Putting a TlaRA on SPOC: Predicting long-period planet yields from *TESS*

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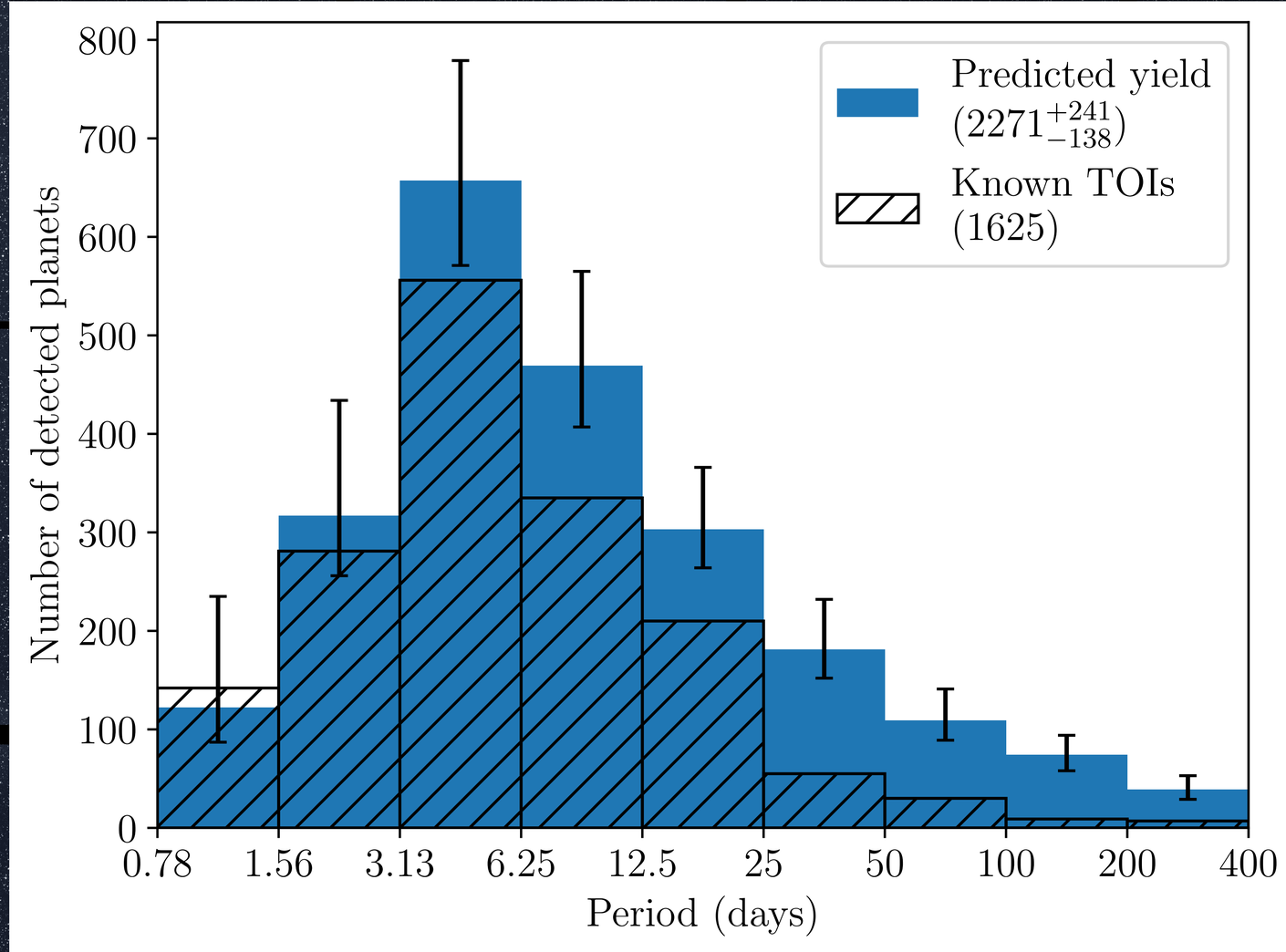
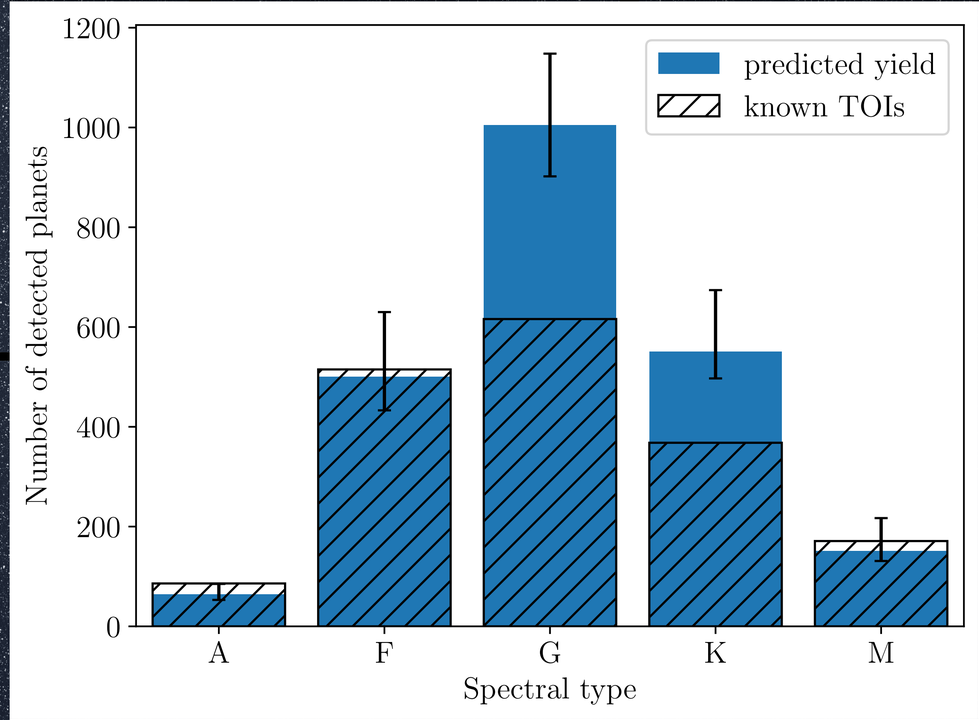
TESS[1] is generally biased towards shorter period planets and many longer period planets are only seen as a single transit or "monotransit". We have developed the Transit Investigation and Recoverability Application (**TlaRA**) pipeline, a tool for making *TESS* sensitivity maps. We then combine these with occurrence rates[2,3] derived from Kepler[4] to estimate yields for *TESS*. We predict 2271^{+241}_{-138} detectable planets from the Year 1 and 3 SPOC FFI lightcurves. By comparing our results to the TOI catalogue, we estimate (with a 3-sigma confidence level) that 75% of planets with periods over 25 days have yet to be discovered.

