

NO DEARTH OF EARTHS

UNVEILING THE EARTH+SUPER-EARTH OCCURRENCE

RATE IN MID-TO-LATE M DWARFS WITH TESS

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BACKGROUND

M Dwarfs not only make up the majority of the stellar population in the solar neighborhood but also host the majority of the terrestrial planets in our galaxy.^[1]

However, there is a gap in our understanding of the variation of planet occurrence rate with stellar mass, especially for Very Low-Mass (VLM) stars with $M < 0.3 M_{\odot}$ for which the statistics are not robust.^[2]

Magnitude-limited sample of **3,825 Very Low-Mass stars** observed with TESS that lie within **100 pc** amplifies the effective volume by ~20 times, compared to the previously targeted distance-limited sample ($d \leq 15$ pc)^[3], for these stars with $M \sim 0.1 - 0.3 M_{\odot}$. Based on our analysis and extrapolating from Kepler statistics, this sample can potentially add **7-41 NEW PLANETS** around mid-/late-M dwarfs!

WHAT HAPPENS TO PLANET OCCURRENCE RATES BELOW $0.5 M_{\odot}$?

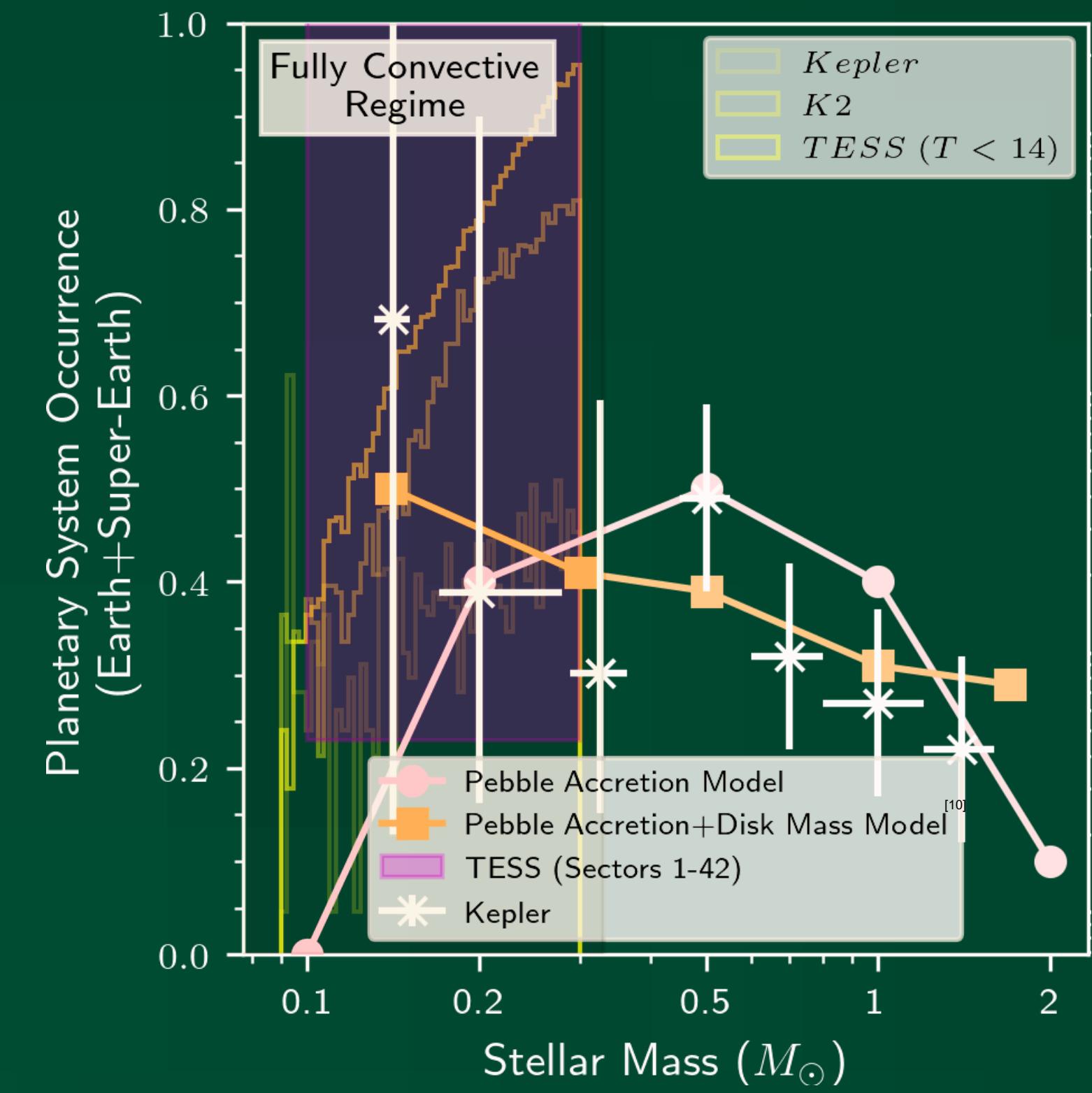


Fig 1: Comparison between pebble accretion models, Kepler, and TESS statistics. Figure adapted from TESS Cycle 5 GO Proposal 6002 (PI : Theissen)

EXOPLANET SURVEY AND CHARACTERISATION PROGRAM FOR EARTH-LIKE ROCKY PLANETS



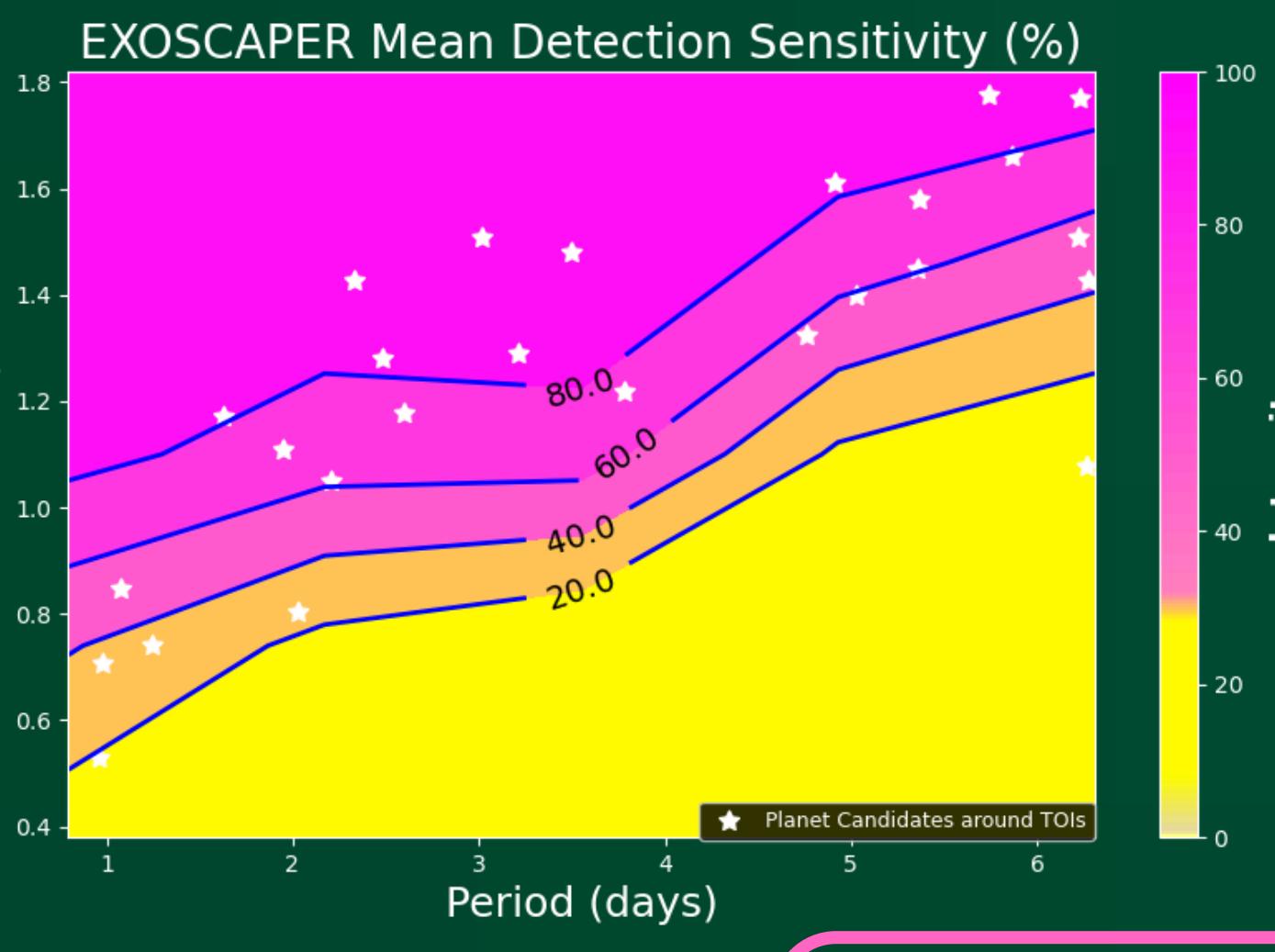
SCAN ME!



