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ON THE VARIABILITY OF LATE B III–V STARS

ADELMAN, S.J.[1]; GENTRY, M.L.[2]; SUDIANA, I.M.[3]

[1] Department of Physics, The Citadel, 171 Moultrie Street, Charleston, SC 29409, USA, email: adelmans@citadel.edu

[2] Department of Political Science and Criminal Justice, The Citadel, 171 Moultrie Street, Charleston, SC 29409, USA, email: gentrym@citadel.edu

[3] Department of Mathematics and Computer Science, The Citadel, 171 Moultrie Street, Charleston, SC 29409, USA, email: sudianai@citadel.edu

This paper studies Hipparcos photometry (ESA 1997) of luminosity class III–V B6–B9 stars from the Bright Star Catalogue, 5th edition (Hoffleit & Warren 1991) and the Supplement of the 4th edition (Hoffleit et al. 1983) which for the most part were not investigated as part of Adelman (1998)'s study of HgMn and magnetic CP stars. Adelman, Yüce & Engin (2000) considered the corresponding supergiants. The stars investigated here include some mCP stars (α^2 CVn variables), β Cephei type, γ Cassiopeiae type variables (or Be stars), irregular variables, slowly pulsating B stars, and SX Arietis type variables as well as microvariables and many stars which need additional observations to determine their variability type as well as constant stars.

Table 1 lists the mean amplitudes of those spectral types with 3 or more class members. These values are indicative of the mean variability. We excluded stars with spurious variability due to duplicity. The Hipparcos photometry does not confirm the reported variability of some stars. In some cases such as the γ Cassiopeiae stars this might indicate changes in the stellar behavior as some class members have long periods of quiescence or reflect the quality of the previous photometry.

The mean amplitudes are smaller than found from most previous studies of other regions of the HR diagram using these same methods. Typically they are between $0\overset{\mathrm{m}}{.}024$ and $0\overset{\mathrm{m}}{.}030$ which are slightly greater than those found for the early K III stars (Adelman 2000). The amplitudes of the giants are slightly less than those of the comparable luminosity II stars found by Adelman, Yüce, & Engin (2000). This suggests that many are constant.

Table 2 (available electronically from the IBVS site as 4968-t2.txt) presents the values for the individual stars including those which were not used in the the mean values. For each star it gives the HR number (if any), names (Bayer, Flamsteed, or variable star designations), the V magnitude of the Bright Star Catalog and/or its Supplement, the spectral type, the Hipparcos number, the standard error (mag), the amplitude (mag), and comments which give the type of variable and the NSV number of the star when the column 'Name' is filled already with another name of the variable.

Table 3 contains selected stars whose amplitudes of variability are significantly greater than those of stars with the same spectral types, usually a factor of two greater than the

type mean, or $0^{m}.05$. Some are well-known variables. Those which have not been well studied should be.

There are also many stars with amplitudes of $0^{m}.01$ which should be considered to be candidates for photometric standards. These are B6 III: 91 λ Cet, B7 III: HR 144, 112 β Tau, 43 Cam, HR 3898, B8 III: 64 Ori, 27 ϕ Sgr, B9III: 25 ν Cas, 73 ξ2 Cet, λ Cen, 14 γ Lyr, B9.5III: 65 θ Aql, B9III–IV: 40 υ^2 Hya, B6IV: 19 Tau, B7IV: α Col, ι Vol, HR 6708, B9IV: KK And, 6 Tau, θ Col, HR 2518, α Del, κ And, ε Tuc, B8IV–V: ϕ Eri, B9IV–V: HR 3856, 33 ι Aqr, 62 η Aqr, B6V: HR 1214, B7V: σ Ari,72 Ori, B8V: 41 Ari, HR 1172, HR 1307, HR 2415, η Cha, HR 4089, 27 β Lib, HR 6628, HR 7507, HR 8014, HR 8112, 17 ι And, B9V: ε Hyi, 13 Tau, 41 υ^4 Eri, 16 λ Aql, β^1 Sgr, 54 α Peg, HR 1723, HR 4735, 35 σ Her, 4 Sgr, 68 Aql, 27 Vul, B9.5V: 4 Ari, 72 ρ Cet, θ Men, 5 Cnc, 77 σ Leo, 7 δ Crv, ι^2 Nor, ζ CrA.

