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Photometric characteristics of the eclipsing binary V355 Aur

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Abstract:

We characterized the eclipsing system V355 Aur by means of new CCD and old photoelectric B, V measurements.

Résumé:

De nouvelles mesures CCD et d'anciennes mesures photoélectriques B et V ont permis de mieux préciser les caractéristiques de la variable à éclipses V355 Aur.

Riassunto:

Nuove misure CCD e precedenti misure fotoelettriche B e V hanno permesso
una piu' precisa caratterizzazione della variabile a eclisse V355 Aur.

Resumen:

Nuevas medidas CCD y anteriores medidas fotoeléctricas B y V han permitido precisar mejor las características de la variable eclipsante V355 Aur.

Introduction

Discovered by Gessner in 1980 on photographic plates, S 10836, in the constellation of Auriga, was immediately considered as a probable eclipsing star. Later, Gessner published seven times of photographic minima (see Table 2). S10836 is the Tycho or GSC star 02918-01961, later renamed V355 Aur (Kholopov et al. 1981).

Observations

A) Visual

At first, the star was observed visually involving a few GEOS observers, but the target was not easy: low amplitude and almost constant during a night, but the variability was considered as sure. The star was included in a photoelectric program during GEOS missions at Jungfraujoch observatory.

B) Photoelectric

Sixty V and fifty-nine B measurements were performed over a period of eleven years using a cooled photometer equipped with filters of the Geneva photometric system attached to the Jungfraujoch Observatory's 76 cm telescope. Transformation of the B-V values from Geneva into Johnson and Morgan's system was done using Meylan and Hauck's formulae (1981). The magnitude variation was determined to be: 10.26 to 10.66 in B and 10.85 to 11.20 in V. The B-V colour index does not vary much: +0.27 to +0.34. One secondary minimum was recorded (see Fig 1). The secondary minimum reached 10.45 (B) and 11.08 (V), respectively. However, it was not possible, from this scattered data set, to find out the period of the star. Table 3 lists all photoelectric measurements, while Fig. 3 presents the V light curve.

C) Rotse1 survey

The Northern Sky Variability Survey (Wozniak et al., 2004) recorded the brightness of V355 Aur under two distinct designations: 4514290 and 4401404 with 211 and 27 data points respectively. Keep in mind that ROTSE1 is a robotic all-sky survey made without filter. From that database, it was possible for us to determine three more secondary minima. Otero et al., (2006) used all the data to determine a period and compute a mean primary minimum time. A complete ROTSE1 light curve is presented in Fig. 4.

D) New CCD measures

Three more observers obtained additional primary minimum timing on the star: Krajci (2006) using no filter, Van Den Abbeel (2008) using a V filter (see Fig. 2) and Brát (2008) using an R filter. Collecting all the available minima (see Table 1) it was possible to present a refined ephemeris for that EA star:

HJD 2447519.27 + 17.6447 E
+/- 0.03 +/- 0.0002

The photographic minima of Gessner were not included in Table 1 or in the calculation of the improved period, but these minima and their respective O-C's are presented in Table 2. The value of photographic minima are, in general, very limited when Julian date is the only information published, as in the case of the Gessner paper. However, some authors have reported the Julian date of the plate, along with a magnitude estimate. In that case, it is possible to use the data of several plates, exposed over a period of a few months, and folding them using the star period. The quality of the minima timing is improved by using several points instead of one.

Discussion

If the nature of the star seems obvious, it is interesting to point out that the Tycho 1 Catalogue (Hog E. et al., 1998) gives a large value for the parallax (99.8 mas), which would place the star around 10 parsecs from the Sun. The standard error on that parallax is very large too (68 mas)! In fact, at that distance, the apparent brightness of the star should almost equal its absolute magnitude. In that case, V355 Aur must be around three hundred times fainter than the Sun would be at 10 parsecs, which seems unlikely according to the B-V value. The parallax value from Tycho 1 is most probably wrong.

