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NEW VBLUW OBSERVATIONS OF THE YELLOW VARIABLE SUPERGIANT Tr 27 - 102 = HD 159378

1. Introduction

The G0 Ia supergiant Tr 27-102 = HD 159378, a member of the open cluster Tr 27, showed to be variable during an observing run in 1977. The light amplitude was about 0.12 mag and the characteristic period about 80 d (van Genderen and Thé, 1977, hereafter called Paper I). In view of its abnormal colour indices compared with other G type supergiants, the presence of a blue companion seemed to be a natural explanation (van Genderen, 1980, hereafter called Paper II). This short note deals with new VBLUW observations made in 1980.

2. Observations

The observations were made with the Walraven VBLUW simultaneous photometer attached to the 90-cm lightcollector at the ESO (La Silla, Chile) during 14 nights in June and July 1980. References concerning the photometric system are given in Paper I. The observations discussed in that Paper were made with the same equipment when the telescope was still in South Africa. Since slight changes in the photometric system originated after some improvements in the equipment were performed after the move to Chili, we only give here the tentative results. However the differences between the photometric systems of 1977 and 1980 are of minor importance for the present note. The exact transformation will be available in the near future. They will be not larger than 0.01 in log intensity scale. The comparison star HD 158528 is the same as in 1977. A diaphragm of 15" aperture has been used. The standard deviations (in log intensity scale) for the observations are in ΔV and $\Delta(V-B)$, $\pm$ 0.002, in $\Delta(B-L)$, $\pm$ 0.005 and in $\Delta(B-U)$, $\pm$ 0.007.

3. Discussion

Figure 1 depicts the light- and colour curves relative to the comparison star in log intensity scale. It shows a rising branch with a time scale of the same order as the light curves of Fig. 1 in Paper I viz. $\sim$ 40 d. The scatter is much smaller than in Paper I, since the sky conditions in Chili are better and the equipment has been improved. Because the intensity in W is low, we omit the curve for the index (U-W), but give an average value in Table 1.

Similar to the observations of 1977 all colours become bluer when the star rises in brightness. A comparison of the average values of brightness and colours of 1980 with those of 1977 shows a remarkable change, which is evident from the last row of Table 1 (the photometric data of the comparison star were checked in 1980 and showed to be constant within the limits of the expected differences between the VBLUW systems of 1977 and 1980). The variable became brighter by 0.13 mag in V, while the colour indices became redder, with the exception of the B-U index, which became bluer. In magnitude scale the changes in V, B, L, U and W are as follows: 0.13, 0.08, -0.18, 0.25 and -0.18 mag respectively (negative signs mean a decrease in flux). Thus the changes are remarkably high in the ultra violet bands: L (3840 A, containing the Balmerlimit), U and W (3630 and 3250 A respectively, at the short wavelength side of the Balmerjump).

With the aid of Fig. 2 of Paper II, which depicts the three two-colour diagrams, one can see the shift of the star's position (after a reddening correction has been applied). It is evident that the determination of physical parameters of the hypothetical blue companion has little sense, as long as colours vary so strongly. Because of this effect, the parameters as derived in Paper II may be spurious. It is thus possible that the blue companion lies in reality closer to the main sequence, that its T_{eff} is higher and its absolute magnitude is fainter than derived in Paper II. The blue companion is certainly no white dwarf. Its absolute brightness is then too low to have any influence on the combined colours. High resolution ultra violet spectroscopy is now the only method to find the characteristics of both components.

The large colour change is presumably related to the little understood phenomenon of supergiant variability. If the blue companion is relatively bright and evolved, it could well be also the cause of the long time scale variation.

Table 1. Average photometric parameters of Tr 27-102 = HD 159378 in 1980 in the VBLUW system (in log int.) and in the UBV system (in mag and with subscript J). For the reddening correction we used $A_V = 3.3\ E_{V-B}$.

	V	V-B	B-L	B-U	U-W	V_J	$(B-V)_J$
	(log intensity)					(mag)	
relative to HD 158528 :	-0.068	0.766	0.350	0.528	0.58		
on the natural system :	-0.667	0.884	0.546	0.903	0.74	8.40	1.94
on the natural system corrected for reddening :	1.64	0.18	0.24	0.46	0.42	4.20	0.5
difference 1980-1977 :	0.05	0.02	0.10	-0.07	0.17	-0.13	0.05

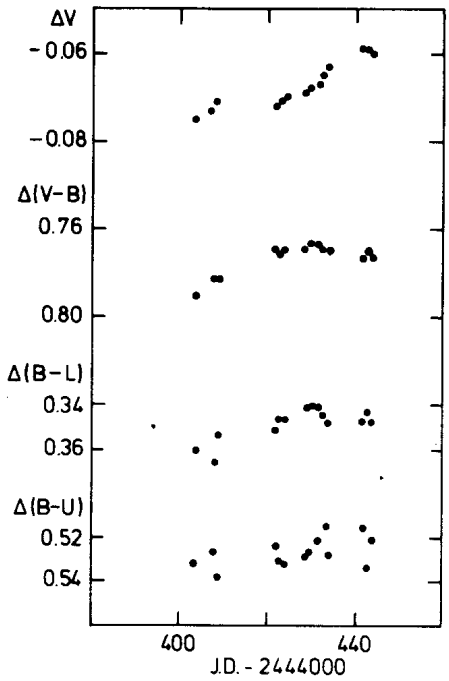

Figure 1

The light- and colour curves of Tr 27-102 = HD 159378 relative to the comparison star (in log intensity scale).

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