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BVR PHOTOELECTRIC OBSERVATIONS OF ER Vul JUNE, JULY, 1981

ER Vul (= HD 200931, BD + 27°3952) was discovered to be a spectroscopic binary system in 1946 (Northcott and Bakos, 1956). The system was suspected to eclipse by Bakos, who was able to confirm the light variation by photoelectric observations, discussed later by Northcott and Bakos (1967). Abrami and Cester (1963) observed the star and produced two light curves in yellow and blue filters. Al-Naimiy (1978) observed the system in B and V filters. All the previous light curves show irregular light variations outside the minima.

CaII H and K emission lines were noted in the spectrum of the system by Bond (1970), lending weight to the suggestion about this by Northcott and Bakos (1967). The system has been classified by Hall (1976) with the RS CVn "short period group" on the basis of these peculiar properties. Budding et al. (1982) reported a high resolution IUE spectrogram for ER Vul which shows a remarkable doubling of the MgII h and k emission lines, which could be interpreted as an indication of intense chromospheric activity over both stars.

The present observations were carried out on five nights during the period 26th June - 11th July, 1981 with very good sky conditions (the mean transperency is $\sim$ 90% in blue). A total of 530 reduced

points in each of B, V and R filters (characteristics given by Jassur, 1979) were obtained using the three beam (unrefrigerated EMI 9558B tubes) photometer, described by Sadik (1978), attached to the 74 inch telescope at Kottamia observatory (Egypt). The comparison and check stars were HD 200270 and HD 200468, respectively. The observations have been given phases using the photometric elements Min I = 2435693.5112 + 0.698095 E (Rudnicki, 1981). These elements seem to give more consistent results than other available ones (e.g. Abrami and Cester, 1963; Al-Naimiy, 1978; and Wood et al., 1980), even though a small shift in the time of primary minimum is still suggested.

Three sets of standard stars, combined with the extinction coefficients obtained from the comparison star observations on the same nights, were used to calculate the scale factors and zero constants, which have been used for the determination of the standard differential magnitudes of the variable star (Hardie, 1962). The standard ΔB, ΔV and ΔR magnitudes of the system are presented graphically with the corresponding phases in Figure 1. The differential standard colour indices of the system with the corresponding phases are presented in Figure 2.

The shape of the bottom of the primary minimum as compared with that of the secondary in all the three light curves indicate a possible occultation, though with variable surface brightness of the secondary component. Since there is no significant variation in the colour of the system with phase, the difference in the light levels outside eclipse can be attributed to the existence of a cool spot on one hemosphere of either component (e.g. see Eaton and Hall, 1979).

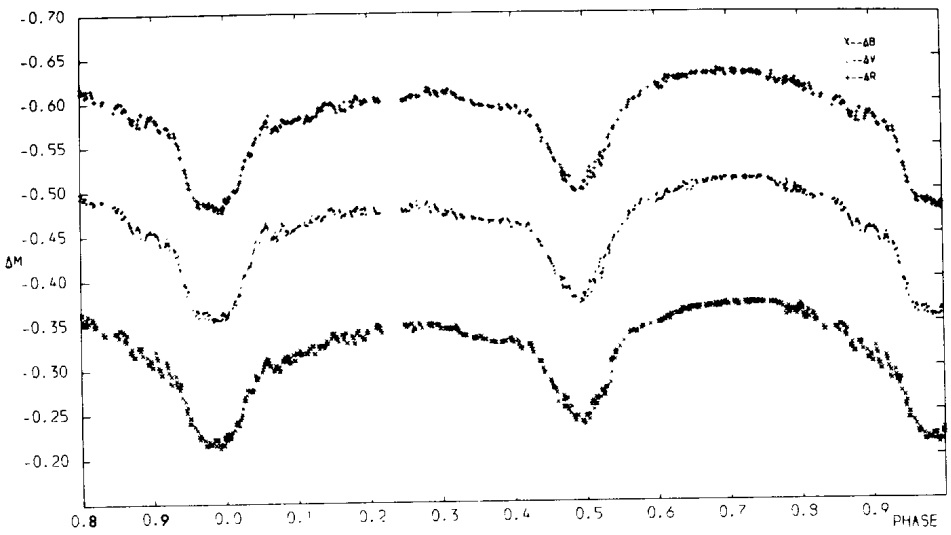

FIG. 1 STANDARD ΔM LIGHT CURVES OF ER VUL.

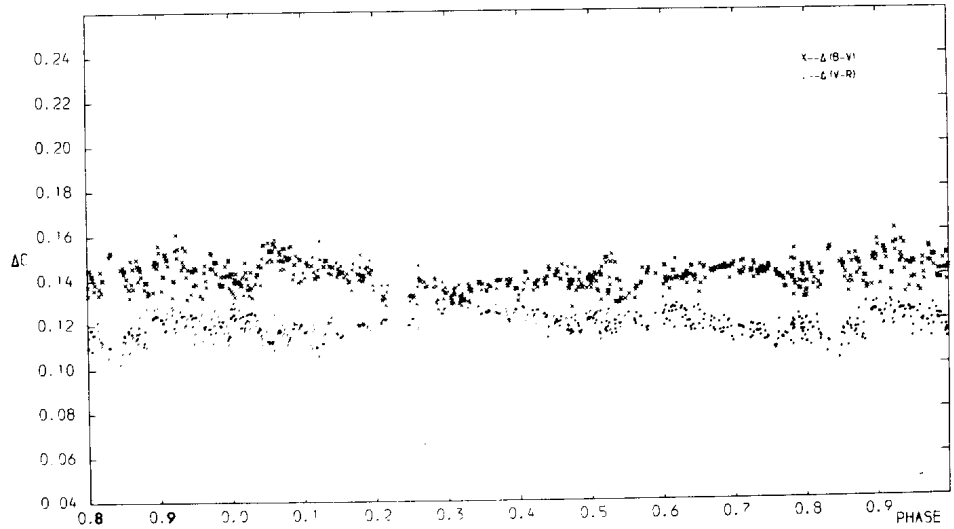

FIG. 2 STANDARD ΔC COLOUR CURVES OF ER VUL.

Comparing the present B and V light curves with those of Al-Naimiy (1978) on the one hand, and those of Northcott et al. (1967)* and Abrami et al. (1963)** on the other, it is possible that a "distortion wave" has migrated with decreasing phase. This would be in a relatively short time scale compared with the other candidates of the short period RS CVn binaries.

Finally, the comparable depths of the minima in the present observations and the comparable shapes of the double Mg II h and k emission features, indicate a very close similarity between the two components of the system which puts the well separated values of G0 V for the primary star and G5 V for the secondary obtained from the spectroscopic solution of Northcott and Bakos (1956) somewhat in doubt.

It is early at this stage of reduction to decide whether the system ER Vul displays an orbital eccentricity of the scale considered by both Abrami et al. (1963) and Northcott et al. (1967) in their solutions. We hope to deal with this matter in a forthcoming more detailed treatment of the present observations.

* Observations were taken in 1956-1957
**Observations were taken in 1956.

T. H. KADOURI
Department of Astronomy
University of Manchester
Manchester M139PL
England

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