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A NEW ALGOL TYPE VARIABLE IN CYGNUS?

In summer 1984 photoelectric photometry of the WR star HD 186943 was carried out at the Tian-Shan High-Altitude ( $\sim 3000\text{m}$ ) Observatory of the Sternberg State Astronomical Institute (SSAI). The star HD 186943 was discovered by Massey (1981) as a double-lined spectroscopic binary with the period  $9^{\text{d}}.55$ . During the observations of HD 186943 the star C2=BD+28 $^{\circ}$ 3434 was used as a comparison, and the star C4=HD 187462 - as a check star. Data concerning these stars are given in Table I. The observations were made with an unrefrigerated WBVR-photometer using the 0.48 m reflector.

Table I

	Name	Sp	W	B	V	R
"Comparison" star	C2=BD+28 $^{\circ}$ 3434	B1 Ibp	7 $^{\text{m}}$ .69	8 $^{\text{m}}$ .70	8 $^{\text{m}}$ .51	8 $^{\text{m}}$ .33
Check star	C4=HD 187462	G05	7 $^{\text{m}}$ .46	7 $^{\text{m}}$ .53	6 $^{\text{m}}$ .97	6 $^{\text{m}}$ .72

W, B, V, R - values were determined by reduction to the photometric standard HD 190603 observed on July 28/29 (JD 2 445 910) and August 1/2 (JD 2 445 914).

After the data processing it became clear that on the night August 17/18 (JD 2 445 930) the light of the "comparison" star C2 fell by  $\sim 0^{\text{m}}.22$  in W,  $\sim 0^{\text{m}}.12$  in B,  $\sim 0^{\text{m}}.09$  in V, and  $\sim 0^{\text{m}}.06$  in R as compared with the previous night. On the last 5 nights of our observations the light still diminished somewhat in W, and in other colours it remained about the level of the night JD 2 445 930. The full amplitudes of the light changes are  $\Delta W_{\text{max}} = 0^{\text{m}}.28$ ;  $\Delta B_{\text{max}} = 0^{\text{m}}.26$  (or  $0^{\text{m}}.13$ , if we disregard the last, "jumped out", point in B);  $\Delta V_{\text{max}} = 0^{\text{m}}.11$ ;  $\Delta R_{\text{max}} = 0^{\text{m}}.07$ .

The W-light curve of the star C2 over the observational period (JD 2 445 900 - 2 445 935) is shown in Figure 1. On the former 30 nights, the light of C2 appeared to remain approximately constant (its variations were  $\lesssim 0^{\text{m}}.015$  as compared to the mean level. The observations of the last successive 5 nights revealed light variations resembling ingress into eclipse for an Algol-type variable.

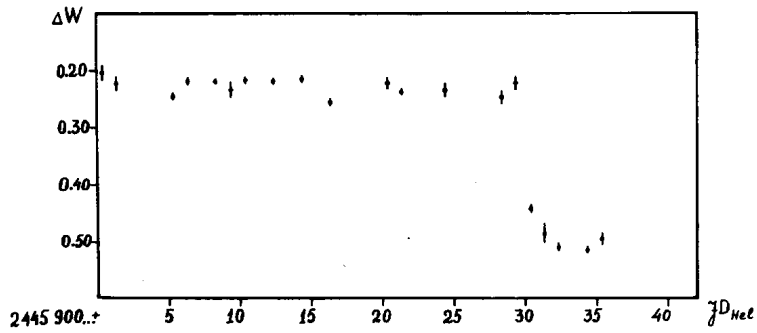


Figure 1: The W light curve for  $BD+28^{\circ}3434$ . The difference between stellar magnitudes of two stars in the sense  $BD+28^{\circ}3434 - HD 187462$ ,  $\Delta W$ , versus Julian Date is shown. Vertical bars indicate nightly scattering between individual observations.

