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Title: Measuring the Rotation Periods of Kepler Field Stars with a New Autocorrelation Method
Type: Contributed Talk
Session: Stellar Activity, Rotation, Ages, Metallicity
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The long-baseline, high precision light curves from the Kepler space mission are revolutionizing the study of stellar rotation. We have developed a new rotation period detection algorithm, based on the autocorrelation function (ACF) of the light curve. Because the ACF measures only the degree of self-similarity of the light curve at a given time lag, the period remains detectable even when the rotational modulation evolves significantly, and when systematic effects and long term trends are present.

Our initial study focused on the 2483 M-dwarfs observed by Kepler, where we detected rotation periods in 1570 (63%), ranging from 0.37-69.7 days (McQuillan, Aigrain & Mazeh, 2013, MNRAS). The rotation period distribution is clearly bimodal, with peaks at ~19 and ~33 days. These two peaks form two distinct sequences in period-temperature space, with the period decreasing with increasing temperature. The two sequences may be indicative of separate age distributions or a fast transition between the two.

We have now fully automated the ACF method and applied it to the complete sample of main sequence stars observed by Kepler, detecting ~25,000 rotation periods across a range of spectral types. The trend of increasing rotation period with increasing mass is clear throughout the range we probed, and the observations fall along a wide but distinct sequence, which is broadly compatible with the rotational isochrones of Barnes (2007), except below 0.6 M_sun, where our results depart markedly from those predicted.