BAV Journal

2021 No. 49 ISSN 2366-6706

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.

http://bav-astro.de

Improved elements of the eclipsing binary NSV 25369 Cyg

Moschner, Wolfgang
Lennestadt, Germany
email: wolfgang.moschner@t-online.de

Frank, Peter
Velden, Germany
email: frank.velden@t-online.de

Bernhard, Klaus
Linz, Austria
email: Klaus1967Bernhard@gmx.at

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.

February 2021

Abstract: *NSV 25396 is mentioned for the first time in the NSV Catalog [1] without a reference to type and period. The amplitude is given there as 0.9 mag (14.2-15.1 mag). The object is listed in the ASAS-SN (Typ RRab) and Atlas (Type EA) variable catalogs, but with a period that does not exactly match our observations. 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.*

Introduction

The type and period of NSV 25369 were first published by ASAS-SN and ATLAS. Different types are mentioned. The authors take this as an opportunity to examine the variable more closely. The variable is listed in the ATLAS [2] and ASAS-SN-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 (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 and ATLAS periods, we have used our data to present an improved period solution.

Periods known so far:

Simbad	no information
ASAS-SN	0.5168292 d (Type = RRab)
ATLAS	1.033655 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

G-band mean magnitude = 350-1000 nm
Integrated BP mean magnitude = 330- 680 nm
Integrated RP mean magnitude = 640-1000 nm

Explanations to the light curve:
Different colors denote different observing nights.

All coordinates are taken from the Gaia DR2 catalogue [8].

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).

NSV 25369 Cyg

Cross-ID's
= ASASSN-V J205117.17+343105.0
= ATOID J312.8209+34.5177
= Gaia DR2 1869248214815201920

Right ascension: 20h51m17.0307s at epoch and equinox J2000
Declination: +34° 31' 04.040" at epoch and equinox J2000
Barycentric right ascension (ICRS) at Epoch=2015.5: 312.820932455° +/- 0.02 mas
Barycentric declination (ICRS) at Epoch=2015.5: 34.517748244° +/- 0.02 mas

Gaia DR2 Catalog:
14.9055 mag G-band mean magnitude
15.4346 mag Integrated BP mean magnitude
14.1720 mag Integrated RP mean magnitude
1.2626 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 significant improvement over the ASAS-SN period and all ATLAS periods, since our minima are not represented with all periods known so far. Our phased light curve shows an EA star with approximately equally deep minima.

The amplitude for Min I is given as 0.55 mag, 15.10-15.65 mag (V) and for Min II as 0.50 mag, 15.10-15.60 mag (V).

NSV 25369 Cyg (improved elements)

Amplitude: Min I: 0.55 mag (instr.) Min II: 0.50 mag (instr.)
Type: EA type eclipsing binary

