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Long term light curve variations of the *Kepler* Cepheid V 1154 Cyg

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Abstract. We present a period analysis of the light curve and its Fourier parameters of the bright Cepheid V1154 Cyg (P=4.925454 days) based on the observations by the *Kepler* space telescope. Fourier parameters R_{21}, R_{31} clearly indicate variations with a period of 158.2 ± 1 days (more than 5σ peak in the power spectrum) with a very small amplitude (0.265-0.275 for R_{21}, 0.065-0.071 for R_{31}) making impossible to detect it with ground-based observations. Finally we discuss that this effect is similar to the Blazhko effect in RR Lyrae stars.

1 Introduction

The Blazhko effect (the periodic modulation of the pulsation period and amplitude) is a quite common although still enigmatical phenomenon among RR Lyrae stars. It is much less common among other radial pulsators, however. Despite the fact that we know many double-mode Cepheids with amplitude and phase modulations [1], there is only one Galactic Cepheid (V473 Lyrae) with confirmed periodic amplitude and phase variations similar to the Blazhko effect observed in RR Lyrae stars [2].

In the field of view of *Kepler* space mission there is only one genuine Cepheid variable - V1154 Cyg (KIC 7548061, HIP 97439, 2MASS J19481545+4307367), which has been observed in long-cadence mode in all quarters and short-cadence mode in Q1, Q5, Q6, Q13-Q17. V1154 Cyg has a mean V brightness of ~ 9.14 mag and period of 4.925454 days.

Previous observational studies of this Cepheid are listed and discussed by Szabó et al. [3] and Derekas et al. [4].

2 Fourier parameters

The normal and folded light curves don't show the strong periodic variability of the pulsation but the visual inspection already suggests that the light curve broadens in the light diagram. We didn't know exactly if this variabilty is periodic or aperiodic we performed the Fourier transformation for detailed analysis.

In comparison with [4] we had almost 3 times longer observation series (63132 individual observations). In order to decrease the random errors of observations we used the moving average of 6 pulsation periods for each quarter.

We studied the change of the light curve shape by examining the temporal variation of the Fourier parameters of the light curve. For this, we fitted the primary frequency and its harmonics with the eight-order Fourier polynomial:

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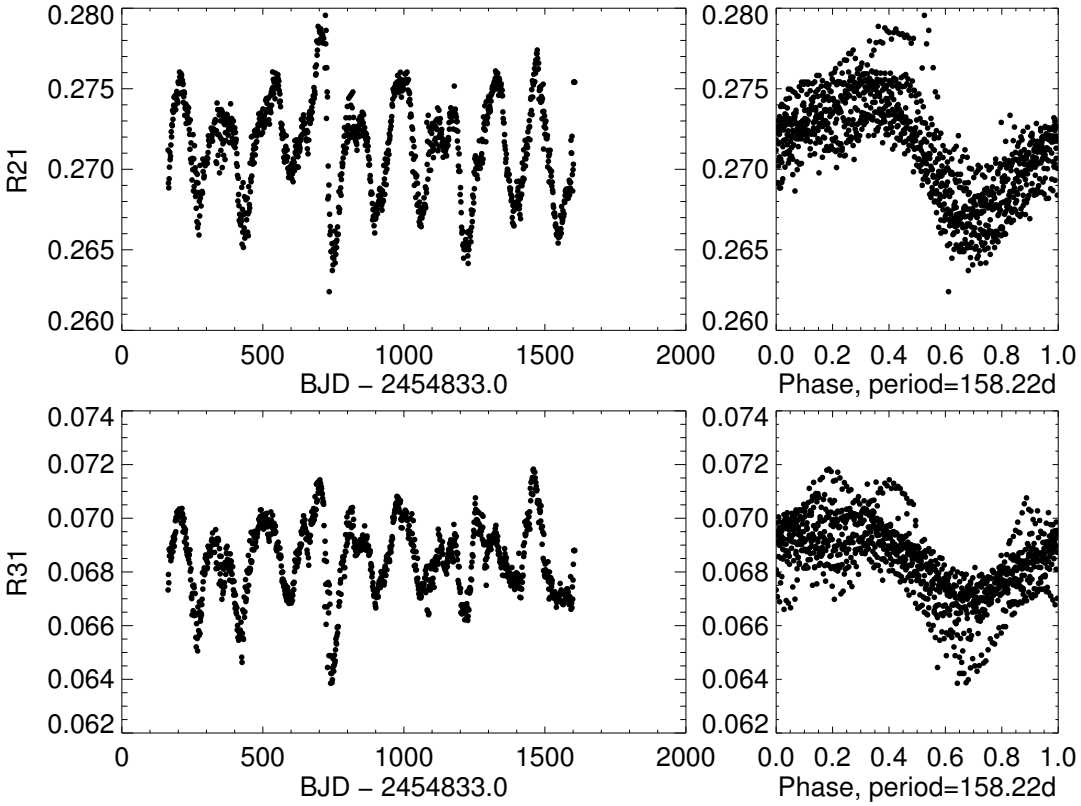

Fig. 1. Modulations for $R_{21} = A_2/A_1$ and $R_{31} = A_3/A_1$ parameters in time series graphs (left) and a phase diagram (right; the found frequency = $0.00632032 c/d^{-1}$) for V1154 Cyg.

$$m = A_0 + \sum_{i=1}^{8} A_i \cdot sin(2\pi f t + \phi_i), \tag{1}$$

where m is the magnitude, A - amplitude, f - frequency, t - time of the observation and ϕ is the phase, index i runs from 1 to 8. We characterised the light curve shapes with the Fourier parameters [5]. Particular results for $R_{21} = A_2/A_1$ and $R_{31} = A_3/A_1$ are presented in fig1.

3 Conclusions

We analyzed data for V1154 Cyg Cepheid covering 9 amplitude modulations cycles with a period is 158.2 days, obtained by the *Kepler* space observatory. Our results indicate that the amplitude modulations of the Fourier parameters R_{21} and R_{31} of V1154 Cyg light curve are very similar (but less in amplitudes) to the phenomenon of the Blazhko-effect in RR Lyrae stars.

References

1. Moskalik & Kolaczowski, MNRAS **394**, (2009) 1649
2. Molnár et al., AN **334**, (2013) 980
3. Szabó et al., MNRAS **413**, (2011a) 2709
4. Derekas et al., MNRAS **425**, (2012) 1312
5. Simon N.R. & Teays T.J., ApJ **261**, (1982) 586