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Improved elements of the eclipsing binary ASASSN-V J205214.61+341019.6 Cyg

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Abstract: *ASASSN-V J205214.61+341019.6 Cyg was discovered by the ASAS-SN-Project and classified as EB 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 ZTF and Atlas variable catalogs, but with a period that does not match our observations exactly.*

Introduction

ASASSN-V J205214.61+341019.6 Cyg was discovered as a photometric variable by the ASASSN-Project [1] and classified as eclipsing binary. The amplitude there is given as 0.11 mag. The variable is listed in the ATLAS [2] and ZTF-Variable Star Database [3].

During these studies, we furthermore discovered several period solutions for this star in an extensive datasheet prepared by the ATLAS project [2]. Only one of these periods that we found by ATLAS is similar to ours. We have at our disposal 25 time series with approx. 4400 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 ASAS-SN, ZTF and ATLAS periods, we have used our data to present an improved period solution.

Periods known so far:

Simbad	no information
ASAS-SN	0.4877620 d
ATLAS	0.4877610 d
VSX [4]	0.4877526 d (ZTF)

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 [4] and self-written programs by Franz Agerer and Lienhard Pagel [5] 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

All coordinates are taken from the Gaia EDR3 catalogue [6].

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).

ASASSN-V J205214.61+341019.6 Cyg

Cross-ID's
= UCAC3 249-239939
= Gaia EDR3 1869189116063188864
= ATOID J313.0616+34.1703
= ZTF J205214.80+341013.2

Right ascension: 20h52m14.7984s at epoch and equinox J2000
Declination: +34° 10' 13.175" at epoch and equinox J2000
Barycentric right ascension (ICRS) at Epoch=2016.0: 313.061669601° +/- 0.01 mas
Barycentric declination (ICRS) at Epoch=2016.0: +34.170330150° +/- 0.02 mas

Gaia EDR3 Catalog:
14.951341 mag G-band mean magnitude
15.241135 mag Integrated BP mean magnitude
14.485741 mag Integrated RP mean magnitude
0.755394 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 an improvement over the ASAS-SN, ZTF and all ATLAS periods, since our minima are not represented with all periods known so far.

The amplitude for Min I is given as 0.40 mag, 15.00-15.40 mag and for Min II as 0.17 mag, 15.00-15.17 mag.

ASASSN-V J205214.61+341019.6 Cyg (improved elements)

Amplitude: Min I: 0.40 mag (instr.) Min II: 0.17 mag (instr.)
Type: EB type eclipsing binary

