BAV Journal

2020 No. 43 ISSN 2366-6706

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.

http://bav-astro.de

The period of the new eclipsing binary Fr258 = GSC 02695-03684 Cyg

Moschner, Wolfgang
Lennestadt, Germany
email: wolfgang.moschner@t-online.de

Frank, Peter
Velden, Germany
email: frank.velden@t-online.de

Bernhard, Klaus
Linz, Austria
email: Klaus1967Bernhard@gmx.at

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.

October 2020

Abstract: *The authors present a phased light curve and a period solution of GSC 02695-03684 Cyg. GSC 02695-03684 Cyg was discovered by Peter Frank in 2016. The variable is not listed in the ASAS-SN catalogue and the period solution from the ATLAS catalogue is wrong.*

Introduction

GSC 02695-03684 Cyg was discovered as a photometric variable by Peter Frank in 2016 and classified as eclipsing binary. The amplitude was given as 0.60 mag, 14.15-14.75 mag (V). The variable is not listed in the VSX [5] and the ASAS-SN catalogue of variable stars [2].

During this study, we discovered several period solutions for this star in an extensive datasheet prepared by the ATLAS project [4]. None of these periods is similar to ours. We have at our disposal 32 time series with approx. 5200 images that were taken between 2010 and 2020. The observation time per night was between 2 and 7 hours.

Since the minima derived from our data cannot be represented by the ATLAS periods at all, we have used our data to present a correct period solution.

Periods known so far:

Simbad	no information
ASAS-SN	no information
ATLAS	0.497598 d
VSX	no information

Observations

400mm ASA Astrograph f/3.7
f = 1471 mm
FLI Proline 16803 CCD-Camera
V-filter
t = 120 sec.
Wolfgang Moschner, Astrocamp/Nerpio, Spain

102mm f/5.0 TeleVue Refractor
f = 509 mm
SIGMA 1603 CCD-Camera, Kodak KAF1603ME
IR & UV cut-off filter
t = 90 sec.
Peter Frank, Velden, Germany

Data analysis

Muniwin [1] and self-written programs by Franz Agerer and Lienhard Pagel [6] were used for the analysis of the frames, after bias, dark and flatfield correction of the exposures. The weighted average of five comparison stars was used.

Explanations:

HJD = heliocentric UTC timings (JD) of the observed minima
mag = (raw instrumental) magnitude

G-band mean magnitude	= 350-1000 nm
Integrated BP mean magnitude	= 330- 680 nm
Integrated RP mean magnitude	= 640-1000 nm

Explanations to the light curve:
The colors of the symbols denote different nights.

All coordinates are taken from the Gaia DR2 catalogue [3].

The coordinates (epoch J2000) are computed by VizieR, and are not part of the original data from Gaia (note that the computed coordinates are computed from the positions and the proper motions).

GSC 02695-03684 Cyg

Cross-ID
= Fr258 Cyg
= Gaia DR2 1869337000380134528
= ATOID J311.8274+34.2612

Right ascension: 20h 47m 18.6024s at epoch and equinox J2000
Declination: +34° 15' 40.721" at epoch and equinox J2000
Barycentric right ascension (ICRS) at Epoch=2015.5: 311.82747467744° +/- 0.01 mas
Barycentric declination (ICRS) at Epoch=2015.5: +34.26123770104° +/- 0.02 mas

Gaia DR2 Catalog:
13.9688 mag G-band mean magnitude
14.4163 mag Integrated BP mean magnitude
13.3558 mag Integrated RP mean magnitude
1.0605 mag BP-RP colour (photBpMeanMag-photRMeanMag)

Results

With our observations obtained with the 400 mm ASA astrograph in Nerpio we have created a phased light curve. The presented elements were calculated by the method of least squares, taking into account all our minima (see table below).

Our ephemeris represents the first correct period solution for this star.

A Min II with an amplitude of 0.10 mag could be found. In the phased light curve (Fig. 1) of Fr258 Cyg, the secondary eclipse occurs at phase (approximately) 0.52.

