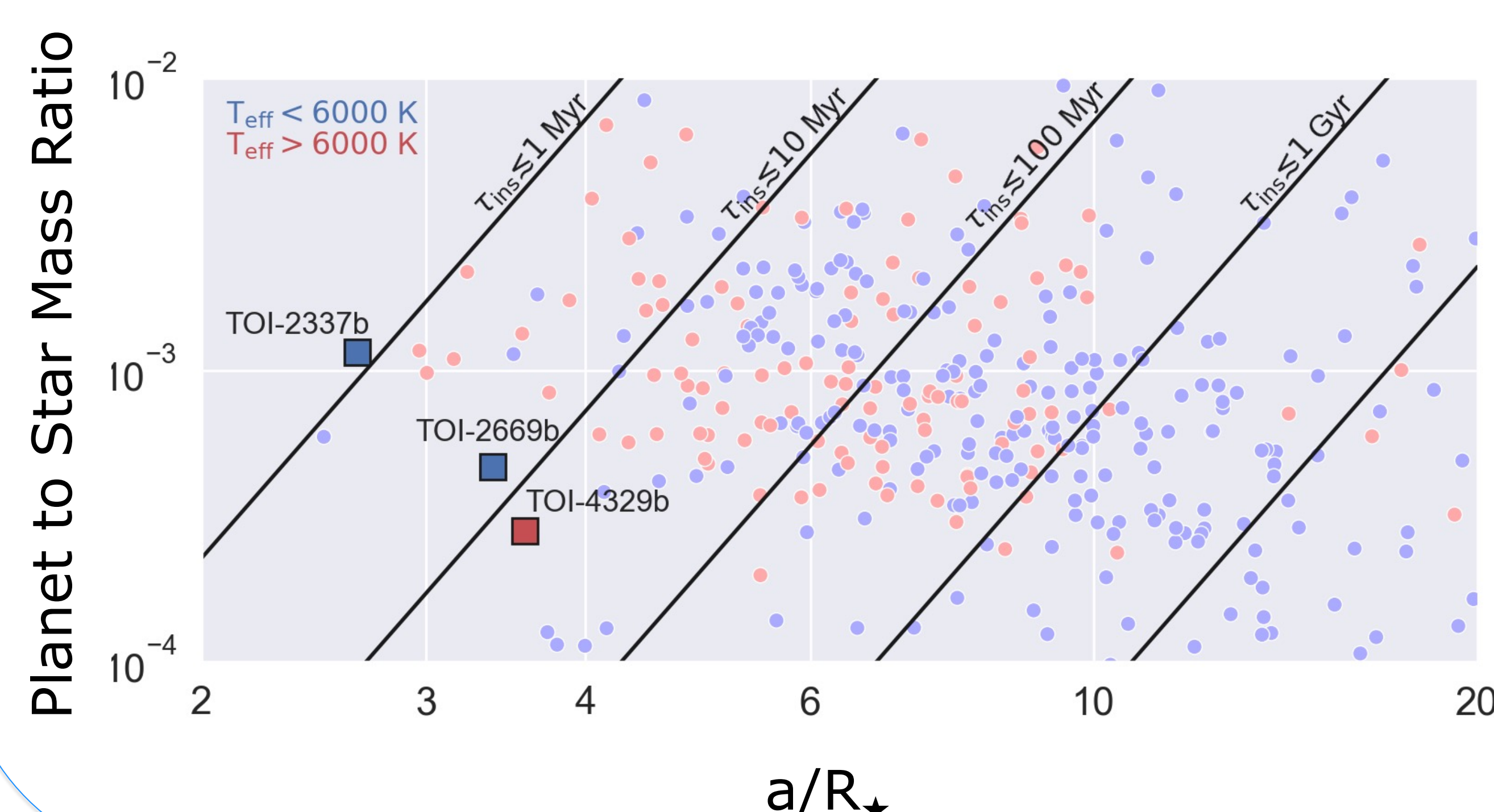


WHAT CAN THESE PLANETS TEACH US?

