



The Period and Variability Analysis of ASASSN-VJ020541.98+474203.4 (GSC 03285-00741)

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Abstract: *The variability of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 was discovered by Gabriel Murawski in 2017, who classified it as an eclipsing binary. The variable star has been listed for some years in several databases with different periods and types. The variable is contained in the authors' archive images between 2016 and 2024. There, 11 minima are found that lead to an improvement of the period. This study refines the period of the eclipsing binary ASASSN-VJ020541.98+474203.4, presenting phased light curves, primary and secondary minima, and O-C diagrams. The improved period provides a foundation for precise future observations and long-term variability studies.*

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

Data analysis

MuniWin [1] and self-written programs by Franz Agerer and Lienhard Pagel [2] 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 [3]. The coordinates (epoch J2000) are computed by VizieR, and are not part of the original data from Gaia (note that the coordinates are computed from the positions and the proper motions).

ASASSN-VJ020541.98+474203.4

Cross-IDs

= GSC 03285-00741

= USNO-A2.0 1350-01960291

= Gaia DR3 356508021012060544

= 1SWASP J020541.95+474202.7

= ATO J031.4248+47.7007

= 2MASS J02054196+4742025

= UCAC4 689-012901

Gaia DR3 catalogue:

Right ascension: 02h05m41.9653s at Epoch J2000

Declination: +47° 42' 02.620" at Epoch J2000

12.2946 mag G-band mean magnitude (350-1000 nm)

12.6160 mag Integrated BP mean magnitude (330-680 nm)

11.8050 mag Integrated RP mean magnitude (640-1000 nm)

0.8110 mag BP-RP

Periods known so far:

VSX [4]	2.616149 d	ATLAS 2 [6]	1.806370 d
ASAS-SN [5]	2.6162506 d	ATLAS 3 [6]	0.903185 d
ATLAS 1 [6]	1.116698 d	ATLAS 4 [6]	1.806373 d

The four ATLAS periods were all determined by the ATLAS team, using four different methods.

Results

The variability of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 was discovered by Gabriel Murawski in 2017, who classified it as an eclipsing binary. In the VSX database the variable is registered as GSC 03285-00741 with the name and period of the discoverer. It contains also a combined phased light curve (Figure 6) of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 using the period (2.616149 d) from the VSX database and the data from the SuperWASP and ASAS-SN project.

As part of the ASAS-SN and ATLAS project, both institutions processed their own data on the variable a few years ago.

The ZTF, WISE, Gaia, and Simbad databases do not provide a period for this variable. However, the ATLAS, ASAS-SN, and VSX databases list different periods for it. Notably, the ATLAS database classifies the variability type as dubious, whereas the VSX and ASAS-SN databases correctly classify it as EA (Eclipsing Binary Type A).

In order to check the elements and improve them if necessary, we analysed 6800 of our archival images between 2016 and 2024 and found 11 minima. These minima (Table 1) were used to determine the period published here. The presented elements were calculated by the method of least squares, taking into account all our minima from JD 2457387 to JD 2460635 (see table below) and assuming that the true phase of Min. II is exactly at 0.5. From our data (Figure 4) we derive a variability approximately between 12.38 and 12.57 mag, with an amplitude for Min. I given as 0.19 mag and for Min. II as 0.12 mag (Filter V).

Our ephemeris represents an improvement over the VSX, ASAS-SN and ATLAS periods. Our observations provide no evidence of a period change during the interval from 2016 to 2024. Determining the precise period facilitates long-term planning and enables more accurate predictions of the minima, which are essential for future observations. Continued constancy of the period remains a prerequisite for achieving this goal.

ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 - improved elements

Type = EA
 Min. I = HJD 2460274.3082 + 2.61616950*E
 ±0.0015 ±0.00000247

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)
W. Moschner	2457387.3670	II	-1103.5	0.0018
W. Moschner	2457748.3959	II	-965.5	-0.0007
W. Moschner	2458029.6342	I	-858	-0.0006
W. Moschner	2458759.5448	I	-579	-0.0013
W. Moschner	2458818.4089	II	-556.5	-0.0010
W. Moschner	2459150.6656	II	-429.5	0.0022
W. Moschner	2459489.4619	I	-300	0.0045
W. Moschner	2459561.3954	II	-272.5	-0.0066
W. Moschner	2460266.4634	I	-3	0.0037
W. Moschner	2460274.3064	I	0	-0.0018
W. Moschner	2460635.3397	I	138	0.0001

Table 1: Minima of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 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.

O-C diagram of ASASSN-VJ020541.98+474203.4 (Moschner 2024)

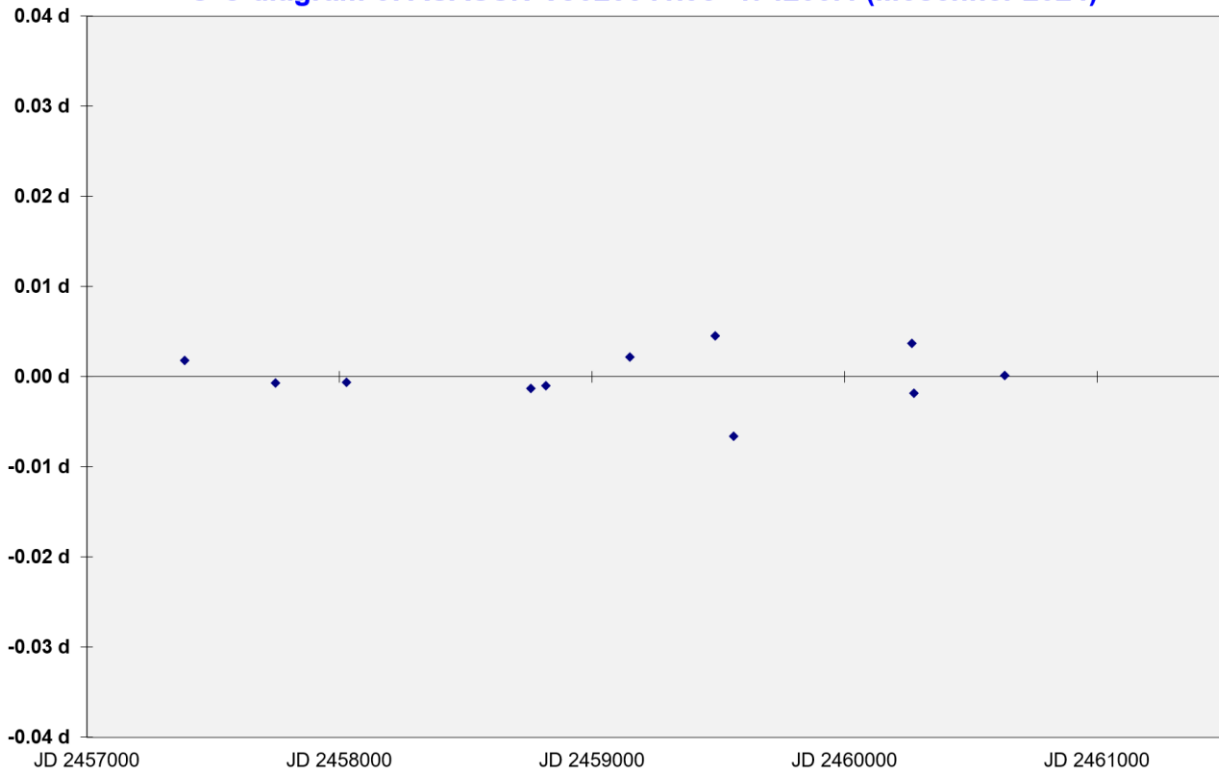


Figure 1: O-C-diagram of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 using the ephemeris given by the authors.