1. Overall yield predictions



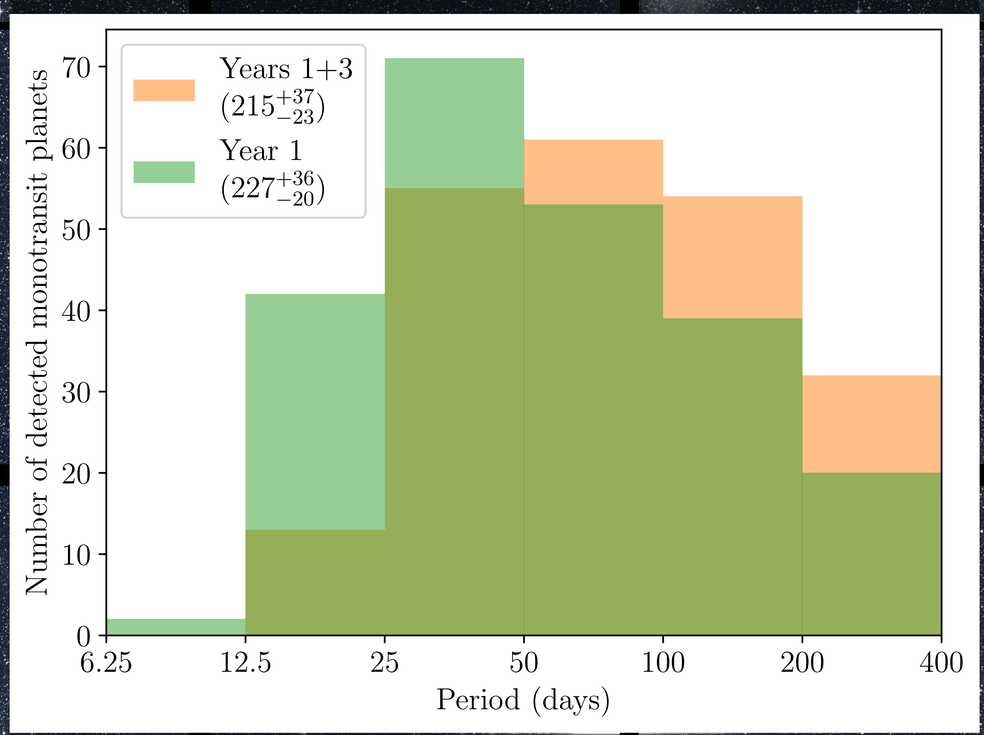
We predict most TESS detections will be short period (<12.5 days) which matches the TOI catalogue. Although we predict a significant number (403^{+64}_{-38}) with periods beyond 25 days. The disagreement with the TOI catalogue is beyond 3-sigma in this period regime, implying more long-period planets are yet to be found in *TESS* data.

2. Yields by spectral type



We find G dwarf stars will be host to the largest number of detections (1005^{+143}_{-103}). Although K dwarf stars are more efficient for the number observed, with $(3.4^{+0.8}_{-0.3}) \times 10^{-3}$ detections predicted per star.

3. Monotransits



We predict (215^{+37}_{-23}) detections from "monotransit" events with only a single transit observed. We find the addition of Year 3 leads to more long-period monos but does not significantly change the overall number.

4. Biennial Duotransits

We predict (113^{+22}_{-13}) detections from "biennial duo transit" events with one transit in Year 1 and another in Year 3. We also compare our predictions to a search conducted for these events[5].

Read the paper for more information!!

Rodel, T., et al., (2024), MNRAS, 529(1) 715

References:

1. Ricker, G. R., et al. (2015), JATIS, 1, 014003
2. Kunimoto, M. and Matthews, JM. (2020). AJ. 159(6) 248
3. Dressing, C. and Charbonneau, D. (2015) ApJ 107(1) 45
4. Borucki, W. J., et al. (2010), Sci, 327, 977
5. Hawthorn, F,. et al. (2024), MNRAS, 528(2) 1841

Background image: *TESS*' first light: https://exoplanets.nasa.gov/news/1523/first-light-tess-shares-first-science-image-in-hunt-to-find-new-worlds/