

PHOTOMETRIC VARIATIONS OF AS296

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Abstract

Photometric observations of the symbiotic star AS296 in U, B, V during the past three years are described and the need for more observations is stressed.

1. Introduction

AS296 is a well-known symbiotic star ($\alpha = 18^{\text{h}}12^{\text{m}}33^{\text{s}}$, $\delta = -0^{\circ}19'53''$ (1950.0)) according to Allen (1984). Normally a faint star, ($V \sim 12$), it is known to show gross spectral changes. It was classified as an s! (very intense) $H\alpha$ source by Merrill and Burwell (1950). Wackerling (1970) noted the presence of molecular absorption and classified it as type Z, that is, as a symbiotic star. Despite showing spectral changes, no major photometric variability was recorded prior to 1988 (Esipov *et al.* 1987 and references therein, McNaught 1988). Munari (1988) discovered AS296 in outburst, being then 4 magnitudes brighter in V than during quiescence. The onset of outburst was between June 1 and 10, 1988 (Munari and Whitelock 1989). The outburst spectrum was quite different from the quiescent one. Kenyon and Fernandez-Castro (1987) determined improved spectral types, obtaining $M5.3 \pm 0.6$ III for the cool component of AS296. The recent outburst of AS296 gives a good opportunity to learn about the physical parameters of this system and to investigate the various conflicting interpretations.

2. Observations

In this work, UBV magnitudes were observed over the last three years at Serra La Nave, the stellar station of Catania Astrophysical Observatory. The observations were carried out with the 91-cm Cassegrain telescope, using a photon counting single-head photometer equipped with an EMI 9789 QA photomultiplier and a diaphragm of 2-mm diameter limiting the telescope field to about 28-arc sec. Observations through U (UG 12-1 mm), B (BG 12-1 mm + GG 13-2 mm) and V (GG 14-2 mm) Schott filters were made consecutively by a movement of the filter wheel, which stops on the chosen filters at the selected time intervals. Every measurement lasted one minute and consisted of nine counts (three each in U, B, and V) with integration times of 12 sec, 4 sec, and 4 sec in U, B, and V, respectively. Due to the shortness of the observations each night, we preferred to adopt the seasonal mean absorption coefficients of Serra La Nave station ($K_U = 0.684 \pm 0.02$, $K_B = 0.387 \pm 0.02$, $K_V = 0.247 \pm 0.02$), those of the single nights being poor in weight but in agreement with the seasonal ones. Reductions of the Serra La Nave observations to the Johnson standard system were made using the standard stars BD+4°3561, HD 170493, and HD 175544 (Landolt 1983) whose characteristics are reported in Table 1. The standard stars were observed nearly each night. The transformation of the nights without observations of standard stars was made using the

mean values of the transformation coefficients $\Sigma_V = -0.12$, $\Sigma_{B-V} = 1.13$, $\Sigma_{U-B} = 1.05$. Every night AS296 was observed together with two comparison stars: BD -0°3445 ($V = 9.463$, $B-V = 1.289$, $U-B = 1.177$) and a nearby star ($V = 11.830$, $B-V = 0.744$, $U-B = 0.186$) with coordinates $\alpha = 18^{\text{h}}12^{\text{m}}37^{\text{s}}.2$, $\delta = -0^{\circ}22'50''.6$ (1950.0). Table 2 gives the U, B, and V observations and their weights, which refer to the number of single observations during a night. In Figure 1, the V magnitudes and the color indices B-V and U-B obtained from the Catania observations are plotted *versus* Julian date.

Table 1. UBV Standard Stars (Landolt 1983)

Star	$\alpha(1985)$	δ	V	B-V	U-B
BD +4° 3561	17 ^h 57 ^m 03 ^s	4°38'00"	9.553	+1.737	+1.264
HD 170493	18 ^h 29 ^m 05 ^s	-1°49'38"	8.037	+1.076	+1.068
HD 175544	18 ^h 55 ^m 02 ^s	+0°14'49"	7.395	+0.107	-0.671

Table 2. U, B, V magnitudes of AS296 observed at Catania Observatory

Date	JD 2440000+	U	B	V	Weight
1988 Aug. 31	7405.39	10.72±0.02	10.86±0.02	9.76±0.02	8
Sep. 1	7406.35	10.60 .02	10.79 .02	9.73 .02	8
3	7408.36	10.70 .02	10.88 .01	9.77 .01	12
Nov. 8	7474.25	11.77 .04	11.92 .03	10.76 .02	8
1989 May 29	7676.45	13.26 .03	13.27 .03	11.84 .03	48
Jul. 3	7711.52	12.73 .02	12.80 .02	11.48 .02	48
Aug. 7	7746.35	11.48 .01	11.54 .01	10.35 .01	24
Nov. 9	7840.24	13.95 .03	14.05 .02	12.24 .02	24
1990 May 27	8039.42	11.76 .01	11.90 .01	10.65 .01	16
Jun. 12	8055.43	11.91 .01	11.94 .01	10.67 .01	21
25	8068.43	11.91 .02	12.00 .02	10.72 .02	4
30	8073.36	11.92 .02	12.03 .02	10.73 .02	6
Jul. 18	8091.41	12.08 .02	12.18 .02	10.77 .02	23
29	8102.38	12.19 .02	12.20 .02	10.79 .02	16
Sep. 16	8151.30	12.34 .01	12.33 .01	10.93 .01	4
18	8153.31	12.36 .02	12.36 .02	10.96 .02	11

The weights refer to the number of single points observed during the night.

