The improved elements of MoV59 Cyg = UCAC3 284-159698

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Abstract: *MoV59 Cyg = UCAC3 284-159698 was discovered by Wolfgang Moschner in 2016, who classified it as an eclipsing binary. The first elements were published by the authors in 2018 [1] , and further observations until 2023 have now improved the elements.*

Observations
400 mm ASA Astrograph f/3.7 - f = 1471 mm, FLI Proline 16803 CCD-Camera - V-filter - t = 120 sec.
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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 EDR3 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).

MoV59 Cyg = UCAC3 284-159698
Cross-IDs
= UCAC3 284-159698   **= 2MASS J20145090+5157349**
= ATO J303.7121+51.9597   **= WISE J201450.9+515735**
= Gaia EDR3 2184335399419200128   **= ZTF J201450.91+515735.0**

Gaia EDR3 catalogue:
Right ascension: 20h14m50.9064s at Epoch J2000
Declination: +51° 57' 34.990"   at Epoch J2000
15.8934 mag G-band mean magnitude (350-1000 nm)
16.3262 mag Integrated BP mean magnitude (330-680 nm)
15.3169 mag Integrated RP mean magnitude (640-1000 nm)
1.0093   mag BP-RP

Periods known so far:
VSX [5]	0.3236476 d
ZTF g-band [6]	0.3236456 d
ATLAS [7]	0.323647 d
WISE [8]	0.3236436 d

Results

The VSX database, the ZTF database, the WISE database and the ATLAS database also list the star as variable, but with different periods. The VSX database lists the first elements of the authors from BAVJ 21 [1]. MoV59 is not listed as a variable in the ASAS-SN Variable Stars Database. In SIMBAD, the variable can be found under the ID of the ATLAS database (ATO J303.7121+51.9597). 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. Our ephemeris represents an improvement over the VSX, ZTF, WISE and ATLAS periods. Our observations do not show evidence for a period change during 2016 – 2023.

MoV59   improved elements

Min. I =   HJD 2457605.5294 + 0.3236463*E
                ±0.0004   ±0.0000008

Observer	Minimum	Type	Epoch	O-C (d)
W. Moschner	2457574.4573	I	-96	-0.0021
W. Moschner	2457574.6198	II	-95.5	-0.0014
W. Moschner	2457576.5625	II	-89.5	-0.0006
W. Moschner	2457581.5791	I	-74	-0.0005
W. Moschner	2457605.5286	I	0	-0.0008
W. Moschner	2457623.4910	II	55.5	-0.0008
W. Moschner	2457691.2962	I	265	0.0005
W. Moschner	2457691.4618	II	265.5	0.0043
W. Moschner	2457916.5535	I	961	0.0000
W. Moschner	2457955.3918	I	1081	0.0007
W. Moschner	2457955.5535	II	1081.5	0.0006
W. Moschner	2457963.4822	I	1106	0.0000
W. Moschner	2457963.6442	II	1106.5	0.0002
W. Moschner	2457979.5043	II	1155.5	0.0016
W. Moschner	2458010.4092	I	1251	-0.0017
W. Moschner	2458010.5779	II	1251.5	0.0052
W. Moschner	2458015.4282	II	1266.5	0.0008
W. Moschner	2458329.5240	I	2237	-0.0022
W. Moschner	2458330.4960	I	2240	-0.0011
W. Moschner	2458330.6590	II	2240.5	0.0001
W. Moschner	2458352.5037	I	2308	-0.0014
W. Moschner	2458397.3305	II	2446.5	0.0005
W. Moschner	2458397.4929	I	2447	0.0010
W. Moschner	2458720.4906	I	3445	-0.0003
W. Moschner	2458755.4451	I	3553	0.0004
W. Moschner	2459053.5237	I	4474	0.0007
W. Moschner	2459069.3825	I	4523	0.0009
W. Moschner	2459069.5442	II	4523.5	0.0007
W. Moschner	2459102.3956	I	4625	0.0020
W. Moschner	2459102.5559	II	4625.5	0.0005
W. Moschner	2459140.4228	II	4742.5	0.0008
W. Moschner	2459403.5472	II	5555.5	0.0008
W. Moschner	2459426.5236	II	5626.5	-0.0017
W. Moschner	2459469.4088	I	5759	0.0003
W. Moschner	2459505.3332	I	5870	0.0000
W. Moschner	2459777.5191	I	6711	-0.0006
W. Moschner	2459788.5233	I	6745	-0.0004
W. Moschner	2459802.4413	I	6788	0.0009
W. Moschner	2459802.6010	II	6788.5	-0.0013
W. Moschner	2459853.4134	II	6945.5	-0.0014
W. Moschner	2460159.4215	I	7891	-0.0009
W. Moschner	2460159.5836	II	7891.5	-0.0006

