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A New Variable Star in Perseus: *GSC 3692-00624*

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Abstract: Discovery of a new variable star in Perseus is presented. It was discovered during observations of variable star V753 Per. Observations were carried out using *BVR* filters at the Ege University Observatory. *B*, *V* and *R* light curves of GSC 3692-00624, a β Lyrae type variable star, are presented.

1 Introduction

A new variable star was discovered during observations of Algol type eclipsing binary star V753 Per. GSC 3692-00624 appeared as a variable star during these observations. Characteristics of the new variable star are given in Table 1. Magnitudes of the variable, comparison and check stars are given in Table 2. Magnitudes of the stars are based on The Naval Observatory Merged Astrometric Dataset *(NOMAD)* Catalog and The Fourth U.S. Naval Observatory CCD Astrograph Catalog (UCAC4) in the third and the fourth columns, respectively. Comparison and check stars were chosen according to the NOMAD1 catalog.

Table 1: Program stars for GSC 3692-00624 (Zacharias et al. 2005).

Star	ID	*RA* (2000) [h m s]	*DEC* (2000) [° ′ ″]
Var	TYC 03692-00624-1 = GSC 3692-00624 = NOMAD1 1477-0085266	01:56:01.64	+57:44:49.1
Comp	TYC 03692-00862-1 = GSC 3692-00862 = NOMAD1 1477-0085213	01:55:57.06	+57:46:54.5
Check	TYC 03692-00817-1 = GSC 3692-00817 = NOMAD1 1477-0085130	01:55:50.25	+57:47:23.9

Table 2: Magnitudes of comparison and check stars (Zacharias et al. 2005, 2012).

Star	ID	NOMAD1			UCAC4	
		B [mag]	*V* [mag]	*R* [mag]	*B* [mag]	*V* [mag]
Var	GSC 3692-00624	12.424	11.855	11.480	12.815	12.315
Comp	GSC 3692-00862	12.496	11.825	11.380	12.864	12.194
Check	GSC 3692-00817	11.678	11.307	11.060	11.713	11.393

2 Observations and Data Analysis

GSC 3692-00624 appeared as a variable star during the CCD observations of V753 Per obtained from beginning 2007 to beginning 2009 with the ROTSE-IIId (Robotic Optical Transient Search Experiment-IIId) telescope which was located at the TÜBİTAK National

Observatory (TUG) site, Antalya, Turkey. These observations were carried out with the 45 cm robotic telescope operated without filters. A code of Schwarzenberg-Czerny (1989, 1996) was used in order to find the period of variable star. The period of variable star was determined as $P=0^d.5512\pm0.0005$ using the first observational point as an initial epoch.

Multi-colour observations of GSC 3692-00624 were done with the Meade 16 inch LX200GPS Schmidt-Cassegrain telescope of the Ege University Observatory site, Izmir, Turkey. Observations have been carried out with a Charge Coupled Device (CCD), Alta Apogee U42, which is attached to the telescope using the Bessel *B*, *V*, and *R* filters. CCD array size is 2048x2048 pixels and the field of view is 17 arc minutes. The Aladin sky atlas was used to make an observing chart (Bonnarel et al. 2000). The identification of the new variable star is shown in Figure 1.

