

The Discovery of a New EA-Type Variable, TIC 160164029

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Abstract This paper presents the discovery of an EA variable star, TIC 160164029, previously unknown in VSX, Simbad, and VizieR. The variability was discovered using the software `LCSIGNALFINDER` and `LCVIEWER` for the analysis of TESS photometry products (PDC_SAP curve). The data were mathematically analyzed using `VSTAR`.

1. Introduction

Algol-type eclipsing variables (EA) are binaries with spherical or slightly ellipsoidal components. It is possible to specify the moments or beginning and end of the eclipses. Between eclipses the light remains almost constant or varies insignificantly because of reflection effects, slight ellipsoidality of the components, or physical variations (Samus *et al.* 2017).

Amateur astronomers analyzing online available time series photometry occasionally discover EA variables. This paper reports such a discovery.

2. Methodology

The flux time series photometry data were downloaded from MAST (Space Tel. Sci. Inst. 2020) and analyzed for periodicity using `LcSignalFinder` (Schmitt *et al.* 2019) using the settings presented in Figure 1.

After discovering a periodically variable signal coming from the star TIC 160164029 suggesting an eclipsing binary of EA type, we checked Simbad, VizieR, and VSX (Watson *et al.*

2014) to see if it was a known variable star, but confirmed that it was not. Although `LCSIGNALFINDER` presented a period, the available data from Zwicky Transient Facility (Masci *et al.* 2019) and TESS (Ricker *et al.* 2014) were used to determine the period of this variable star using DCDFT (Ferraz-Mello 1981) algorithm, available in `VSTAR` (Benn 2013). For the analysis of the range, the TESS data were shifted to ZTF g-band zero point. Also, the ZTF r-band observations were shifted to ZTF g-band zero point.

To calculate the range, a polynomial fit was applied to the maxima and minima to help identify the extrema and calculate the errors of measurement. The mean magnitude was taken as a baseline, and from that was extracted the arithmetic median of five random points around the extrema.

3. Results

Using this technique we obtained the results shown in Table 1. Figures 2 and 3 are the phase plot of TIC 160164029 and the power spectrum of the DCDFT, respectively.

4. Discussion

The purpose of this paper is to report an example of an EA variable which has been not recognized previously. The basis of this statement is that position searches (i. e., R. A. and Dec.) in SIMBAD, and position searches in the *General Catalogue of Variable Stars* (Samus *et al.* 2017) and through the SAO/NASA ADS Astronomy Query Form (http://adsabs.harvard.edu/abstract_service.html) failed to find any reference to the target star TIC 160164029.

The fact that the star shows variability with the presented period suggests that the variability is of EA type. The power spectrum of the DCDFT transform shows half of the real period. The period resulting from here had to be multiplied by 2.

Table 1. Table showing the variable star data results for TIC 160164029.

Period (d)	Min. Mag. (g)	Max. Mag. (g)	Prime Eclipse Time (JD)
0.83955 ± 0.000006	14.434 ± 0.004	13.808 ± 0.015	2459003.728

Figure 1. Representative image showing the settings used for the detection of the periodic variable signals in TESS data.