Min I = HJD (UTC) 2458382.4852 + 1.0336353*E
±0.0006 ±0.0000006

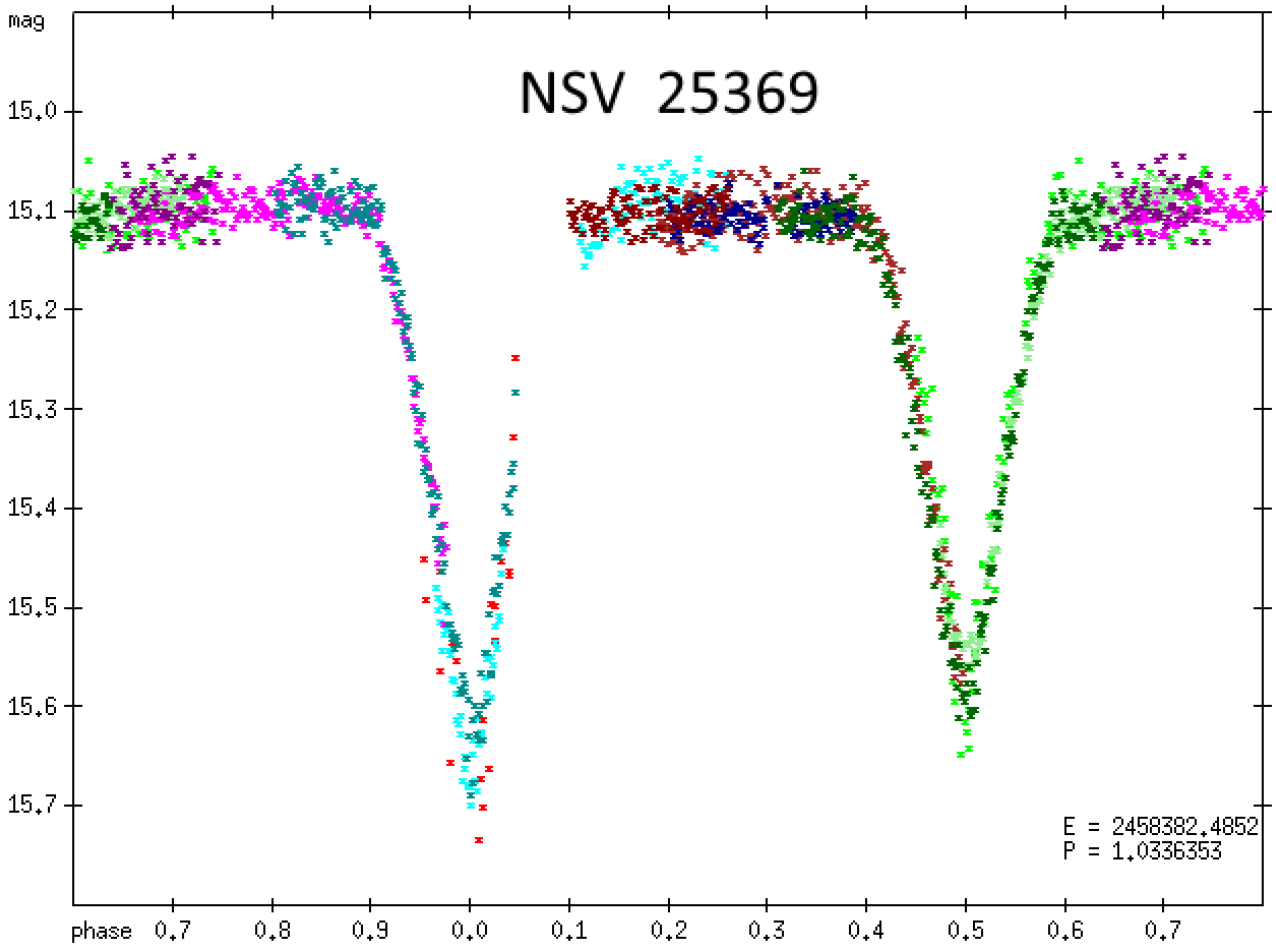

Figure 1: Phased light curve of NSV 25369 Cyg using the ephemeris given by the authors. The vertical axis shows raw instrumental magnitudes. Different colors denote different observing nights. Only the data points from the better nights were used to display the light curve. An FLI Proline 16803 camera + a V-filter (2016-2020) was used.

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)
P. Frank	2456654.2492	I	-1672	0.0022
P. Frank	2457287.3468	II	-1059.5	-0.0018
P. Frank	2457307.5052	I	-1040	0.0007
P. Frank	2457658.4252	II	-700.5	0.0015
P. Frank	2457684.2633	II	-675.5	-0.0013
P. Frank	2457733.3615	I	-628	-0.0008
W. Moschner	2457894.6090	I	-472	-0.0004
W. Moschner	2457965.4115	II	-403.5	-0.0018
W. Moschner	2458321.4991	I	-59	-0.0017
W. Moschner	2458382.4867	I	0	0.0015
W. Moschner	2458687.4076	I	295	0.0000
W. Moschner	2458710.6636	II	317.5	-0.0008
W. Moschner	2458761.3127	II	366.5	0.0002
W. Moschner	2459075.5368	II	670.5	-0.0009
W. Moschner	2459120.5031	I	714	0.0023

Table 1: Minima NSV 25369 Cyg, O-C using the ephemeris given by the authors.
The O-C of the secondary minima were computed assuming that the true phase is at exactly 0.5.