EXOPLANET SURVEY AND CHARACTERIZATION PROGRAM FOR EARTH-LIKE ROCKY PLANETS

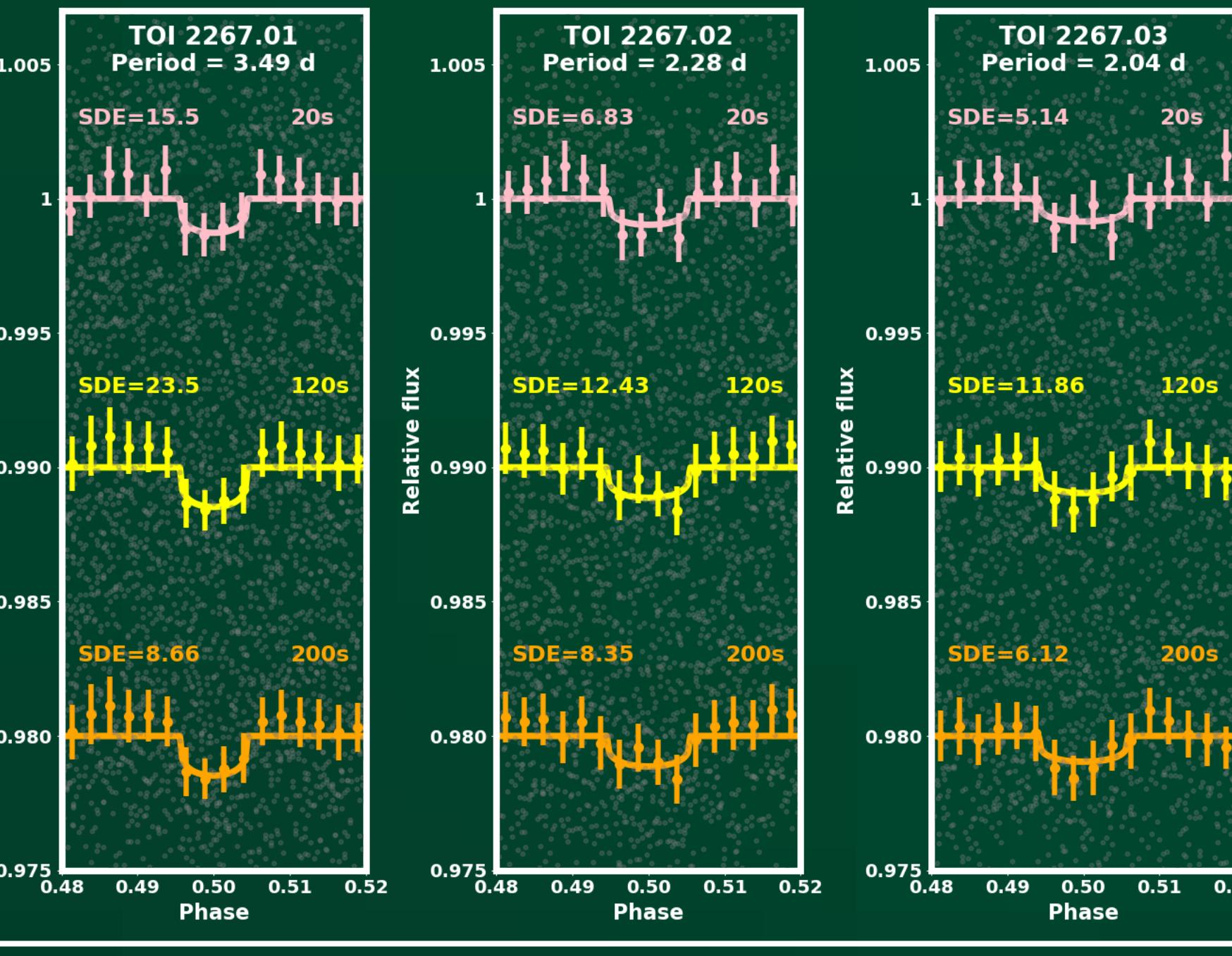
EXOSCAPER is a survey program for detecting and characterizing terrestrial planets around faint stars.

