Stellar Rotation of Kepler Exoplanet Host Stars
Scarcity of Short-Period Planets around Fast Rotators

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Using an algorithm based on the autocorrelation function (McQuillan, Aigrain & Mazeh 2013), we derived stellar rotational periods for 737 main-sequence exoplanet host stars. Comparing the stellar rotational period with the orbital period of the closest detected planet in each system, we have found that the spin-orbit distribution reveals a striking lack of close-in planets around fast rotators.

The Autocorrelation Function (ACF)
The ACF measures the degree of self-similarity of the observed light curve over a range of time lags. For rotational modulation, the repeated spot-crossing signature leads to ACF peaks at lags corresponding to the rotational period and its integer multiples. We adopt this technique of period detection over Fourier-based methods since the ACF has been shown to produce clear and robust results even when the amplitude and phase of the photometric modulation evolve significantly, and when systematic effects and long-term trends are present\(^1\). Kepler’s long-baseline, high-precision light curves are revolutionizing the study of stellar rotation, and the ACF is the ideal way to exploit these data.

Figure 1. Example of a light curve and its ACF - KOI-805. The orbital period is 10.32d and the transits are clearly visible. The detected rotational period (10.14d) is marked on the ACF with a dashed line and corresponding period intervals are marked on the light curve as red dashed lines. It can be clearly seen that the rotational period detected matches the repeating flux modulations.

References:

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