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The period of the eclipsing binary Fr190 = UCAC3 242-230799 Cyg

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Abstract: *Fr190 = UCAC3 242-230799 Cyg was discovered by Peter Frank in the year 2014 and classified as an EA eclipsing binary. The authors present a phased light curve, a list of primary and secondary minima, O-C diagrams and an improved period solution of the star. The object is also listed in the Atlas variable catalog, but with a period that does not match our observations.*

Introduction

Fr190 = UCAC3 242-230799 Cyg was independently discovered by the ATLAS project [1] as a photometric variable and classified as dubious, with the remark: the star may not be a true variable.

During these studies, we furthermore discovered several period solutions for this star in an extensive datasheet prepared by the ATLAS project. None of these periods is similar to ours. We have at our disposal 52 time series with approx. 9400 images that were taken between 2013 and 2022. 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, we have used our data to present an improved period solution.

Periods known so far:

Simbad [2]	no information
ASAS-SN [3]	no information
ATLAS	0.393283 d
VSX [4]	no information
ZTF [5]	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 [6] and self-written programs by Franz Agerer and Lienhard Pagel [7] 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

All coordinates are taken from the Gaia EDR3 catalogue [8].

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

Fr190 = UCAC3 242-230799 Cyg

Cross-ID's
= Gaia EDR3 2029973072218721920
= ATOID J302.5033+30.9871
= 2MASS 20100079+3059138
= USNO-A2.0 1200-14598428

Right ascension: 20h10m00.7960s at epoch and equinox J2000
Declination: +30° 59' 13.848" at epoch and equinox J2000
Barycentric right ascension (ICRS) at epoch=2016.0: 302.50334010323° +/- 0.01 mas
Barycentric declination (ICRS) at epoch=2016.0: +30.98718950548° +/- 0.02 mas

Gaia EDR3 Catalog:
15.069409 mag G-band mean magnitude (350-1000 nm)
15.558073 mag Integrated BP mean magnitude (330- 680 nm)
14.407160 mag Integrated RP mean magnitude (640-1000 nm)
1.150913 mag BP-RP color

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) and assuming that the true phase of Min II is exactly 0.5.

Our ephemeris represents a substantial improvement over the ATLAS periods, since our minima cannot be reproduced by any of these periods. Although one of the ATLAS periods is very similar to one quarter of our period, we can exclude it with our measurements.

We derive (raw instrumental) amplitudes of 0.40 mag (15.48-15.88 mag) for Min I and 0.06 mag (15.48-15.54 mag) for Min II.

Fr190 = UCAC3 242-230799 Cyg (improved elements)

Amplitude: Min I: 0.40 mag (instr.) Min II: 0.06 mag (instr.)
Type: EA type eclipsing binary