O-C diagram of ASASSN-VJ020541.98+474203.4 (ASAS-SN 2024)

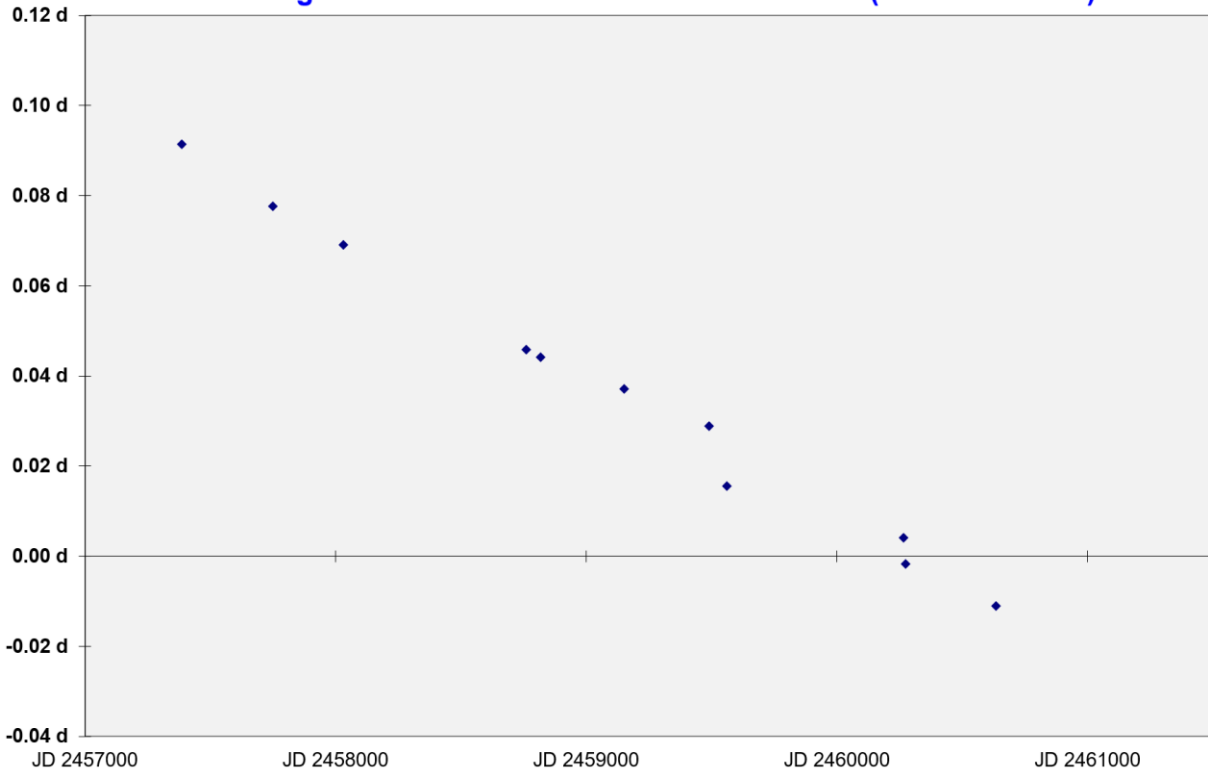


Figure 2: O-C-diagram of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 using the period from the ASAS-SN Project (2.6162506 d).