- ✓ Utilizing a custom pipeline, identifies candidates missed by TESS pipelines
- ✓ Validates known candidates with increased sensitivity
- ✓ Designed to detect multi-planetary systems
- ✓ Perform integrated statistical vetting using community-sourced tools



Pipeline is most sensitive towards Super-Earths!

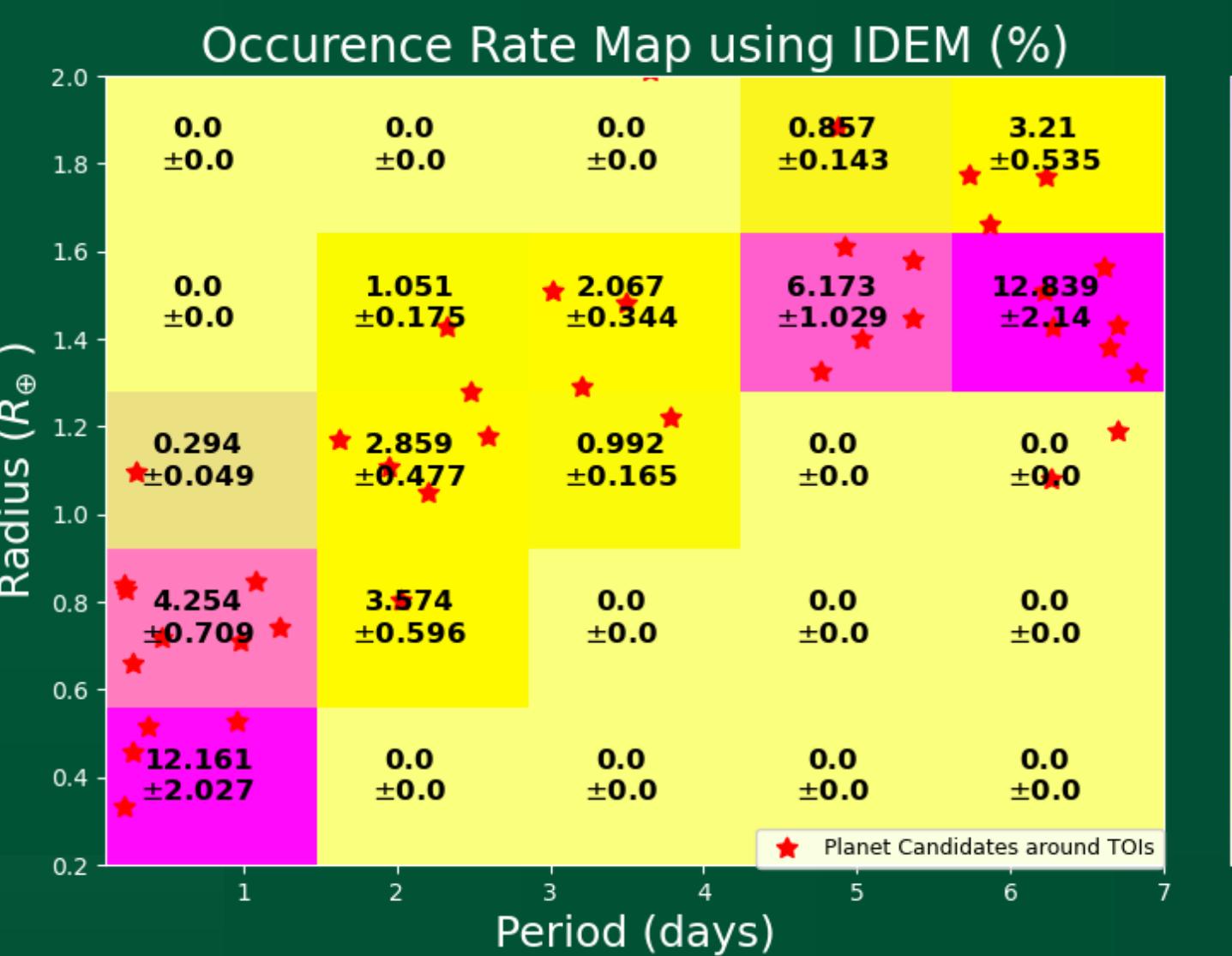
TOI 2267 - TIC 459837008



MULTI-PLANET SYSTEM OF THREE EARTH-SIZED PLANETS AROUND A M5V AND M6V BINARY ALSO RECOVERED BY EXOSCAPER!