Min I = HJD (UTC) 2457962.6125 + 0.4877588*E
±0.0016 ±0.0000010

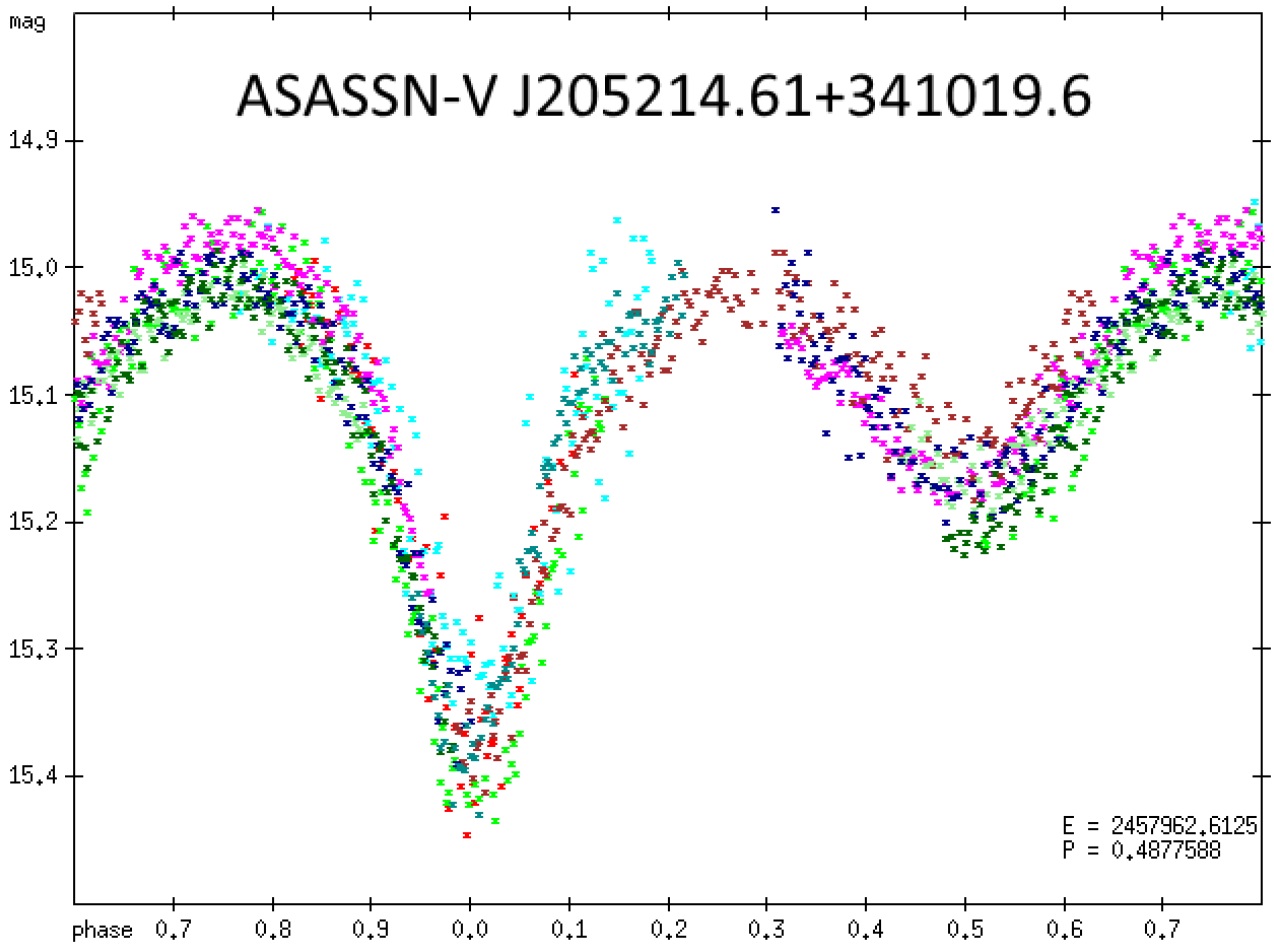

Figure 1: Phased light curve of ASASSN-V J205214.61+341019.6 Cyg using the ephemeris given by the authors. The vertical axis shows raw instrumental magnitudes. Different colors denote different observing nights. Only the data points from the better nights were used to display the light curve. A FLI Proline 16803 camera + V-filter (2016-2020) was used.

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)
P. Frank	2456937.3388	I	-2102	-0.0047
P. Frank	2457287.3184	II	-1384.5	0.0080
P. Frank	2457297.3127	I	-1364	0.0032
P. Frank	2457298.2744	I	-1362	-0.0106
P. Frank	2457307.5408	I	-1343	-0.0116
P. Frank	2457684.3480	II	-570.5	0.0019
W. Moschner	2457946.5179	I	-33	0.0015
W. Moschner	2457962.6156	I	0	0.0031
W. Moschner	2457965.5490	I	6	0.0099
W. Moschner	2458006.5151	I	90	0.0043
W. Moschner	2458321.6066	I	736	0.0036
W. Moschner	2458326.4826	I	746	0.0020
W. Moschner	2458696.4406	II	1504.5	-0.0051
W. Moschner	2458710.5931	II	1533.5	0.0024
W. Moschner	2458761.3198	II	1637.5	0.0023
W. Moschner	2459051.5451	II	2232.5	0.0111
P. Frank	2459070.5521	II	2271.5	-0.0046
W. Moschner	2459075.4371	II	2281.5	0.0029
W. Moschner	2459096.3954	II	2324.5	-0.0125
W. Moschner	2459139.3245	II	2412.5	-0.0061
W. Moschner	2459171.2767	I	2478	-0.0021

Table 1: Minima ASASSN-V J205214.61+341019.6 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.

