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AN INVESTIGATION OF SHORT TIMESCALE VARIABILITY IN 6 EARLY B STARS

Six early B stars suspected of short period variability on timescales of about a day or less were investigated photometrically in September 1982 at the University of Toronto. Observations were made in the B band with the Department of Astronomy 0.4 m telescope relative to nearby comparison stars. The standard deviation in each measurement was typically 0.01 magnitudes or more. A transformation equation of the form  $\delta_B = \delta B(\text{observed}) + 0.050 \delta(B-V)$  (Percy, 1982) was used. (B-V) values were taken from published data or were estimated from the spectral type. A differential extinction coefficient of the form  $\delta B = -k_B \delta(\sec z)$  was assumed, with  $k_B = 0.40$  magnitudes. (Eight determinations in July and August give  $k_B = 0.41 \pm 0.06$  (Percy, 1983)).

Of the six stars variability was confirmed in three cases: V358 Per, 2 Vul, and V819 Cyg. In no case could a convincing fit be made to previous periods. In addition, two of the check stars, HD13970 and HR7577, were observed to have relatively large amplitude, short timescale variations.

Notes on Individual Stars

1 Cam

A companion 10.3" away with V magnitude 6.9 gives a combined magnitude  $V=5.45$  and colour  $(B-V)=0.18$ . Jerzykiewicz and Sterken (1982) report possible variability on a timescale of hours with range 0.01 magnitude in b. No significant variation of 1 Cam (V) relative to 2 Cam (C1) was detected in this study, but the data are clearly insufficient to rule out variability.

2 Cam

A double star with separation 0.3". Combined photometry and spectral type are given. No significant variation of 2 Cam (C1) relative to HR1314 (C2) was detected.

HR8105

There is a companion star 21.5" away with V magnitude 12.2. All photometry is of HR8105 alone. Jerzykiewicz and Sterken (1982) report variation, possibly on a timescale of hours, with range 0.02 magnitudes in y. No significant variation of HR8105 (V) relative to HD202126 (C1) was detected in this study.

HD202126

A B magnitude of 6.82 was obtained by comparison with HR8120. The spectral type is from the SAO catalogue, and (B-V) is estimated from the spectral type. No significant variation of HD202126 (C1) relative to HR8120 (C2) was detected.

V358 Per

Listed as a Be star in Jaschek and Egret (1981). Hill (1967b) reports an amplitude of 0.09 magnitudes and a period of 1.241 days. Variability has been confirmed, but the observations do not fit Hill's light curve. Errors are large because the stars are faint and in a crowded field.

HD13831

Listed as a Be star in Jaschek and Egret (1981). It has been checked for constancy by Hill (1967a).

HD13970

There appear to be hour-to-hour variations relative to HD13831 (which does not exhibit such rapid changes relative to V358 Per). The observed range of HD13970 (C2) relative to HD13831 (C1) is about 0.07 magnitudes in B.

V568 Cyg

A suspected beta Cephei star (Bolton, 1982). Listed as a Be star in Jaschek and Egret (1981). No significant variation of V568 Cyg (V) relative to HD196120 (C1) was detected.

HD196120

The spectral type is from the SAO Catalogue. No significant variation of HD196120 (C1) relative to HD195102 (C2) was detected.

HD195102

The spectral type is from the SAO Catalogue.

Table I: A list of the stars observed

	Name	HR	HD	V	B-V	Sp
V	1 Cam	1417	28446	5.77	0.18	B0III
C1	2 Cam	1466	29316	5.35	0.07	A8V
C2	HR1314	1314	26764	5.19	0.05	A2Vn
V	HR8105	8105	201819	6.54	-0.14	B1Vp
C1	HD202126	--	202126	6.76:	0.06:	A2
C2	HR8120	8120	202240	6.05	0.21	F0III
V	V358 Per	--	13890	8.51	0.19	B1III
C1	HD13831	--	13831	8.27	0.10	B0IIIp
C2	HD13970	--	13970	8.30	0.14	B5Ib
V	V568 Cyg	7927	197419	6.66	-0.16	B2IV-Ve
C1	HD196120	--	196120	6.67	-0.12	B9
C2	HD195102	--	195102	7.00	-0.06	B9
V	2(ES)Vul	7318	180968	5.43	0.02	B0.5IV
C1	HD181751	--	181751	6.6:	-0.06:	B8
C2	1 Vul	7306	180554	4.77	-0.05	B4IV
V	V819 Cyg	7600	188439	6.29	-0.11	B0.5IIIIn
C1	HR7591	7591	188252	5.91	-0.18	B2III
C2	HR7577	7577	188074	6.20	0.36	F2V

