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A NEW W UMA-TYPE VARIABLE STAR NEAR R CMa

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TYC 5965-2398-1 (GSC 05965-02398) was discovered as a short period variable star during photometric observations of Algol-type eclipsing binary stars R CMa. It is situated about 4 arcmin from R CMa inside the field of view of the CCD camera. No information about the variability of this star has been found via ADS. The star has $V=10.48$, $B - V=0.31$ according to SIMBAD (Tycho-2) data base, the 2MASS catalogue gives $J=9.758$, $H=9.615$, $K=9.551$ magnitudes in the infrared bands.

The observations were performed in the B filter for five nights in December 2012 with an Apogee U9000 CCD camera attached to the 0.5 m telescope of the Thai National Observatory of the National Astronomical Research Institute of the Thailand (NARIT). We used HD 56971 and HD 56994 as comparison stars.

The standard procedures for the CCD data reduction and the aperture photometry have been applied to the images. Resulting instrumental magnitude differences ΔB (TYC 5965-2398-1–HD 56994) are shown in Figure 1. A well-defined short-period light curve with double minima is evident. The periodogram analysis was undertaken using the package PerSea written by G. Maciejewski, which is based on the optimal period search method of Schwarzenberg-Czerny (1996). The resulting periodogram is shown in Figure 2. The dominant peak is at frequency 3.3003 c/d. Another possible peak is located at twice the dominant frequency, at about 6.6006 c/d. The values of two possible periods were improved and the phased light curves are shown in Figures 3 and 4 respectively.

The phased light curve with a period of 0.15178 ± 0.00002 days ($f=6.58843 \pm 0.0018$ c/d) may manifest Delta Scuti type variability with a mean amplitude of 0.036 mag and epoch of maximum of light curve on 2456280.7371.

The double wave phased curve better corresponds to W UMa type binary star variability with a period of 0.30349 ± 0.0006 days ($f=3.2950 \pm 0.007$ c/d), epoch of minimum 2456281.25290 and primary minimum depth of 0.044 mag. The low amplitude of this eclipsing binary can be caused by low inclination or high third light which is common for W UMa stars.

The $B - V=0.31$ index of TYC 5965-2398-1 indicates about F0-F1 spectral class, thus we cannot rule out completely the Delta Scuti interpretation based on the spectral class alone. On the other hand, the shape of the phase curve for the half (0.15-day) period has a slow ascending branch and a rapid descending one. Such a shape does not correspond

