

NEAR-ULTRAVIOLET VARIABILITY IN THE KEPLER FIELD

E. Bertone¹, M. Sachkov², D. Olmedo¹, M. Olmedo¹ and M. Chavez¹

Abstract. We present a large catalog of near-ultraviolet (NUV) light curves for almost 400,000 point sources in the *Kepler* field. It represents one of the largest database for studying NUV variability of a variety of point-like objects (such as pulsating stars, eclipsing binaries, or flare stars) down to a limiting magnitude of $\text{NUV} \simeq 21.5$. It also allows a complementary characterization of the variability for objects with observations at other wavelengths.

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1 The MGCK catalog

The Multi-visit *GALEX*-CAUSE *Kepler* (MGCK) catalog (Olmedo et al. 2020, in preparation) is a database of NUV (1771–2931 Å) light curves of point-like sources in the whole 104 deg² *Kepler* field (Borucki et al. 2010). It is based on the previous *GALEX*-CAUSE *Kepler* (GCK) collection of NUV fluxes (Olmedo et al. 2015) of the point sources detected in the observations by *GALEX* (Martin et al. 2005), within the Complete All-Sky Ultraviolet Survey Extension (CAUSE). The observational program, funded by Cornell University (P.I. James Lloyd), was conducted in August-September 2012 over a period of 46 days, during which *GALEX* scanned several times the *Kepler* field, allowing the construction of time series for a large part of the GCK sources. The MGCK catalog contains the light curves of 385,539 point sources and reaches a limiting magnitude of $\text{NUV} \simeq 21.5$ at 3σ , as depicted in Fig. 1. The best sampled light curves have 22 data points with signal-to-noise ratio $\text{SNR} > 3\sigma$; the average number of visits per object is 10, while the median is 11 (Fig. 1). Note that 61,687 sources have just one valid ($> 3\sigma$) detection, therefore no variability can be assessed for this sub-sample. Nevertheless, almost all objects with $\text{NUV} < 18$ mag generally have more than 10 points in their light curves, all of them detected with $\text{SNR} > 10$.

In Fig. 2, we present two examples of MGCK light curves for a faint object, the star KIC 7731201, and for a brighter source, KOI-671, known to be a rotationally variable star.

The MGCK database has 291,094 sources in common with the *Kepler* Input Catalog (KIC; Brown et al. 2011). As the time period of the *GALEX*-CAUSE observations overlapped with Quarter 14 of the *Kepler* program, the MGCK data can be compared with simultaneous optical data, allowing for multiwavelength analyses. As an example, Fig. 3 shows the simultaneous MGCK and *Kepler* light curves of the eclipsing binary V481 Lyr and of the flare star KIC 7459173. We note that the brightness changes in the NUV are far stronger than the variability shown in the visible interval.

The MGCK catalog will provide a powerful supplement to previous photometric surveys for the study of the space ultraviolet in the time domain (e.g., Gezari et al. 2013; Conti et al. 2014; Miles & Shkolnik 2017)). The complete database of the MGCK catalog will be publicly available at <http://www.inaoep.mx/~modelos/mgck>.

References

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¹ Instituto Nacional de Astrofísica, Óptica y Electrónica, Luis E. Erro 1, 72840 Tonantzintla, Puebla, Mexico

² Institute of Astronomy, Russian Academy of Sciences, Pyatnitskaya str. 48, 119017 Moscow, Russia