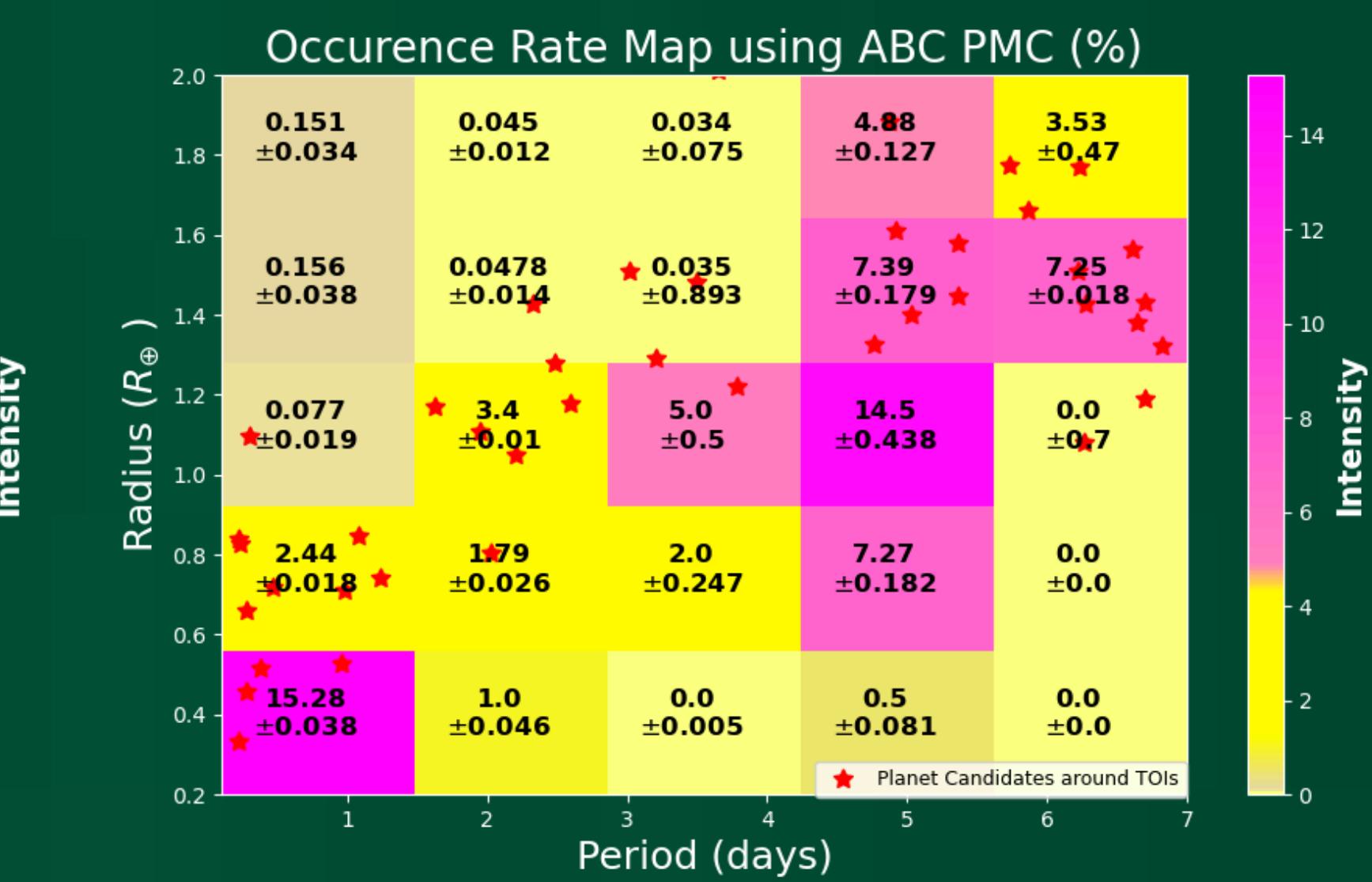
EXOSCAPER DETECTED 1 OF 3 PLANETS IN THE TOI-2267 SYSTEM, TOI-2267.02, BEFORE THE FIRST TESS PIPELINE ALERT!

INVERSE DETECTION EFFICIENCY METHOD (IDEM)^[4]