W. Moschner	2460178.3584	II	7949.5	0.0027
W. Moschner	2460178.5164	I	7950	-0.0011
W. Moschner	2460213.4724	I	8058	0.0012

Table 1: Minima of MoV59 Cyg = UCAC3 284-159698, O-C using the improved elements from the authors. The O-C of the secondary minima were calculated assuming that the true phase is at exactly at 0.5.
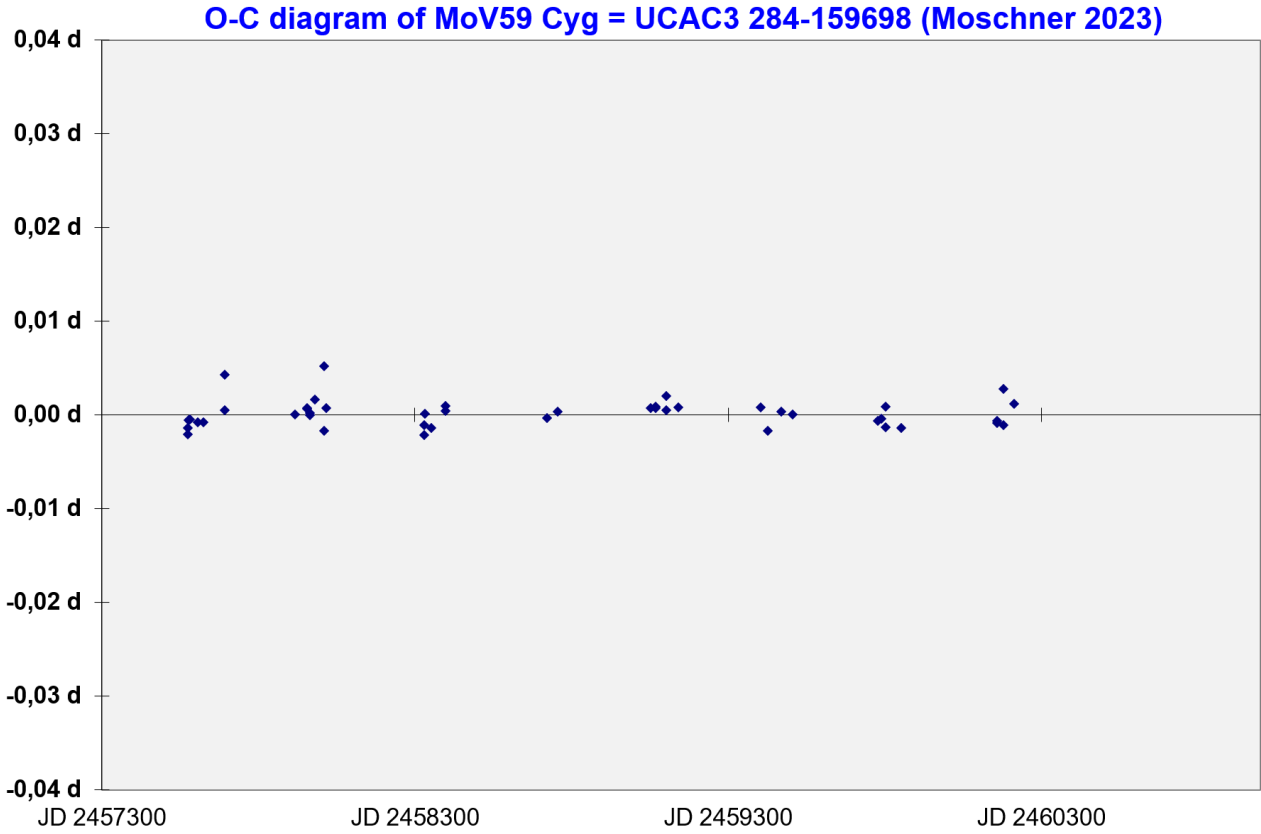