Min I = HJD (UTC) 2457240.3743 +1.5731260*E
±0.0008 ±0.0000008

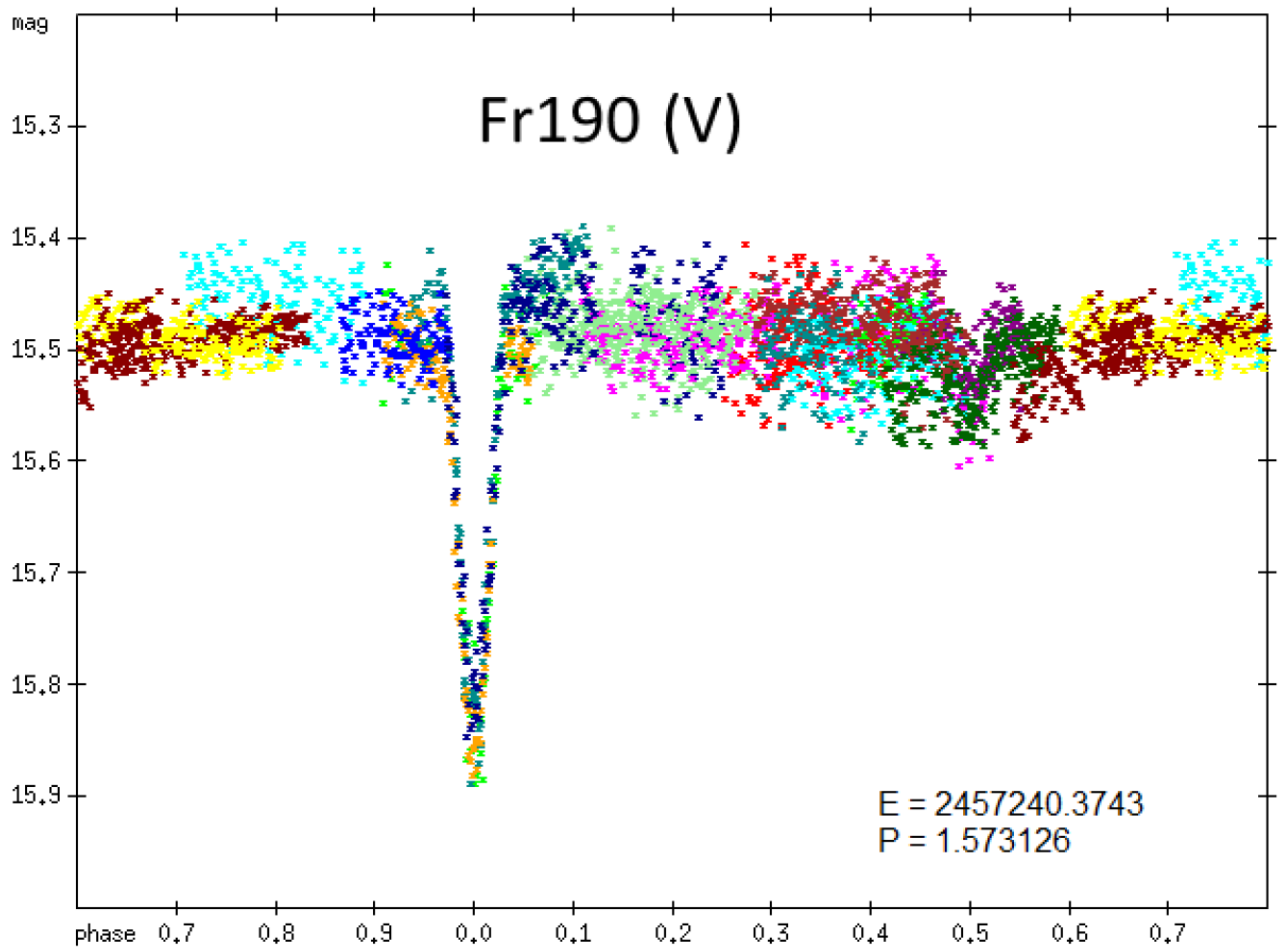

Figure 1: Phased light curve of Fr190 = UCAC3 242-230799 Cyg using the ephemeris given by the authors. The vertical axis shows raw instrumental magnitudes. Different colors denote different observing nights. Only the data points from the better nights were used to display the light curve. A FLI Proline 16803 camera + V-filter (2016-2020) was used.

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)
P.Frank	2457240.3736	I	0	-0.0007
Moschner/Frank	2457932.5504	I	440	0.0007
Moschner/Frank	2457954.5741	I	454	0.0006
W. Moschner	2458636.5252	II	887.5	0.0016
W. Moschner	2458673.4920	I	911	-0.0001
W. Moschner	2458758.4408	I	965	-0.0001
W. Moschner	2459090.3709	I	1176	0.0004
W. Moschner	2459417.5814	I	1384	0.0007
W. Moschner	2459782.5437	I	1616	-0.0022

Table 1: Minima from Fr190 = UCAC3 242-230799 Cyg. O-C using the ephemeris given by the authors. The O-C of the secondary minima were calculated assuming that the true phase is at exactly 0.5.

