

THE WFCAM VARIABLE STAR CATALOG

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We present the catalog with 245 identified variable stars in the WFCAM database, which almost all were observed on the YZJHK photometric wavebands. We present also a set of new variability indices that are several times more efficient than previous ones. From this catalog we are studying different types of not well-known variable stars on the infrared bands.

Stellar variability in the near-infrared (NIR) remains largely unexplored. The exploitation of public science archives with data-mining methods offers a perspective for the time-domain exploration of the NIR sky. We perform a comprehensive search for stellar variability using the optical-NIR multi-band photometric data in the public Calibration Database of the WFCAM Science Archive (WSA; Hambly et al. 2008; Casali et al. 2007), with the aim of contributing to the general census of variable stars, and to extend the current scarce inventory of accurate NIR light curves for a number of variable star classes.

Standard data-mining methods are applied to extract and fine-tune time-series data from the WSA. We introduce new variability indices designed for multi-band data with correlated sampling, and apply them for pre-selecting variable star candidates, i.e., light curves that are dominated by correlated variations, from noise-dominated ones. Pre-selection criteria are established by robust numerical tests for evaluating the response of variability indices to colored noise characteristic to the data. We perform a period search using the string-length minimization method (SLM; Lafler & Kinman 1965; Stetson 1996) on an initial catalog of 6170 variable star candidates pre-selected by variability indices. Further frequency analysis is performed on positive candidates using four additional methods in combination, in order to cope with aliasing.

We find 245 periodic variable stars (CAT01) and additional 386 objects with suspected variability (CAT02) with uncertain periods or apparently aperiodic variation.

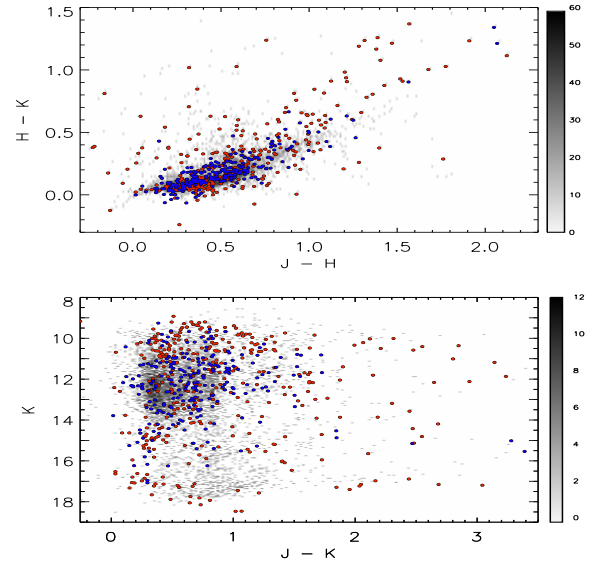


Fig. 1. The color-color (bottom panel) and the color-magnitude (up panel) diagram to sample analyzed. The sources selected by cutoff surface (in grey), the CAT01 sources (blue circles), the CAT02 sources (red circles).

Only 49 of these objects had been previously known, including 11 RR Lyrae stars in the outskirts of the globular cluster M3 (Cacciari et al. 2005). Using the multi-band light curves of these stars, we provide a preliminary classification of the new variable stars with well-measured light curves, but the variability types of a large amount of objects remain ambiguous. Most of the classified variables are contact binary stars, but we also find several pulsating stars, RR Lyrae stars and Cepheids. We also identify 19 red variable objects ($Z-K > 1.3$), among which 12 are located in the direction of known star-forming regions, suggesting that these are embedded objects, probably pulsating pre-main sequence stars.

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