



The elements of Fr88 Cyg = WISE J200954.4+343108

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Abstract: *The variability of Fr88 Cyg = WISE J200954.4+343108 was discovered by Peter Frank in 2009, who classified it as an eclipsing binary. The authors present phased light curves from ASAS-SN [1], a list of primary and secondary minima, O-C diagrams and an improved period solution of the star.*

Observations

400 mm ASA Astrograph f/3.7 - f = 1471 mm, FLI Proline 16803 CCD-Camera - V-filter - t = 120 sec.
Wolfgang Moschner, Astrocamp/Nerpio, Spain
102 mm 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 [2] and self-written programs by Franz Agerer and Lienhard Pagel [3] were used for the analysis of the frames, after bias, dark and flatfield correction. The weighted average of 5 comparison stars was used.

Explanations:

HJD = heliocentric UTC timings (JD) of the observed minima
All coordinates are taken from the Gaia DR3 catalogue [4]. 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).

Fr88 Cyg = WISE J200954.4+343108

Cross-IDs

= UCAC3 250-208751

= ATO J302.4767+34.5191

= Gaia DR3 2058718291897710208

= ASASSN-V J200954.47+343107.3

= 2MASS J20095440+3431089

= ZTF J200954.40+343109.0

Gaia DR3 catalogue:

Right ascension: 20h09m54.4060s at Epoch J2000

Declination: +34° 31' 08.974" at Epoch J2000

14.0126 mag G-band mean magnitude (350-1000 nm)

14.4650 mag Integrated BP mean magnitude (330-680 nm)

13.3905 mag Integrated RP mean magnitude (640-1000 nm)

1.0745 mag BP-RP

Periods known so far:

VSX [5] 0.8101908 d

WISE [8] 0.8101908 d

ASAS-SN [1] 0.8101906 d

ZTF g-band [6] 0.8101732 d

ATLAS [7] 0.8101830 d

Results

The VSX database, the ZTF database, the WISE database, the ASAS-SN variable stars database and the ATLAS database also list the star as variable, but with different periods. In SIMBAD, the variable can be found under the ID of the ATLAS database (ATO J302.4767+34.5191). The presented improved elements were calculated by the method of least squares, taking into account all minima (see table below) and assuming that the true phase of Min. II is exactly at 0.5. The last two minima of Table 1 were determined from incomplete light curves and therefore weighted accordingly lower in the calculation of the improved elements (see Remarks). Our ephemeris represents an improvement over the VSX, ASAS-SN, ZTF, WISE and ATLAS periods. Our observations do not show evidence for a period change during 2009 – 2023.

Fr88 Cyg improved elements

Type = EB

Min. I = HJD 2455073.3793 + 0.8101937*E
 $\pm 0.0015 \quad \pm 0.0000004$

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Remarks
P. Frank	2455073.3799	I	0	0.0006	Weighting 10
P. Frank	2457248.3452	II	2684.5	0.0009	Weighting 10
P. Frank	2457265.3554	II	2705.5	-0.0030	Weighting 10
Moschner/Frank	2458312.5340	I	3998	0.0003	Weighting 10
Moschner/Frank	2458316.5850	I	4003	0.0003	Weighting 10
Moschner/Frank	2458320.6351	I	4008	-0.0005	Weighting 10
Moschner/Frank	2458357.5005	II	4053.5	0.0010	Weighting 10
W. Moschner	2460177.6030	I	6300	0.0034	Weighting 3
W. Moschner	2460230.2600	I	6365	-0.0022	Weighting 3

Table 1: Minima of Fr88 Cyg = WISE J200954.4+343108, O-C using the elements from the authors. The O-C of the secondary minima were calculated assuming that the true phase is at exactly at 0.5.

