

Know Thy Star(s) - Know Thy Planet (Occurrence Rates)

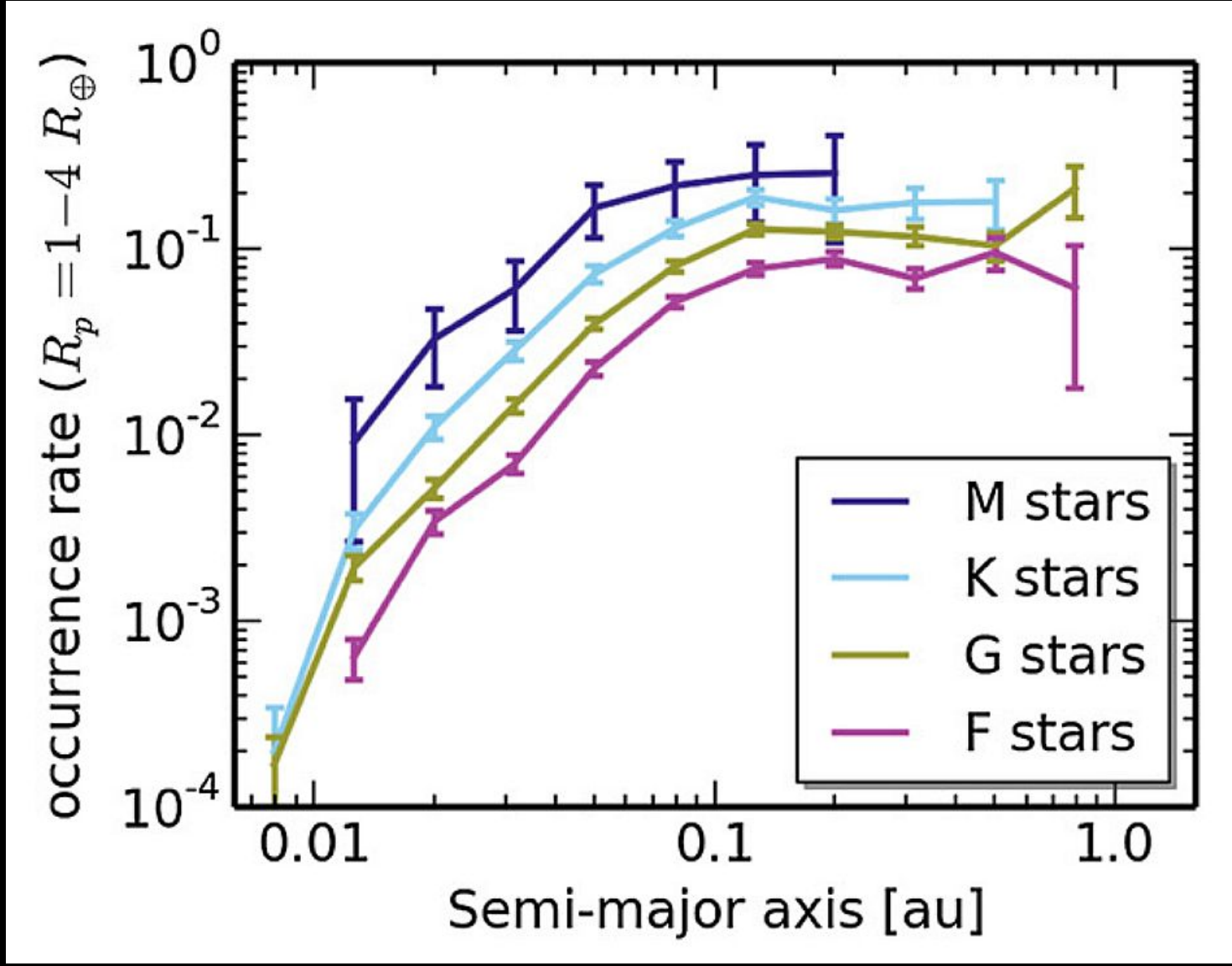


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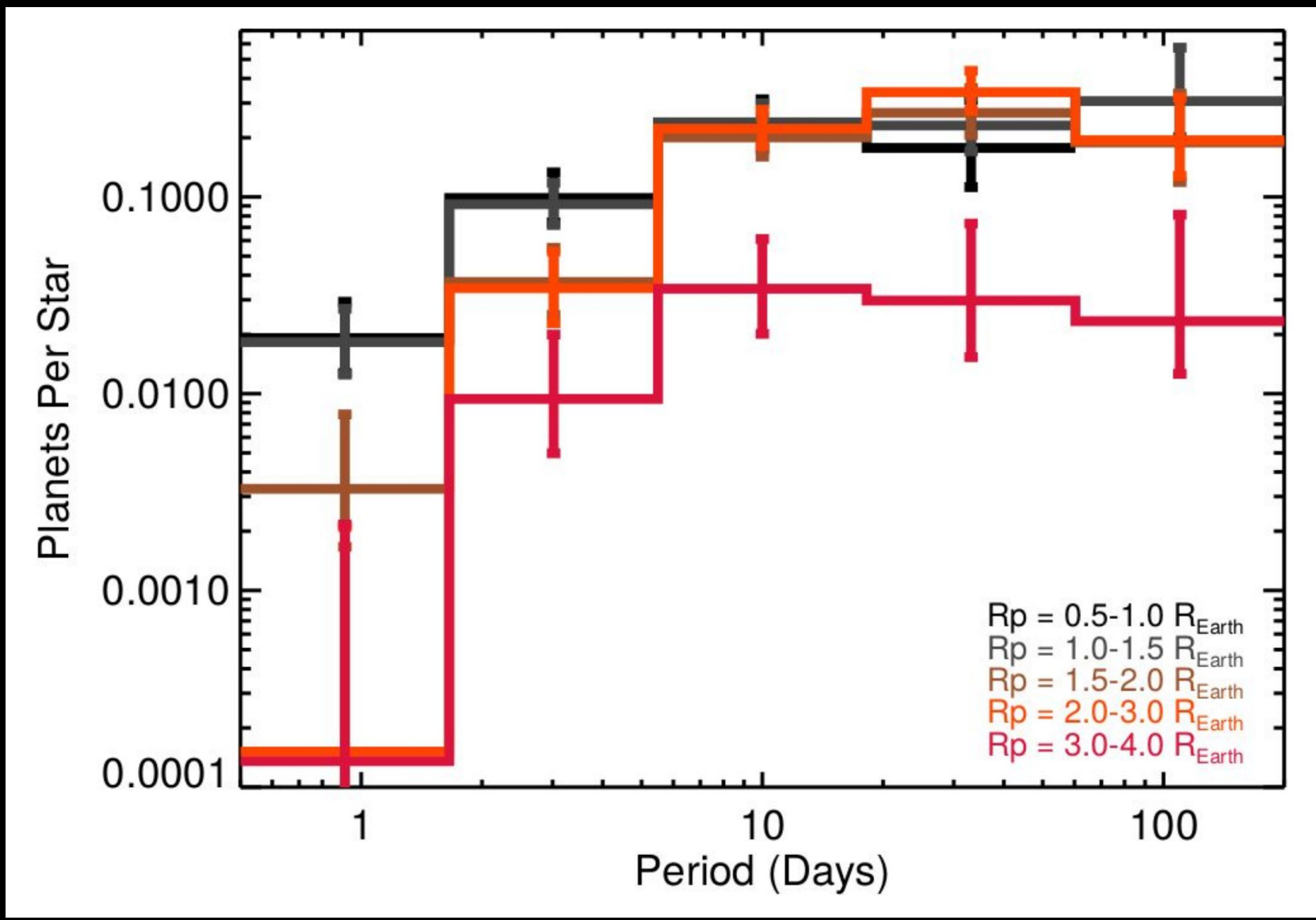
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University of Toledo
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Small stars, small planets, short periods