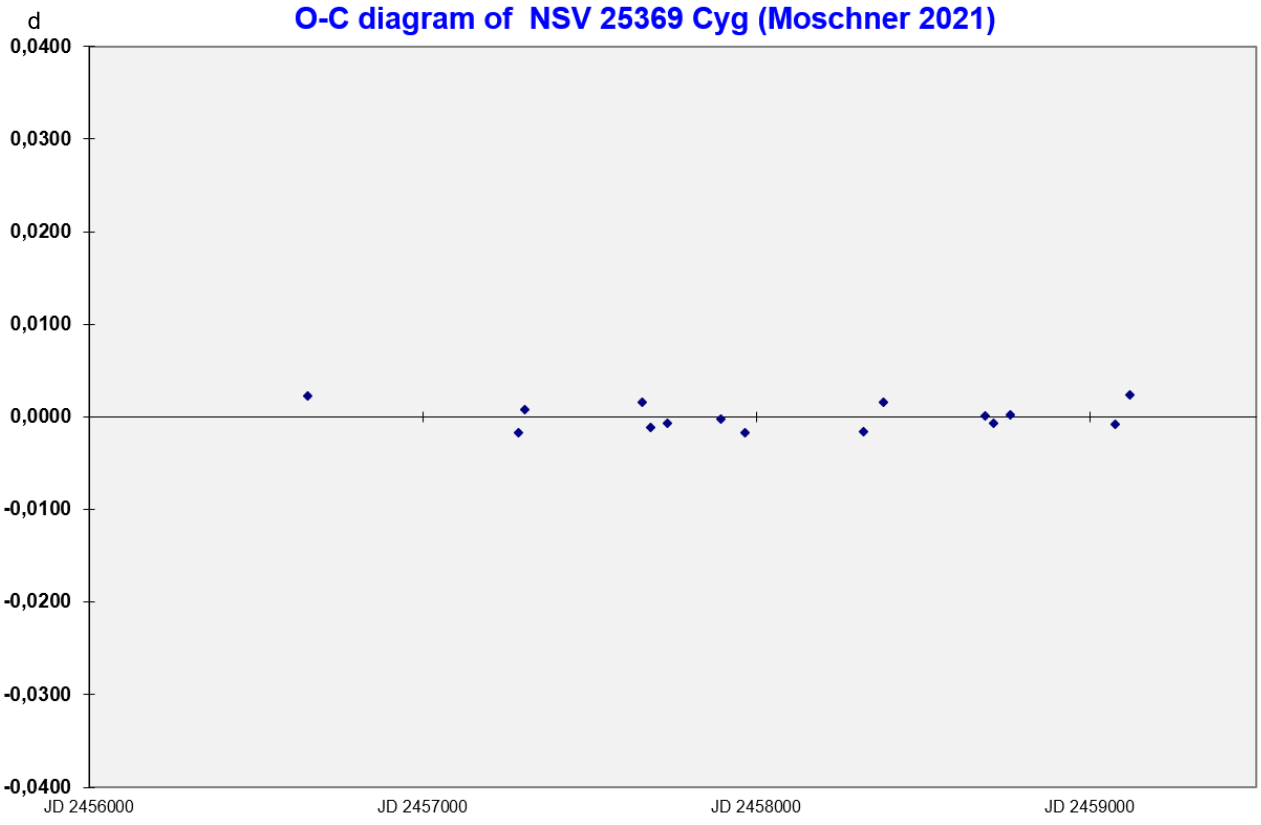

Figure 2: O-C-diagram for NSV 25369 Cyg using the ephemeris given by the authors.

