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VARIABILITY IN THE MINIMA DEPTH OF THE DOUBLE SYSTEM HD 135421

BV Dra and BW Dra (ADS 9537, HD 135421) were detected as eclipsing binaries in 1965 by Batten and Hardie. Photometric observations by Wood (1970), Rucinski (1976) and Yamasaki (1979) have shown that they are normal W UMa systems. New photometric observations have been presented by Rovithis and Rovithis (1987) for the system. Dapergolas et al. (1989a, b) and Dapergolas et al., 1990 have also carried out BV photoelectric observations of BV Dra and BW Dra respectively.

These two eclipsing binaries were observed from 19 May through 21 May 1991 with the 1.2m Kryonerion telescope and a single channel photon counting photometer. The photometer employs a high gain 9789QB phototube and conventional BV filters. Its output is fed directly to a microcomputer enabling rapid data access.

The data reduction is the standard one. The comparison star is for both cases BD +62° 1385 and the accuracy of observations is 0.02 mag.

Table I lists the dates of observations and phases covered whereas Figures 1 and 2 summarize the results for B and V colours.

Table I

<u>BV Dra</u>		<u>BW Dra</u>	
Date	Phase	Date	Phase
19 May 1991	.70 - .31	19 May 1991	.21 - .94
20 May 1991	.45 - .16	20 May 1991	.49 - .34
21 May 1991	.39 - .03	21 May 1991	.01 - .75

In Table II the times of minima and the O-C values are listed for the V and B bands respectively.

Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values were determined from the following linear ephemerides:

$$\text{BV Dra } T = 2442878.372 + 0.3500663 E \text{ (Geyer et al., 1982).}$$

$$\text{BW Dra } T = 2442572.538 + 0.2921671 E \text{ (Geyer et al., 1982).}$$

BV DRA (CB)

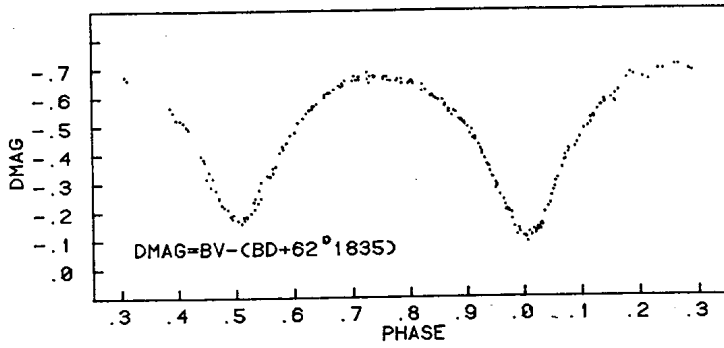


Figure 1a

BV DRA (CV)

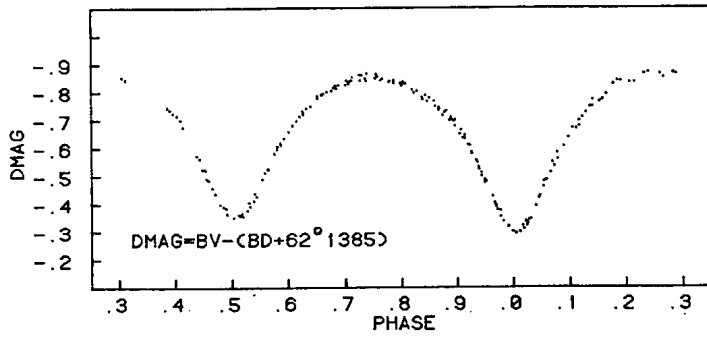


Figure 1b

BW DRA (CB)

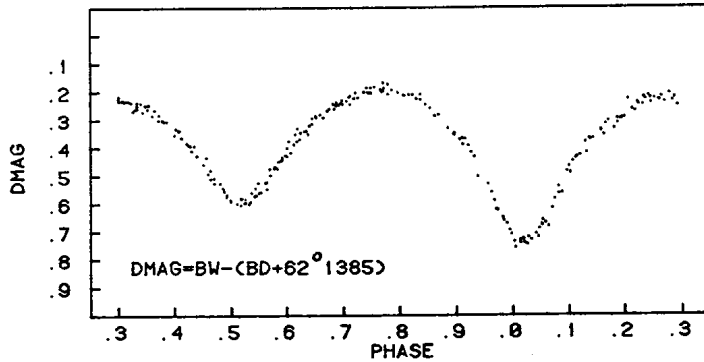


Figure 2a

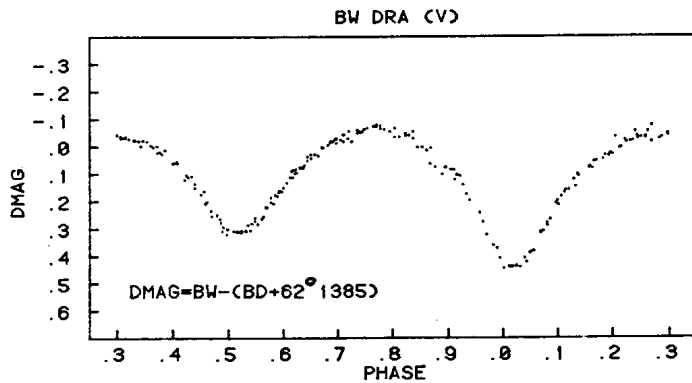


Table II

a) BV Dra

Type of minima	V colour		B colour	
	Heliocentric Jul. Day	(O-C) Phase	Heliocentric Jul. Day	(O-C) Phase
Primary	2448396.4684 ±.0002	0.0038 ±.0005	2448396.4684 ±.0003	0.0039 ±.0009
Secondary	2448397.3447 ±.0002	0.5071 ±.0004	2448397.3439 ±.0003	0.5046 ±.0008
Primary	2448397.5187 ±.0002	0.0041 ±.0006	2448397.5187 ±.0002	0.0041 ±.0006
Secondary	2448398.3948 ±.0001	0.5038 ±.0002	2448398.3953 ±.0001	0.5083 ±.0003

a) BW Dra

Type of minima	V colour		B colour	
	Heliocentric Jul. Day	(O-C) Phase	Heliocentric Jul. Day	(O-C) Phase
Secondary	2448396.4541 ±.0003	0.518 ±.001	2448396.4552 ±.0002	0.5215 ±.0007
Primary	2448397.4781 ±.0002	0.0228 ±.0007	2448397.4782 ±.0002	0.0229 ±.0007
Secondary	2448398.5002 ±.0002	0.5211 ±.0007	2448398.4997 ±.0003	0.519 ±.001

Table III

Differences between the amplitudes of Primary and Secondary minima for

BW Dra in B, V colours		
Date	ΔB (mag)	ΔV (mag)
1991	0.13	0.13
1990	0.18	0.17
1989	0.11	0.10
1982	0.13	0.12
1981	0.07	0.07
1980	0.06	0.05

Figures 1a and b show the light curve of BV Dra for B, V colours respectively whereas Figure 2a and b is the same for BW Dra.

From Fig. 1a,b and Fig. 2a,b it can be seen that BV Dra and BW Dra have nearly symmetric light curves.

The difference between primary and secondary minima is ≈ 0.13 mag in B and V for BW Dra whereas for BV Dra we measure 0.07 mag for B and V.

From the observations presented previously by Dapergolas et al. (1989b), Rovithis and Rovithis (1987) and Geyer et al. (1982) it is found that the difference between the amplitudes of primary and secondary minima varies from year to year (see Table III) and does not change from colour to colour for BW Dra.

This variation from year to year is not found for BV Dra.

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