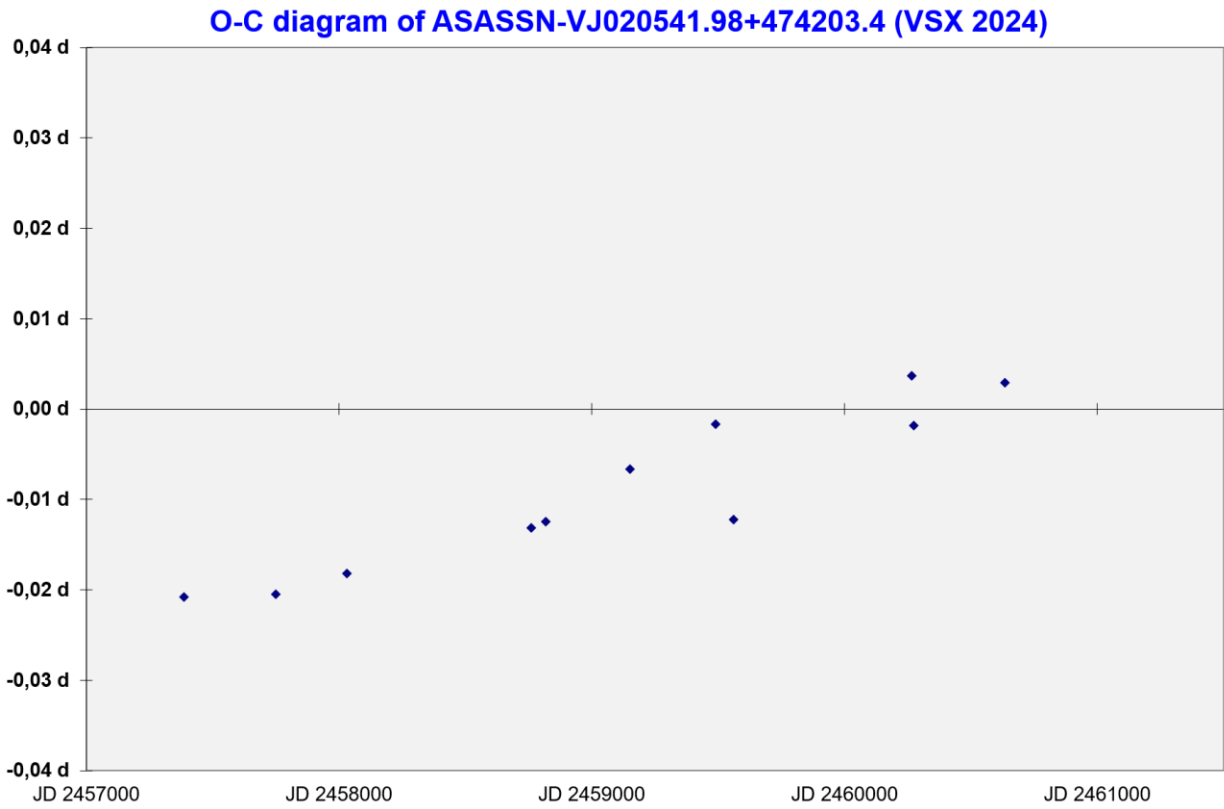


Figure 3: O-C-diagram of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 using the period from the VSX database (2.616149 d).