GSC 02695-03684 Cyg new elements

Amplitude: Min I: 0.60 mag (instr.) Min II: 0.10 mag (instr.)
Type: EA type eclipsing binary

Min I = HJD (UTC) 2457962.5687 + 0.6990779*E
+-0.0011 +-0.0000014

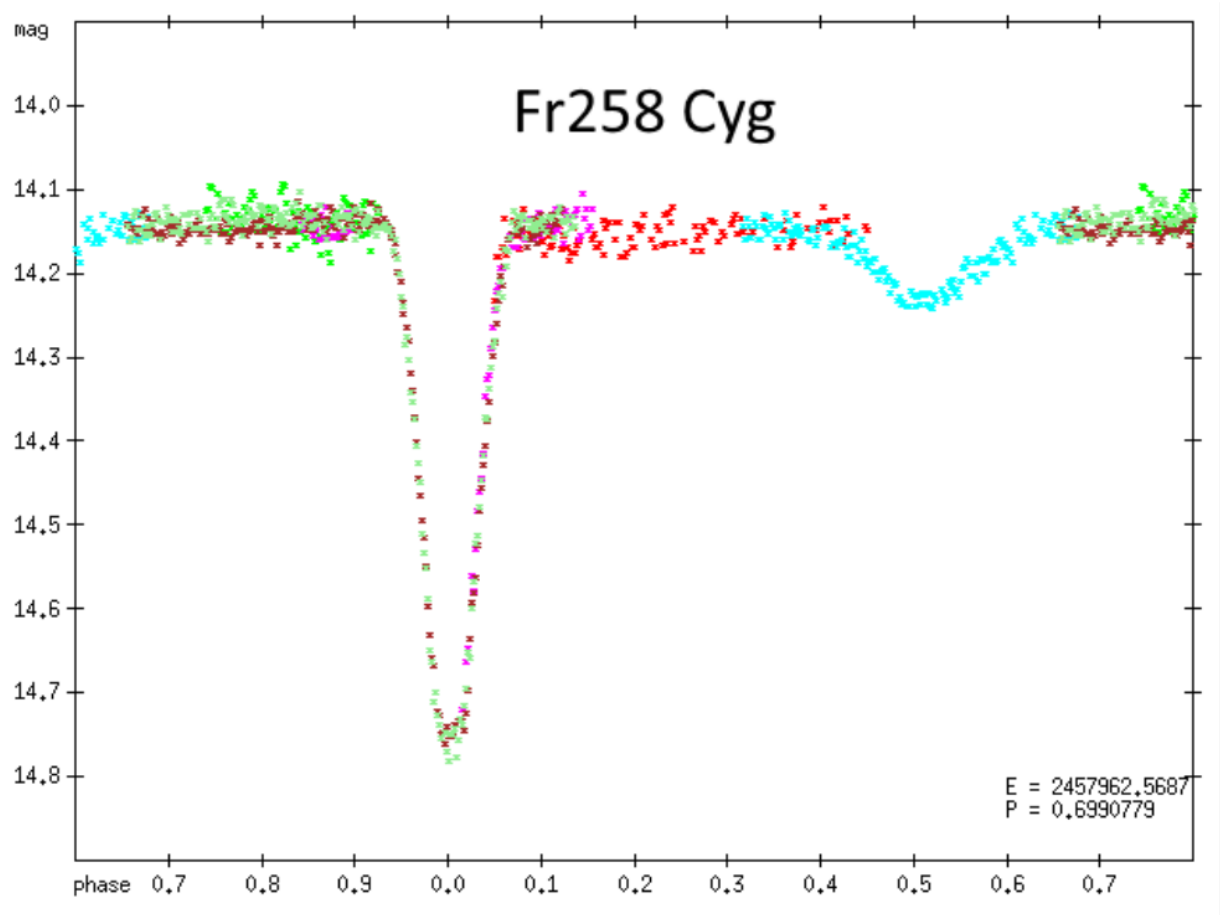

Figure 1: Phased light curve of GSC 02695-03684 Cyg using the ephemeris given by the authors. The vertical axis shows raw instrumental magnitudes. Different colors denote different observing nights. Only the data points from the better nights were used to display the light curve. An FLI Proline 16803 camera + a V-filter (2017-2020) was used. Presented elements were calculated by taking into account all minima (see table below) with the method of least squares.