3. Results

From the V plot it is evident that after the first outburst, the star presents a very slow return to the quiescence interrupted by two quick luminosity decreases, followed by two equally quick outbursts of lesser luminosity. The mean duration of each decrease or increase of luminosity is about 200 days. From the last observations, it is possible to deduce that after about 800 days from the outburst, AS296 had reached only the middle of the return toward the normal magnitude of the quiescence. From the color indices, it is

evident that no differences exist between the U and B behavior, while a careful look at the B-V plot shows that the V increase is about one magnitude less than that of the other two colors. Compared to typical symbiotic stars, the light curve of AS296 presents similarities and anomalies; for example, the maximum was reached relatively quickly. Only an intense and long observational campaign could give the data necessary for constructing the model of this interesting symbiotic star.

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References

- Allen, D. A. 1984, *Proc. Astr. Soc. Australia*, **5**, 369.
Esipov, U. F., Ipatov, A. P., and Yudin, B. F. 1987, *Astrophys. J.*, **25**, 487.
Kenyon, S. J. and Fernandez-Castro, T. 1987, *Astron. J.*, **93**, 938.
Landolt, A. U. 1983, *Astron. J.*, **88** (3), 439.
McNaught, R. H. 1988, *IAU Circ.*, No. 4628.
Merrill, P. W. and Burwell, C. G. 1950, *Astrophys. J.*, **112**, 72.
Munari, U. 1988, *IAU Circ.*, No. 4622.
Munari, U. and Whitelock, P. A. 1989, *Mon. Not. Roy. Astron. Soc.*, **239**, 273.
Wackerling, L. A. 1970, *Mem. Roy. Astron. Soc.*, **73**, 153.

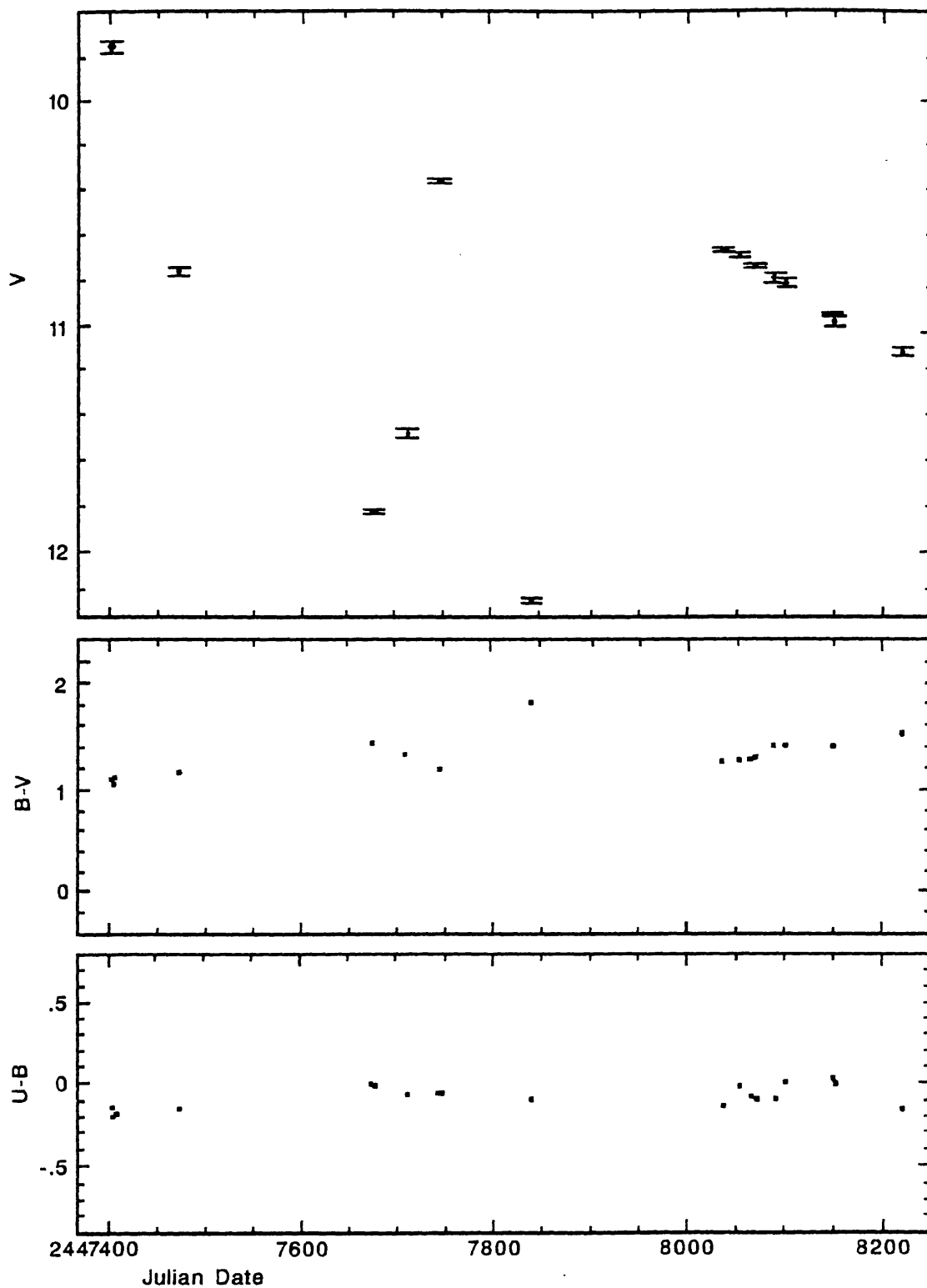


Figure 1. The V magnitudes and the color indices B-V and U-B, obtained from the Catania observations. Each point represents the mean value of the observations collected in one single night, the size the mean error of the night