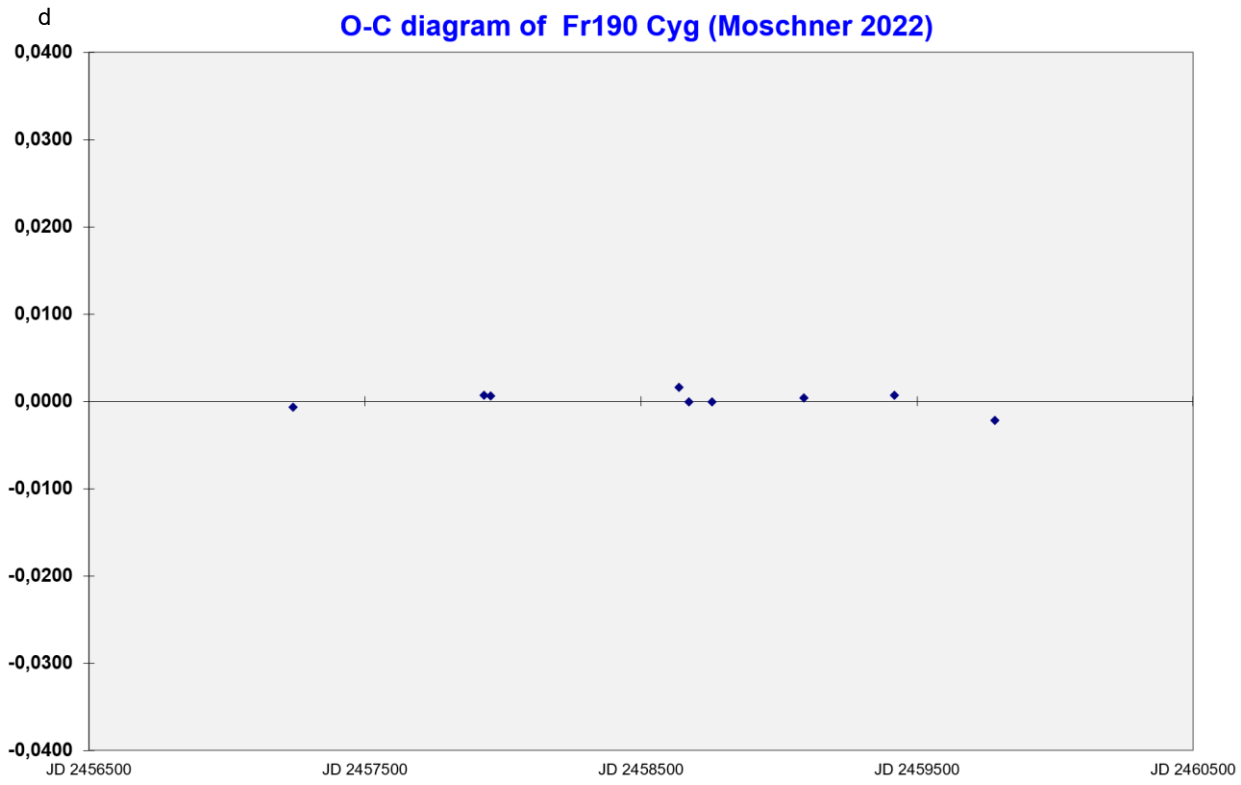

Figure 2: O-C-diagram from Fr190 = UCAC3 242-230799 Cyg using the ephemeris given by the authors.

