The period of Fr259 Vul = ASASSN-V J203310.45+242300.9

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Abstract: *The variability of Fr259 Vul = ASASSN-V J203310.45+242300.9 was discovered by Peter Frank in 2016, who classified it as an eclipsing binary. The authors present phased light curves from ASAS-SN [1] and ATLAS [2], 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
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 [3] and self-written programs by Franz Agerer and Lienhard Pagel [4] 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 EDR3 catalogue [5]. 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).

Fr259 Vul

Cross-IDs
= ASASSN-V J203310.45+242300.9   **= 2MASS J20331048+2422584**
= ATOID J308.2936+24.3828   **= GSC 02161-01228**
= Gaia EDR3 1831488649046043520   **= UCAC3 229-241853**

Gaia EDR3 catalogue:
Right ascension: 20h33m10.4858s at Epoch J2000
Declination: +24° 22' 58.478"   at Epoch J2000
13.5530 mag G-band mean magnitude (350-1000 nm)
13.8502 mag Integrated BP mean magnitude (330-680 nm)
13.1066 mag Integrated RP mean magnitude (640-1000 nm)
0.7436   mag BP-RP

Periods known so far:

VSX [6]	1.5719 d
ASAS-SN [1]	1.5718182 d
ATLAS [2]	1.571936 d

Results

The VSX database, the ASAS-SN database and the ATLAS database also list the star as variable, but with different periods. In the VSX database, the variable is still listed under the designation ASASSN-V J203310.49+242258.5. In the ASAS-SN database, the variable can only be found under the current designation ASASSN-VJ203310.45+242300.9. There is no entry in the SIMBAD database. The presented 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. Our ephemeris represents an improvement over the VSX, ASAS-SN and ATLAS periods. From the ASAS-SN data (Figure 1) we derive a variability approx. between 13.28 and 13.63 mag, with an amplitude for Min I of 0.35 mag and for Min II of 0.27 mag (uncalibrated V). The variable has a companion at a distance of 6.5" (2Mass J20331038+2423047). Our observations do not show evidence for a period change during 2016 – 2023.

Fr259 Vul   improved elements

Min. I   =   HJD 2458713.5539 + 1.5718570*E

                         ±0.0005   ±0.0000009

Observer	HJD-Date Minima	Type	Epoch	O-C (d)
P.Frank	2457627.4014	I	-691	0.0001
W. Moschner	2458698.6218	II	-9.5	0.0006
W. Moschner	2458713.5536	I	0	-0.0002
W. Moschner	2459021.6365	I	196	-0.0011
W. Moschner	2459118.3088	II	257.5	0.0021
W. Moschner	2459129.3085	II	264.5	-0.0013
W. Moschner	2460152.5891	II	915.5	0.0011
W. Moschner	2460171.4518	II	927.5	0.0016

Table 1: Minima of Fr259 Vul = ASASSN-V J203310.45+242300.9, 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.
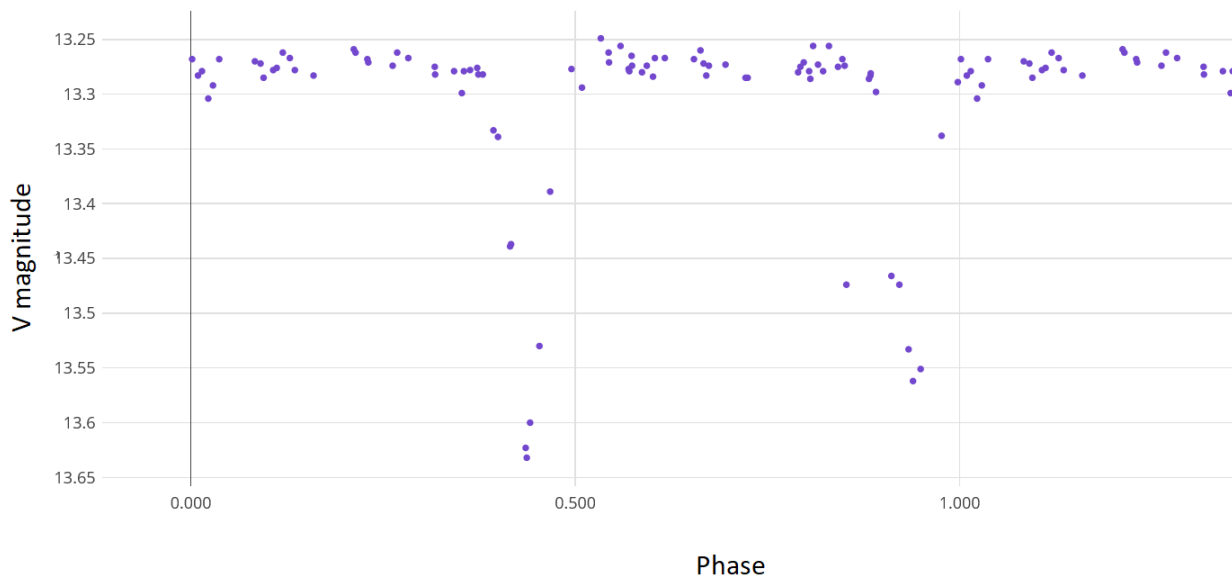