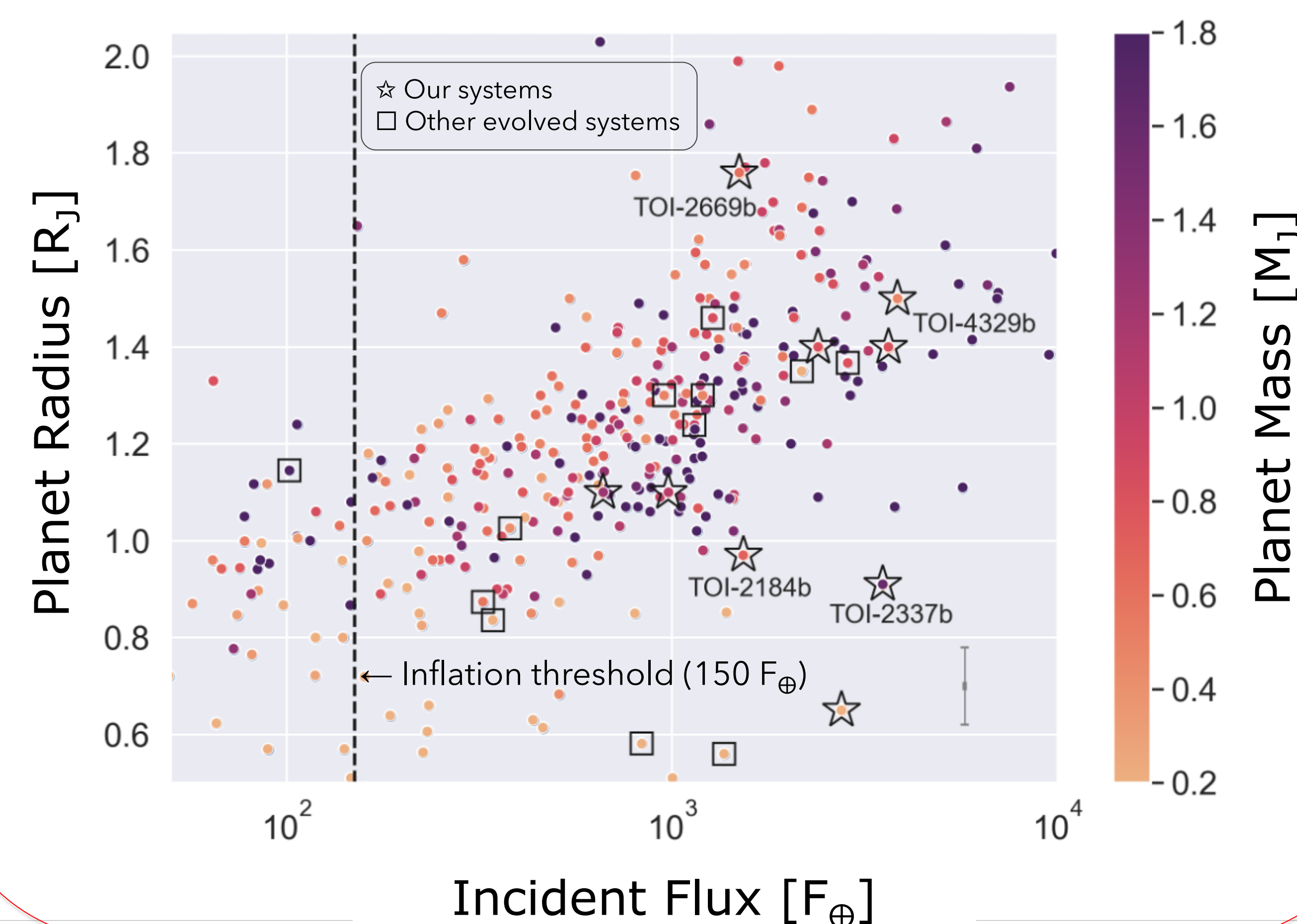
In addition to hundreds of candidates, our search has uncovered 4 confirmed planets:

- TOI-2184b (Saunders et al. 2022)
- TOI-2337b, TOI-4329b, TOI-2669b (Grunblatt et al. 2022)