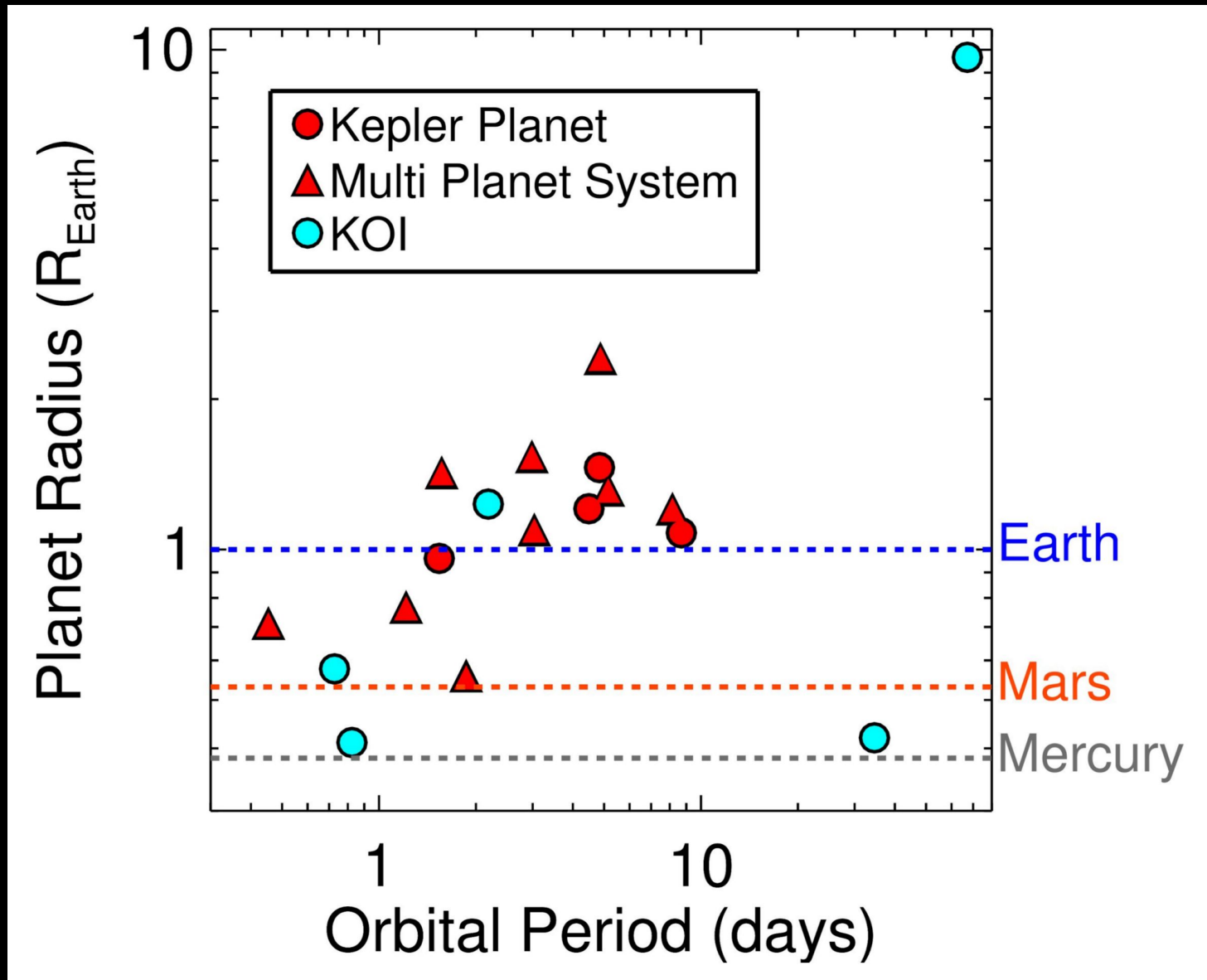


Small stars, small planets, short periods



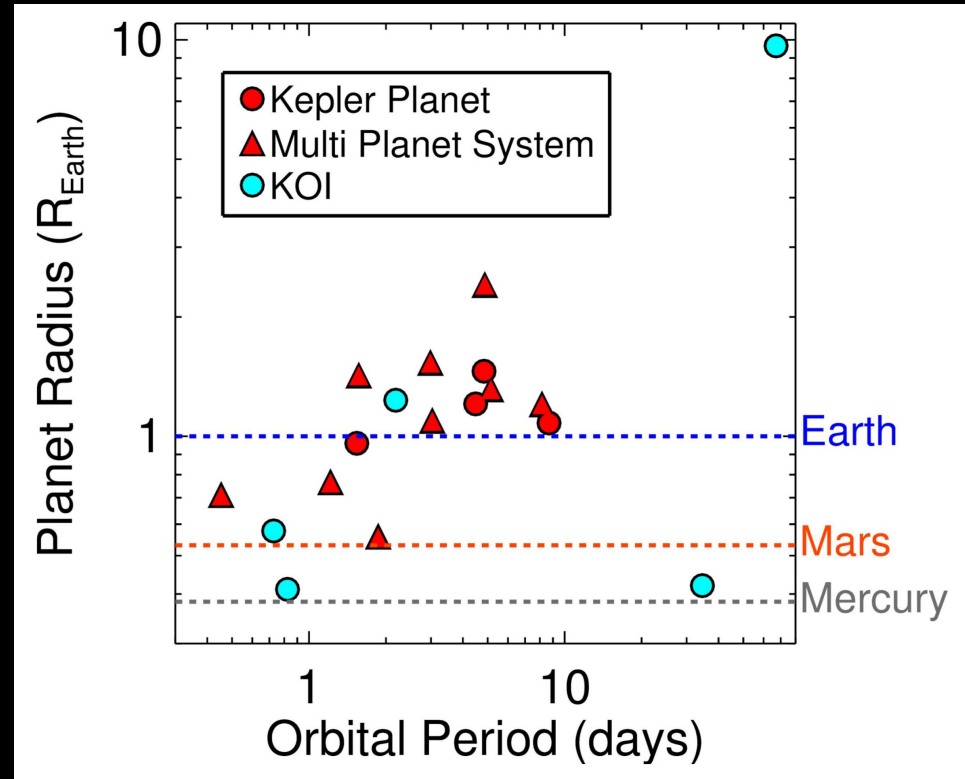
What about mid-type M dwarfs?
($T_{\text{eff}} \lesssim 3400 \text{ K}$)

Mostly small, short period planets



Planet Occurrence Calculation

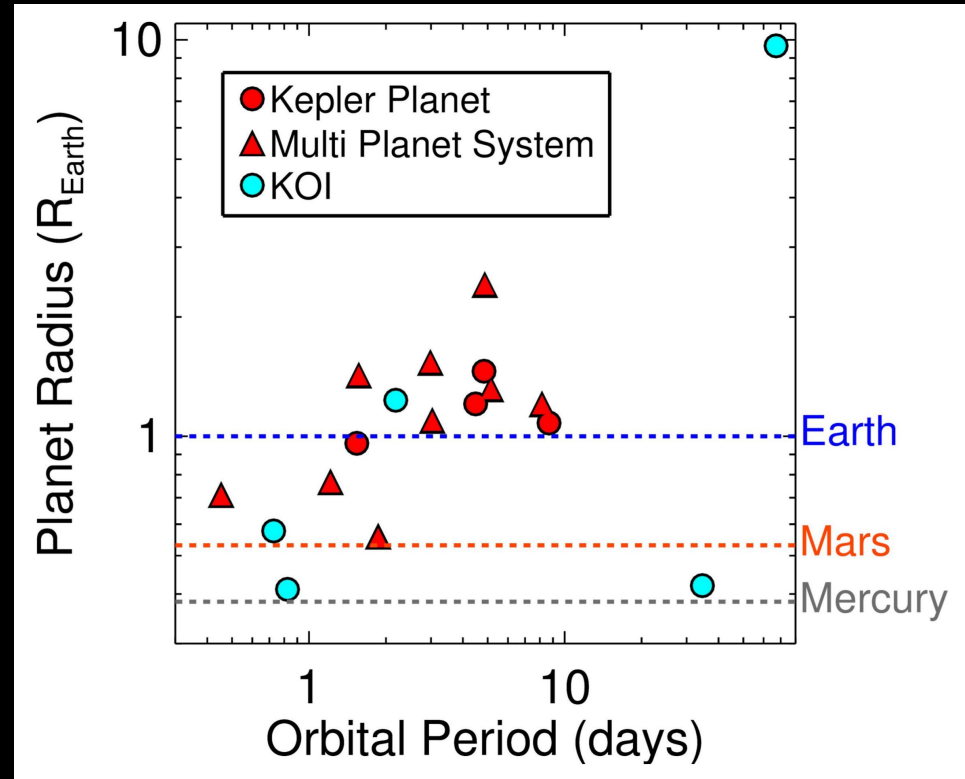
$$f(R_p, P) = \sum_{i=1}^{N_p(R_p, P)} \frac{a_i}{R_{\star, i} N_{\star, i}}$$



