Photometric measurements of an unknown variable star near M29

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Abstract

A unknown W UMa type contact binary system was observed in August 2012 near the young open cluster M29 (NGC6913) in the constellation Cygnus. After additional CCD measurements during 8 nights in August and September 2012, the period of this close binary system could be calculated with $0.^{d}3065$.

Introduction

During the evaluation of photometric measurements in August 11, 2012 in constellation Cygnus at M29 an unknown variable was detected. The detection was made during checking the standard deviations of the observed stars with the software "Muniwin".[1] Figure 1 shows the standard deviations of all stars in the observed field of view in this night. Do to the short observation time of 4 hours, only stars with short periods were detectable.

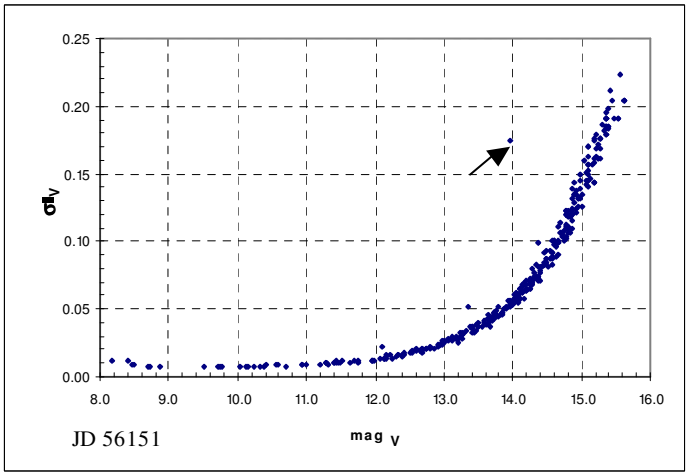


Fig. 1 Dispersion diagram for 372 stars for the observation of M29. The unknown variable is marked.

The following search in the catalogs VSX and VizieR could not provide any evidence that this star is variable. According the VicieR and SIMBAD database the exact designation and coordinates of this star could determined according Table 1.

Table 1. Catalog-name and coordinate of the variable star

Catalog	Designation	RAJ2000	DEJ2000.
UCAC4	644-092136	20 23 47.552	+38 39 01.09
USNO-B1.0	1286-0409452	20 23 47.587	+38 39 01.70
GSC2.3	N343018329	20 23 47.579	+38 39 01.32
2MASS	J20234755+3839011	20 23 47.552	+38 39 01.17

Observations

Despite the low brightness (for amateurs) of about 14^m further observations were planned in the following nights. Because of the short nights in August and September, it was not possible to detect a light curve of a complete period but after analysis of all measurements in August and September 2012 with the software "Peranso"[2] a period of P = $0.^d3065$ was found. (Table 2) With these elements, the time can be calculated for a primary minimum :

$$T_{min.} = HJD\ 2456157.49179 + 0.^d3065\ E \qquad \pm 0.^d00283$$

The light curves shows a mean brightness with V Filter of $14.^m27$. The primary minimum could determined with $14.^m82$ and for the secondary minimum with $14.^m75$. Table 4 shows all light curves.

Table 2. Overview of all observed minima and maxima

UT Date	HJD+2400000	Error	Cycle No.	No. of frames	Filter	Type of minima
17. Aug. 2012	56157.49179	± 0.000088	0	216	V	Primary
18. Aug. 2012	56158.41075	± 0.000072	3	218	V	Primary
18. Aug. 2012	56158.56511	± 0.000132	3.5	"	V	Secondary
19. Aug. 2012	56159.48463	± 0.000106	6.5	221	V	Secondary
26. Aug. 2012	56166.37940	± 0.000151	29	219	V	Primary
26. Aug. 2012	56166.53404	± 0.000117	29.5	"	V	Secondary
27. Aug. 2012	56167.45349	± 0.000125	32.5	228	V	Primary
27. Aug. 2012	56167.60547	± 0.000111	33	"	V	Secondary
16. Sept. 2012	56187.37588	± 0.000232	97.5	206	V	Primary
16. Sept. 2012	56187.52871	± 0.000075	98	"	V	Secondary
17. Sept. 2012	56188.45005	± 0.000199	101	117	B	Primary
20. Sept. 2012	56191.36012	± 0.000249	101.5	111	B	Secondary

The measurements with the V filter was not a problem but the observation in September with B Filter could not performed optimally. Because of the large zenith angle and the long exposure time of 4 minutes the measurements were very difficult. All images were calibrated with dark and flat frames and evaluated with the software Muniwin. Table 3 and Fig. 4 shows the stars which were used for the calibration procedure.