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)
P. Frank	2457658,4699	I	-435	0,0001
P. Frank	2457684,3359	I	-398	0,0002
Moschner/Frank	2457693,4227	I	-385	-0,0010
P. Frank	2457733,2712	I	-328	0,0000
Moschner/Frank	2457946,4898	I	-23	-0,0001
Moschner/Frank	2457962,5695	I	0	0,0008
Moschner/Frank	2457965,3636	I	4	-0,0014
Moschner/Frank	2457976,5491	I	20	-0,0012
W. Moschner	2458002,4175	I	57	0,0014
W. Moschner	2458321,5445	II	513,5	-0,0007
W. Moschner	2458326,4397	II	520,5	0,0009
W. Moschner	2458696,6006	I	1050	0,0001
W. Moschner	2458710,5828	I	1070	0,0007
W. Moschner	2459096,4733	I	1622	0,0002
P. Frank	2459112,5506	I	1645	-0,0013

Table 1: Minima GSC 02695-03684 Cyg, O-C using the ephemeris given by the authors.

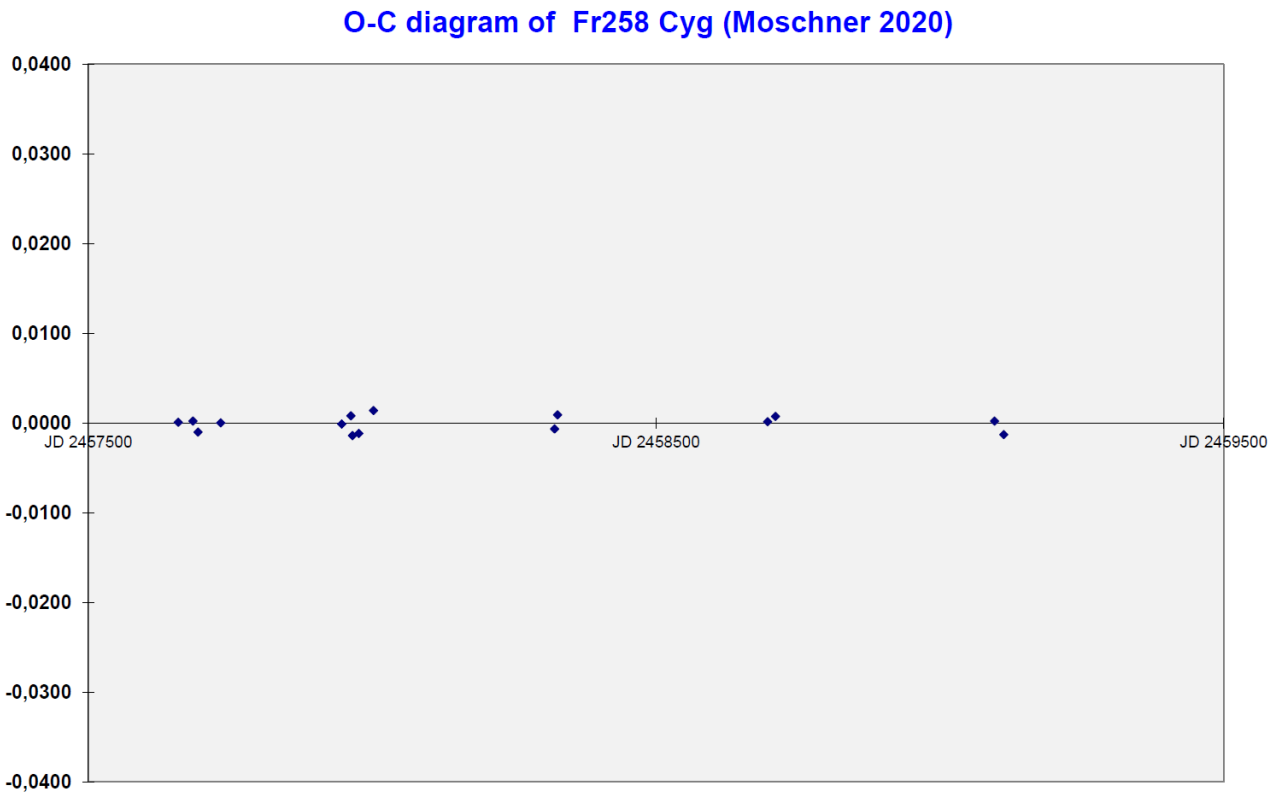

Figure 2: O-C-diagram for GSC 02695-03684 Cyg using the ephemeris given by the authors.