Occurrence rates require precise R_\star

$$f(R_p, P) = \sum_{i=1}^{N_p(R_p, P)} \frac{a_i}{R_{\star, i} N_{\star, i}}$$

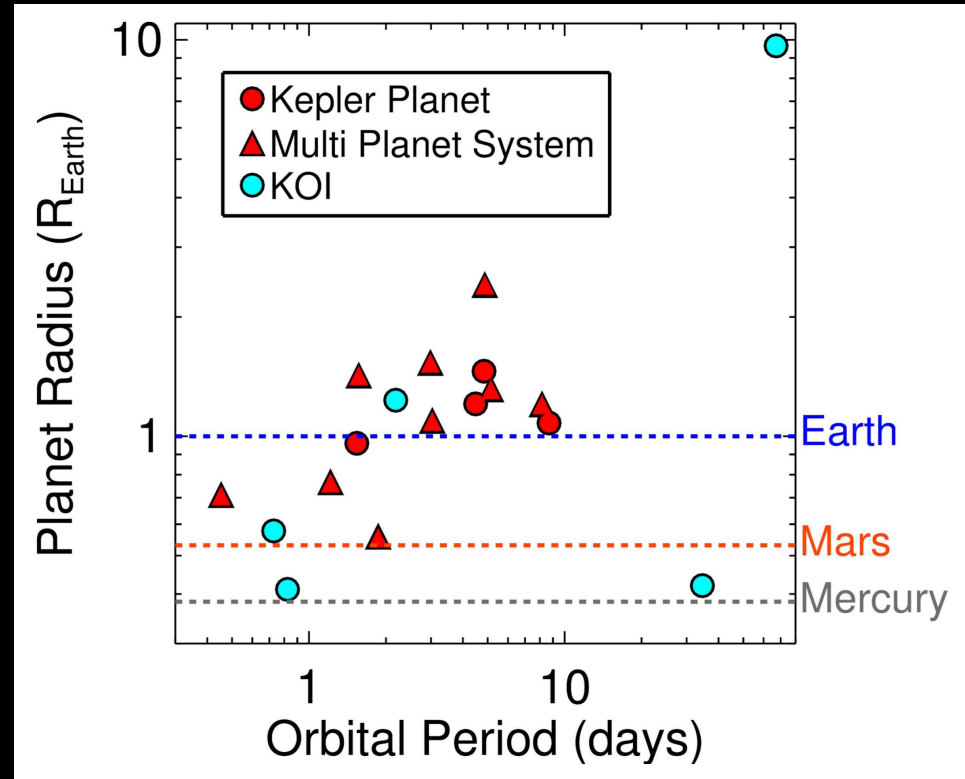
$$S/N = \frac{R_p^2 / R_\star^2}{\text{CDPP}_{\text{eff}}} \sqrt{\frac{t_{\text{obs}}}{P}}$$



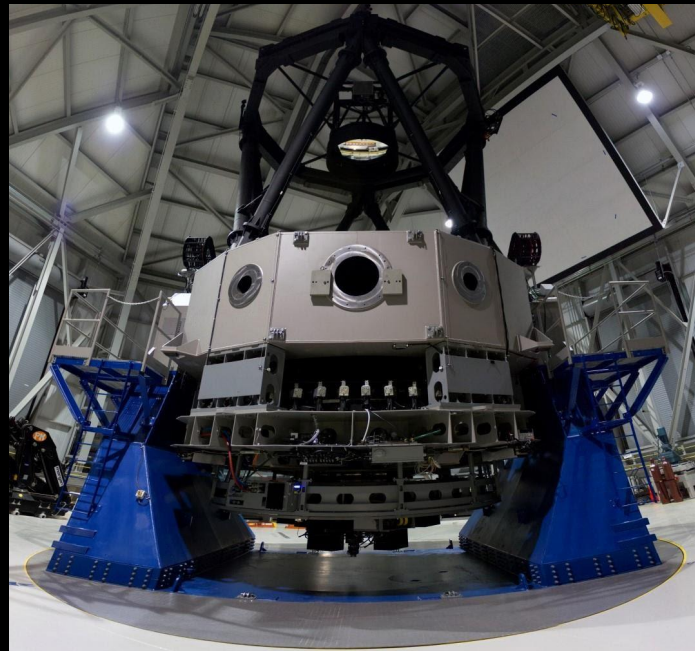
Photometric uncertainties ~30%

$$f(R_p, P) = \sum_{i=1}^{N_p(R_p, P)} \frac{a_i}{R_{\star, i} N_{\star, i}}$$

$$S/N = \frac{R_p^2 / R_{\star}^2}{\text{CDPP}_{\text{eff}}} \sqrt{\frac{t_{\text{obs}}}{P}}$$



