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ON THE PHOTOMETRIC FEATURES OF R CrB DUST ENVELOPE

The variable stars of RCB type constitute a small subclass of old evolved objects which show random Algol-like fadings of large amplitude (Zhilyaev et al., 1975). Besides the drastic photometric variability they show several peculiar features, as follows:

1. helium-rich, hydrogen-deficient composition (Searle, 1961; Danziger, 1965),
2. quasi-periodic light variations of intermediate amplitude (Feast, 1975; Alexander et al., 1972),
3. bright emission lines at minimum brightness (Payne-Gaposhkin, 1963),
4. variability of light polarization (Efimov, 1980),
5. infrared excess (Feast and Glass, 1973; Shenavrin et al., 1979; Stein et al., 1969).

Some of these RCB properties can be reasonably interpreted assuming that dust cloud condensations are the reason of the occasional brightness fadings. While the stellar brightness gets dimmer, the colour indices, IR-excess, degree of the light polarization and the intensity of emission lines are enhanced.

Let us consider the optical properties of the dust cloud without touching the question of the dust genesis. In spite of numerous multicolour photoelectric observations of the star, the optical properties of RCB circumstellar dust are not completely understood. For a long time two observational facts, viz.

a.) the profound difference of the reddening factors R

$$R = A_V/E_{b-v} = \Delta V/\Delta(B-V)$$

for descending ($R_\downarrow$) and ascending ($R_\uparrow$) branches of a light curve, since according to observations $R_\downarrow >> R_\uparrow$;

b.) noticeable variability of factor $R_\uparrow$ during the recovery phase as the star brightness grows from minimum to the normal level ; led some investigators to the spurious conclusion that RCB dust significantly differs from interstellar dust with $R_{is} = 3.2$ (Wing et al., 1972).

Our study implies that it is not the case. Fernie et al., (1972) were the first who turned attention to the case that $R_{\downarrow} >> R_{is}$ could not be only due to the intrinsic properties of the dust particles but might also point to the existence of dense obscuring clouds which partially cover the stellar disk. An assumption of the heterogeneity of obscuring matter over the disk of the star allows to explain the variability in the $R_{\downarrow}$ and $R_{\uparrow}$ (Pugach, 1984). To avoid or at least to reduce the influence of the heterogeneity upon $R_{\uparrow}$ one should make photometric observations near the normal brightness ($\Delta V \approx 0^m.5$) when obscuring matter is more or less uniform in a projection over the stellar disk.

We took our UBVR-observations of R CrB during its recovery phases when the brightness of the star was approaching to the normal level and V-magnitudes ranged within $5^m.8$ - $6^m.6$. Observations were made at Terskol Peak, the Caucasus (3100 m) with the 0.5 m reflector equipped with an automatic single-channel photometer. We used HD 141352 = BD $+28^\circ 2475$ (F2) as a comparison star and HD 140913 = BD $+28^\circ 2469$ (G0 V) as a check one. Their magnitudes were obtained by means of differential measurements with standard star BS 5889 = HD 141714= BD $+26^\circ 2737$ (G5 III).

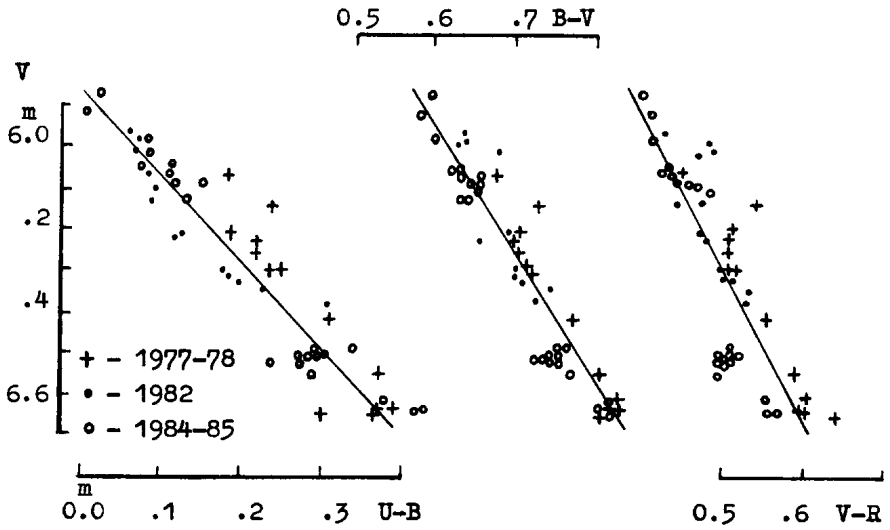

Figure 1

We observed two R CrB minima in 1977-78 and 1982 and the 1983-84 minimum was observed by Goncharova (1985). In Fig. 1 V-R, B-V and U-B colour indices are plotted against V-magnitudes (1977-78 -- crosses, 1982 -- dots and 1983-84 -- circles). The solid lines represent the law:

$\Delta V = 3.81\ \Delta(V-R)$; $\Delta V = 3.20\ \Delta(B-V)$; $\Delta V = 2.12\ \Delta(U-B)$.

Two remarks are to be added to these figures.

1. Data of the three minima of R CrB are within the limit of one relation. It points to the constant character of the optical properties of the dust within some years.

2. The V versus (B-V) and V versus (V-R) dependences for R CrB exactly coincide with that of interstellar extinction law (Schultz, Wiemer, 1975) implying that RCB dust causes the same extinction effect within 0.4 - 0.7 microns as the interstellar matter.

Thus, as follows from our observations, the optical properties of the RCB dust bear a strong resemblance with that of interstellar matter in the R, V, B passbands and slightly differ from interstellar law for the ultraviolet region.

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