Table 3. Reference stars used for calibration

Star	Catalog	Designation	RA (J2000)	DEC (J2000)	B mag	Vmag
Comp	UCAC4	644-092115	20 23 40.909	+38 37 43.72	13.787	12.761
Check	UCAC4	644-092152	20 23 52.195	+38 44 39.00	12.590	12.194
Check2	UCAC4	644-092128	20 23 45.426	+38 39 52.59	15.329	14.501
Check3	UCAC4	644-092159	20 23 55.848	+38 36 54.11	14.660	13.566

Fig. 4 AAVSO Finding chart

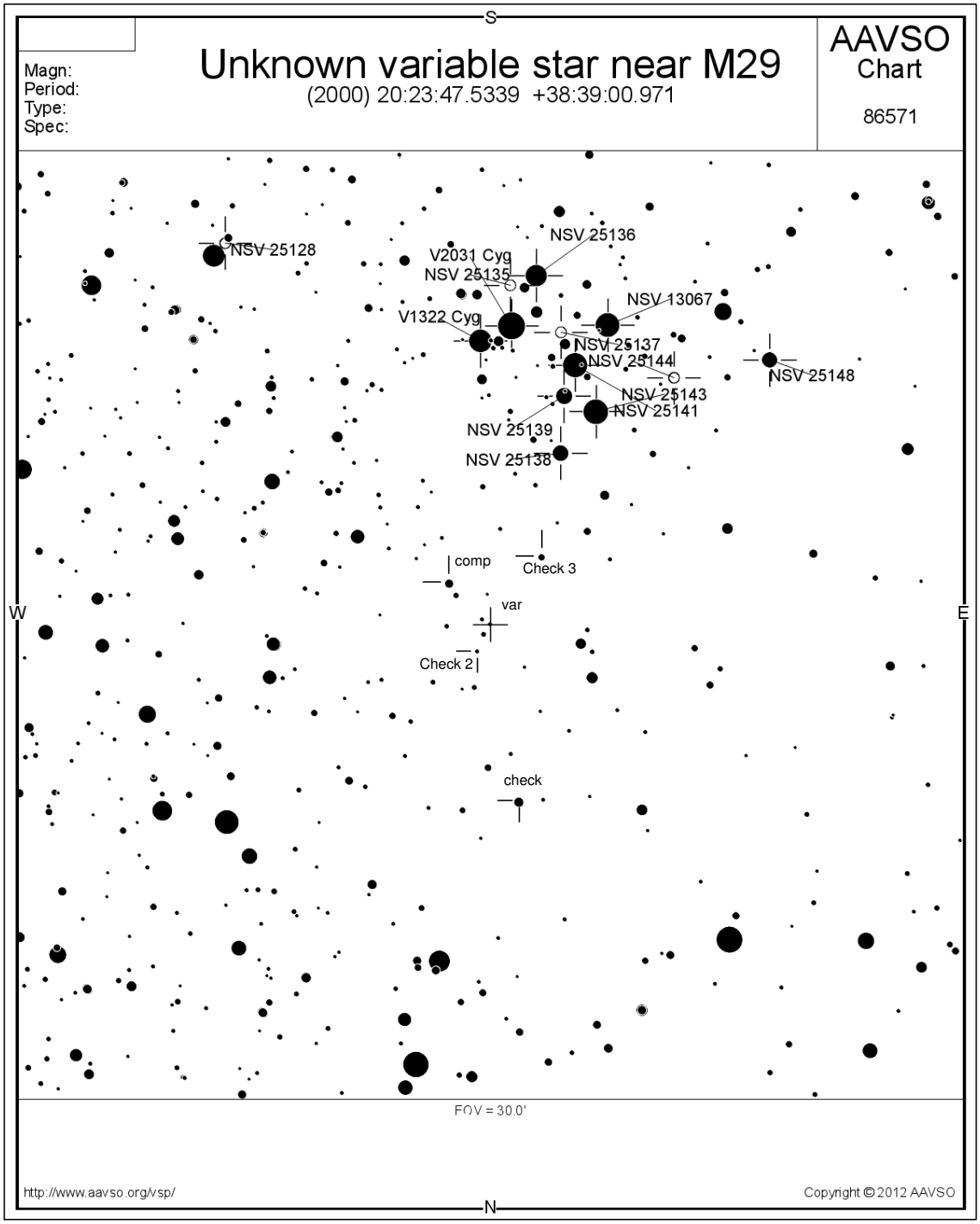
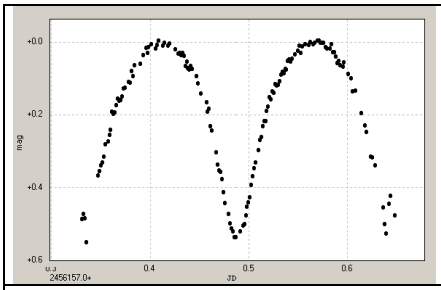
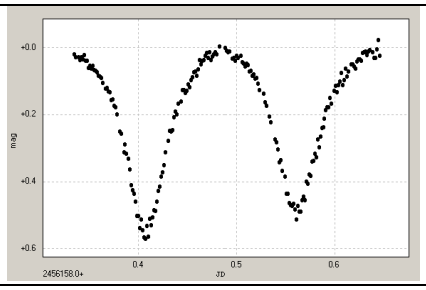
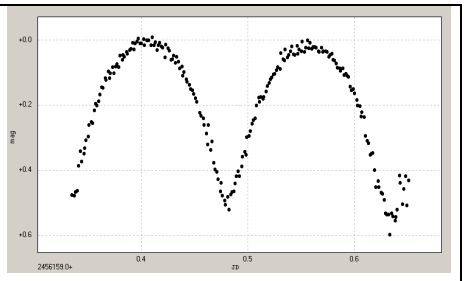
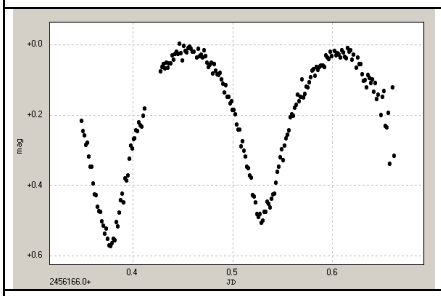
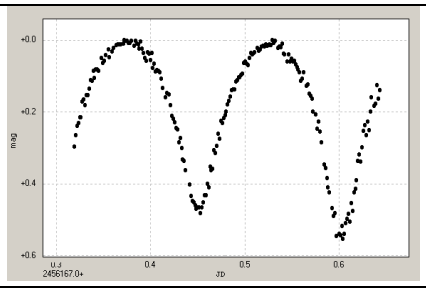
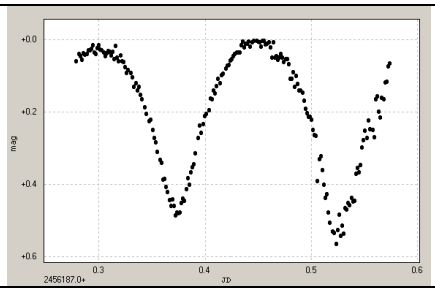
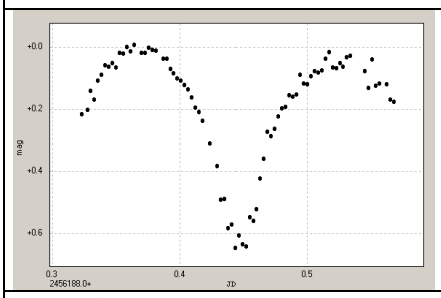
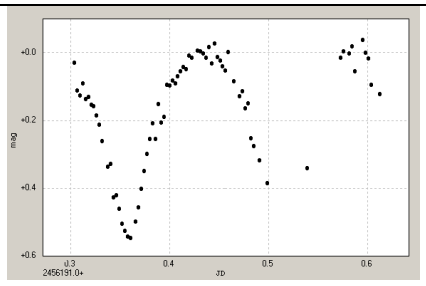