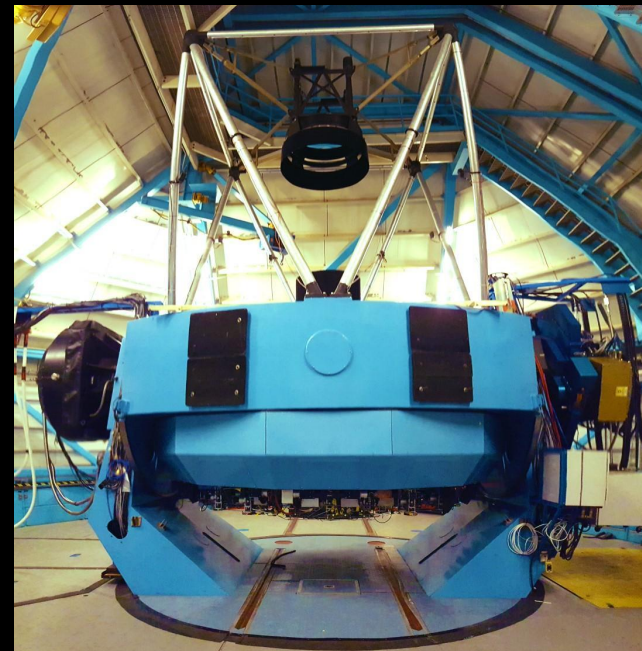
Spectroscopic uncertainties $\sim 10\%$



DCT – 4.3m

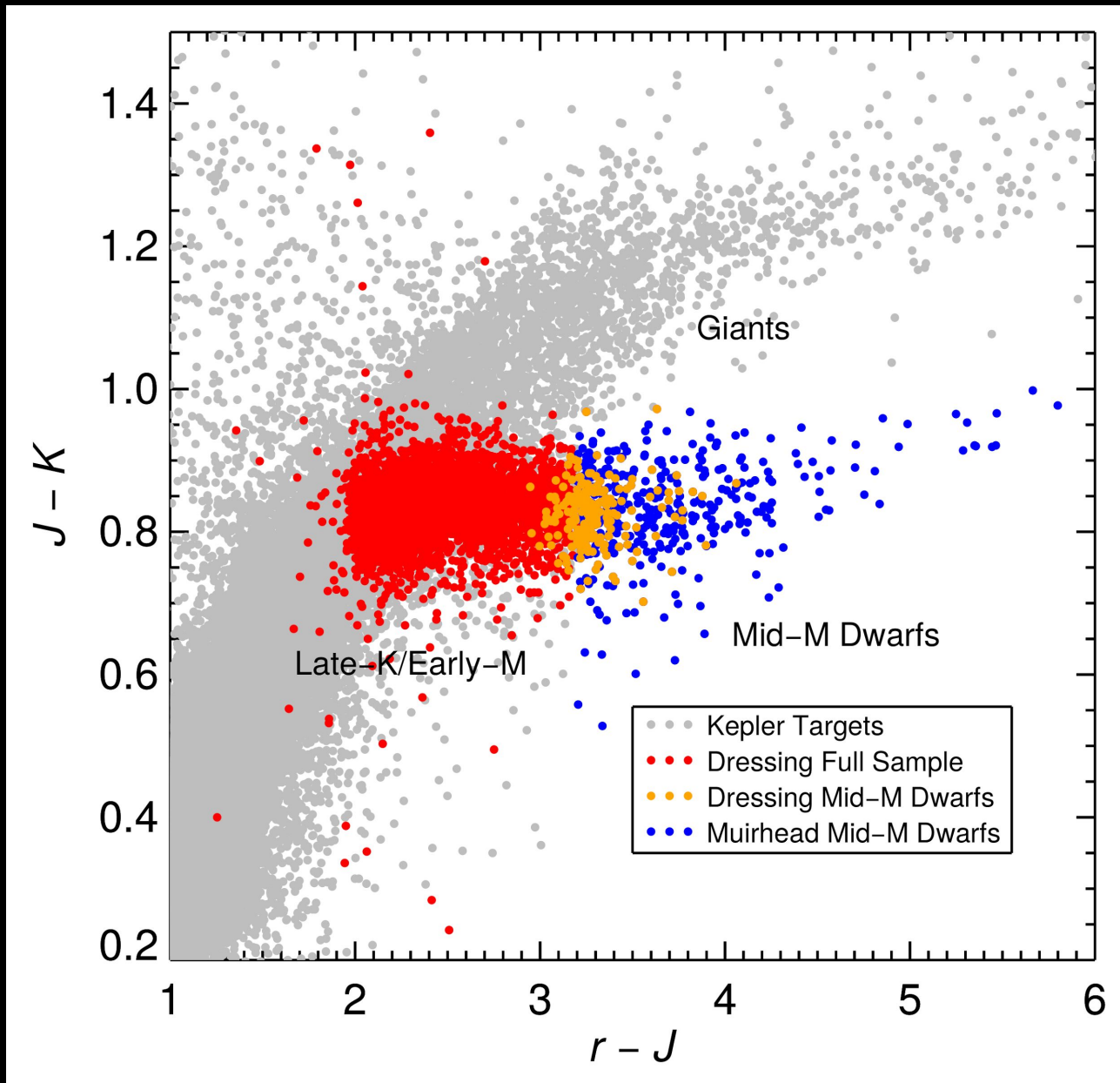


IRTF – 3m

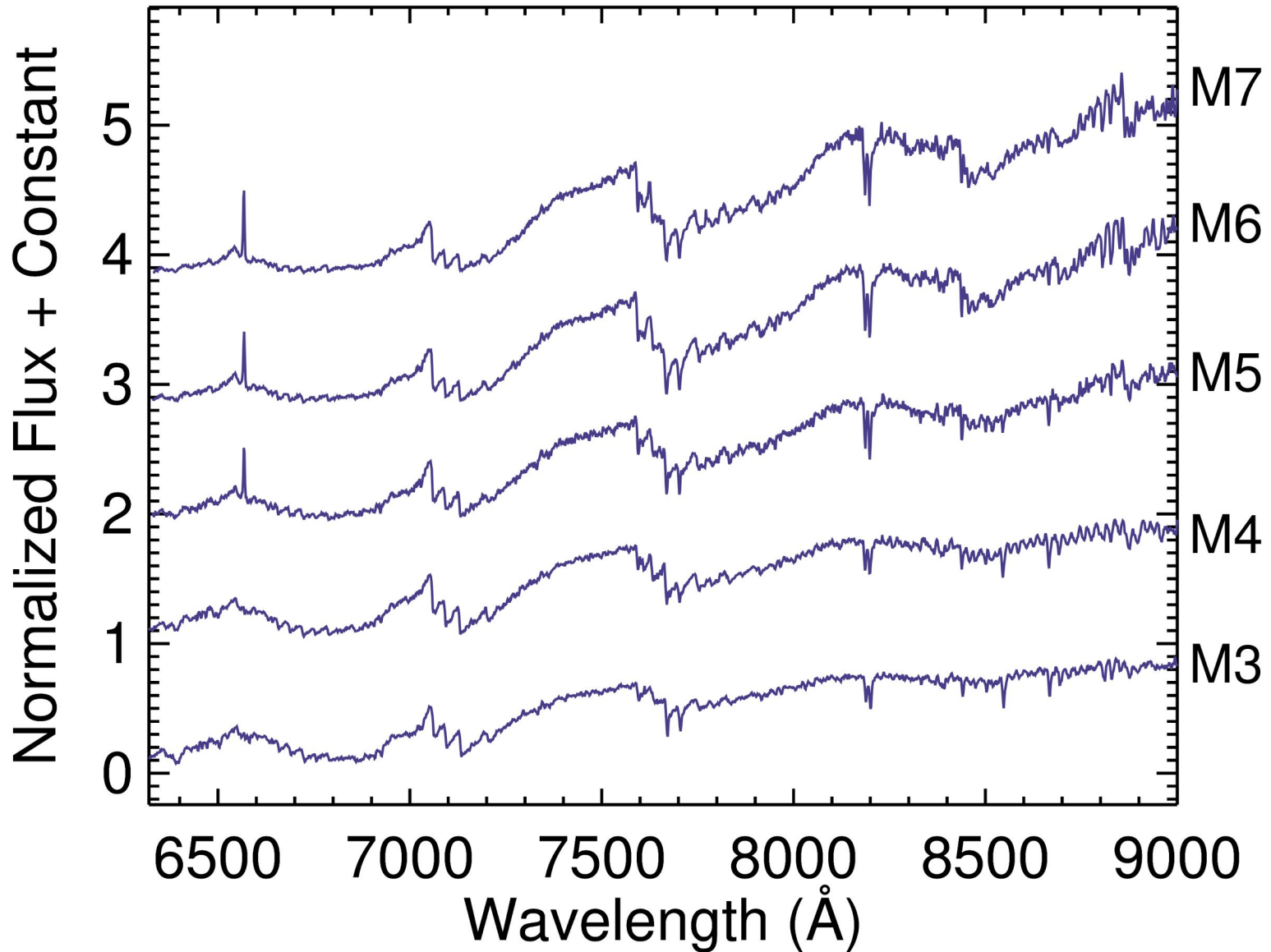


WIYN – 3.5m

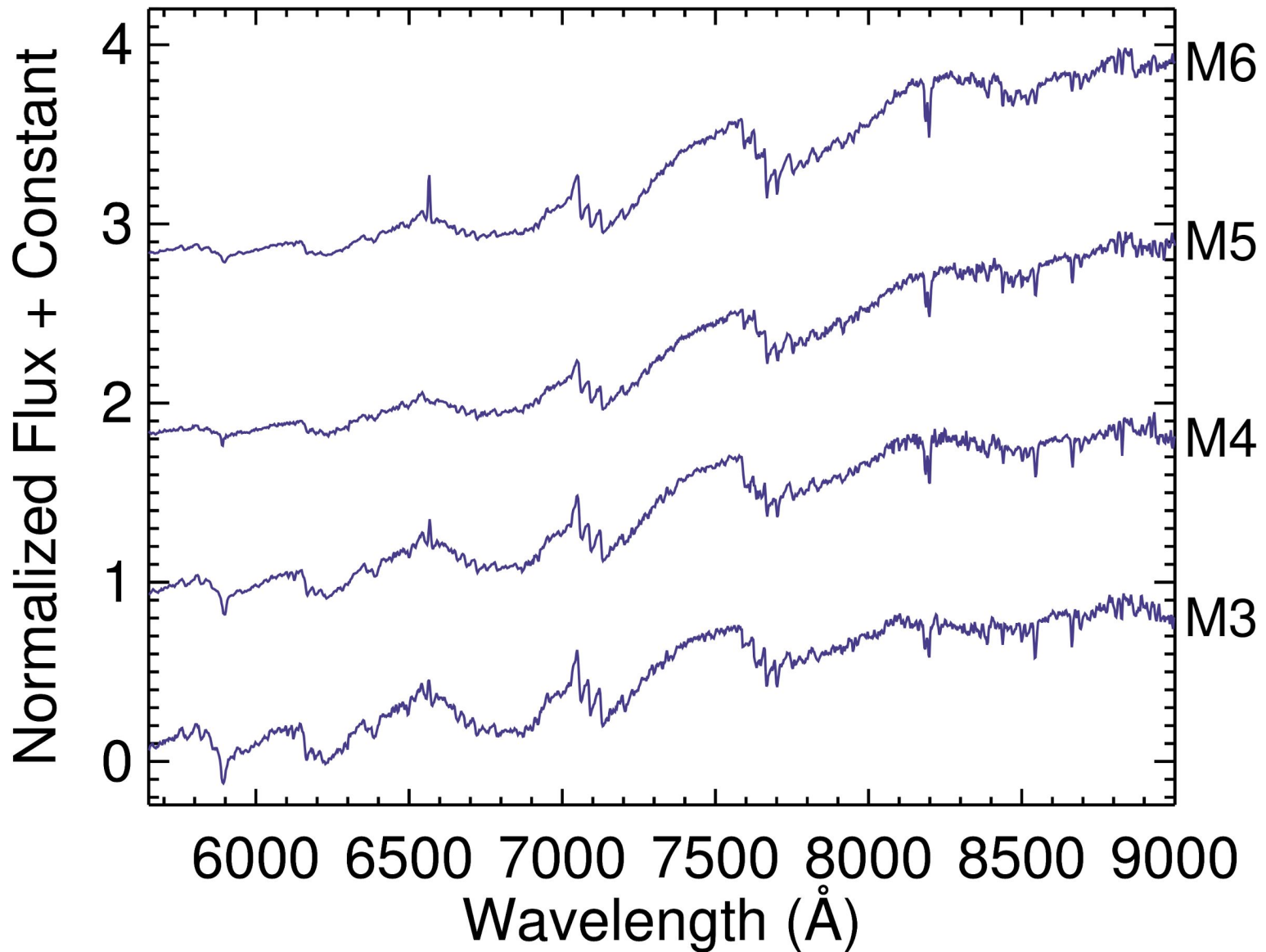
~550 mid-type M dwarfs in *Kepler* field