For stars with HR numbers the source for photometry and spectral types is Hoffleit (1982). Otherwise, unless noted, Nicolet (1978) was used for photometry and Jaschek (1978) for spectral type.

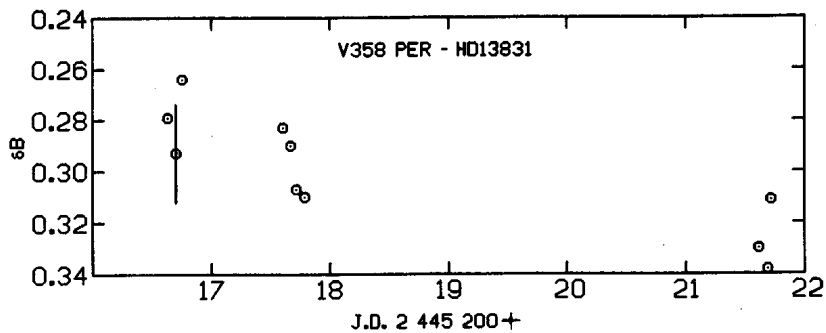


Figure 1. Photoelectric observations of V358 Per (V) relative to HD13831 (C1). The typical error in each measurement is shown.

Table II  
Summary of observations

V	C1	C2	Nights	Obs'ns	$\bar{\sigma}(V-C1)$	$\bar{\sigma}(C1-C2)$
1 Cam	2 Cam	HR1314	2	3	0.012	0.009
HR8105	HD202126	HR8120	3	12	0.009	0.010
V358 Per	HD13831	HD13970	3	10	0.019	0.016
V568 Cyg	HD196120	HD195102	4	12	0.008	0.010
2 Vul	HD181751	1 Vul	3	9	0.017	0.017
V819 Cyg	HR7591	HR7577	5	15	0.008	0.011

Each measurement  $\delta B_i$  has standard deviation  $\sigma_i$ . The mean of the  $\sigma_i$  is  $\bar{\sigma}$ , and the mean of the  $\delta B_i$  is  $\bar{\delta B}$  with standard deviation  $\sigma_{\bar{\delta B}}$ . The variation is significant only if  $\sigma_{\bar{\delta B}} > \bar{\sigma}$ .

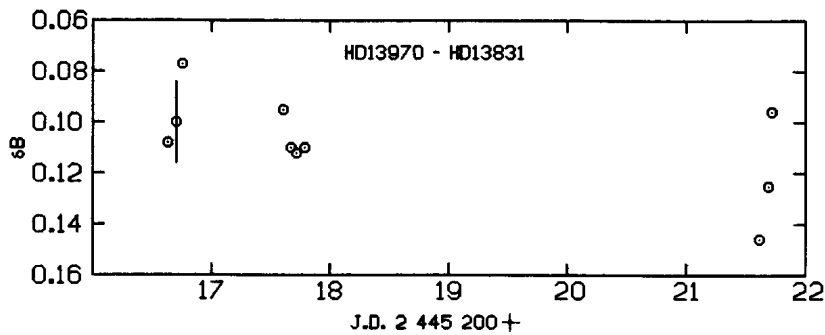


Figure 2. Photoelectric observations of HD13970 (C2) relative to HD13831 (C1). The typical error in each measurement is shown.