Acknowledgments

Many thanks to Patrick Wils, for his help concerning the nature of this eclipsing star, to Andrew Elliott who checked the English version of this paper, to all the people who participated to the measurements on V355 Aur at Jungfraujoch Observatory. The graphics are generated by the Peranso software (www.peranso.com).

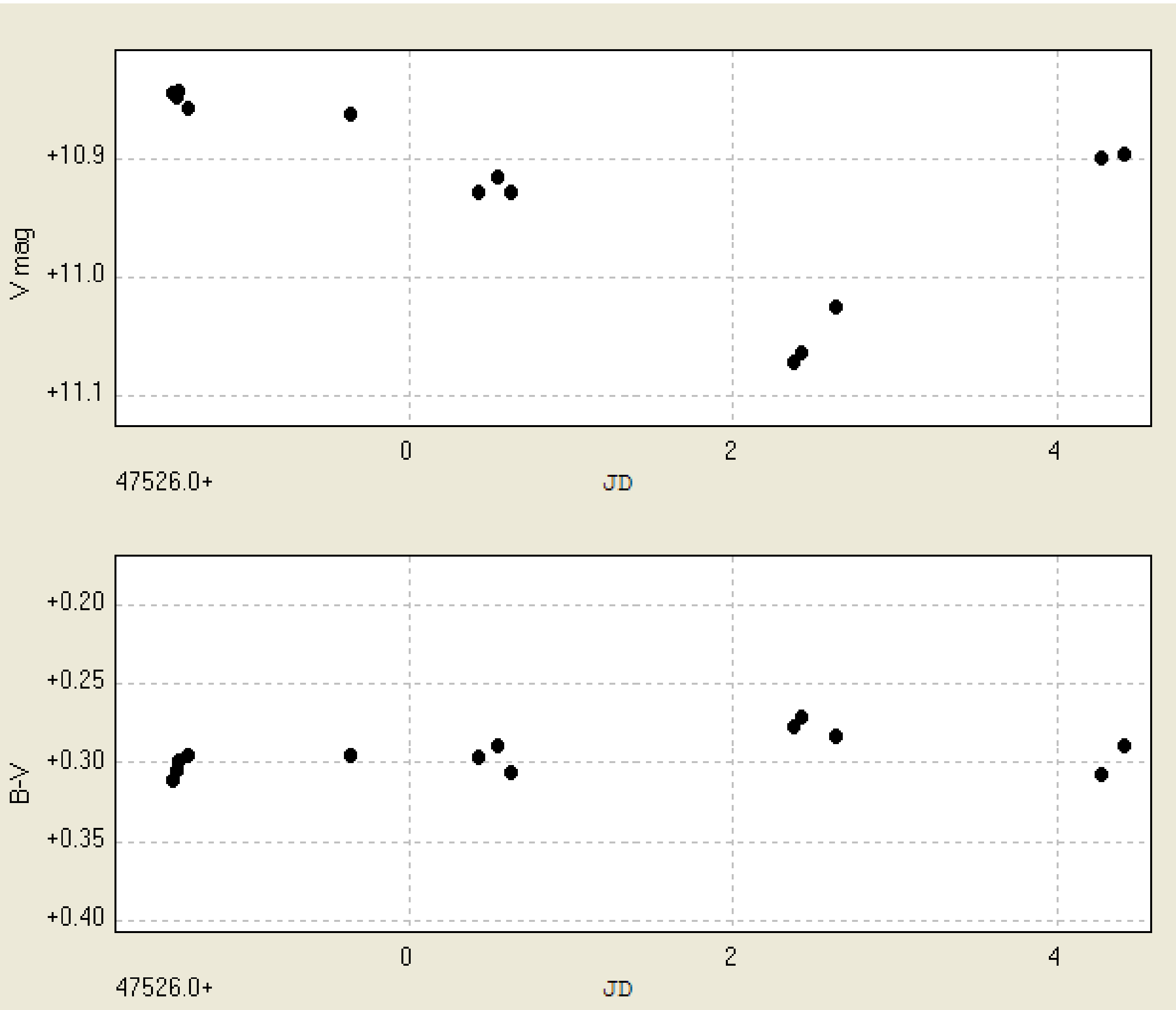

Figure 1: Jungfraujoch observed photoelectric secondary minimum in V band (top panel) and B-V index (bottom panel).