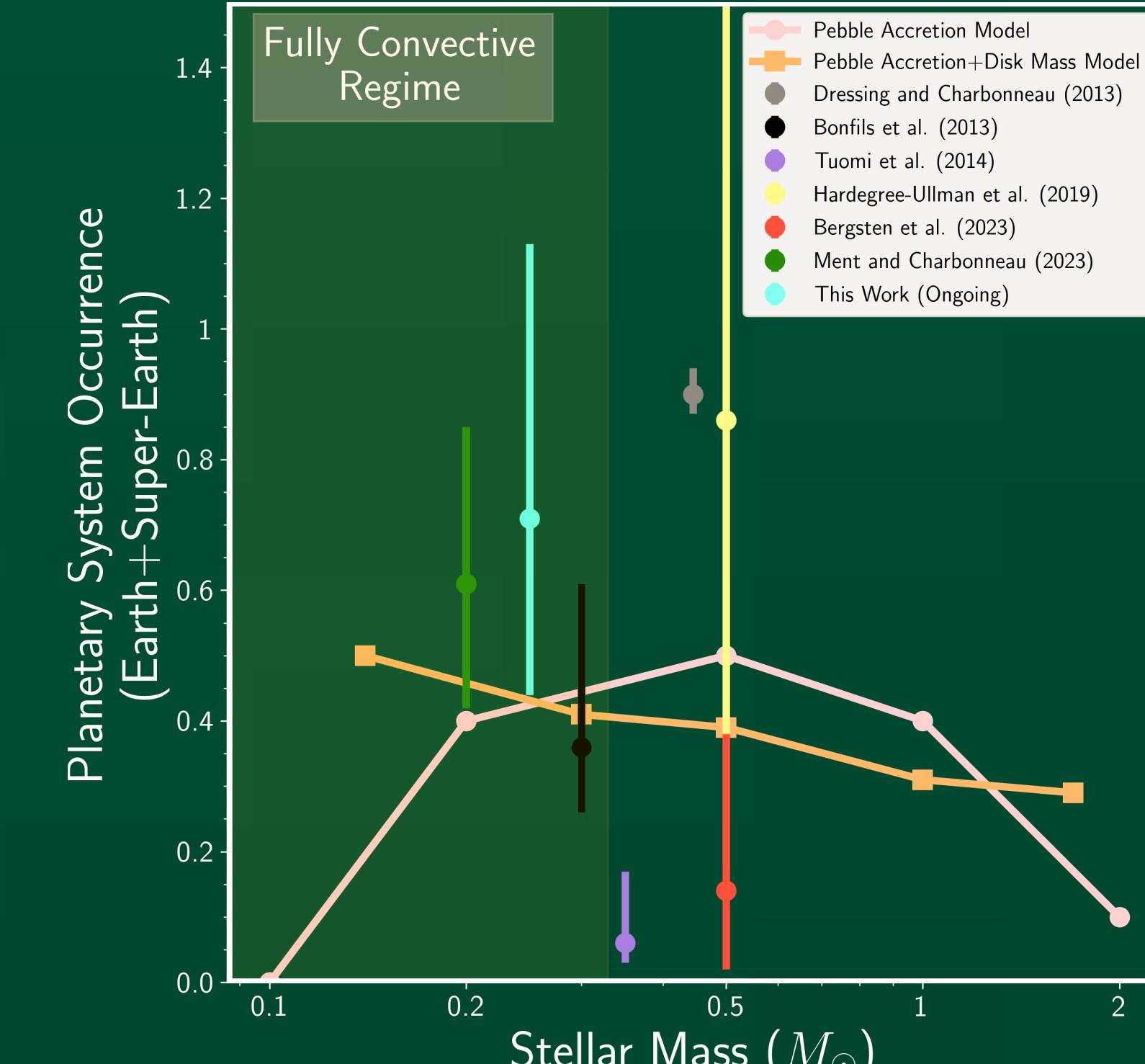
$$\eta = 0.61 \pm 0.34 \text{ PLANETS PER STAR}$$

ABSOLUTE BAYESIAN COMPUTATION - POPULATION MONTE CARLO (ABC PMC)^[5]



$$\eta = 0.71^{+0.42}_{-0.27} \text{ PLANETS PER STAR}$$

CURRENT FINDINGS



TRENDS CONSISTENT WITH PEBBLE ACCRETION?

MORE RESULTS COMING SOON IN KARPOOR ET AL (IN PREP)!!

ACKNOWLEDGEMENT

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SELECT REFERENCES

- [1] Hardegree-Ullman et al., 2019, AJ, 158, 75
- [2] Mulders et al., 2015, ApJ, 798, 112
- [3] Winters et al., 2021, AJ, 161, 63
- [4] Dressing and Charbonneau, 2013, AJ, 767, 195
- [5] Kunimoto and Matthews, 2020, AJ, 159, 248
- [6] Bonfils et al., 2013, A&A, 549, A109
- [7] Tuomi et al., 2014, MNRAS, 441, 1545
- [8] Ment and Charbonneau, 2023, AJ, 165, 265
- [9] Bergsten et al., 2023, AJ, 166, 234
- [10] Chachan and Lee, 2023, ApJL, 952, L20