The Ca II H&K Rotation-Activity Relation in 50 Mid-to-Late Type M-Dwarfs

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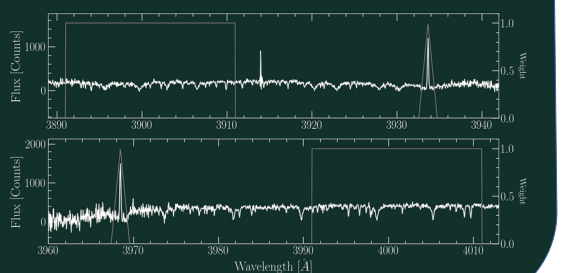
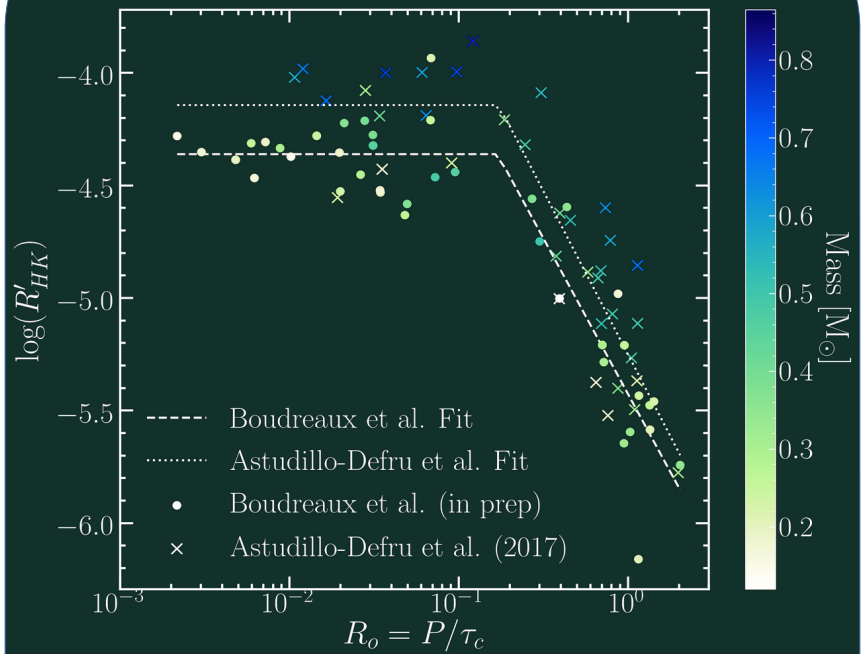
Mid-to-late M-dwarfs show more magnetic activity than classical magnetic dymano theory predicts [1]. This leads to the open question: what mechanism generates and maintains these fields in fully convective stars? These stars show a tight correlation between rotation rates and magnetic activity which suggests a rotationally-modulated dynamo similar to an $\alpha\Omega$ dynamo. We measure activity of 50 spectroscopically identified M-dwarfs selected from the MEarth survey. These stars span spectral classes from M5.0 to M3.5 and have photometric rotation periods ranging from hours to months.

Measurements

Our work is based on R~33000 spectra from the Magellan Inamori Kyocera Echelle (MIKE) spectrograph. S-indices are transformed to R'_{HK} values using a correction factor based on color [2]. Rotational periods are converted to Rossby numbers through the convective overturn time, also based on a color [3].

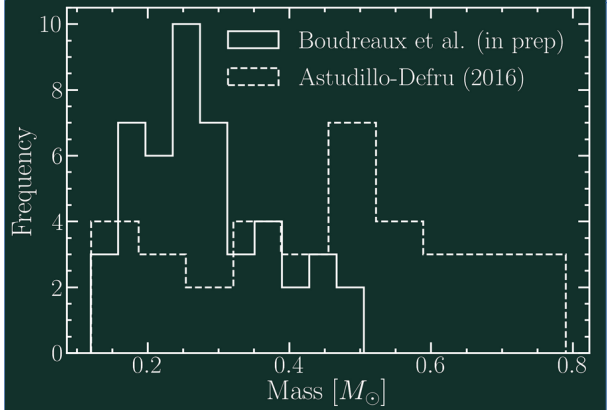


Results



Rotation-Activity Relation for our dataset along with measurements from Astudillo-Defru et al. (2017). A broken power law is fit, via *pymc3* [4], to both datasets. The overall R'_{HK} activity level has a mass dependence. However, the unsaturated regime slope and break-point between the saturated and unsaturated regimes are consistent within one sigma.

Mass Range



Our sample is dominated by mid-to-late M dwarfs. If we limit the sample from Astudillo-Defru et al. (2017) to the same mass range as our data set, the fitted rotation-activity relations are consistent to within one sigma.

References

[1] Chabrier, G., & Baraffe, I. 1997, A&A, 327, 1039
[2] Astudillo-Defru, N., Delfosse, X., Bonfils, X., et al. 2017, A&A, 600, A13
[3] Wright, N. J., Newton, E. R., Williams, P. K. G., Drake, J. J., & Yadav, R. K. 2018, MNRAS, 479, 2351
[4] Salvatier, J., Wiecki, T. V., & Fonnesbeck, C. 2016, PeerJComputer Science, 2, e55.