COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 6144

Konkoly Observatory
Budapest
10 June 2015

HU ISSN 0374 – 0676

SEARCH FOR VARIABLES IN THE OPEN CLUSTER KING 12

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Open clusters are physically related groups of stars held together by mutual gravitational attraction. Therefore, these populate a limited region of space, typically much smaller than their distance from the Sun, so that the members are all approximately at the same distance. They are believed to originate from large cosmic gas and dust clouds, and to continue to orbit the Milky Way through the disk. Also, as all the stars in a cluster are formed from the same diffuse nebula, they are all of similar initial chemical composition. In many clouds visible as bright diffuse nebulae, star formation still takes place, so that we can observe the birth of new young star clusters (Massi et al. 2015).

Variable stars play an important role in stellar astrophysics. They offer, in general, the only possibility to look inside stars (asteroseismology), and they represent an important way to measure distances (Zejda et al. 2012).

We searched for variables in the central region of the young open cluster King 12 (C 2350+616) which, to our knowledge, was never done, up to now. This cluster is located in the Galactic disk ($l = 116\overset{\circ}{.}121$ and $b = -0\overset{\circ}{.}151$) at a distance of about 2.9 kpc from the Sun (Lata et al. 2014). The most interesting fact is that it still contains pre-main sequence stars at an age of approximately 12 Myr (Davidge 2012).

The observations were performed in August and September 2010 at the Hvar Observatory, University of Zagreb, using the 1 m Austrian-Croatian Telescope (ACT). The telescope was equipped with a Apogee Alta U47 CCD camera of 1024×1024 pixels, resulting in a field-of-view of about $3'$ square. The integration times for the observations in the Bessell I filter system were set either to 20 or 45 s, depending on the weather conditions. In total, 674 frames of about 500 minutes of photometry in six nights were secured. After the basic CCD reductions (bias-subtraction and flat fielding), we applied point spread function (PSF) photometry within IRAF. The further reduction steps were performed using the standard technique for time series CCD observations. The complete observation log is listed in Table 1.

All differential light curves were examined in more detail using the Phase Dispersion Minimization method (PDM, Stellingwerf 1978) within the software Peranso[1]. An analysis with a discrete Fourier algorithm gave the same noise level over the searched frequency range as PDM.

[1] http://www.peranso.com/

Table 1: Observation log.

JD(start) 2455400+	JD(end) 2455400+	N	JD(start) 2455400+	JD(end) 2455400+	N
20.464288	20.620203	266	60.381684	60.405388	33
21.554554	21.620735	115	63.424560	63.447975	82
26.545666	26.611418	118	67.348276	67.363623	60

Primarily, we were searching for variations on times scales of a few hours (typical δ Scuti type pulsation) but also for very high amplitude variations on the time scales of weeks and months. For the latter, we would not be able to retrieve the exact periods put to sort out good candidates. In total, we investigated 54 stars in the central part of King 12.

Figure 1 shows the upper limits of non-variability for the investigated stars. The dependency of them on the apparent magnitude is caused by the photon noise. The detection limits is about 8 mmag for the brightest stars and decreases to about 0.04 mag for the faintest ones. We found no star which shows a statistically significant peak in its frequency spectrum in the range from 12 h down to 20 min. Of course, we are not able to exclude variability on other time scales and/or with lower amplitudes than reported here.

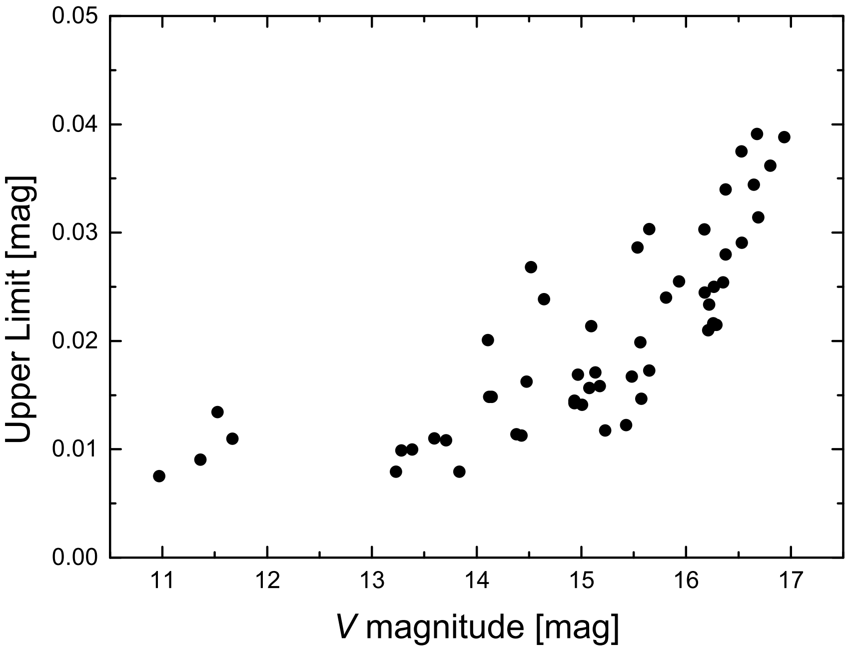

Figure 1. Upper limits of variability of stars in the field of King 12.

Acknowledgements: This project is financed by the SoMoPro II programme (3SGA5916). The research leading to these results has acquired a financial grant from the People Programme (Marie Curie action) of the Seventh Framework Programme of EU according to the REA Grant Agreement No. 291782. The research is further co-financed by the South-Moravian Region. It was also supported by the grants 7AMB14AT015, 14-26115P, and the financial contributions of the Austrian Agency for International Co-operation in Education and Research (BG-03/2013 and CZ-09/2014). HB acknowledges financial support by Croatian Science Foundation under the project 6212 "Solar and Stellar Variability". This research has made use of the WEBDA database, operated at the Department of Theoretical Physics and Astrophysics of the Masaryk University.

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