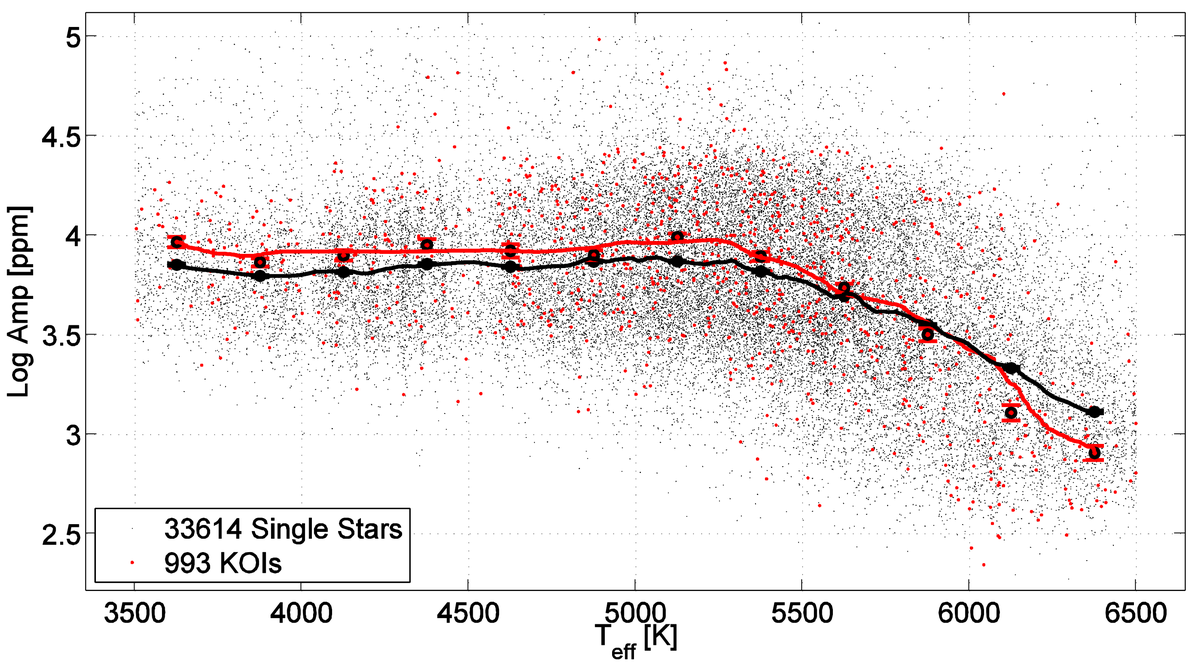
Photometric Amplitude Distribution of Stellar Rotation of *Kepler* KOIs

Indication for Spin-Orbit Alignment of Cool Stars

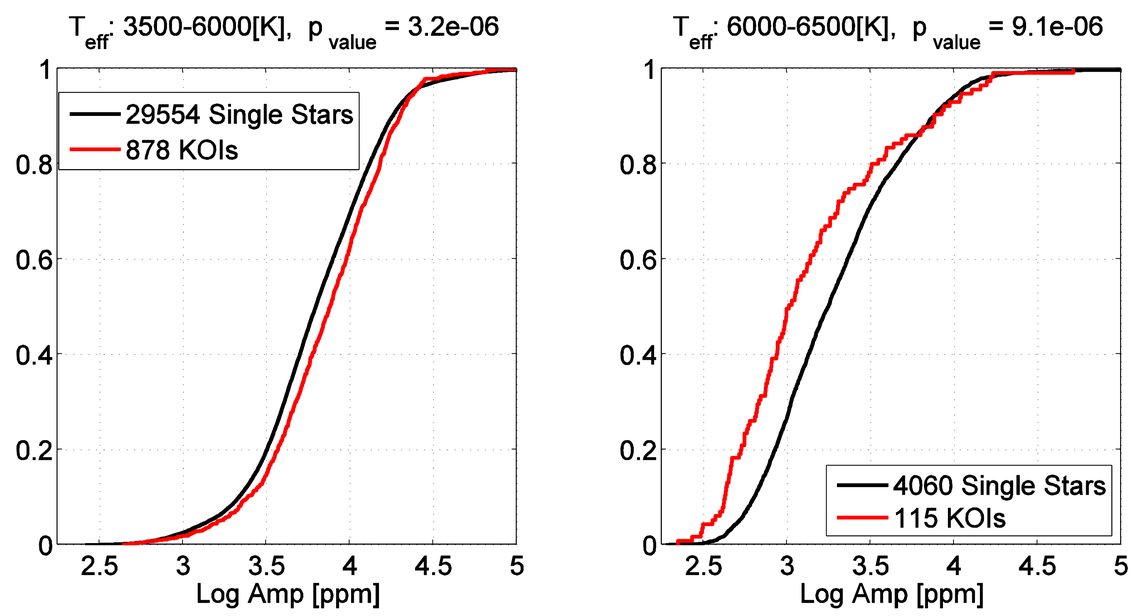
Tsevi Mazeh[1], Hagai Perets[2] and Amy McQuillan[1]

The observed amplitude of the rotational photometric modulation of a star with spots should depend on the inclination of its rotational axis relative to our line of sight. Therefore, the distribution of the observed rotation amplitudes of a large sample of stars depends on the distribution of their projected axes of rotation. Thus, comparison of the stellar rotational amplitudes of the Kepler KOIs with those of Kepler single stars *might* provide a measure to indirectly infer the properties of the spin-orbit inclination of Kepler KOIs.

We apply this technique to the large samples of KOIs and single stars in the temperature range of 3500-6500 K. The KOI sample includes small and large planets, single transiting planets and known multiple planetary systems and short and long orbital periods.



The derived amplitudes of the photometric stellar rotation for 33,614 (black) single stars and 993 (red) KOIs. Amplitudes are given by their log values in ppm. Each of the two samples are divided into 250 K temperature bins, and the median of each bin is plotted. Also plotted are the running medians of each sample.



Cumulative distributions of the photometric amplitudes of the single stars (black) and the KOIs (red) for cool (3500—6000 K; left) and hot 6000—6500 K; right) stars.
The p-value of the two-sided KS test for each range of temperatures is given above each panel.

Conclusions:

- **The amplitudes of cool KOIs are slightly, on the order of 10%, higher than those of the single stars,**
- **suggesting cool systems tend to be aligned with their planetary orbits**
- **(See Albrecht et al. 2012).**
- **In contrast, the amplitudes of hot KOIs are systematically lower by a factor of ~0.6 than those of the hot single stars.**
- **Because of the large samples, both findings are highly significant.**
- **Same features are found for small and large planets, and for short- and long-orbital planetary periods.**

[1]Tel Aviv University, Tel Aviv, Israel
[2]Technion, Haifa, Israel