Table 4. Light curves of all observations

		
August 17, 2012	August 18, 2012	August 19, 2012
		
August 26, 2012	August 27, 2012	September 16, 2012
		
September 17, 2012	September 23, 2012	

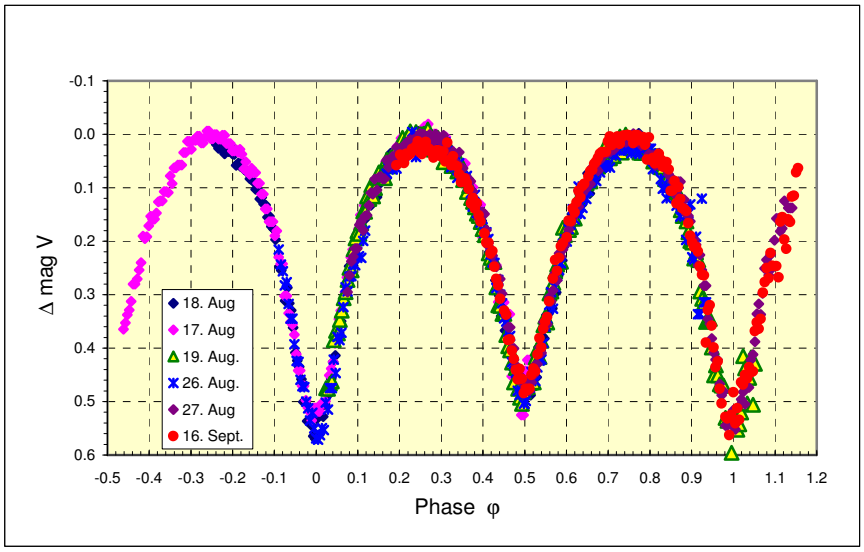


Fig. 5 Phase of all V measurements

Summary

The light curves of the measurements indicate that this variable is an eclipsing variable star of type W UMa (EW system). The nearly identical minima of the light curve, and the period duration of $0.^{d}3065$ fit well with the characteristics of such variables. [3] To improve the accuracy of the measurements larger telescopes should be used. The exposure time of 120 s for V and especially 240s for B filter is already close to 1% of the period. To determine other system parameters spectroscopic radial velocity measurements would be necessary.

[1] Muniwin, Version 1.2.30, CCD Data processing software for differential photometry
[2] Peranso, Version 2.50, light curve and period Analysis Software
[3] Light curves of variable stars, A Pictorial Atlas, C. Sterken and C. Jaschek, Cambridge University Press