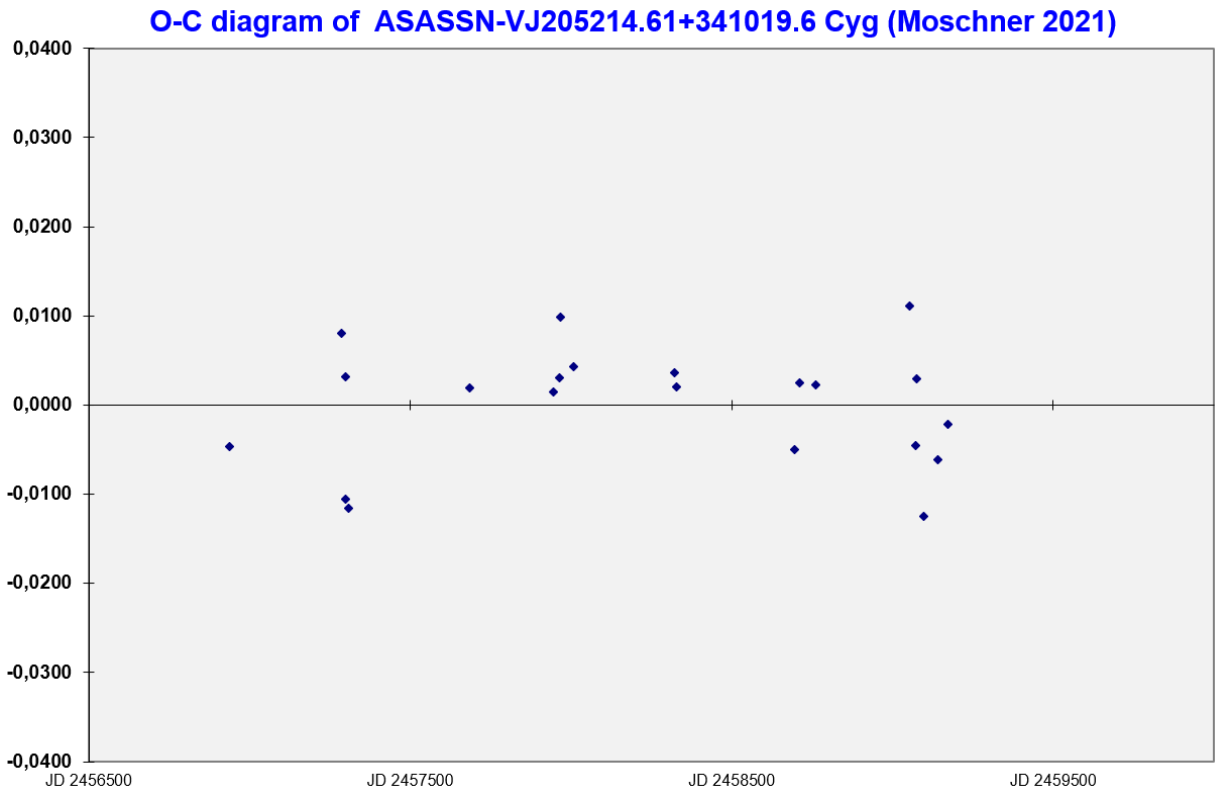

Figure 2: O-C-diagram for ASASSN-V J205214.61+341019.6 Cyg using the ephemeris given by the authors.