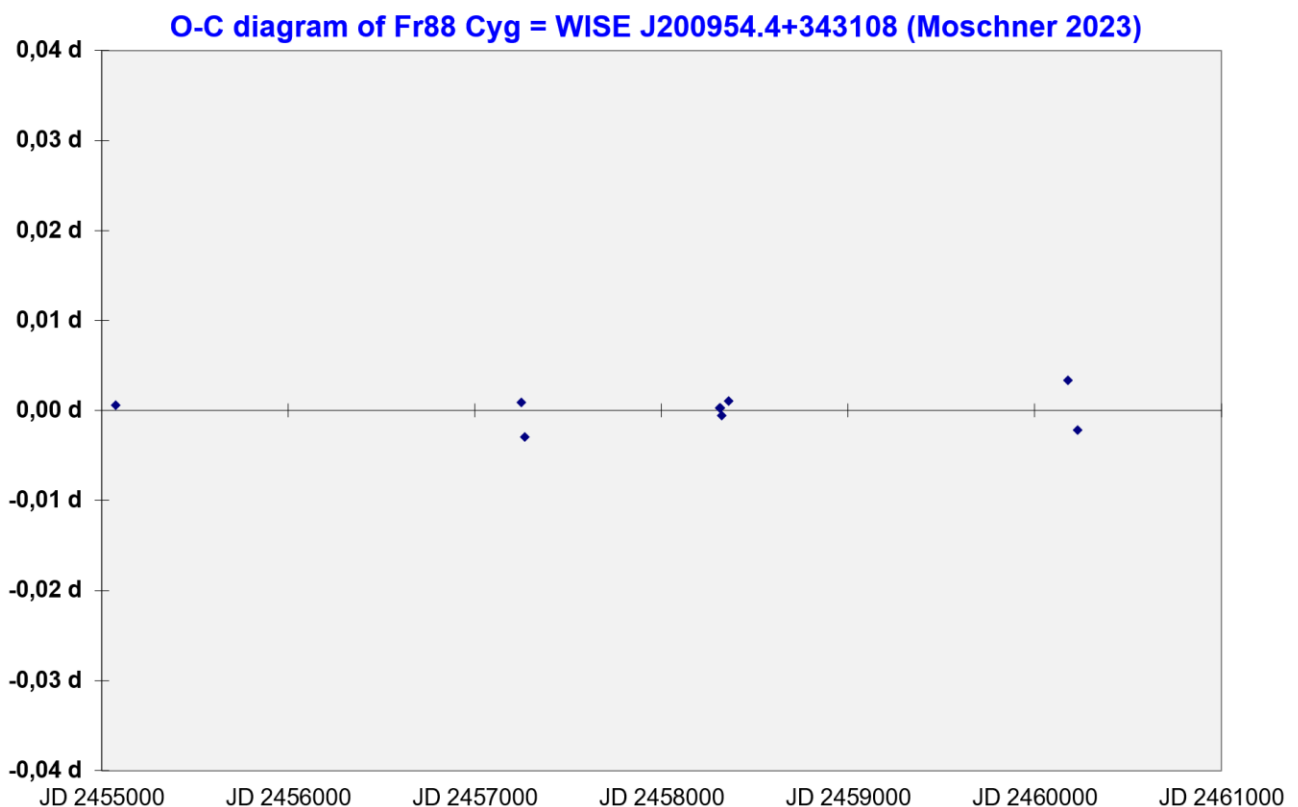


Figure 1: O-C-diagram of Fr88 Cyg = WISE J200954.4+343108 using the improved ephemeris from the authors.