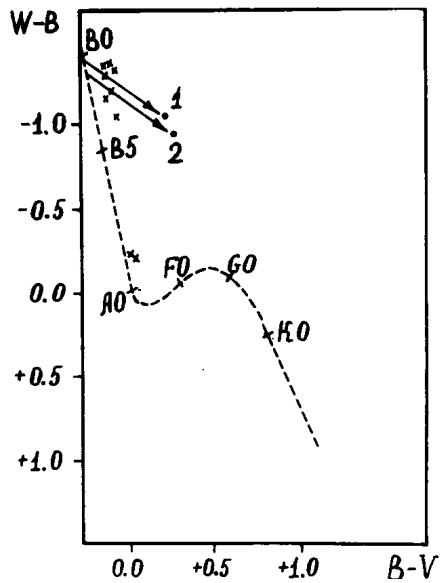


Figure 2: The colour - colour diagram. The dashed curve is the main sequence, crosses mark supergiants. The positions of  $BD+28^{\circ}3434$  are shown by points 1 and 2 corresponding to its maximum and minimum light. Direction of reddening is indicated by lines with arrows.

Table II

JD He1 2 445 900+	W	B	V	R
0.298	7 <sup>m</sup> .66	8 <sup>m</sup> .72	8 <sup>m</sup> .53	8 <sup>m</sup> .53
1.355	7.68	8.71	8.52	8.51
5.352	7.70	8.69	8.50	8.51
6.236	7.68	8.69	8.50	8.48
8.263	7.68	8.69	8.50	8.50
9.235	7.69	8.70	8.53	8.51
10.272	7.68	8.69	8.51	8.49
12.251	7.68	8.68	8.50	8.49
14.311	7.67	8.69	8.50	8.50
16.371	7.71	8.71	8.53	8.51
20.348	7.68	8.70	8.51	8.49
21.220	7.70	8.70	8.52	8.52
24.335	7.69	8.70	8.50	8.48
28.275	7.71	8.71	8.52	8.49
29.226	7.68	8.69	8.51	8.50
30.236	7.90	8.81	8.60	8.56
31.224	7.94	8.82	8.60	8.55
32.214	7.97	8.83	8.61	8.56
34.208	7.97	8.83	8.62	8.56
35.211	7.95	8.96	8.60	8.57

Fortunately, the star C2 was reduced to the photometric standard HD 190603 on an almost constant part of its light curve. W, B, V, R values given in Table I for C2 correspond to this constant part of the curve. The magnitudes of C2 and C4 were reduced for differential extinction taking into account their colour indices.

The W, B, V, R - photometry of the star C2=BD+28°3434 is given in Table II. The colour-colour diagram is shown in Figure 2 where points 1,2 mark the positions of C2. The upper point (1) corresponds to the "constant" part of the light curve (JD 2 445 900 - 2 445 929), and the lower one - to the minimum light (JD 2 445 930 - 2 445 935).

Let us take the intrinsic colour for B0 -B1 supergiants to be equal to  $(B-V)_0 = -0.20$  as it follows from Figure 2. Then the colour excesses for positions 1 and 2 are  $E_{B-V}(1)=0.41$ ,  $E_{B-V}(2)=0.47$ . If we take the absolute stellar magnitude for a B0I star  $M_V = -6.4$  according to Underhill (1966), the corresponding distance modulus is  $5 \cdot \lg d - 5 + A_V = 14.91$  (15.01), and the distance is  $d \approx 5 \text{ kpc}$ .

Using the results obtained by Sharov (1963) we can estimate the interstellar extinction in the direction of Cygnus to be higher than  $2^m/\text{kpc}$ . High extinction yields an anomalously low luminosity for the star BD+28°3434,  $M_V \approx -2.5$ , which is inconsistent with the luminosity of type I supergiants. This low luminosity is rather consistent with the spectral type B3V.

In conclusion it is worth to note that in case the observed effect of the light fall is really an "ingress" into eclipse, the period of the "eclipsing binary system" BD+28°3434, showing resemblance to Algol - type variables by its light curve, should be more than  $30^d$ .

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