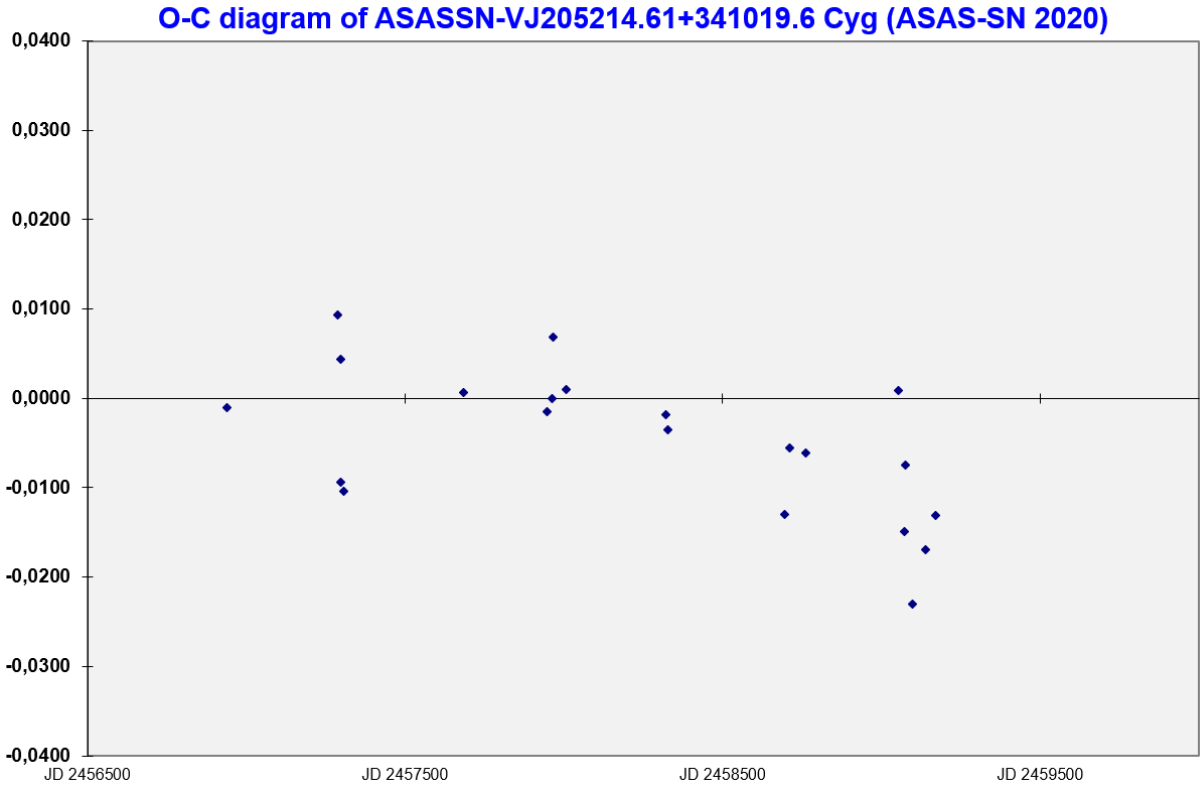

Figure 3: O-C-diagram for ASASSN-V J205214.61+341019.6 Cyg using the period from ASAS-SN.