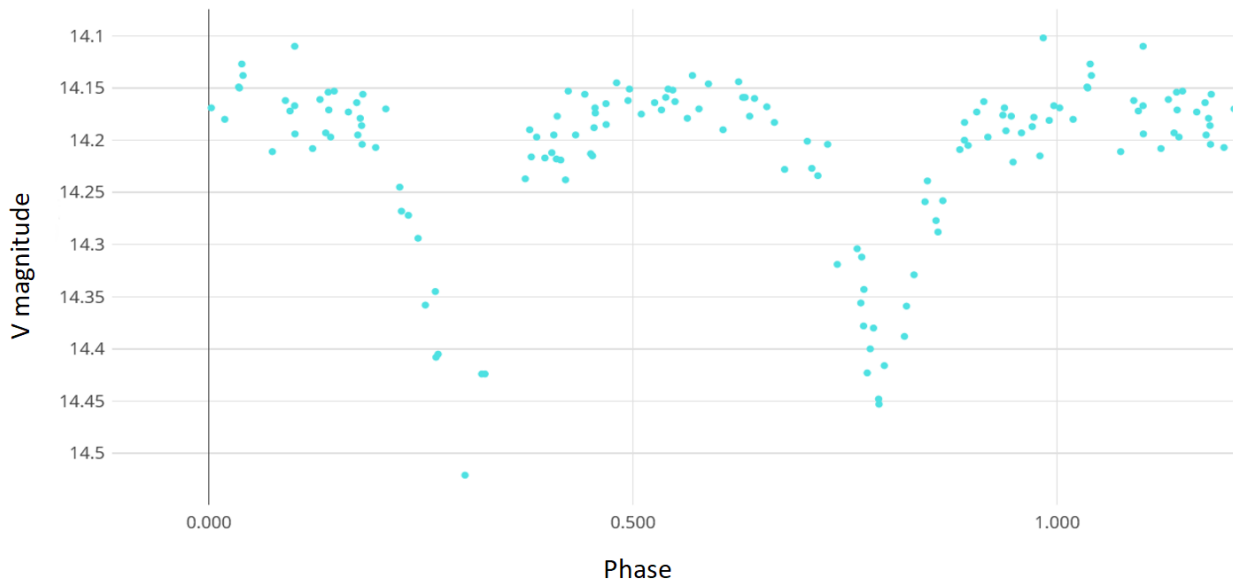


Figure 2: Phased light curve of Fr88 Cyg = WISE J200954.4+343108 using the period and data (V-Band) from ASAS-SN. This graphic is taken from the ASAS-SN website.

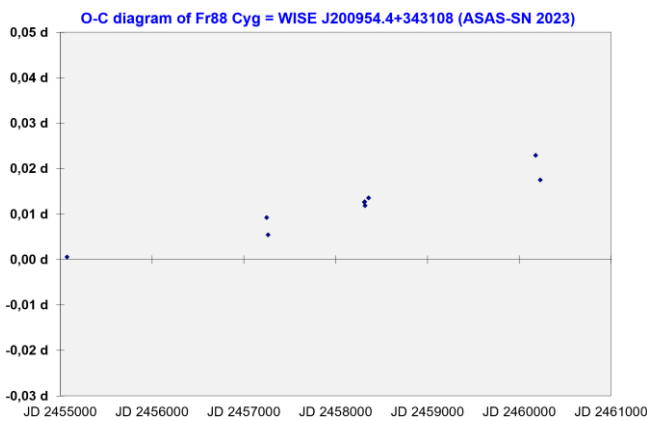


Figure 3

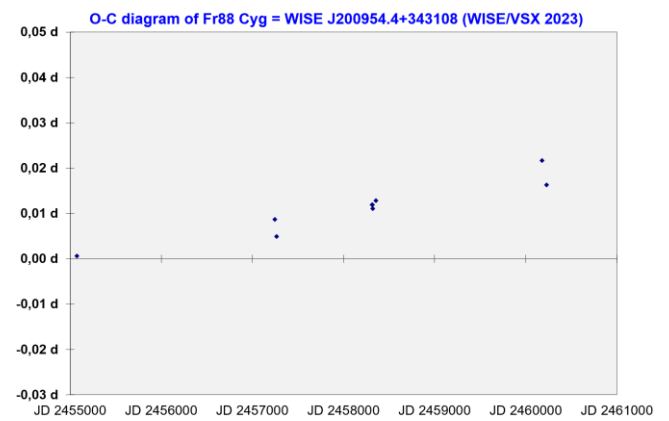


Figure 4

Figure 3: O-C-diagram of Fr88 Cyg = WISE J200954.4+343108 using the period from the ASAS-SN Variable Stars Database (0.8101906 d).

Figure 4: O-C-diagram of Fr88 Cyg = WISE J200954.4+343108 using the period from the WISE project/VSX database (0.8101908 d).

Acknowledgements

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