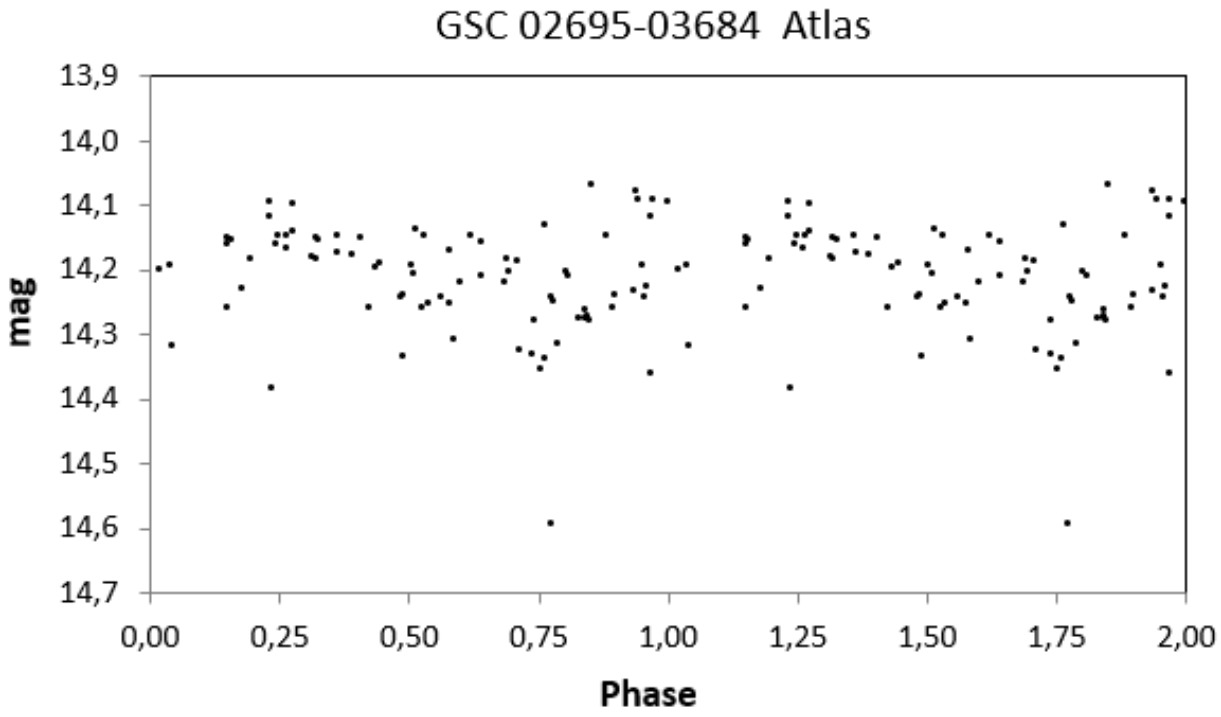

Figure 4: Phased light curve of GSC 02695-03684 Cyg using the ATLAS data and the ephemeris HJD 2457962.5687 + 0.497598 d*E (period from ATLAS).

Acknowledgements

This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France, the International Variable Star Index (VSX) database, operated at AAVSO, Cambridge, Massachusetts, USA and the ASAS All Star Catalogue operated by the Ohio State University.

The authors thank David Motl for providing his MuniWin photometry program, Franz Agerer (BAV) and Lienhard Pagel (BAV) [6] for providing their personal data analysis program. The authors also thank Stefan Hümmerich for advice on the preparation of the manuscript.

References

[1] Motl, David: MuniWin
http://c-munipack.sourceforge.net

[2] All-Sky Automated Survey for Supernovae ASAS-SN
http://www.astronomy.ohio-state.edu/asassn/index.shtml
Shappee et al., 2014, ApJ, 788, 48S
https://ui.adsabs.harvard.edu/abs/2014ApJ...788...48S
Jayasinghe et al., 2019, MNRAS, 485, 961J
https://ui.adsabs.harvard.edu/abs/2019MNRAS.485..961J:

[3] Gaia DR2 (Gaia Collaboration, 2018)
European Space Agency.
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=I/345

[4] A first catalog of variable stars measured by ATLAS (Heinze+, 2018)
http://vizier.u-strasbg.fr/cgi-bin/VizieR-3?-source=J/AJ/156/241/table4

[5] The International Variable Star Index
https://www.aavso.org/vsx/index.php?view=search.top

[6] Pagel, Lienhard: Starcurve
https://www.bav-astro.eu/index.php/weiterbildung/tutorials