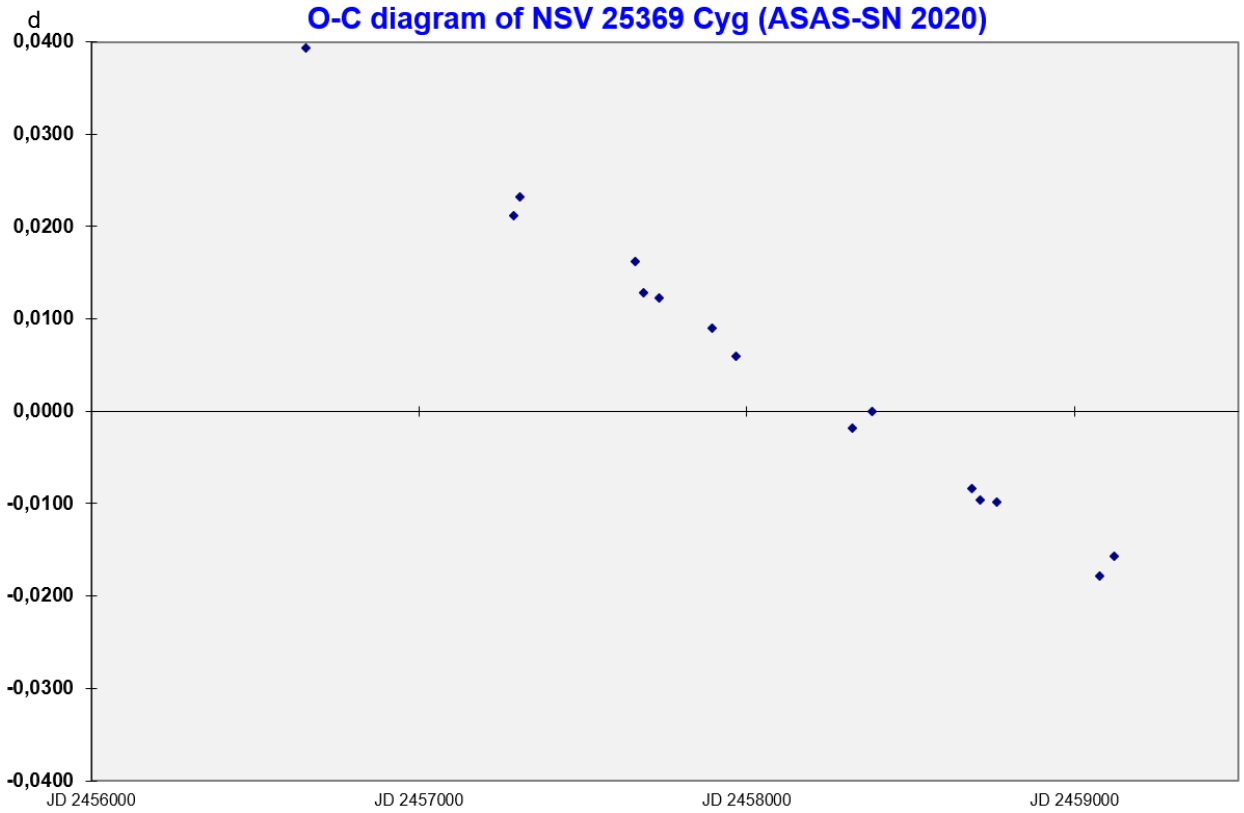

Figure 3: O-C-diagram for NSV 25369 Cyg using the period from ASAS-SN.
The period was doubled (1.0336584 d)