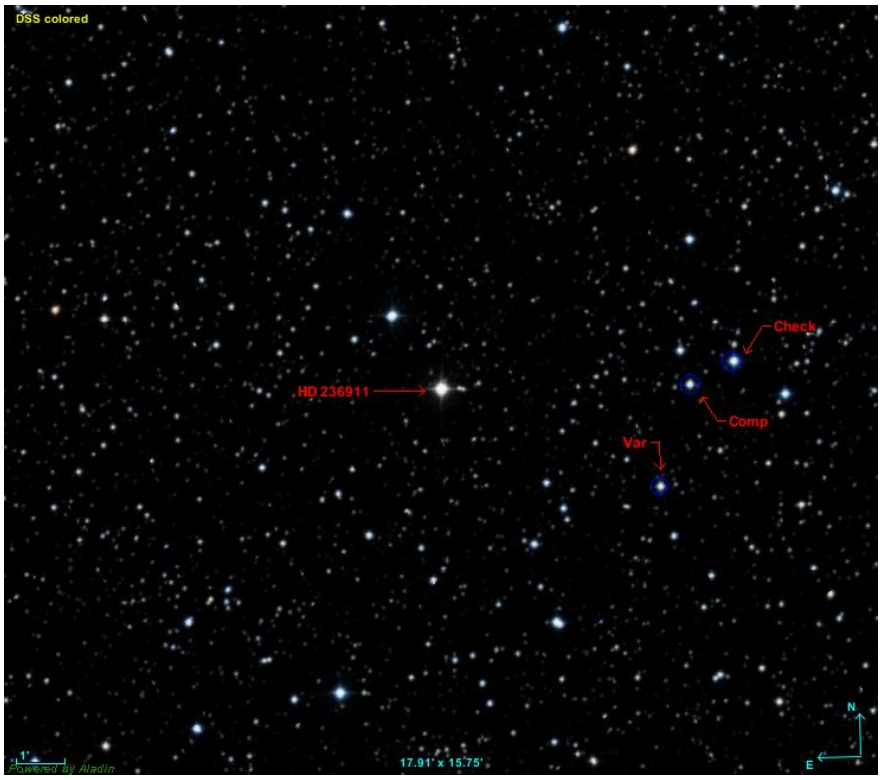

Figure 1: The identification of program stars.

Reduction of observations were made with IRAF (Image Reduction and Analysis Facilities) packages (Massey & Davis 1992). Magnitude measurements of the stars were carried out with the digiphot-apphot packages in the IRAF. All observation points were transformed to the Heliocentric Julian Dates (HJD). Stars which do not show any light changes were chosen as the comparison and check stars.

GSC 3692-00624 was classified as a β Lyrae type eclipsing binary star. It was observed at 4th November, 5th November and 6th November in 2010. AVE software (Barberá 1996) has been used for minima timings determination. AVE software uses the Kwee-van Woerden method to get minima timings (Kwee & van Woerden 1956). The eclipse timings obtained from observations are given by

$$\begin{aligned} &\text{Min I}\,(\text{HJD}) = 2455505.5303 \pm 0.0003 \\ &\text{Min I}\,(\text{HJD}) = 2455506.6349 \pm 0.0005 \\ &\text{Min II}\,(\text{HJD}) = 2455506.3590 \pm 0.0023 \\ &\text{Min II}\,(\text{HJD}) = 2455507.4639 \pm 0.0004 \end{aligned} \qquad (1)$$

The O-C values were calculated using the actual primary minimum time (T_0 (HJD) = 2455505.5303) and period $0^d.5512$. O-C graphic is shown in Figure 2. Using a least-squares method, new light elements of GSC 3692-00624 are given by

$$T_{minI}\,(\text{HJD}) = 2455505.5263(18) + 0^d.552371(1) \times E \qquad (2)$$

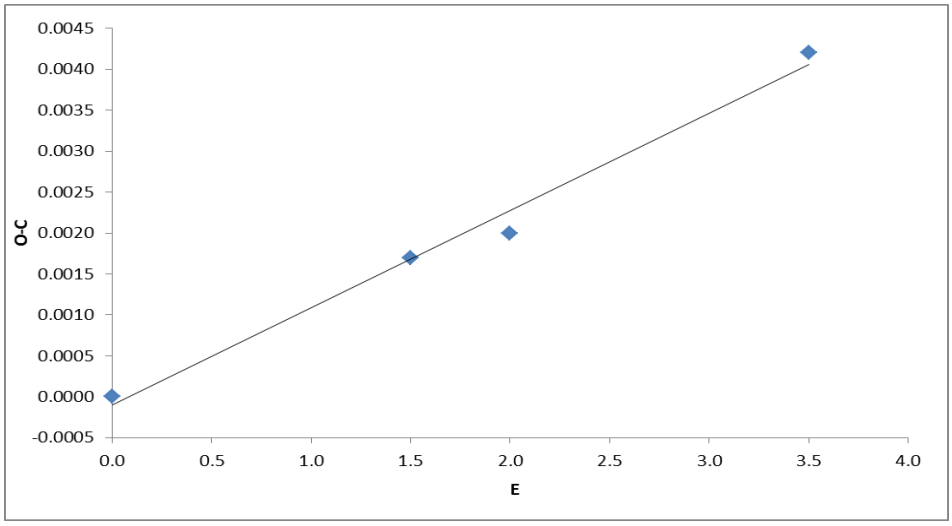

Figure 2: O-C diagram of GSC 3692-00624.