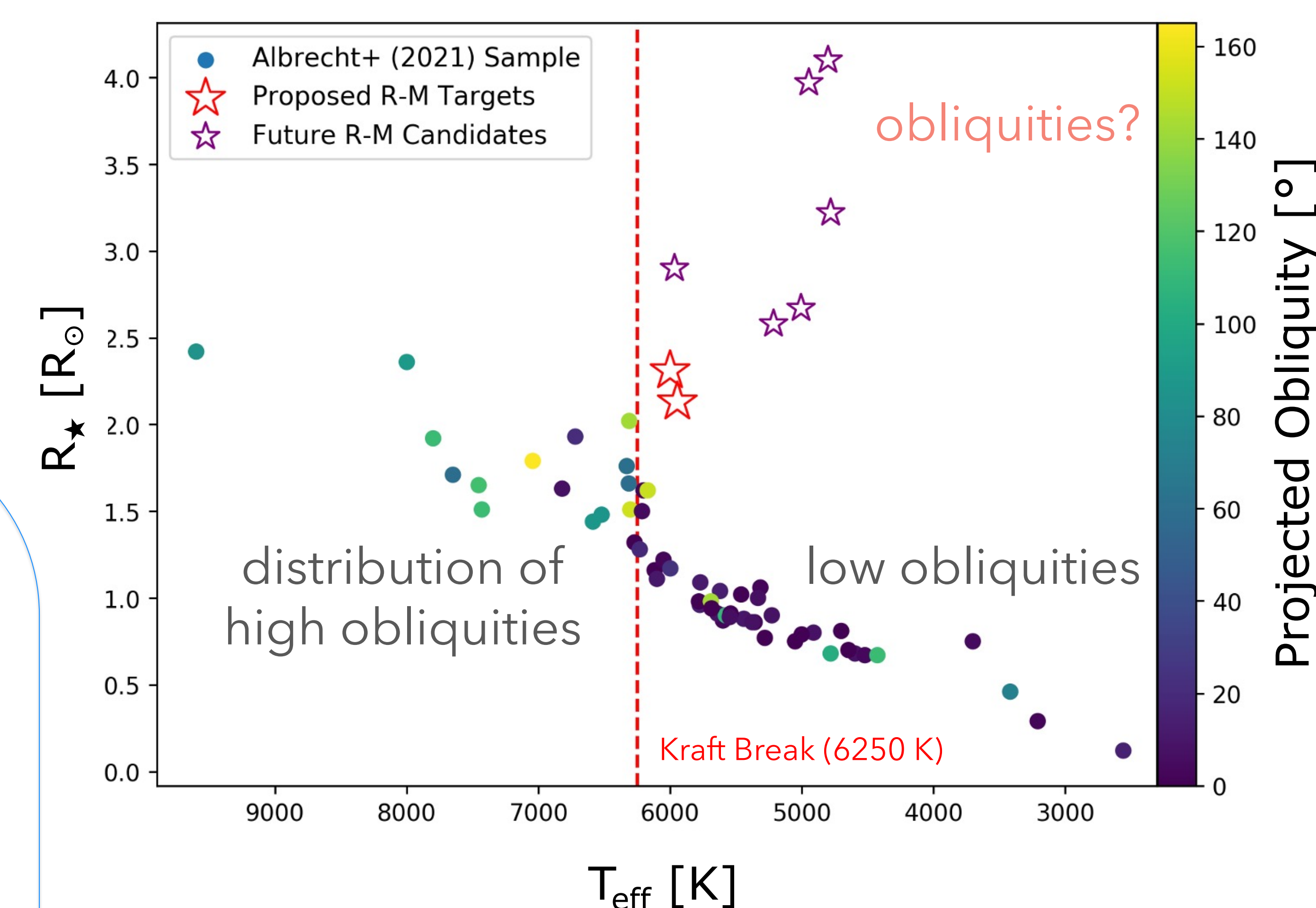
HOW PLANETS INSPIRAL:
TOI-2337b may be experiencing the fastest rate of orbital decay of any planet known to date.



HOW PLANETS INFLATE:
Evolved planetary systems do not appear to follow a clear mass-radius-flux trend, and additional factors likely contribute to their inflation efficiencies.



FUTURE OBSERVATIONS



The red dashed line shows the Kraft Break (Kraft 1967), a threshold that distinguishes between hot, rapidly rotating stars and cooler stars with longer rotation periods.

Stars which are cooler than the Kraft Break have deeper convective envelopes that can drive braking of stellar rotation.

By measuring the Rossiter-McLaughlin Effect, we will constrain the sky-projected obliquities of planets transiting evolved stars.

If planets around subgiants are aligned, convective obliquity damping must be very efficient on <1 Gyr timescales. If not, convective obliquity damping likely requires longer timescales to operate.

References:

- Saunders, N., Grunblatt, S., Huber, D. et al. (2022) "TESS Giants Transiting Giants I: A Non-inflated Hot Jupiter Orbiting a Massive Subgiant." *AJ*, 163, 2
- Grunblatt, S., Saunders, N., Sun, M. et al. (2022) "TESS Giants Transiting Giants II: The Hottest Jupiters Orbiting Evolved Stars." *AJ*, 163, 3
- Albrecht, S., Marcussen, M., Winn, J. et al. (2021) "A Preponderance of Perpendicular Planets." *ApJL*, 916, 1
- Kraft, R. (1967) "Studies of Stellar Rotation. V. The Dependence of Rotation on Age among Solar-Type Stars." *ApJ*, 150

← FOR MORE INFORMATION ABOUT THESE PLANETS, SEE SAM GRUNBLATT'S TALK: FRIDAY 11:30 AM (ARCHITECTURES 2)