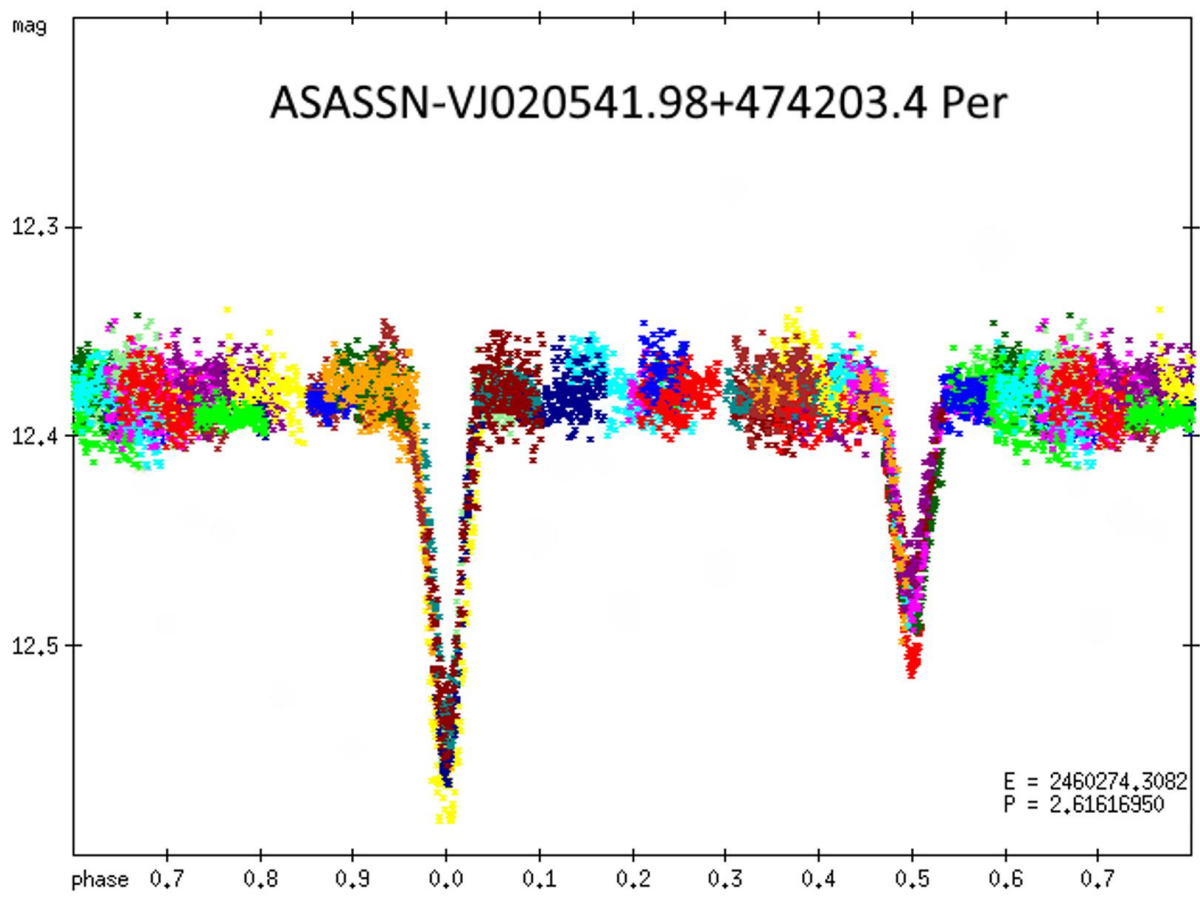


Figure 4: Phased lightcurve of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 using the period and data (V-Band) from the authors.