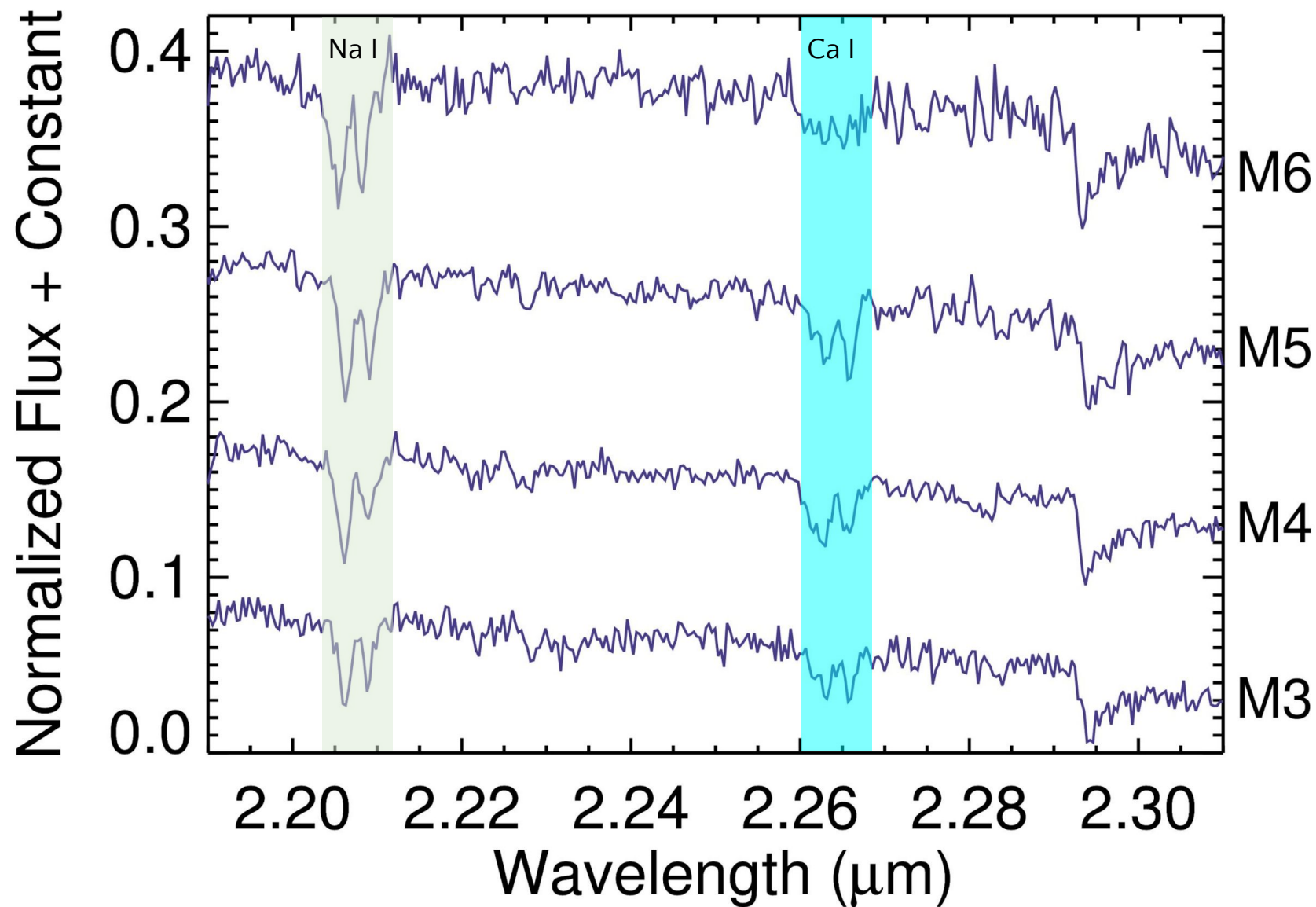
DCT - 49 Spectra



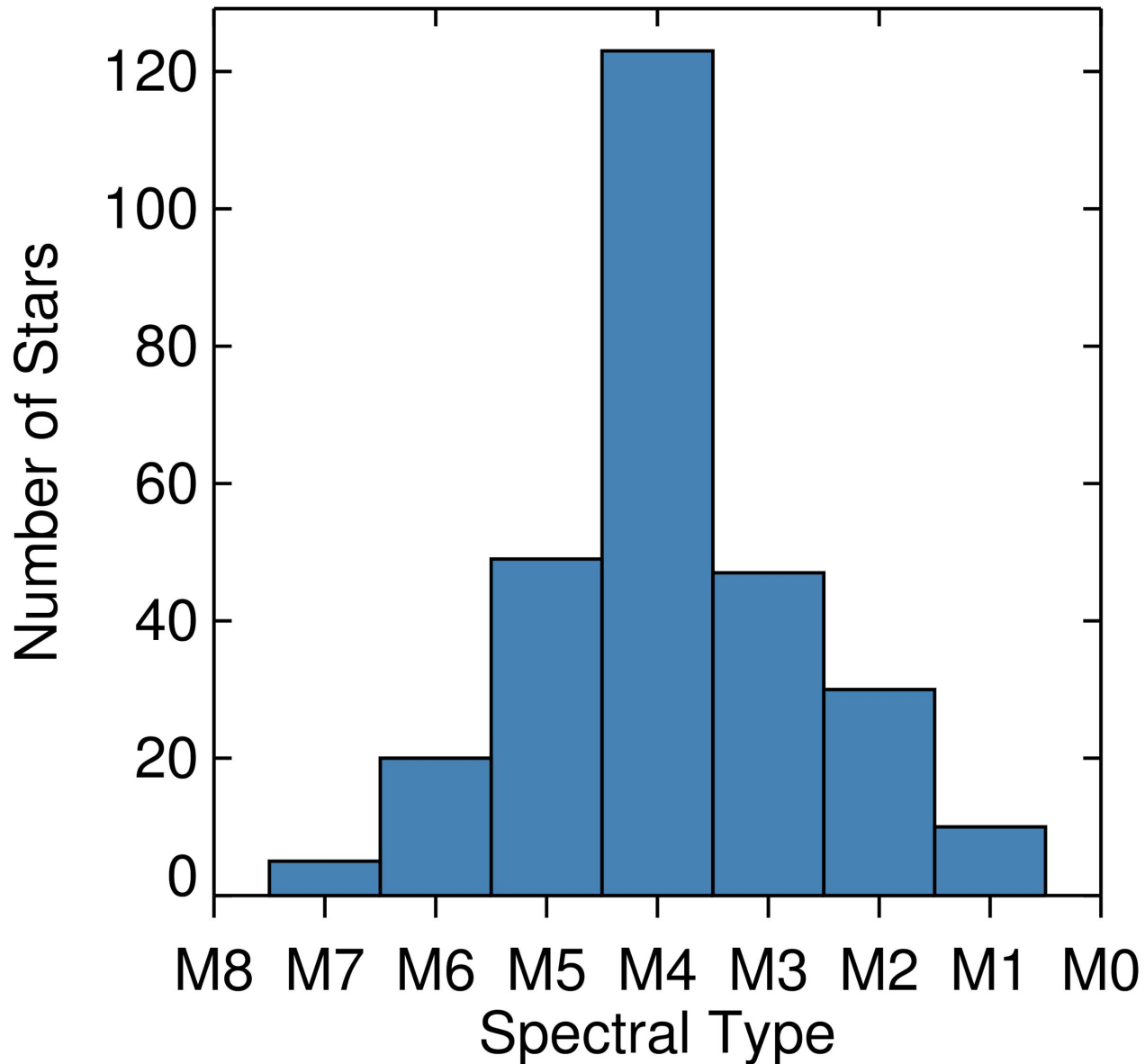
WIYN - 220 Spectra



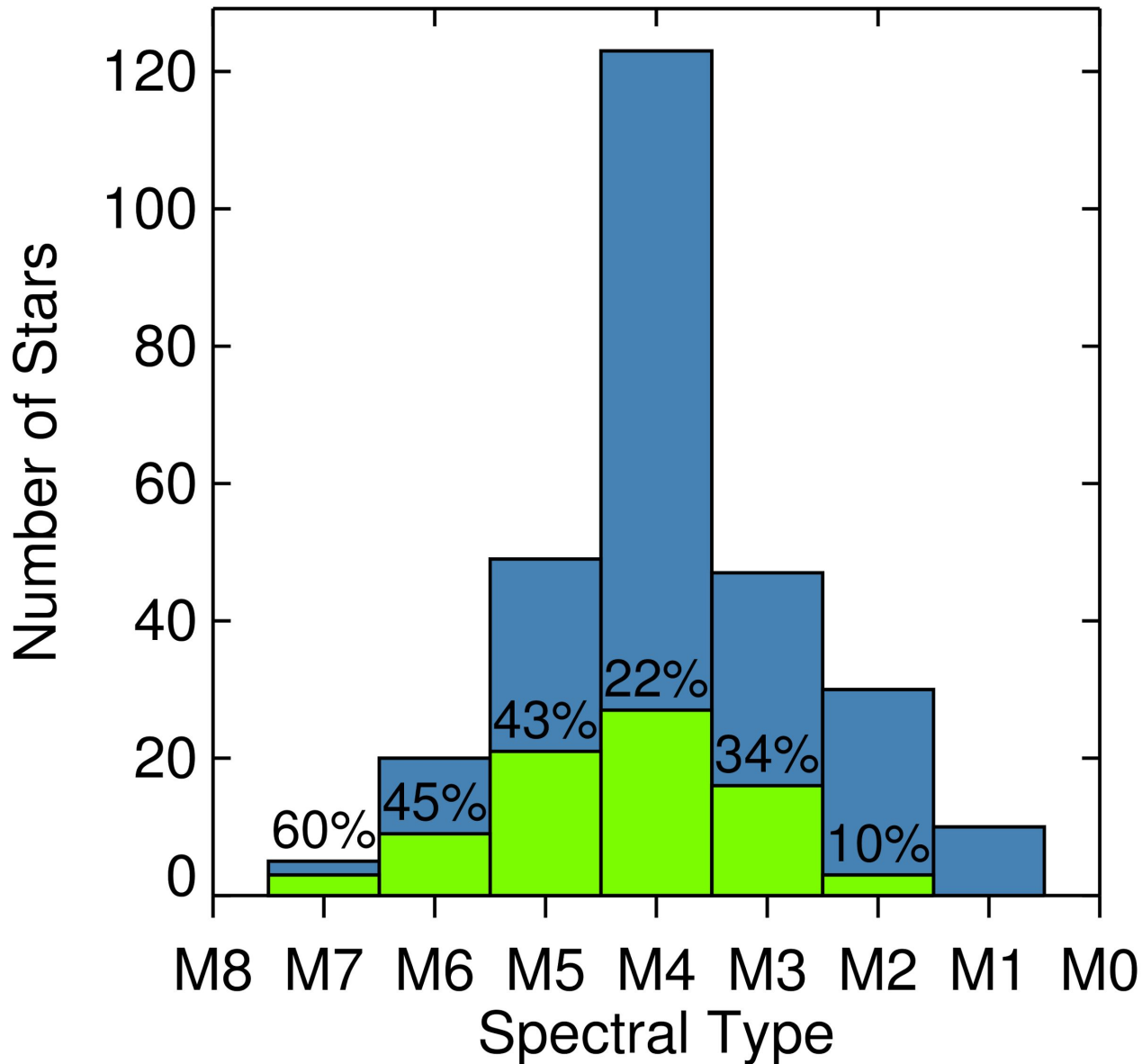
IRTF - 85 Spectra