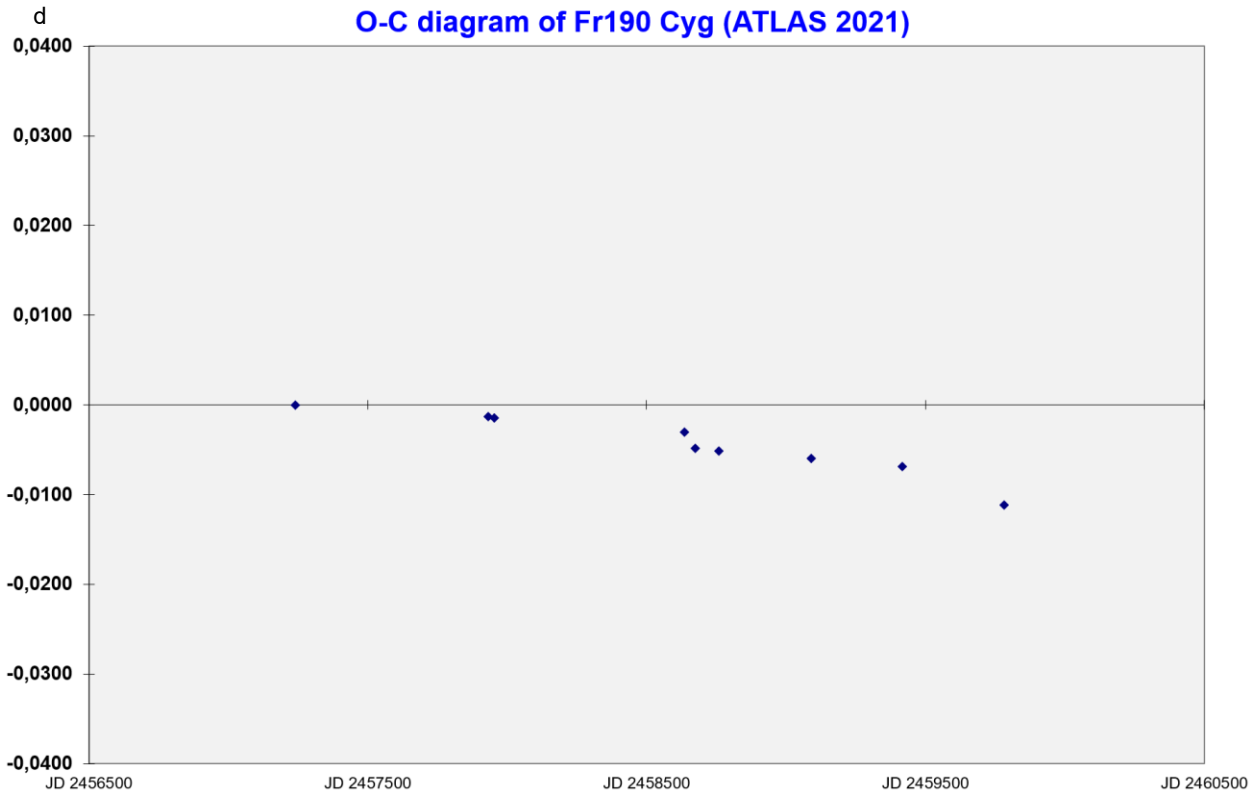

Figure 3: O-C-diagram from Fr190 = UCAC3 242-230799 Cyg using the period from ATLAS.