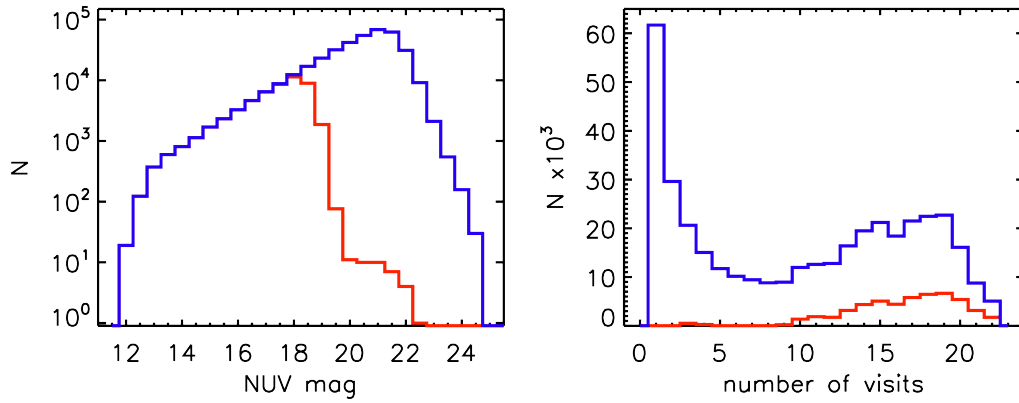


Fig. 1. **Left:** NUV magnitude (from the GCK catalog) distribution of the MGCK sources with at least one 3σ detection (blue line). The red line shows the distribution of sources that have all light curve points detected at $\text{SNR} > 10$. **Right:** Distribution of sources per number of visits. The color code is the same as in the left panel.

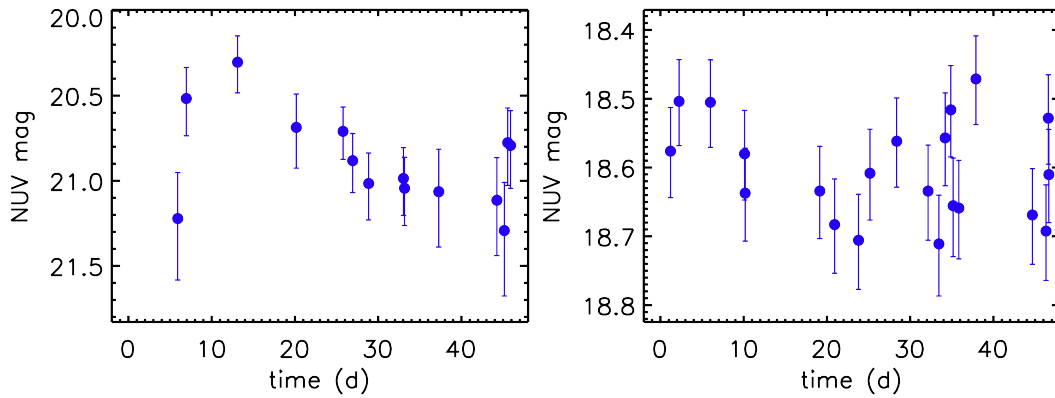


Fig. 2. **Left:** MGCK light curve of KIC 7731201. **Right:** MGCK light curve of KOI-671.

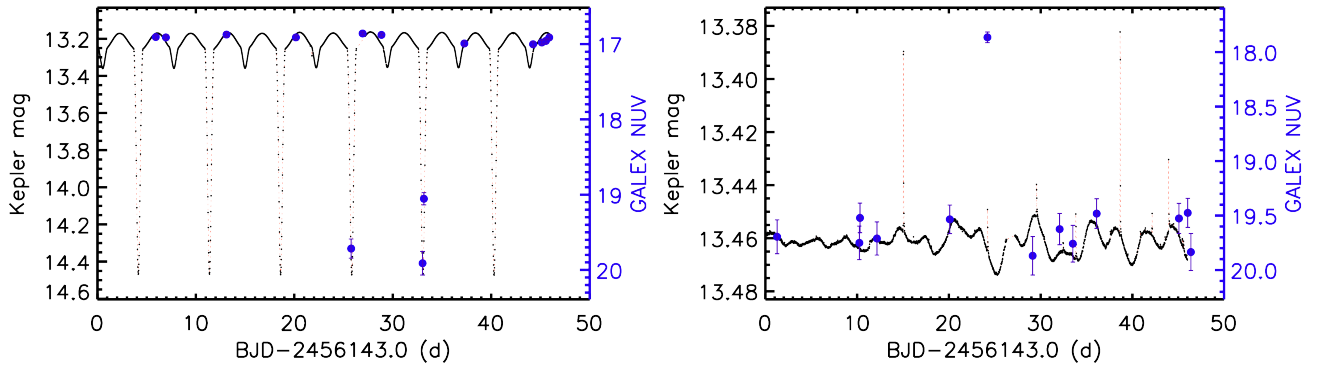


Fig. 3. **Left:** Simultaneous MGCK (blue points, right axis) and *Kepler* (black points, left axis) light curves of V481 Lyr. **Right:** Same as the left panel, but for KIC 7459173.