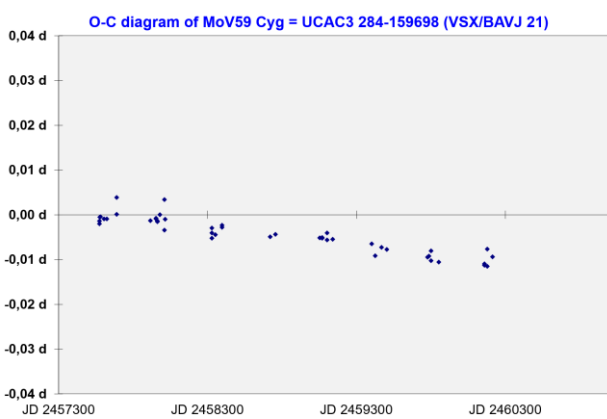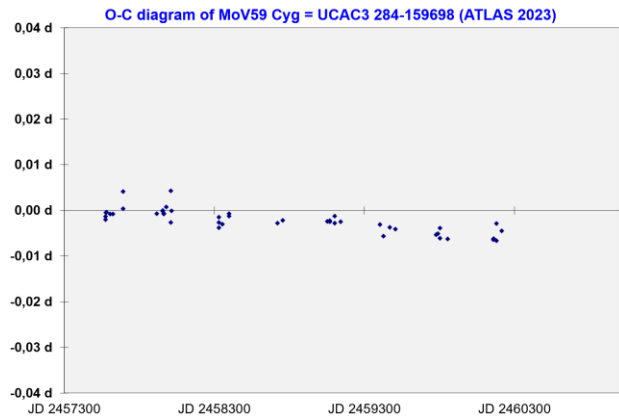Figure 1: O-C-diagram of MoV59 Cyg = UCAC3 284-159698 using the improved ephemeris from the authors.

Figure 2

Figure 3

Figure 2: O-C-diagram of MoV59 Cyg = UCAC3 284-159698 using the period from VSX/BAVJ 21 (0.3236476 d).
Figure 3: O-C-diagram of MoV59 Cyg = UCAC3 284-159698 using the period from the ATLAS project (0.323647 d).

Acknowledgements

References

[1] BAV Journal No. 21 (2018)
https://www.bav-astro.eu/images/Up_Journal/BAVJ_21_first_elements_6_new_Variable_Part_VI_kor4_final-1.pdf

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

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

[4] Gaia EDR3 (Gaia Collaboration. 2020)
European Space Agency.
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=I/350

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

[6] ZTF Zwicky TransientFacility, Systematic Exloration of the Dynamic Sky
https://www.ztf.caltech.edu/

[7] 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

[8] WISE catalog of periodic variable stars (Chen et al., 2018)
J/ApJS/237/28/table2

[9] SIMBAD Astronomical Database - CDS (Strasbourg)
http://simbad.cds.unistra.fr/simbad/sim-id?Ident=%4017563570&Name=ATO%20J303.7121%2b51.9597&submit=submit