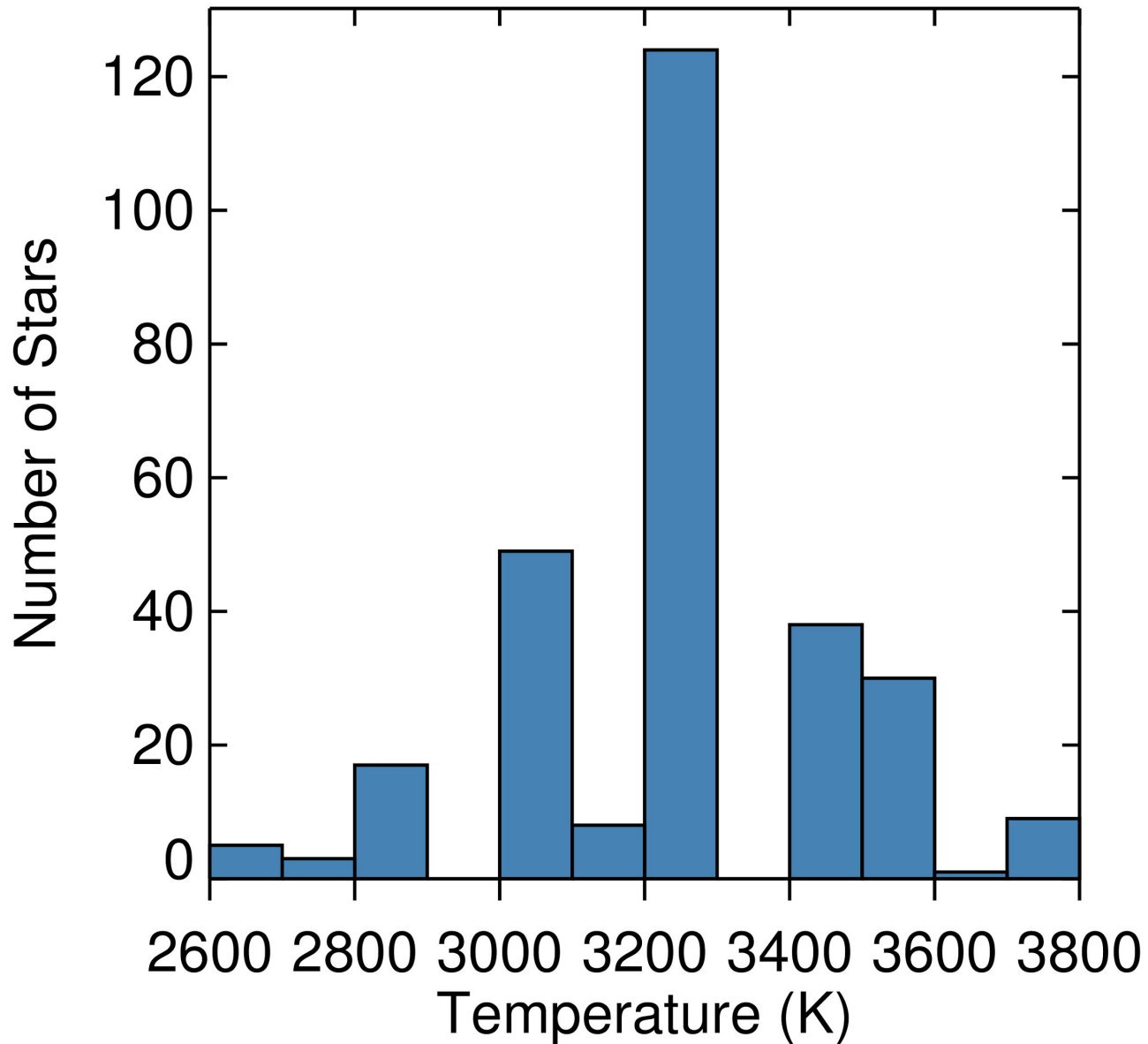
Spectral Type Distribution



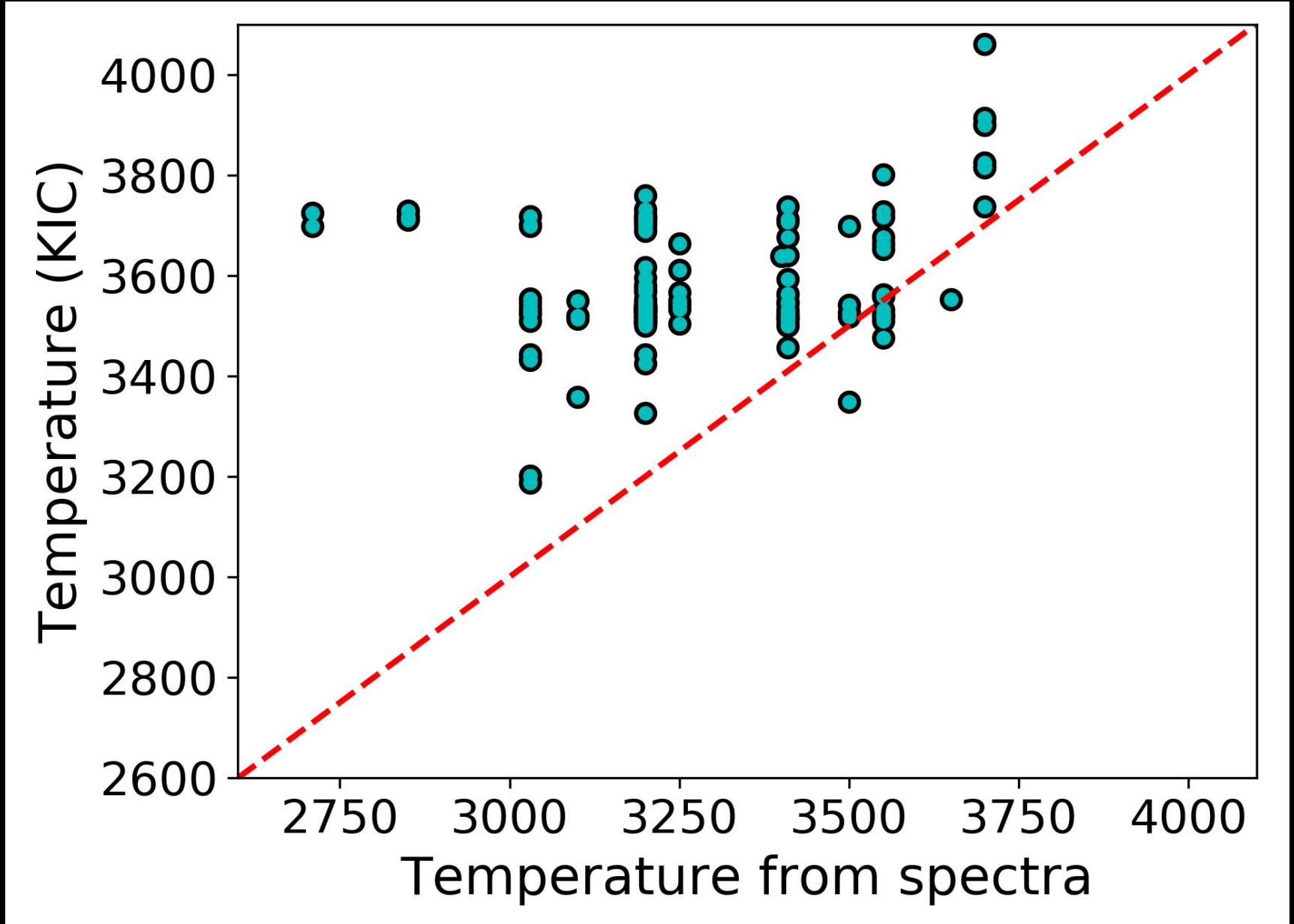
H α emission activity - 28%



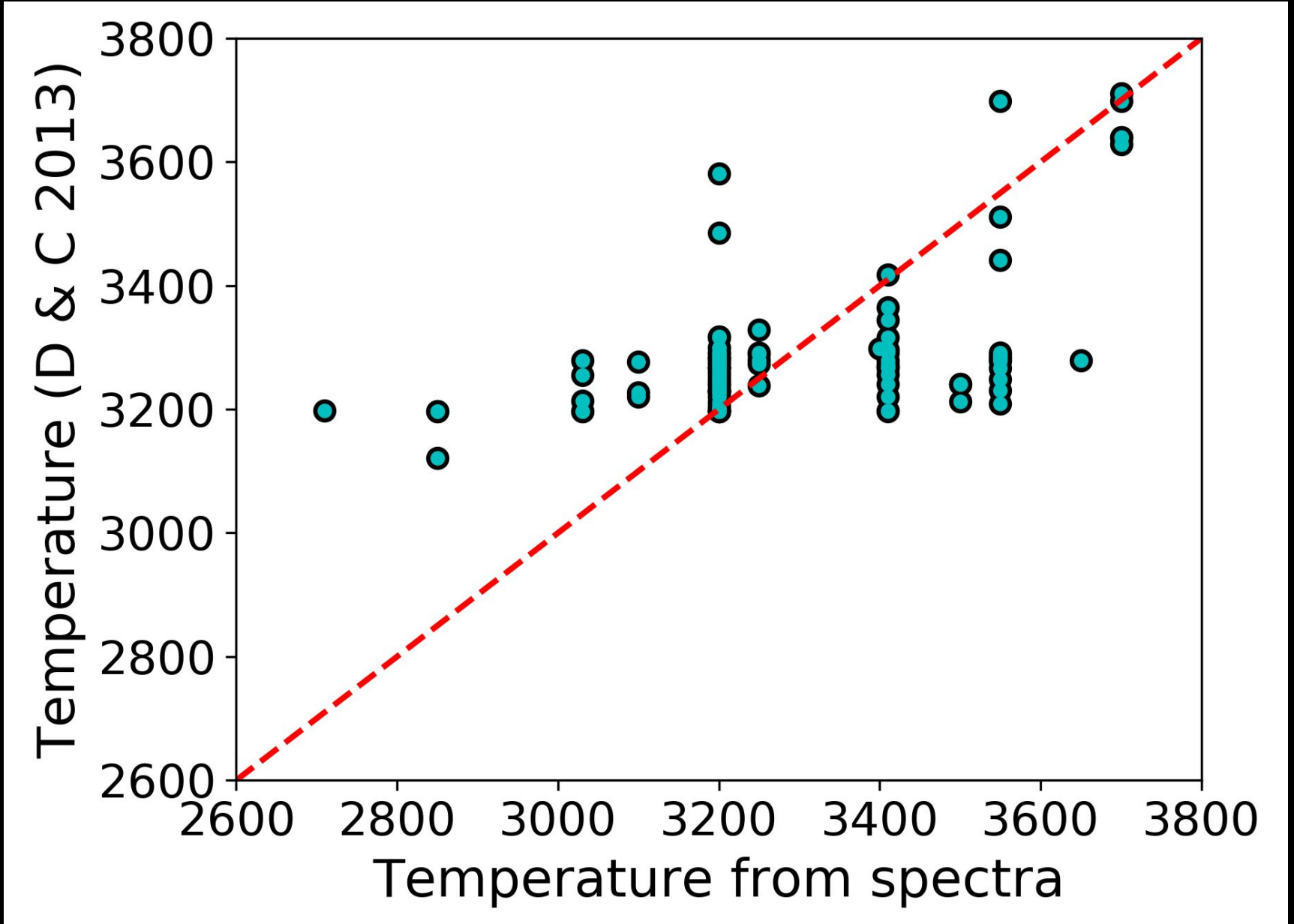