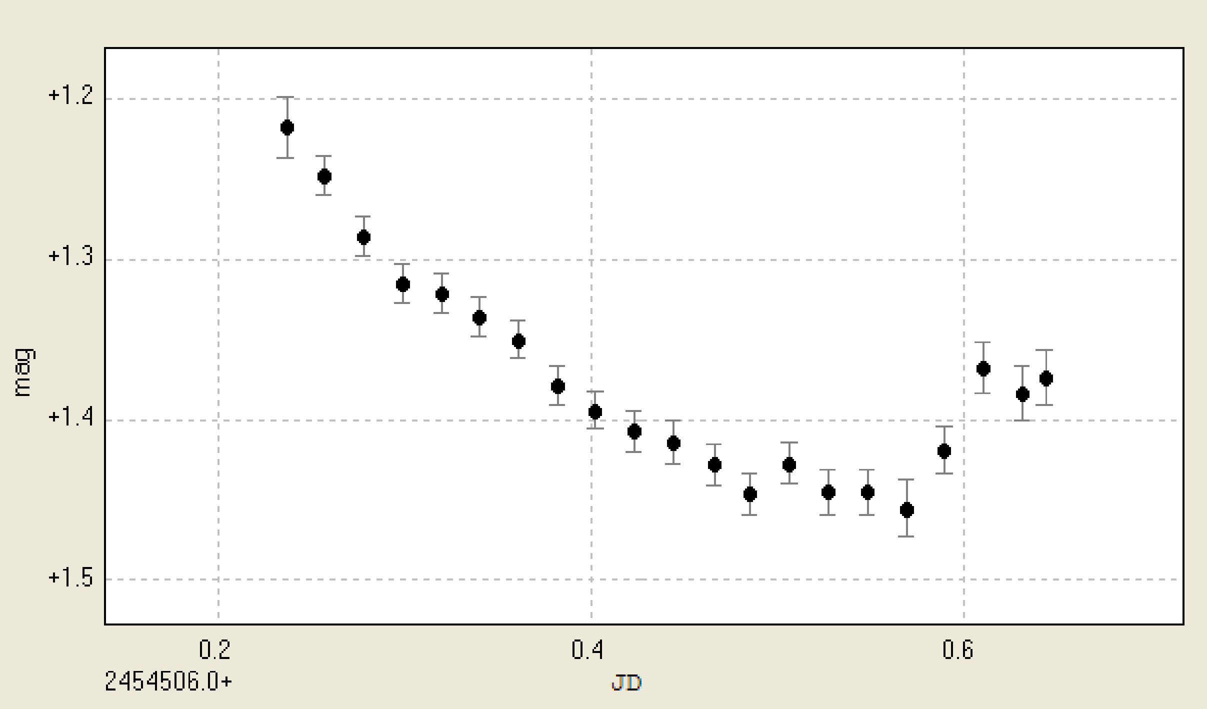

Figure 2: Van Den Abbeel observed primary minimum with a CCD camera and a V filter.