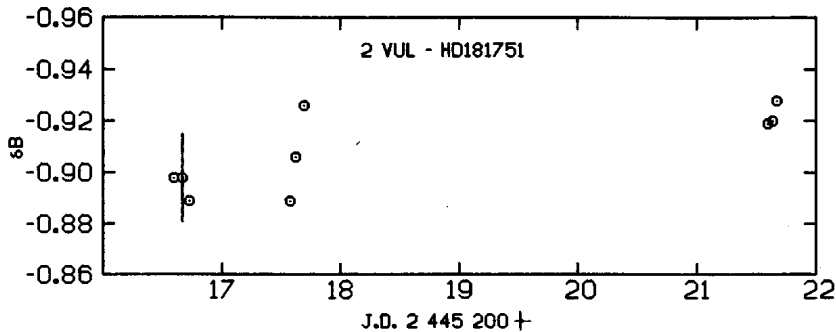


Figure 3. Photoelectric observations of 2 Vul (V) relative to HD181751 (C1). The typical error in each measurement is shown.

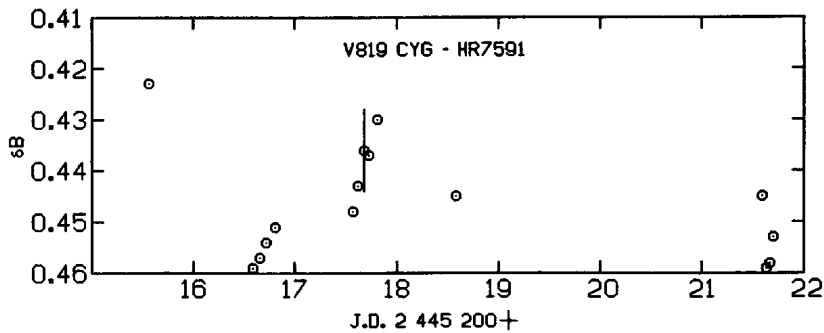


Figure 4. Photoelectric observations of V819 Cyg (V) relative to HR7591 (C1). The typical error in each measurement is shown.

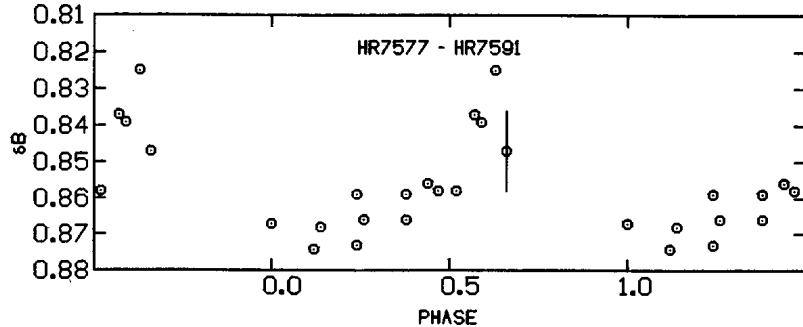


Figure 5. Photoelectric observations of HR7577 (C2) relative to HR7591 (C1), plotted with a period of 0.485 days. The typical error in each measurement is shown.

#### 2 Vul

Short period variability is confirmed, with amplitude about 0.04 magnitudes in B. Data do not fit Lynds' (1959) period of 0.6096 days.

#### HD 181751

Spectral type and V magnitude are from the SAO Catalogue. (B-V) is estimated from the spectral type.

#### 1 Vul

Listed as a suspected variable in Kukarkin et al (1965). No significant variation of 1 Vul relative to HD181751 (C1) was detected in this study.

#### V819 Cyg

The light curve of V819 Cygni (V) relative to HR7591 (C1) clearly indicates short period variation with an amplitude of 0.03 magnitudes in B. The data do not fit Lynds' (1959) period of 0.3775 day.

HR7591

Listed as a suspected variable in Kukarkin et al. (1965). Because both V819 Cyg (V) and HR7577 (C2) appear to be varying also, it was not possible to confirm this.

HR7577

HR7577 displays changes in brightness of up to 0.03 magnitudes in only two hours, relative to both V819 Cyg and HR 7591. The variation of HR7577 (C2) - HR 7591 (C1) can be fitted to a 0.485 day period with amplitude 0.05 magnitudes in B.

The observations described in this paper have been deposited in the IAU Archives. The author wishes to thank Dr. John R. Percy for discussions and much helpful advice. Financial support in the form of a Mary H. Beattie Fellowship is also gratefully acknowledged.

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