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Stellar ultraviolet excesses in the Kepler field

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Abstract. We present a preliminary catalog of stars in the *Kepler* field that have a near ultraviolet (NUV) excess over the photospheric level, indicative of a significant stellar activity. NUV data come from the *GALEX* CAUSE *Kepler* catalog by Olmedo et al. (2015). The NUV excess level does not seem to correlate with the rotation period, but the percentage of stars with excess increases with increasing metallicity.

Key words. techniques: photometric – stars: activity – ultraviolet: stars

1. Introduction

In August-September 2012, the *GALEX* space telescope has fully mapped, in the near ultraviolet band (NUV; 1771–2831 Å), the *Kepler* field, where more than 3000 exoplanets have been discovered, as part of a program funded by Cornell University (P.I. James Lloyd). From these observations, we constructed the *GALEX* CAUSE *Kepler* photometric catalog (GCK; Olmedo et al. 2015) which includes 660,490 point sources, 475,000 of which have a counterpart in the *Kepler* Input Catalog (Brown et al. 2011). The GCK catalog also contains about 70% of the 200,000 stars with *Kepler* light curves in the *Kepler* Stellar (KS) database. The GCK catalog complements the wealth of data available for this stellar field obtained through multiple observational programs, both photometric and spectroscopic, at different wavelength ranges (e.g., 2MASS, SDSS, KIS, HST). The aim of this work is to derive UV excesses of KS stars included in the GCK catalog. The UV emission excess, above the photospheric value, is an indicator of stellar activity, which is mostly generated in the chromosphere and can strongly affect the circumstellar region and the atmosphere of nearby exoplanets.

2. NUV excess in the Kepler field stars

For each star in common in the KS and GCK catalogs, we computed the corresponding synthetic photospheric photometry, for the NUV, V, J and K bands, based on theoretical spectra obtained from model photospheres (Husser

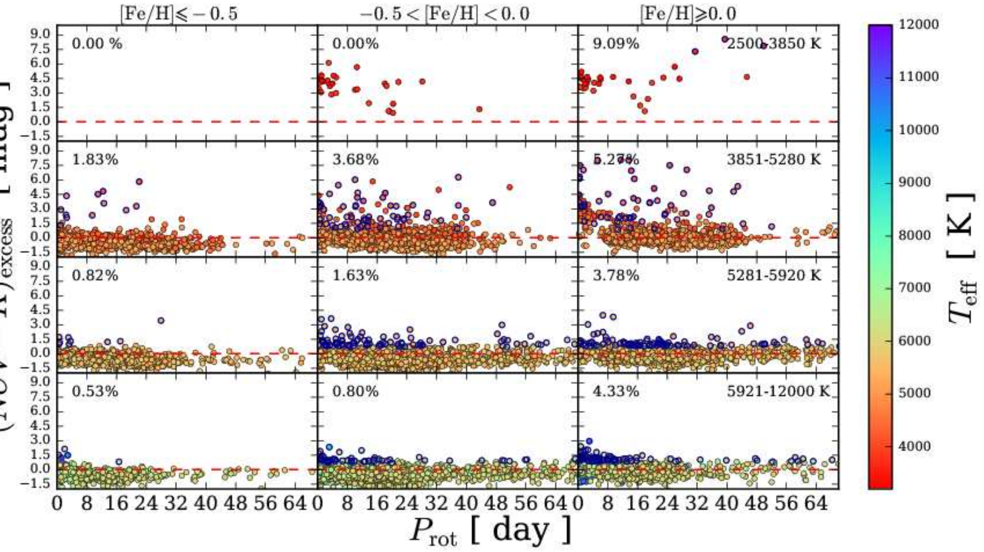

Fig. 1. (NUV-K)$_{\rm excess}$ vs. rotation period of a subsample of GCK–KS stars, in bins of $T_{\rm eff}$ (rows) and [Fe/H] (columns). The color of the dots indicates the $T_{\rm eff}$. Blue-countoured dots represent UVex stars; the percentage of UVex stars is indicated in each panel.

et al. 2013), assuming the effective temperature ($T_{\rm eff}$), surface gravity, and overall metallicity from Mathur et al. (2017).

We calculate the NUV excess as (NUV-K)$_{\rm excess}$=(NUV-K)$_{\rm obs}$–(NUV-K)$_{\rm phot}$. We then identified the most UV active stars (UVex) in the GCK–KS crossmatch catalog as those sources that deviate more than 3σ from the average (NUV-K) excess value, in bins of $T_{\rm eff}$. We found 2468 UVex stars. In Fig. 1, we plot the (NUV-K)$_{\rm excess}$ for a sub-sample of the GCK–KS objects with rotation periods ($P_{\rm rot}$) from McQuillan et al. (2014), Reinhold & Gizon (2015), and Mazeh et al. (2015), divided in bins of $T_{\rm eff}$ and [Fe/H]. We do not observe a clear dependence of the NUV excess values on $P_{\rm rot}$, even though the UVex stars tend to cluster at low values of $P_{\rm rot}$, especially for warmer stars. On the contrary, the percentage of UVex stars shows a positive correlation with metallicity in the whole $T_{\rm eff}$ interval. More details on this work will be provided by Olmedo et al. (in preparation).

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