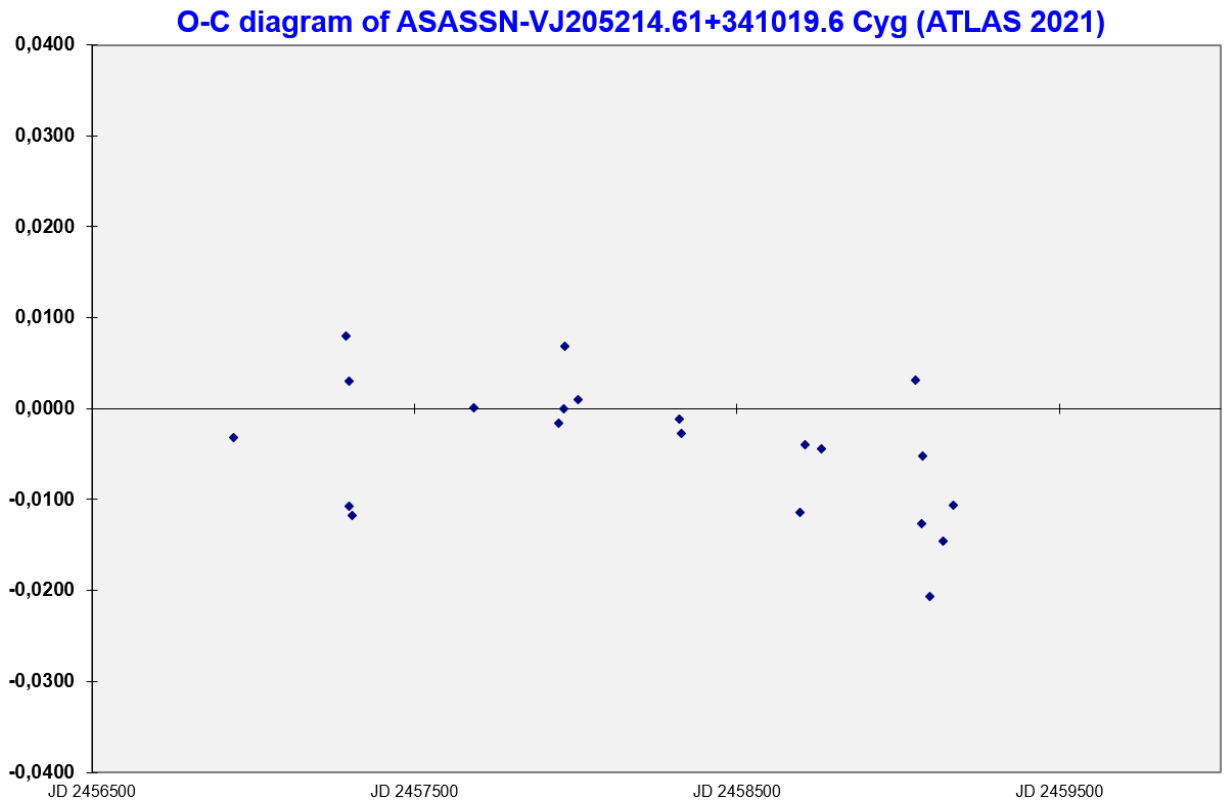

Figure 4: O-C-diagram for ASASSN-V J205214.61+341019.6 Cyg using the period from ATLAS.