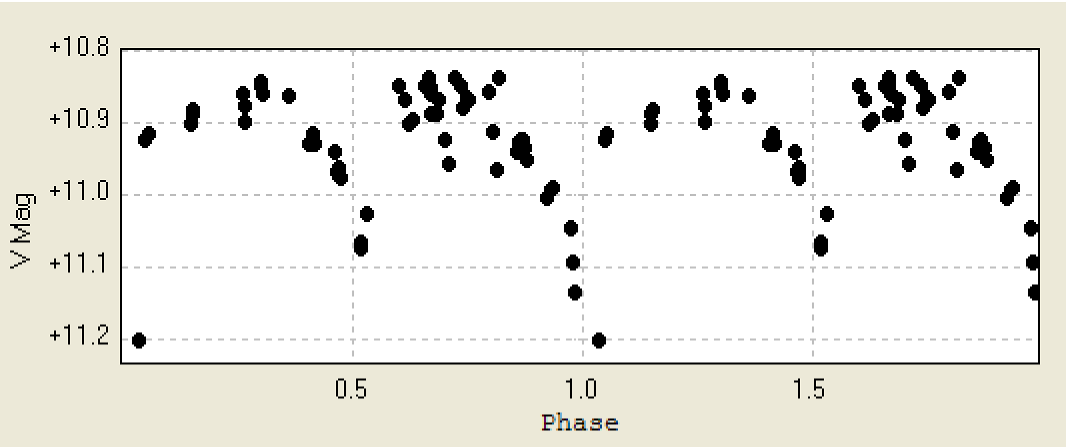

Figure 3: Jungfraujoch composite V light curve using above ephemeris.

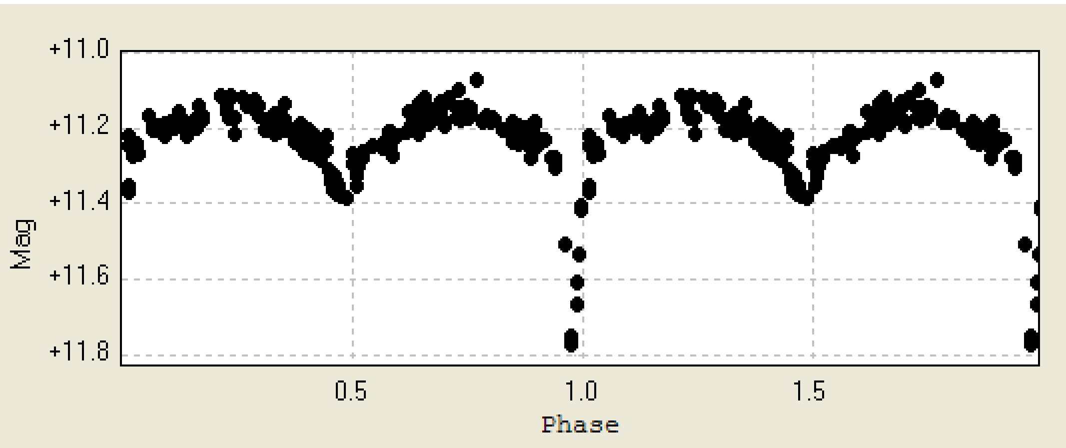

Figure 4: Rotse1 measurements composite light curve using above ephemeris.

Table 1: V355 Aur list of observed minima.

Hel. J.D. 2400000 +	Obs.	E	O-C
47527.98	Jungfraujoch B	0.5	-0.12
47528.14	Jungfraujoch V	0.5	0.04
51277.680	Otero S. et al.	213	0.080
51462.853	Rotse	223.5	-0.017
51515.918	Rotse	226.5	0.114
51604.014	Rotse	231.5	-0.013
53359.6683	Krajci T.	331	-0.0093
54453.5888	Brat L.	393	-0.0618
54506.5626	Van Den Abbeel F.	396	-0.0222

Table 2: V355 Aur list of observed photographic minima.

Hel. J.D. 2400000 +	Obs.	E	O-C
39915.4	Gessner H.	-431	1.0
41300.5	Gessner H.	-352.5	1.0
41361.4	Gessner H.	-349	0.1
41598.5	Gessner H.	-335.5	-1.0
41679.3	Gessner H.	-331	0.4
41741.4	Gessner H.	-327.5	0.8
43849.5	Gessner H.	-208	0.3
43955.3	Gessner H.	-202	0.3

Table 3: V355 Aur photometry from Jungfraujoch.
$B\text{-}V_G$ refers to Geneva system color index, $B\text{-}V_J$ refers to Johnson and Morgan system.