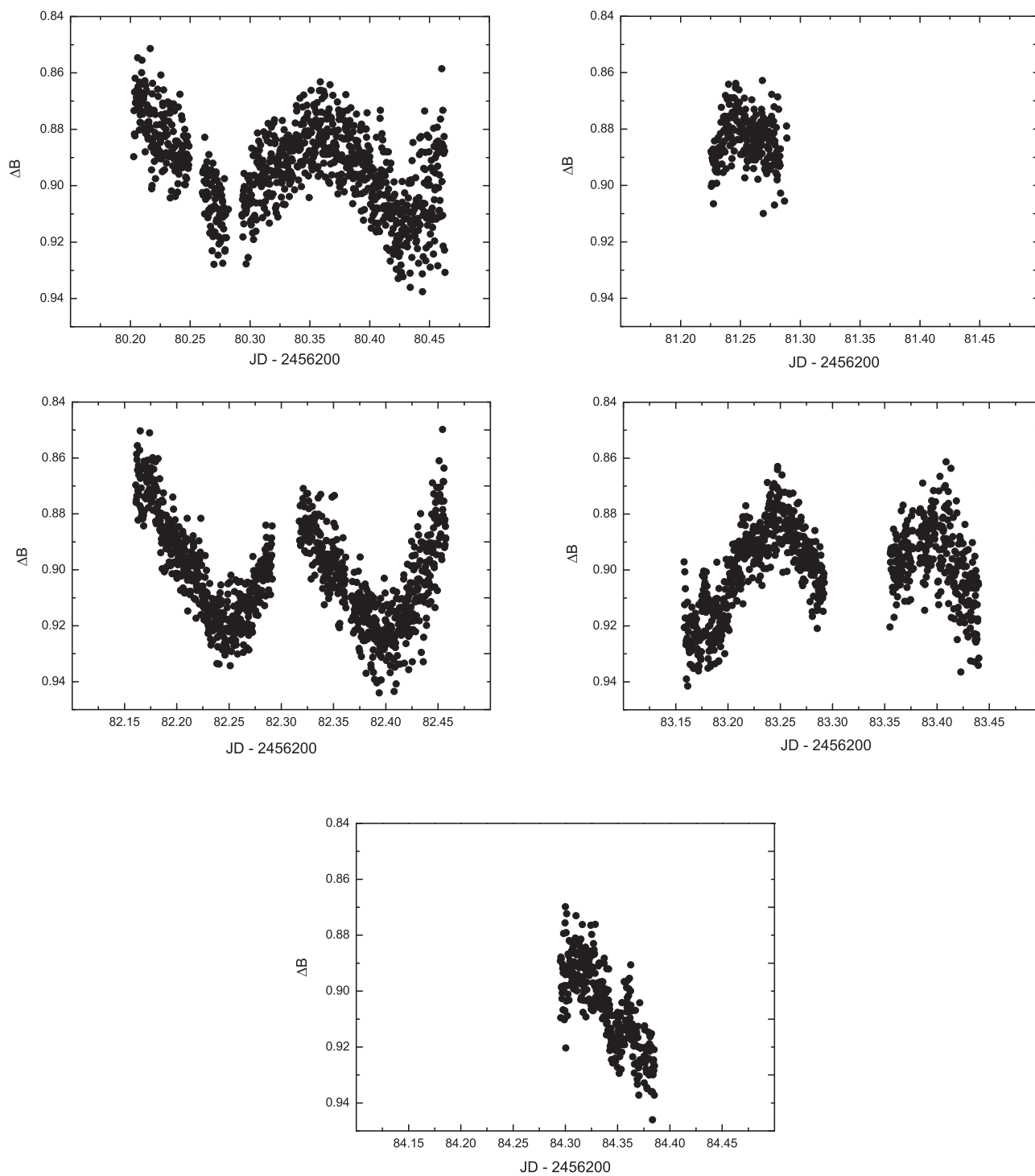


Figure 1. B-filter differential magnitudes (TYC 5965-2398-1–HD 56994).

to light curves of high amplitude Delta Scuti type stars that show a rapid ascending and a slow descending branch. Thus, the curve for 0.15 day is artificial.

The observations obtained at JD 2456280 and 2456282 clearly show two distinct minima, and two distinct maxima. These minima-maxima show the same depth. This is a characteristics of a W UMa-variable rather than a Delta Scuti type pulsators. We believe that the double-minima light curve better represents the found variability and corresponds to the binary nature of early F spectral-class components. We conclude that TYC 5965-2398-1 belongs to the class of short-period W UMa-type stars.

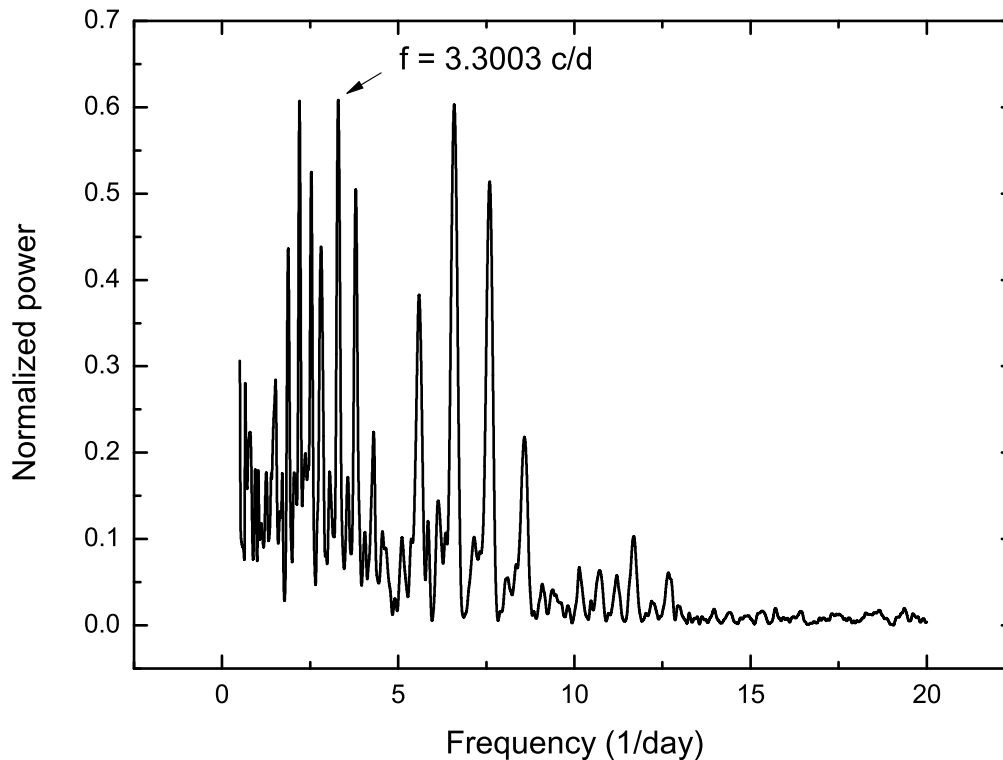


Figure 2. The periodogram of instrumental magnitudes (TYC 5965-2398-1–HD 56994). The dominant peak at 3.3003 c/d is marked by an arrow.