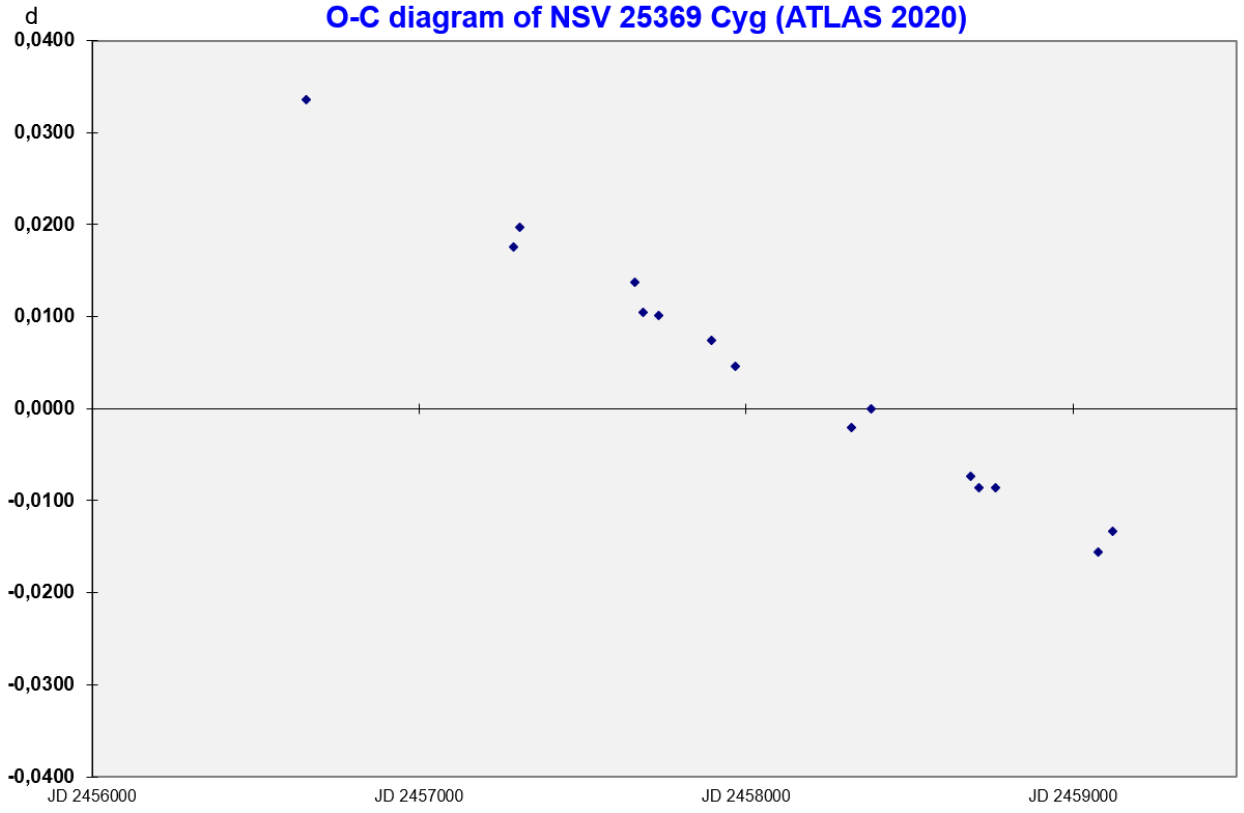

Figure 4: O-C-diagram for NSV 25369 Cyg using the period from ATLAS.

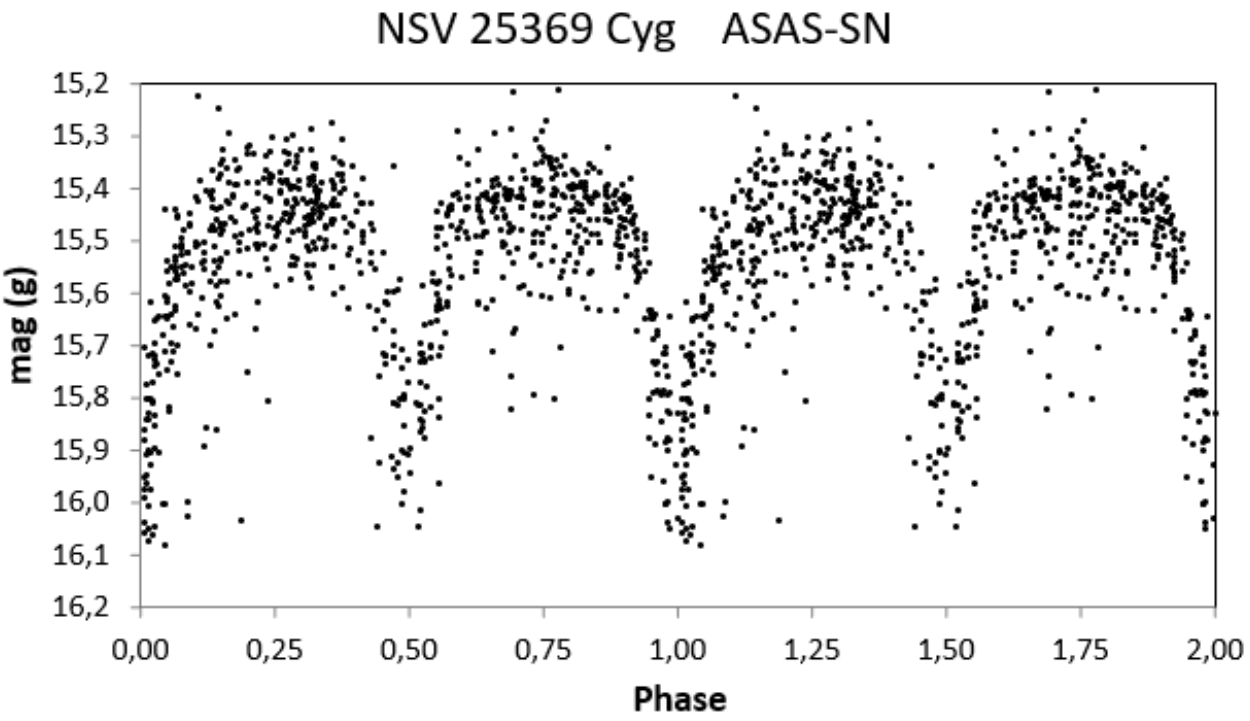

Figure 5: Phased light curve of NSV 25369 Cyg using the new elements and data from ASAS-SN (g-Band).