Hel. JD +2400000	V	$B\text{-}V_G$	$B\text{-}V_J$
47151.3616	10.90	-0.60	0.30
47151.3856	10.89	-0.57	0.32
47151.4220	10.88	-0.57	0.32
47153.3193	10.86	-0.58	0.31
47153.4075	10.87	-0.57	0.32
47153.4432	10.90	-0.57	0.32
47524.5394	10.84	-0.58	0.31
47524.5651	10.85	-0.59	0.31
47524.5776	10.84	-0.60	0.30
47524.6303	10.86	-0.60	0.30
47525.6428	10.86	-0.60	0.30
47526.4262	10.93	-0.60	0.30
47526.5484	10.92	-0.61	0.29

Table 3: V355 Aur photometry from Jungfraujoch (continued).

Hel. JD +2400000	V	B-VG	B-VJ
47526.6303	10.93	-0.59	0.31
47528.3782	11.07	-0.62	0.28
47528.4220	11.06	-0.63	0.27
47528.6379	11.03	-0.61	0.28
47530.2782	10.90	-0.58	0.31
47530.4143	10.90	-0.61	0.29
48978.4679	10.92	-0.58	0.32
48978.6630	10.96	-0.59	0.30
48981.3421	10.93	-0.58	0.32
48981.3949	10.92	-0.58	0.32
48981.4553	10.92	-0.56	0.33
48981.5435	10.93	-0.57	0.32
48981.6394	10.95	-0.59	0.30
48982.4345	11.00	-0.59	0.31
48982.5449	10.99	-0.59	0.30
48982.6178	10.99	-0.58	0.31
48983.3463	11.04	-0.58	0.32
48983.4011	11.09	-0.58	0.31
48983.4629	11.13	-0.56	0.33
48984.4268	11.20	-0.54	0.34
49721.5690	10.96	-0.62	0.28
49721.6614	10.84	-0.60	0.30
49722.3579	10.94	-0.59	0.30
50070.6880	10.85		
50336.5561	10.89	-0.59	0.31
50336.6166	10.86	-0.57	0.32
50456.5029	10.97	-0.58	0.31
50456.5550	10.97	-0.57	0.32
50456.5904	10.96	-0.59	0.31
50456.6217	10.98	-0.55	0.34
50460.3180	10.89	-0.58	0.31
50460.3979	10.87	-0.57	0.32
50461.2937	10.85	-0.59	0.30
50461.3666	10.88	-0.59	0.30
50461.4735	10.87	-0.58	0.31
50461.5249	10.87	-0.59	0.31
50461.5972	10.87	-0.59	0.30
50462.3673	10.86	-0.59	0.31

Table 3: V355 Aur photometry from Jungfraujoch (continued).

Hel. JD +2400000	V	B-VG	B-VJ
50462.4742	10.91	-0.58	0.31
51076.6508	10.87	-0.59	0.30
51077.5821	10.84	-0.56	0.33
51077.6189	10.85	-0.57	0.32
51077.6335	10.85	-0.58	0.31
51078.5517	10.84	-0.58	0.31
51165.6922	10.85	-0.61	0.29
51172.5769	10.92	-0.59	0.30
51172.6852	10.92	-0.60	0.29

References:

Brát, L., et al., 2008, Open Eur. Journ. On Var. Stars, 94, 1 (2008OEJV...94....1B)
Gessner, H., 1980, Mitt. Verand. Sterne, **8**, 157, (1980MitVS...8..157G)
Gessner, H., 1980, Mitt. Verand. Sterne, **8**, 175-177, (1980MitVS...8..175G)
Hog, E., et al., 1998, Astron. Astrophys., 335, L65-L68, (1998A&A...335L..65H)
Kholopov, P.N. et al.,1981, IBVS **2042** , (1981IBVS.2042....1K)
Krajci, T., 2006, IBVS **5690**, (2006IBVS.5690....1K)
Meylan, G., Hauck B., 1981, Astron. Astroph. Suppl. Ser., **46**, 281, (1981A&AS...46..281M)
Otero, S., Hoogeveen, G.J., and Wils, P., 2006, IBVS **5674**, (2006IBVS.5674....1O)
Van Den Abbeel, F., 2008, Personal communication
Wozniak, P.R., et al., 2004, *AJ*, **127**, 2436, Northern Sky Variability Survey: Public Data Release (2004AJ....127.2436W)