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Reference:

Schwarzenberg-Czerny, A. 1996, *ApJ*, **460**, L107

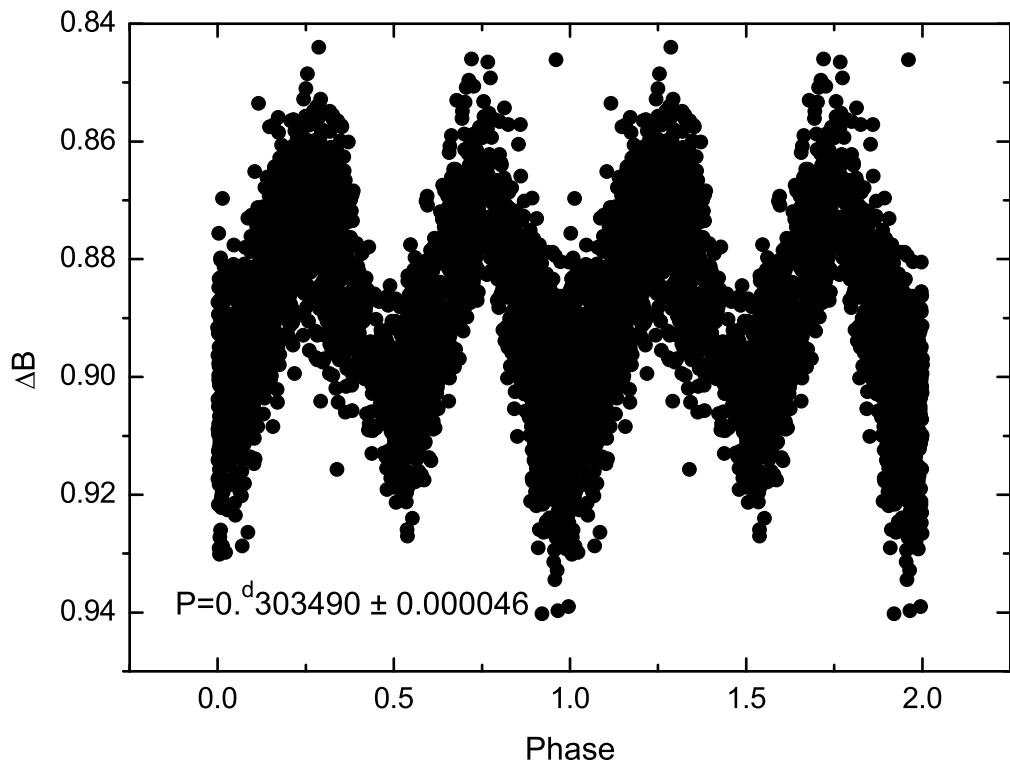


Figure 3. Light curve phased with the 0.303490 day period.

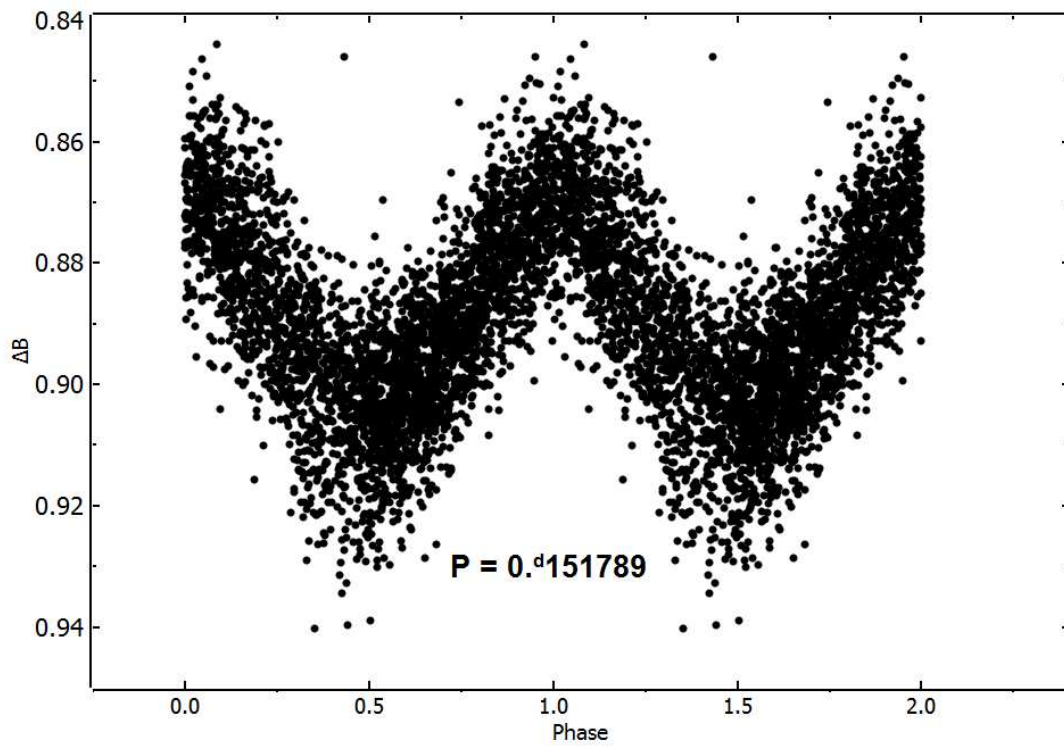


Figure 4. Light curve phased with the 0.151789 day period.