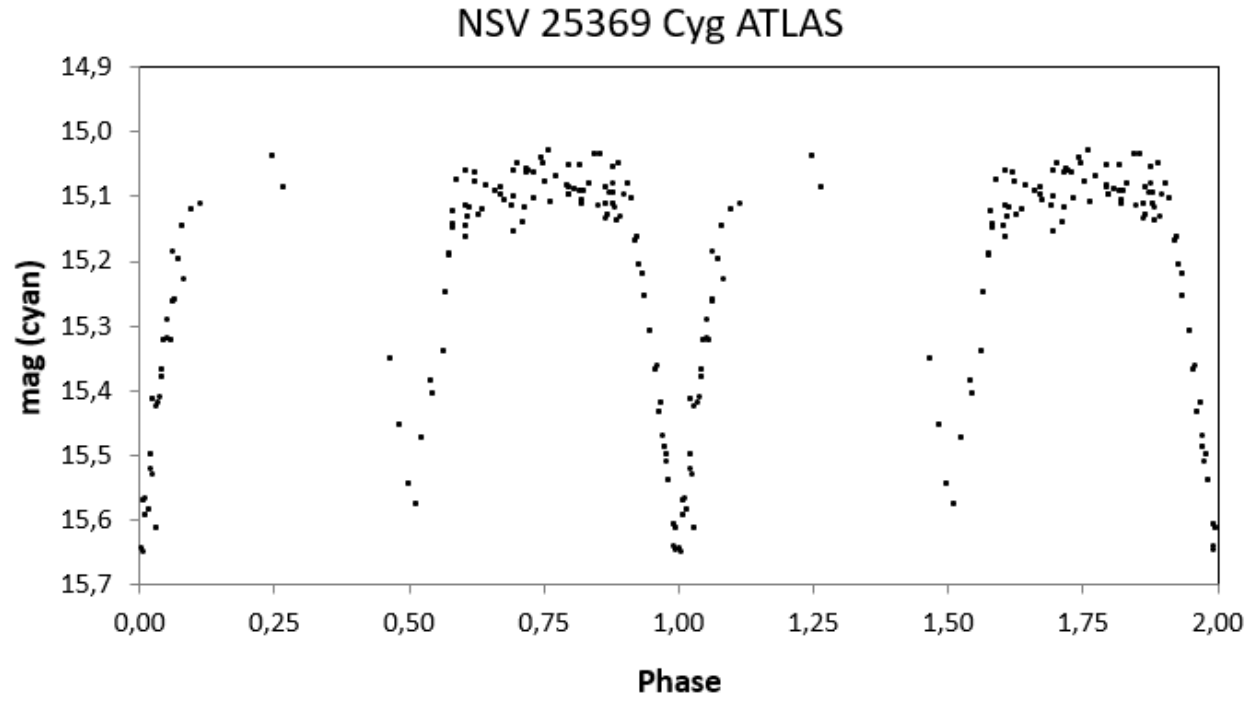

Figure 6: Phased light curve of NSV 25369 Cyg using the new elements and data from ATLAS (Cyan-Filter 420-650 nm).

Acknowledgements

This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France, the International Variable Star Index (VSX) database, operated at AAVSO, Cambridge, Massachusetts, USA and the ASAS All Star Catalogue operated by the Ohio State University.

The authors thank David Motl [5] for providing his MuniWin photometry program, Franz Agerer (BAV) and Lienhard Pagel (BAV) [6] for providing their personal data analysis program.

References

[1] New Catalogue of Suspected Variable Stars Supplement (Kazarovets+ 1998)
The NSV Supplement Catalog (11206 rows)
https://vizier.u-strasbg.fr/viz-bin/VizieR?-source=II/219

[2] 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

[3] All-Sky Automated Survey for Supernovae ASAS-SN
http://www.astronomy.ohio-state.edu/asassn/index.shtml
Shappee et al., 2014, ApJ, 788, 48S
https://ui.adsabs.harvard.edu/abs/2014ApJ...788...48S
Jayasinghe et al., 2019, MNRAS, 485, 961J
https://ui.adsabs.harvard.edu/abs/2019MNRAS.485..961J:

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

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

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

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

[8] Gaia DR2 (Gaia Collaboration, 2018)
European Space Agency.
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=I/345