

# Constraints on Small-size Planet Occurrence around Nearby Early-to-mid M Dwarfs from the APACHE Project

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## Abstract

APACHE [1] is a ground-based photometric survey intended to find planets transiting the closest and smallest main-sequence stars. Here, we try to answer an outstanding question: in light of the bounty of small planets transiting small stars uncovered by the Kepler mission, should APACHE have found one planet so far? We estimate APACHE's ensemble sensitivity to exoplanets by performing end-to-end simulations of observations of ~350 nearby early-to-mid M dwarfs, gathered by APACHE between 2012 July and 2015 August. For 2–10  $R_{\oplus}$  planets, we compare this sensitivity to results from Kepler [2] and MEarth ground-based photometric survey [3]. APACHE is sensitive to transits of planets the size of Neptune. In light of this sensitivity, we discuss our lack of detections of transiting Neptunes based on the analysis of the first three years of survey data, and compare our results with known populations of Neptune-sized exoplanets around nearby early M dwarfs, discovered by both radial velocity and transit surveys. Furthermore, we put in context these results with the preliminary statistics of an M-dwarf survey from [HARPSN@TNG](#) within the large programme GAPS (Global Architecture of Planetary Systems [4]), focused on targets under monitoring with APACHE.

## References

- [1] Giacobbe, P., Damasso, M., Sozzetti, A., et al. 2012, MNRAS, 424, 3101
- [2] C. D. Dressing and D. Charbonneau. The Occurrence Rate of Small Planets around Small Stars. *ApJ*, 767:95, April 2013. doi: 10.1088/0004-637X/767/1/95.
- [3] Z. K. Berta, J. Irwin, and D. Charbonneau. Constraints on Planet Occurrence around Nearby Mid-to-late M Dwarfs from the MEARTH Project. *ApJ*, 775:91, October 2013. doi: 10.1088/0004-637X/775/2/91.
- [4] Desidera, S.; Bonomo, A. S.; Claudi, R. U. et al. The GAPS programme with HARPS-N at TNG. IV. A planetary system around XO-2S. *Astronomy & Astrophysics*, Volume 567, 2014