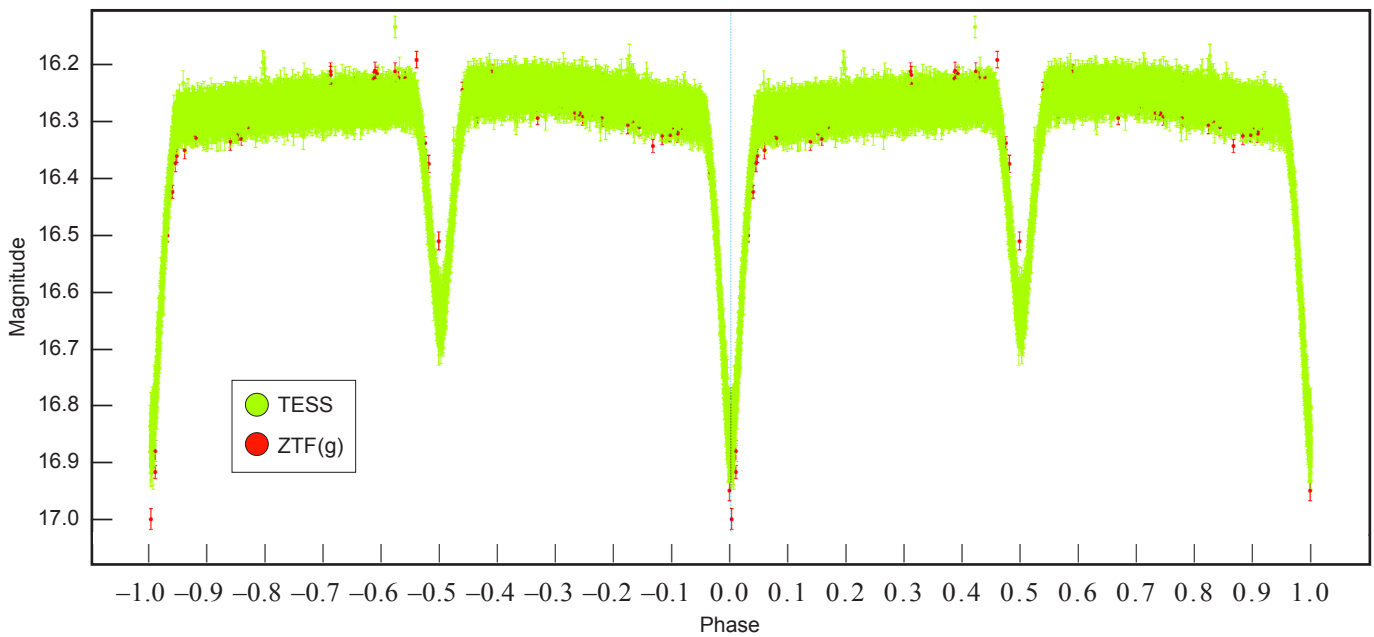


Figure 2. Phase plot in two cycles of TIC 160164029 using TESS and ZTF data. Period: 0.83955. Epoc: 2459003.728.

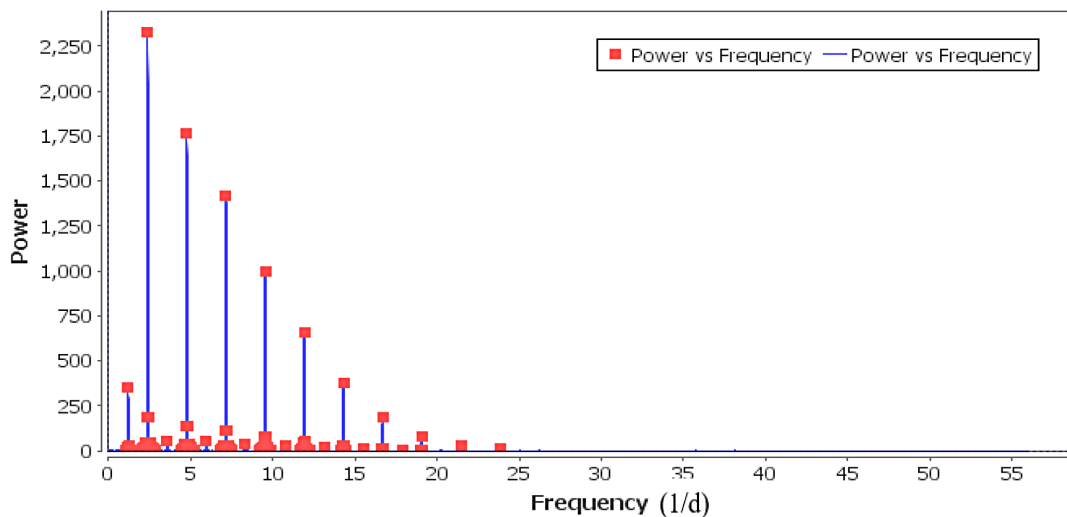


Figure 3. The power spectrum of the DCDFT transform from vSTAR. The biggest frequency is accompanied by aliases.

5. Conclusion

The star TIC 160164029 is proposed as a new EA candidate with a period of 0.83955 d. The discovery was made analyzing the TESS database in sectors 25 and 26.

6. Acknowledgements

This research used the SIMBAD database and the AAVSO International Variable Star Index (VSX) variable star type designations.

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