The new light elements in Equation (2) were used in order to construct the phase diagrams. The *B*, *V*, and *R* light curves of variable star are given in Figure 3, Figure 4 and Figure 5, respectively. Observational files of GSC 3692-00624 are given in the Appendix 1.

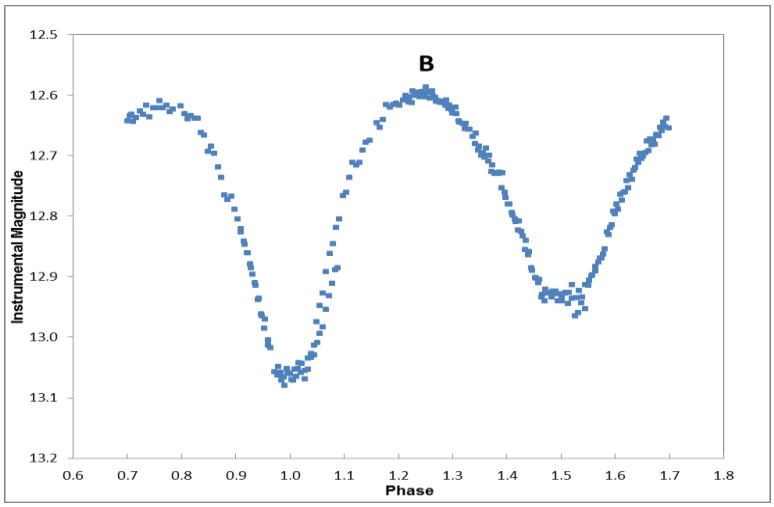

Figure 3: The phase diagram in Filter *B*.

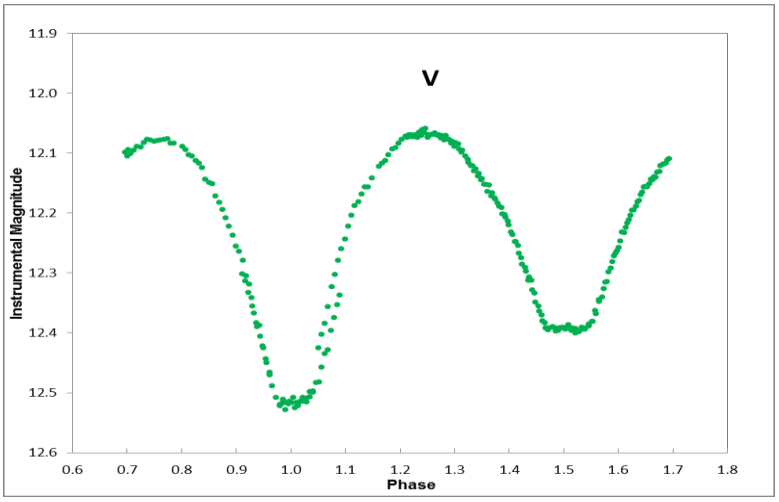

Figure 4: The phase diagram in Filter *V*.