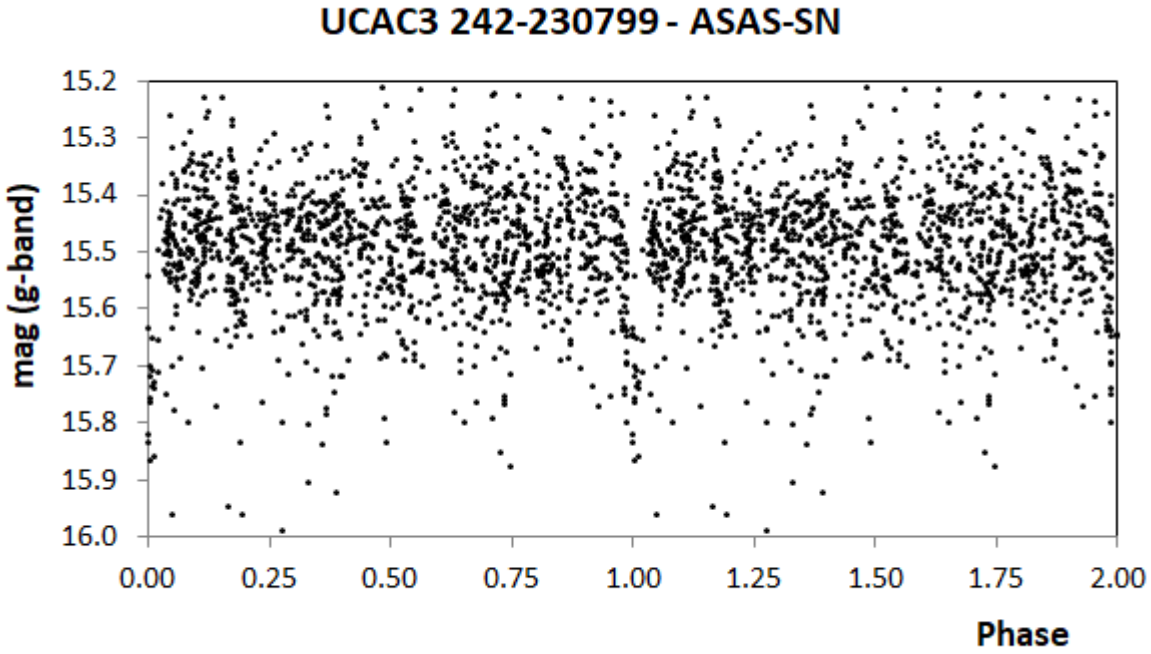

Figure 4: Phased light curve from Fr190 = UCAC3 242-230799 Cyg using the new elements (period = 1.5731260 d) and data from ASAS-SN (g-Band).

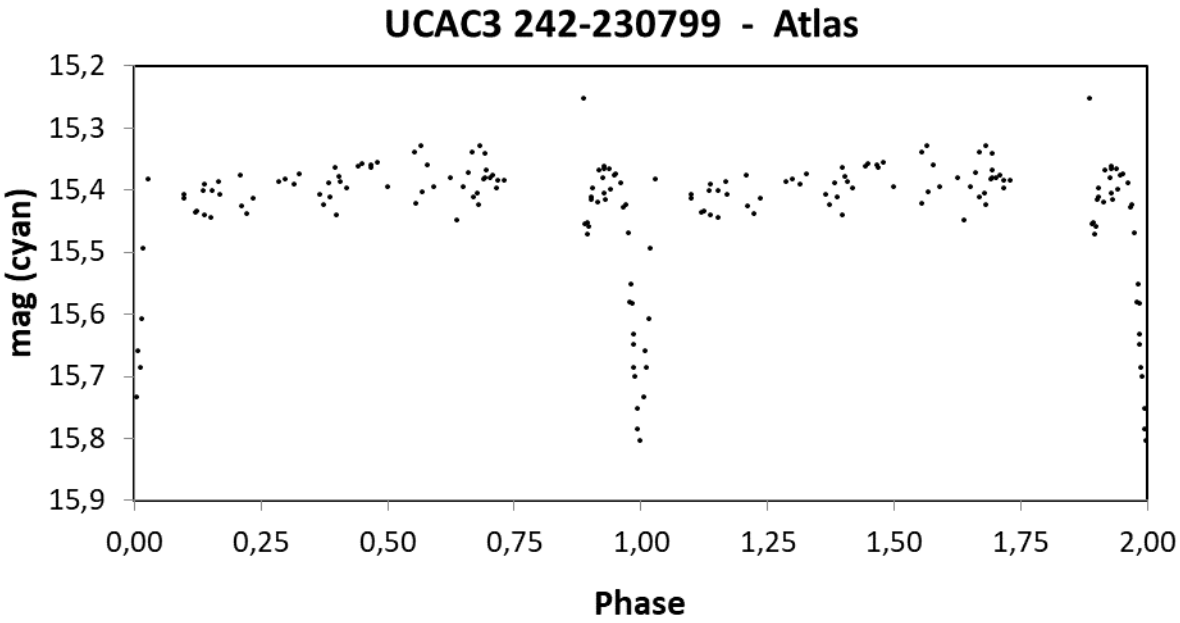

Figure 5: Phased light curve from UCAC3 242-230799 Cyg using the new elements (period = 1.5731260 d) and data from ATLAS (Cyan-Filter 420-650 nm).

Acknowledgements

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The authors thank David Motl for providing his MuniWin photometry program. Franz Agerer (BAV) and Lienhard Pagel (BAV) for providing their personal data analysis program.

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