

# Characterisation of 92 Southern *TESS* Cool Dwarfs and a Tentative Radius Valley Detection with 100 Candidate Planets



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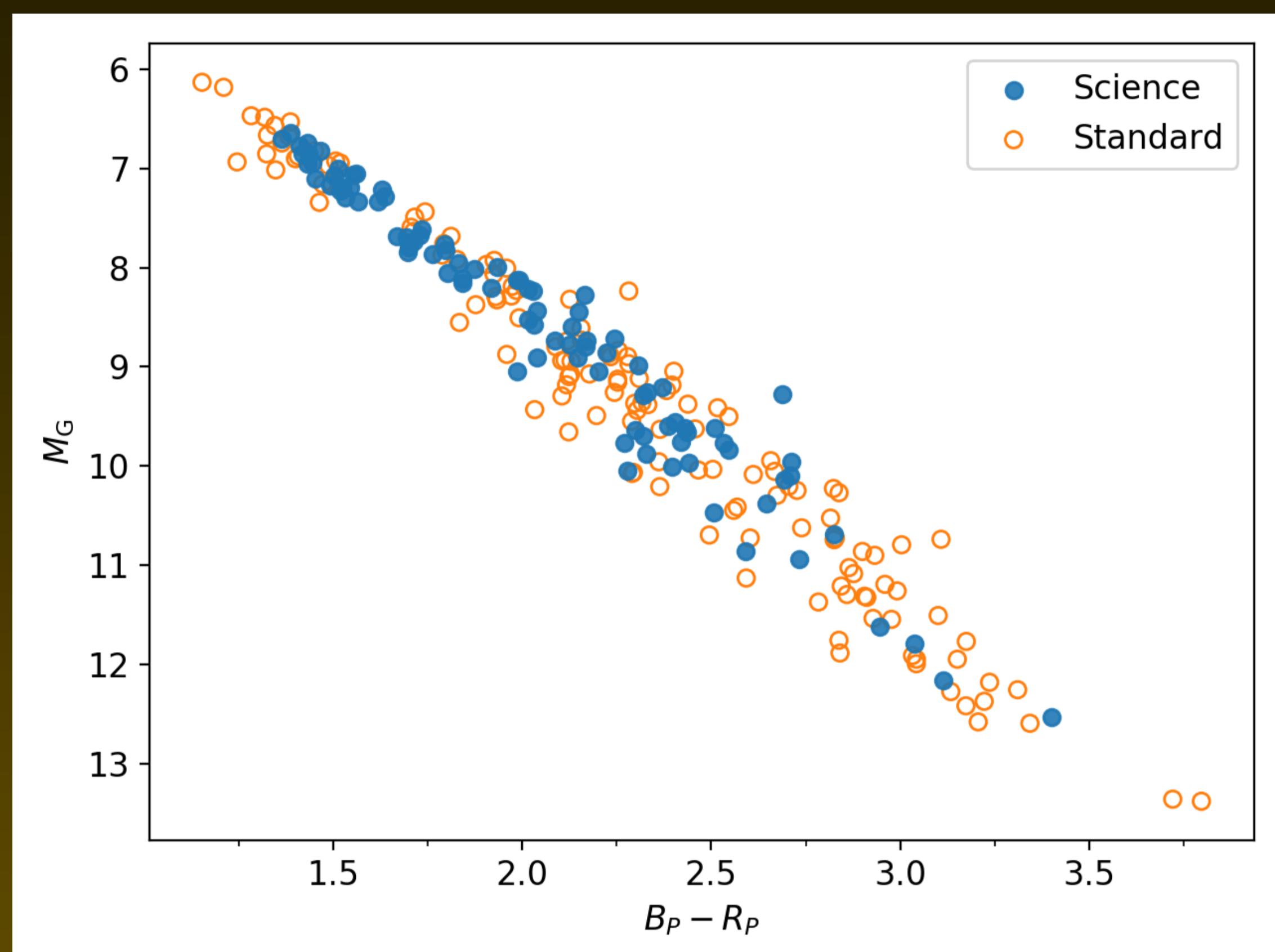
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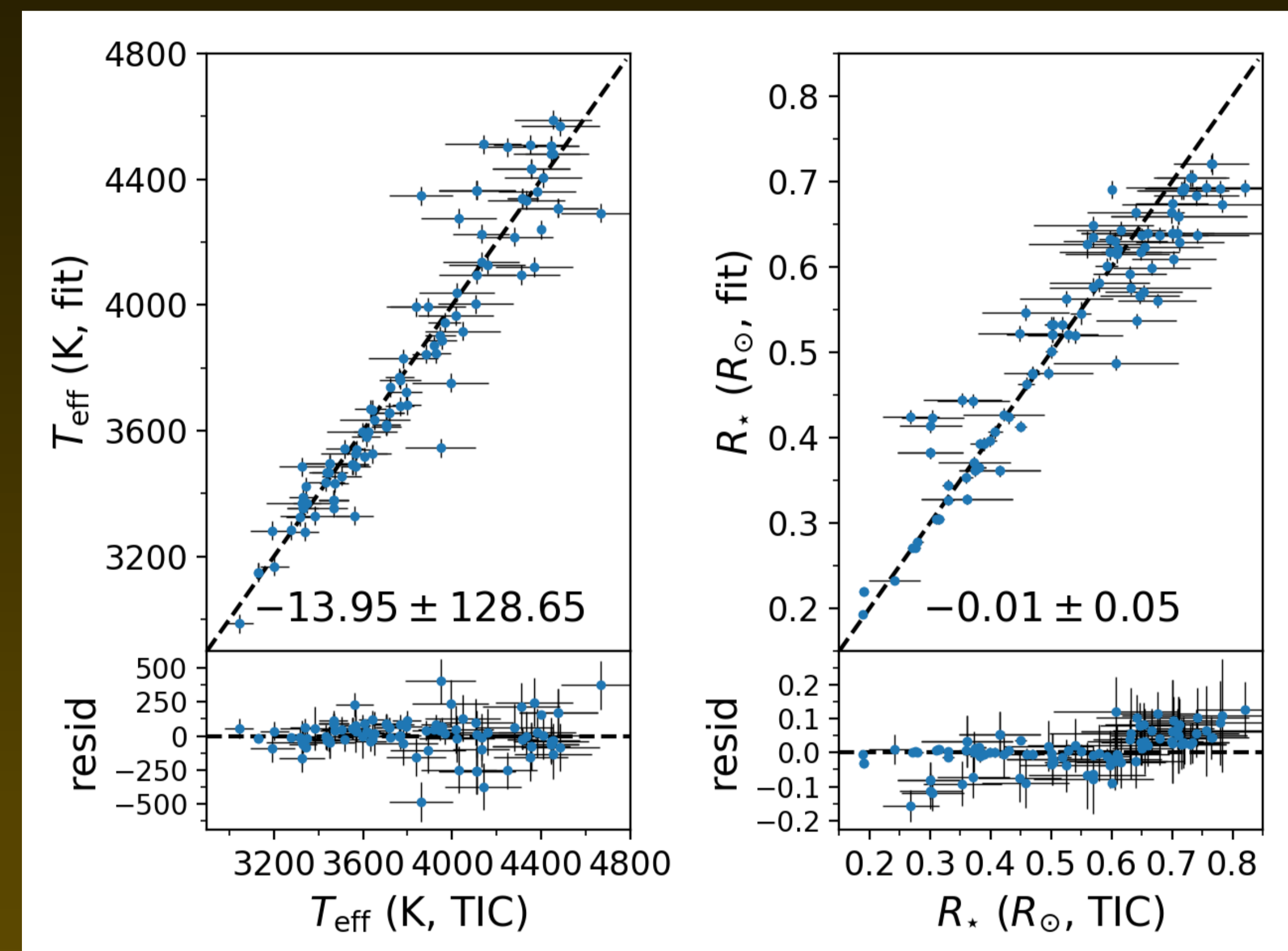
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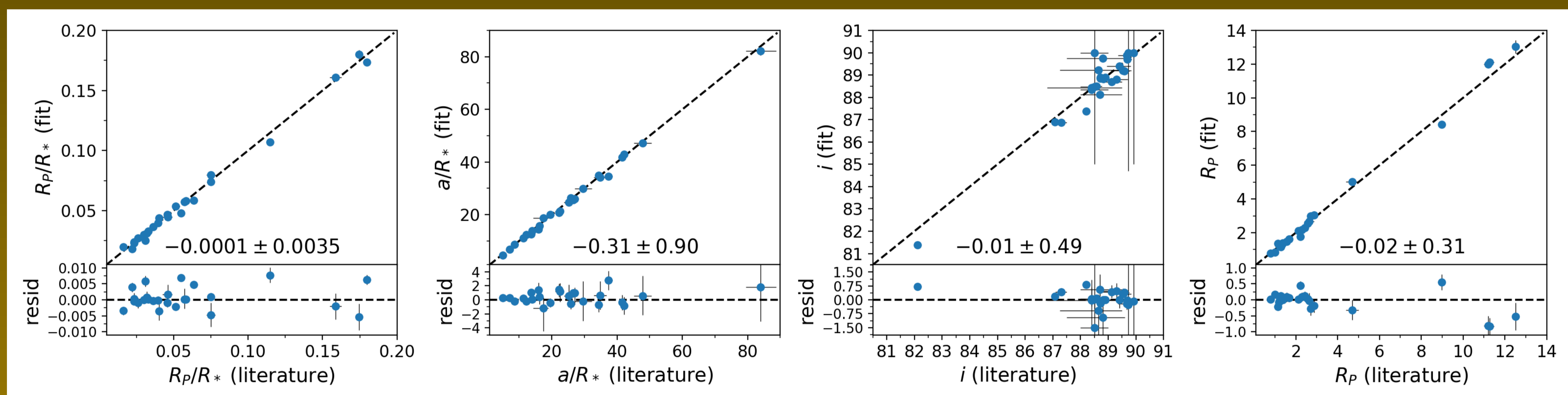
In Rains et al. 2021 (arXiv:2102.08133) we conducted a medium resolution optical ( $3,500 < \lambda < 7,000 \text{ \AA}$ ) spectroscopic survey of 92 cool ( $3,000 \lesssim T_{\text{eff}} \lesssim 4,500 \text{ K}$ ) southern *TESS* candidate exoplanet hosts & 136 cool dwarf benchmarks using WiFeS on the ANU 2.3 m Telescope. We determine benchmark calibrated stellar  $T_{\text{eff}}$  and  $R_{\star}$  precise to 0.8% and 1.7% respectively, which we use to model the *TESS* transit light curves of our 100 candidate planets. Our resulting values of  $R_p$  are precise to 3.5% and consistent with the 30 already confirmed planets. From this uniform analysis we see further tentative evidence that the exoplanet radius valley is present for planets orbiting cool dwarfs—a historically small, but now rapidly growing sample thanks to *TESS*—and investigate systematics in the *TESS* Input Catalogue.