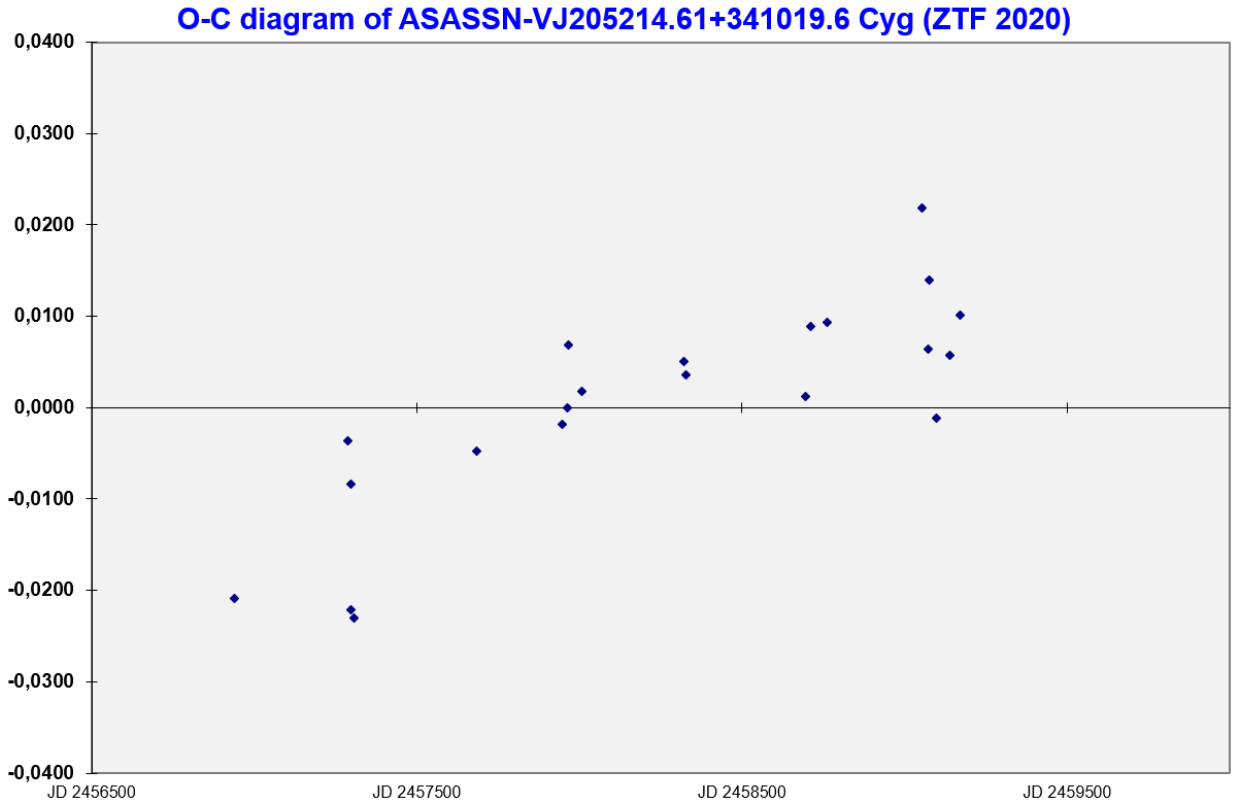

Figure 5: O-C-diagram for ASASSN-V J205214.61+341019.6 Cyg using the period from ZTF (VSX).