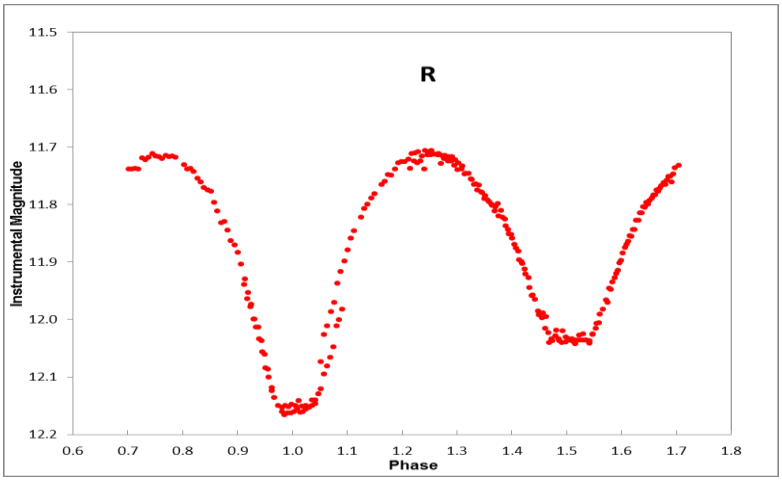

Figure 5: The phase diagram in Filter *R*.

The secondary minima are shown in Figure 6 and Figure 7. Using this two minima, the duration of the flat part of the secondary minimum is determined as 58±3 minutes.

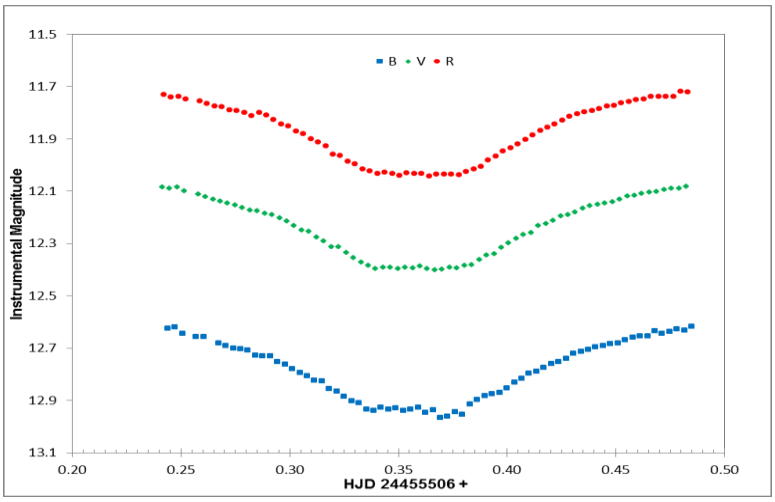

Figure 6: The secondary minimum at HJD 24455506.

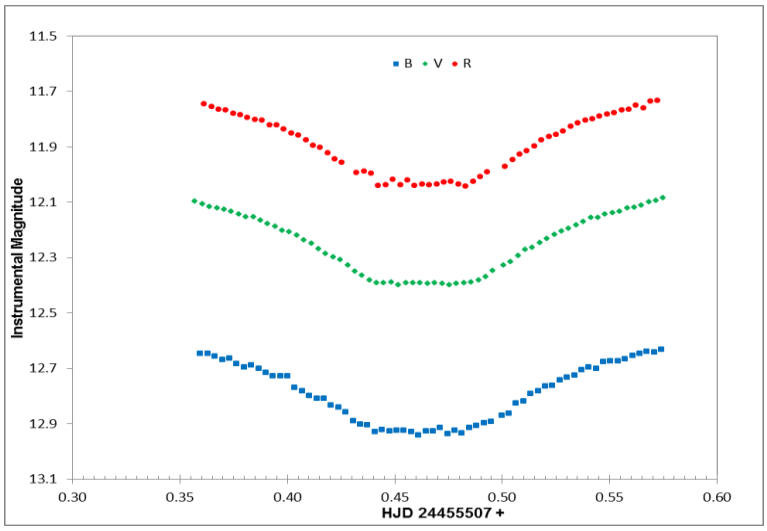

Figure 7: The secondary minimum at HJD 24455507.

3 Summary

A new variable star was discovered in Perseus during V753 Per observations. GSC 3692-00624 was classified as a β Lyrae type variable star, the new light elements are given by Equation (2). Unfortunately, our limited observations did not allow accurate determination of the orbital period, which is apparent from Figures 3 - 5 on the ascending branch around phase 1.1. The duration of the flat part of the secondary minimum is determined as 58±3 minutes.

According to the colour indice of variable star, the spectral type should be F8 or F9 type (Takeda et al. 2005).

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