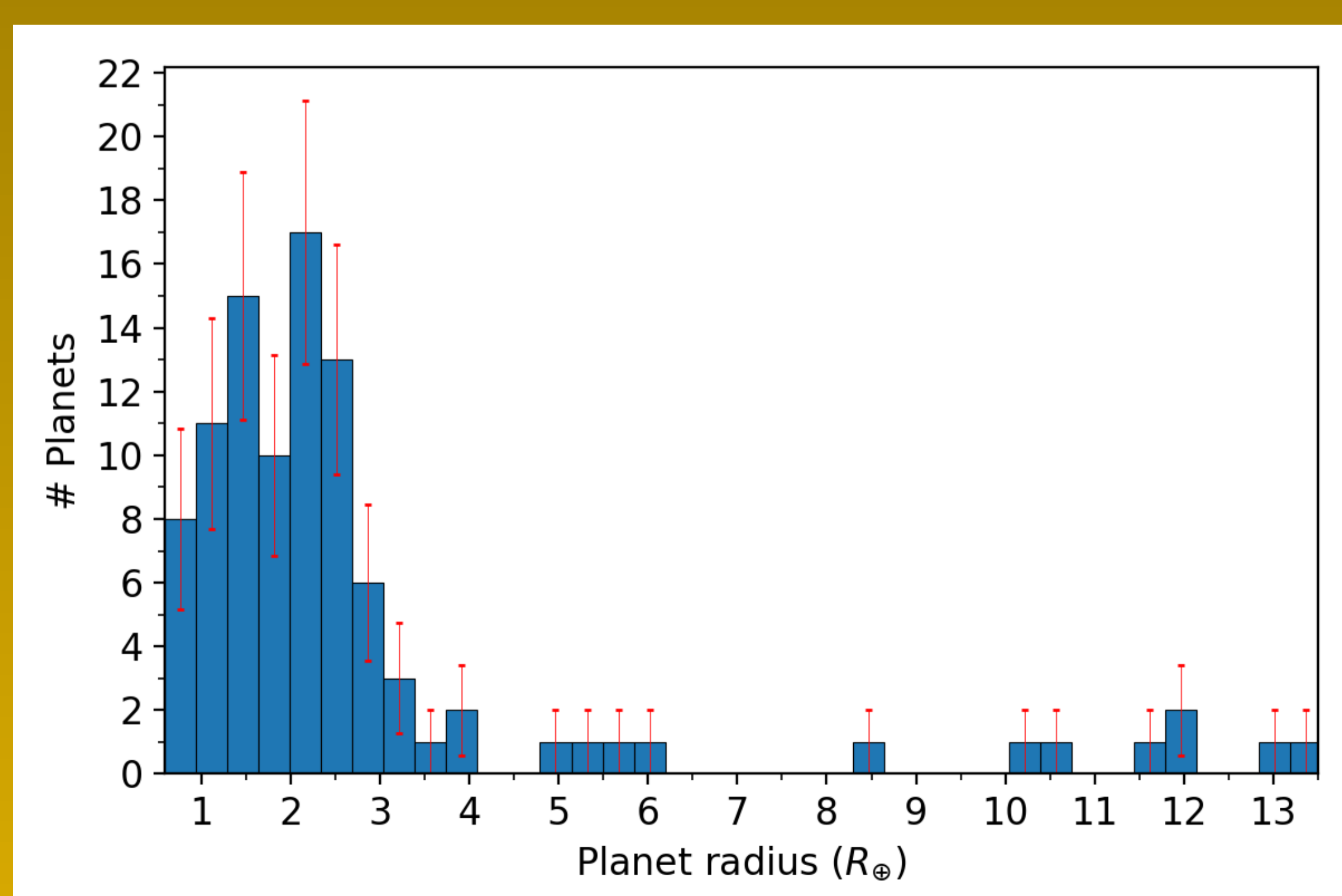
*Gaia* DR2  $M_G$  versus  $(B_p - R_p)$  colour-magnitude diagram for science targets (filled blue circles) and cool dwarf benchmarks (orange open circles).



Comparison of  $T_{\text{eff}}$  and  $R_{\star}$  with those from the *TESS* input catalogue. The median and standard deviation of each set of residuals is annotated.



Comparison of  $R_p/R_{\star}$ ,  $a/R_{\star}$ ,  $i$ , and  $R_p$  to literature results. Our two largest literature planets, TOIs 129.01 and 551.01, are hot Jupiters in a grazing configuration that leaves their radii poorly constrained. As such, they have been left off for clarity, though our results are consistent within uncertainties. The median and standard deviation of each set of residuals are annotated and exclude these two planets.



Histogram of candidate planet radii with  $R_p < 14 R_{\oplus}$  with  $0.35 R_{\oplus}$  width bins and Poisson uncertainties. Note that we tentatively detect the exoplanet radius valley at a  $\sim 1\sigma$  level, though remain limited by our small sample size.