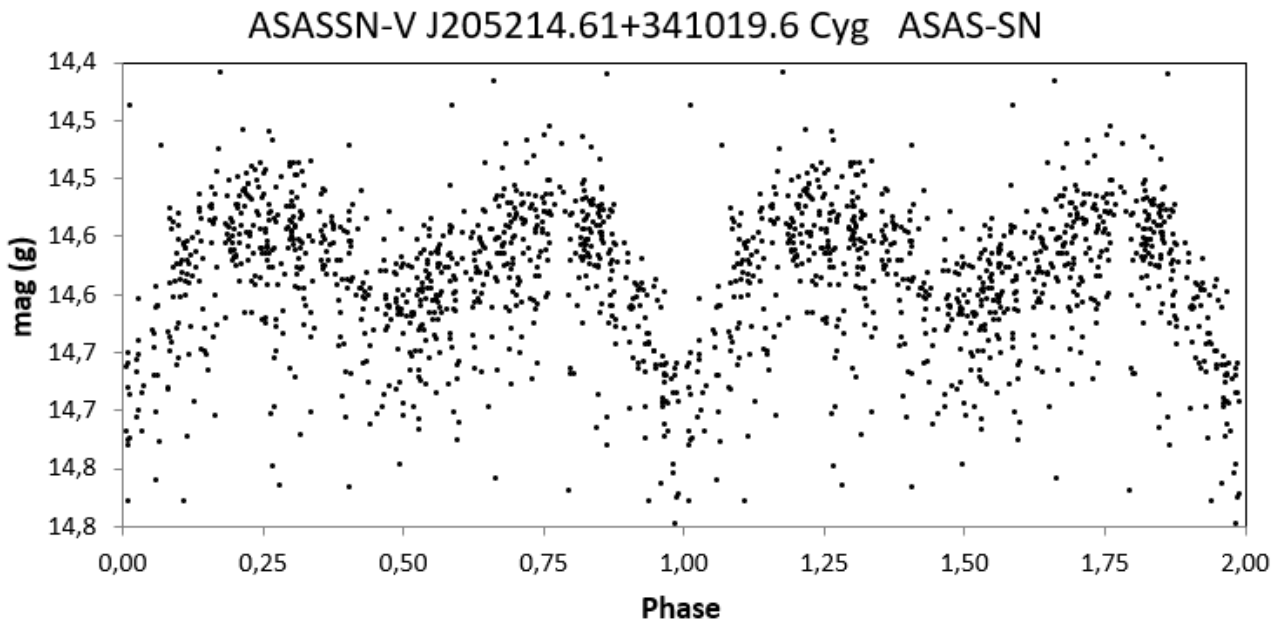

Figure 6: Phased light curve of ASASSN-V J205214.61+341019.6 Cyg using the new elements and data from ASAS-SN (g-Band).

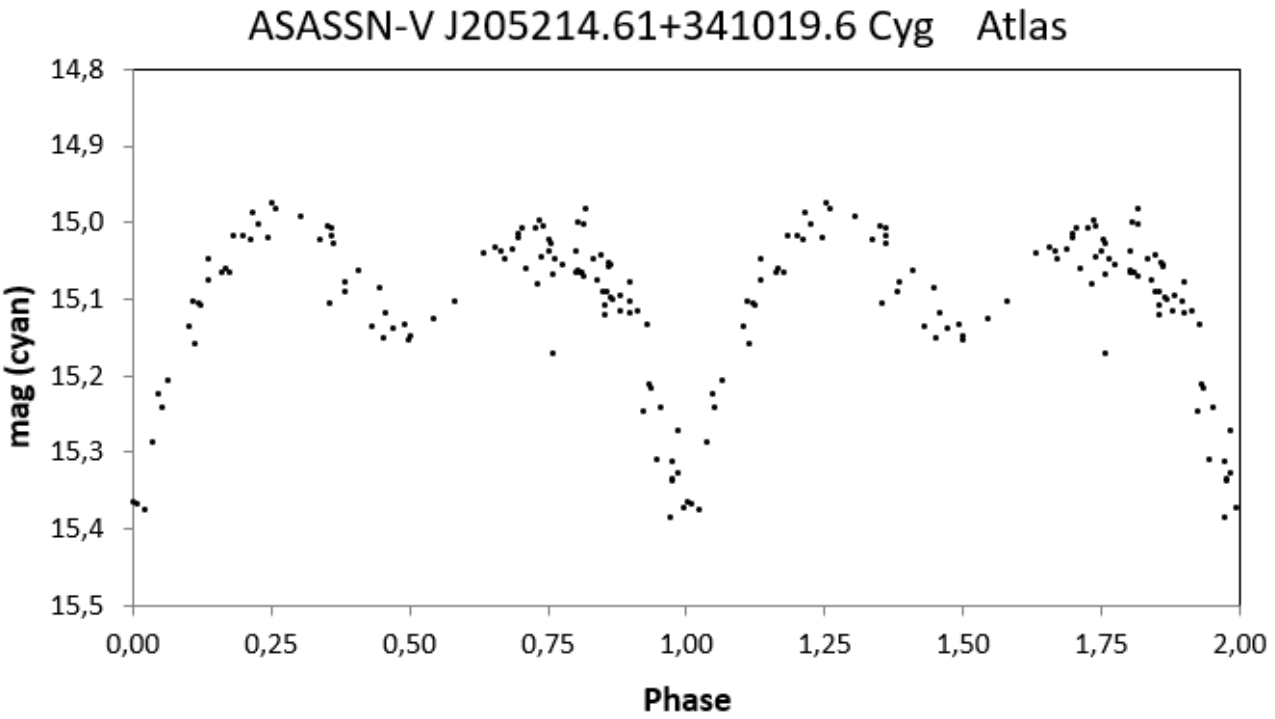

Figure 7: Phased light curve of ASASSN-V J205214.61+341019.6 Cyg using the new elements and data from ATLAS (Cyan-Filter 420-650 nm).

Acknowledgements

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The authors thank David Motl [4] for providing his MuniWin photometry program. Franz Agerer (BAV) and Lienhard Pagel (BAV) [5] for providing their personal data analysis program.

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