Figure 1: Phased light curve of Fr259 Vul = ASASSN-V J203310.45+242300.9 using the period and data (V-Band) from ASAS-SN. This graphic is taken from the ASAS-SN website.
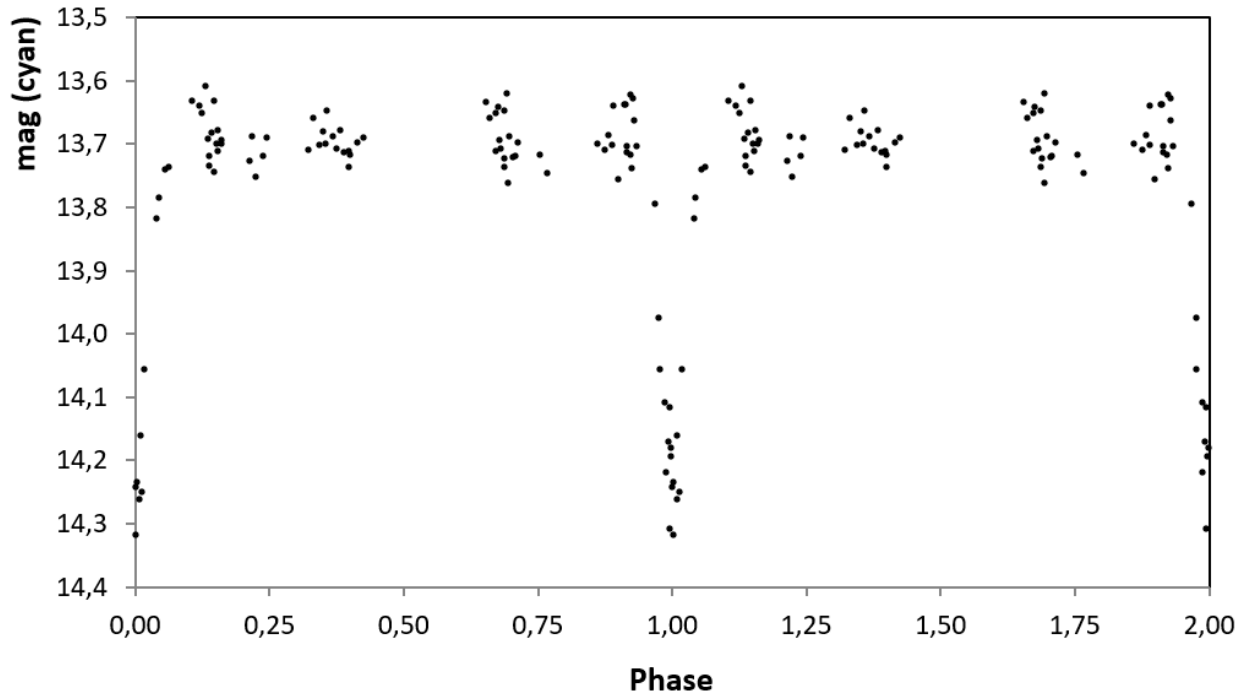
Figure 2: Phased light curve of Fr259 Vul = ASASSN-V J203310.45+242300.9 using the improved elements and data from ATLAS (Cyan-Filter 420-650 nm). There is a data gap at the time of Minimum II.
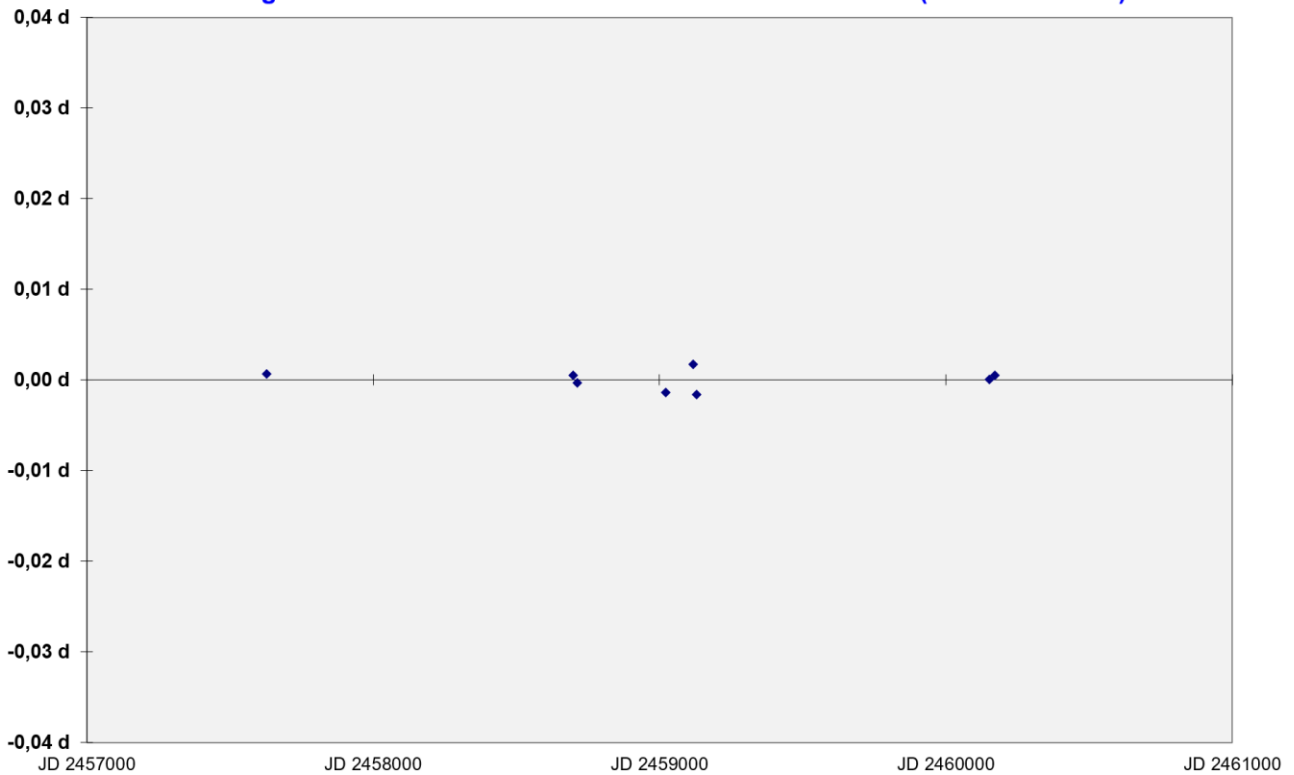