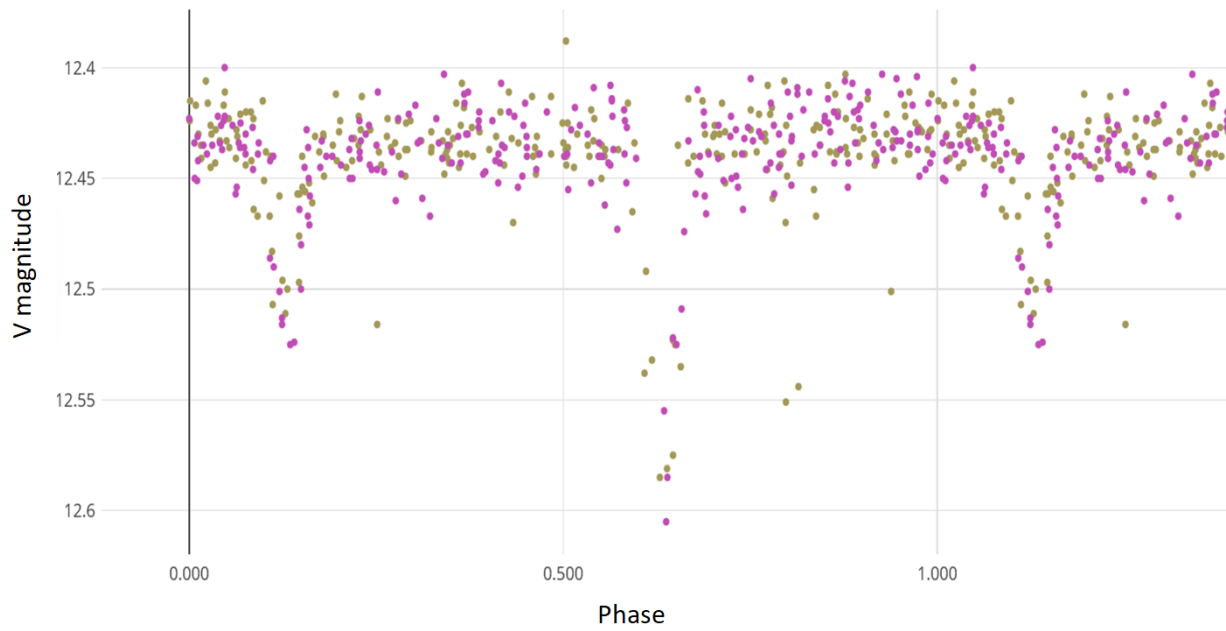


Figure 5: Phased light curve of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 using the period and data (V-Band) from the ASAS-SN project. This graphic is taken from the ASAS-SN website.

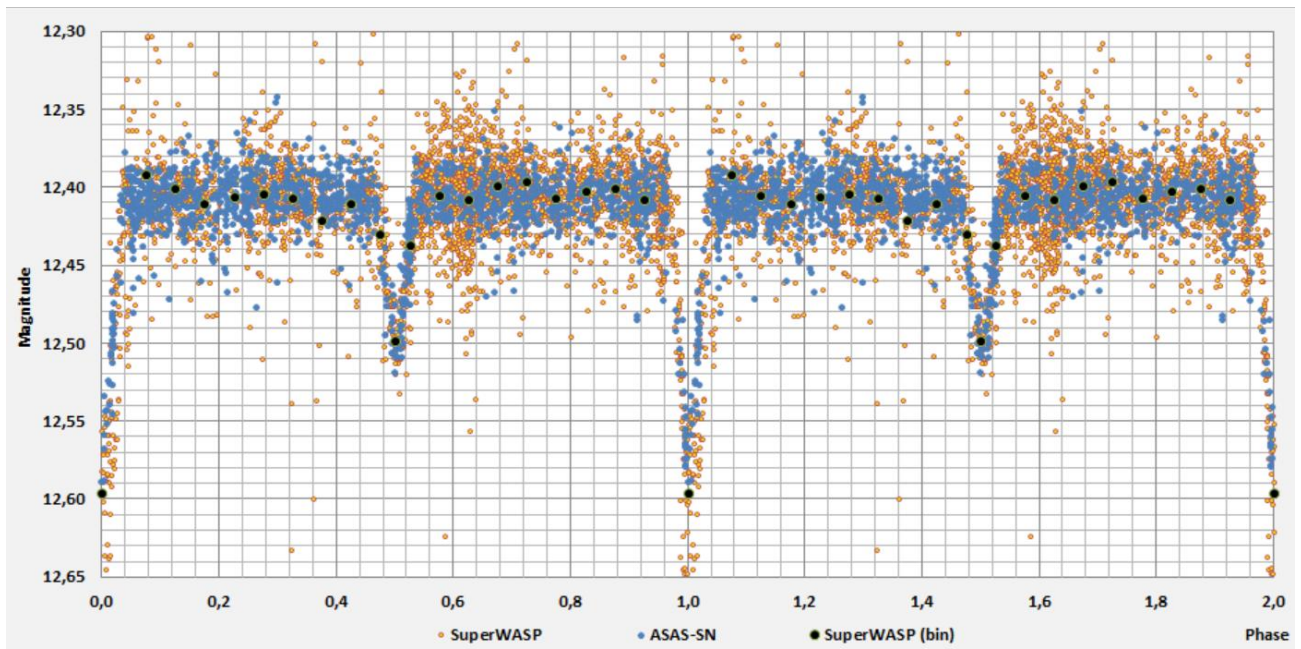


Figure 6: Combined phased light curve of ASASSN-VJ020541.98+474203.4 = GSC 03285-00741 using the period (2.616149 d) from the VSX database and the data from the SuperWASP and ASAS-SN project. This graphic is taken from the AAVSO website.

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