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ON THE CAUSE OF PERIODICAL LIGHT VARIATIONS OF SOME RED DWARF STARS

At least three red dwarf stars are at present known which show periodical light variations. Although all three are spectrum binaries the light variations are definitely not due to eclipses. The name of these stars, V magnitude at minimum, amplitude and period of light variation, absolute magnitude M_V and spectral class are given in the Table.

Name	V_{min}	ΔV	Period	M_V	Sp
BY Dra	8.4	0.2	$3^d.84$	7,6	K6Ve
CC Eri	8.7	0.3	1.56	8.4	K7Ve
FF And	10.4	0.06	2.17	8.7	dM0e

The photometric behaviour of these stars has been studied by Evans, Chugainov and Krzeminski (1-4). It has been found that the essential common features of them are irregular variations of the amplitude and phase of the light curve. Another important feature is the small amplitude of colour variations. The change of the (B-V) colour during one observational season usually does not exceed the errors of observation. Changes of the (U-B) colour are not negligible but these, probably, reflect the presence of some small flare activity not unusual for red dwarfs.

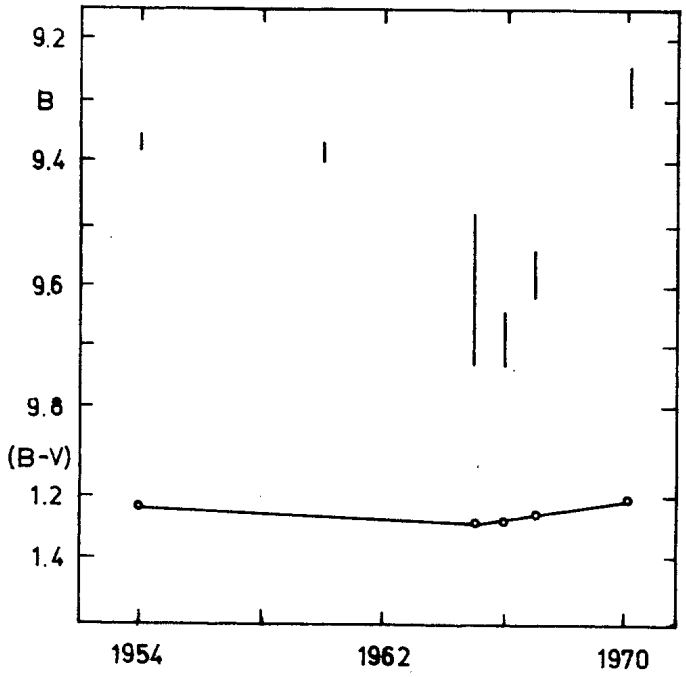
The existence of irregular variations of phase and amplitude is the main argument contra the eclipse hypotheses. Beside these, as was found by Evans and Kraft, the duration of the minimum in the case of eclipse would be much shorter than observed because the separation of the components is at least 10 times their radii.

Krzeminski (4) has shown that the interpretation of light variations by radial pulsations is not acceptable because the periods are two order of magnitude greater than those which were obtained on the base of the theory of red dwarfs.

The interpretation suggested by us (3) and developed by Krzeminski (4) is that the observed light variations are caused by the presence of a spot on the surface of a rotating star. In order to obtain the observed amplitude of light variation it is necessary to suppose that the area of such a spot is about 10 percents of the stellar surface and

its effective temperature differs by several hundreds degrees from the temperature of the rest of the surface.

Adopting this interpretation, one wants to know whether the spot is bright or dark. The comparison of light and colour variations in the case of BY Dra is interesting in this respect. Plotted on Figure I for six observational seasons are the upper and the lower limits of the B magnitude connected by vertical lines and the mean values of the (B-V) colour (dots). We have obtained these data from photoelectric observations obtained by us and other observers (3-5) in the period of 1954-1970. One finds from these graphs that the (B-V) measures range from + 1.20 to + 1.24. In 1965-1966 the star was the reddest, the amplitude of light variations the largest and the mean light reached the minimum. In order to explain such a behaviour



of the star it is reasonable to suppose that the non-uniformity of the surface brightness was the largest in 1965-66 and it was due to a decrease of the effective temperature of the disturbed area.

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(1) D.S.Evans, Monthly Notices of the RAS, 119, 526, 1959.
(2) D.S.Evans, Monthly Notes of the ASSA, 23, 68, 1964.
(3) P.F.Chugainov, I.B.V.S., No.122, 1966.
(4) W.Krzeminski, In "Low-Luminosity Stars", p.57, Gordon and Breach, 1969.
(5) A.Masani, P.Broglia, E.Pestarino, Contr. dell'Osserv. Astron. di Milano-Merate, Nuov, Ser., No.59, 1955.

Editor's note:

The continuous observation of Chugainov's stars would be extremely important because diagrams like that on the opposite page may reveal the existence of cycles similar to the solar cycle in these stars.

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