Temperature Distribution



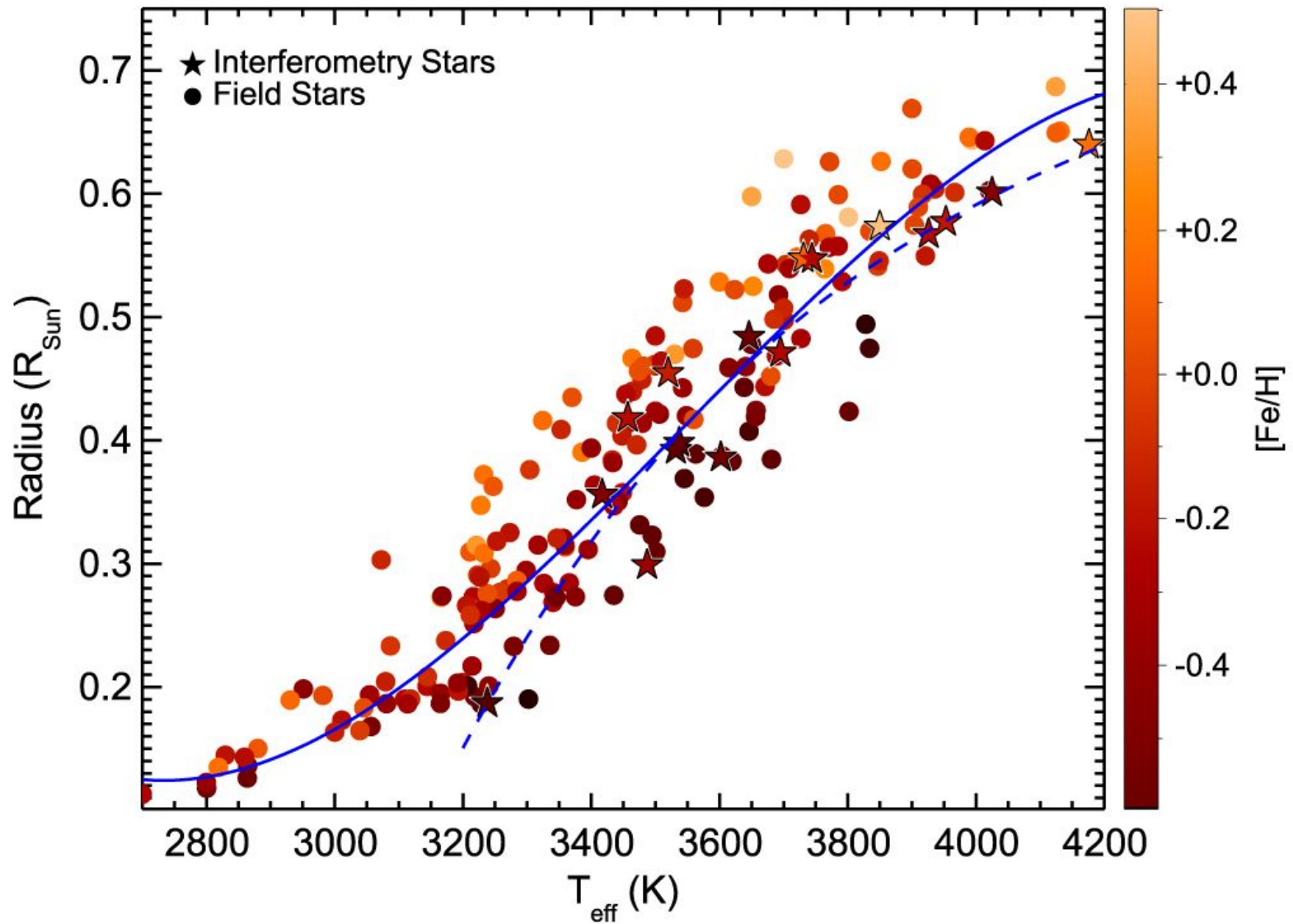
Very different from KIC temperatures



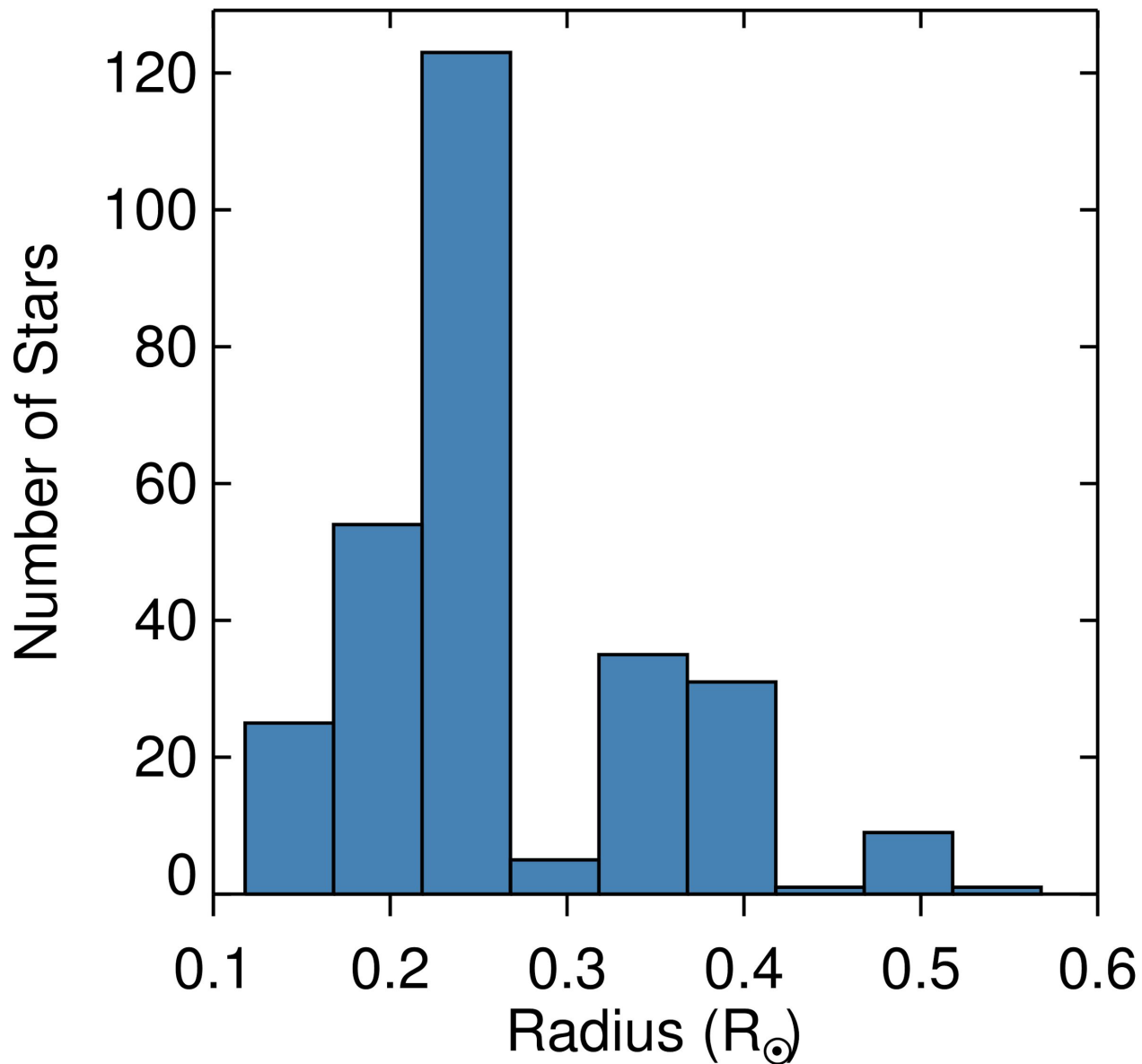
Also different from Dressing & Charbonneau (2013)



$T_{\text{eff}} - R_{\star}$ relationship (Mann+ 2015)



Radius Distribution



M3-M7 Planet Occurrence Rate

$2.18^{+0.47}_{-0.34}$

planets per