Figure 3: O-C-diagram of Fr259 Vul = ASASSN-V J203310.45+242300.9 using the ephemeris given by the authors.
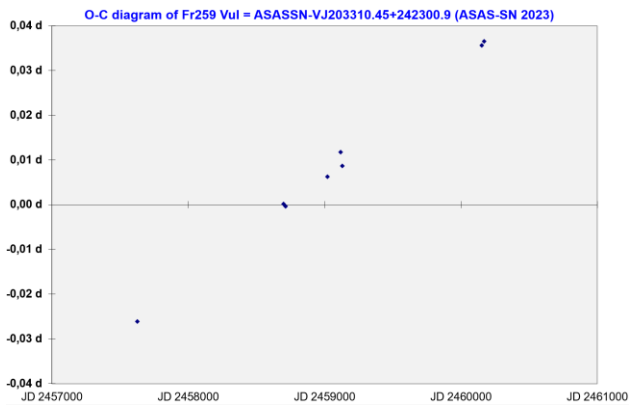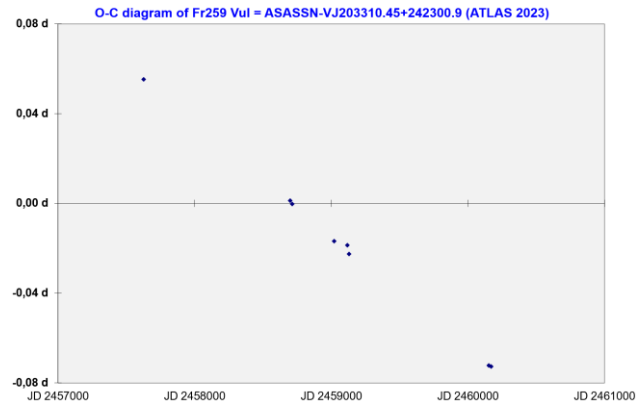
Figure 4

Figure 5

Figure 4: O-C-diagram of Fr259 Vul = ASASSN-V J203310.45+242300.9 using the period from the ASAS-SN project (1.5718182 d).
Figure 5: O-C-diagram of Fr259 Vul = ASASSN-V J203310.45+242300.9 using the period from the ATLAS project (1.571936 d).

Acknowledgements

References

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    https://www.bav-astro.eu/index.php/weiterbildung/tutorials

[5] Gaia EDR3 (Gaia Collaboration. 2020)
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