Table 1: The mean amplitudes of various types of B6 through B9 stars

Spectral classes	Number	Mean Amplitude (mag)	Comment
B6IIII	18	0.028 ± 0.013	
B7IIII	30	0.025 ± 0.012	
B8III	55	0.026 ± 0.010	
B8.5III	3	0.023 ± 0.006	
B9III	48	0.026 ± 0.023	
B9.5III	10	0.023 ± 0.007	
B7III–IV	5	0.024 ± 0.009	
B8III–IV	4	0.045 ± 0.037	
	3	0.027 ± 0.006	without V487 Car
B9III–IV	7	0.027 ± 0.016	
B9.5III–IV	3	0.020 ± 0.000	
B6IV	22	0.030 ± 0.016	
B7IV	17	0.043 ± 0.058	
	16	0.030 ± 0.023	without 31 Aqr
B8IV	11	0.028 ± 0.013	
B9IV	28	0.024 ± 0.014	
B9.5IV	4	0.028 ± 0.015	
	3	0.020 ± 0.000	without V817 Tau
B7IV–V	3	0.027 ± 0.006	
B8IV–V	7	0.026 ± 0.010	
B9IV–V	14	0.024 ± 0.009	
B6V	44	0.036 ± 0.024	
	42	0.032 ± 0.015	without IP Vel & AL Scl
B7V	47	0.035 ± 0.036	
	45	0.028 ± 0.011	without V392 Pup & GG Lup
B7/8V	3	0.023 ± 0.006	
B8V	137	0.036 ± 0.059	
	131	0.025 ± 0.013	without β Per, HU Tau, V831 Cen, V760 Sco, V822 Her, & V822 Aql
B8/9V	18	0.027 ± 0.006	
B9V	130	0.027 ± 0.019	
	12	0.025 ± 0.012	without NO Pup & HD104568
B9.5V	80	0.046 ± 0.121	
	77	0.024 ± 0.008	without AR Aur, δ Lib, & RX Her

Table 3: Some stars with amplitudes greater than stars of similar spectral type

Name	HD number	Spectral type	HIP number	SE (mag)	Amp. (mag)	Comments
3 V377 Vul	182255	B6III	95260	0.0017	0.07	SPB
12 HK CMa	49333	B7IIIn	32504	0.0019	0.05	ACV
IT Vel	70084	B7III	40662	0.0019	0.05	ELL
V761 Cen	125823	B7IIIp	70300	0.0047	0.06	SXARI
IU CMa	44953	B8IIIHewk	30426	0.0015	0.05	ACV
OX Pup	63401	B8III	37982	0.0020	0.06	ACV
5 PT Ser	140873	B8III	77227	0.0024	0.05	
V4198 Sgr	177863	B8III	93887	0.0032	0.05	NSV 11743 SPB
13 V388 And	220885	B9III	115755	0.0018	0.05	ACV
V442 Cep	209809	B9III	108938	0.0062	0.14	NSV 14018, EB
DZ Eri	28843	B9III	21192	0.0081	0.11	SXARI
54 LM Vir	114846	B9III	64520	0.0025	0.06	EW
V487 Car	84809	B8III–IV	47893	0.0065	0.10	NSV 4623, ACV
TX Lep	34797	B8/9III/IV	24827	0.0023	0.06	ACV
HR 2968	61925	B6IVe	37345	0.0013	0.06	U
IU Lib	138764	B6IV	76243	0.0036	0.06	SPB
18 ι Lyr	178475	B6IV	93903	0.0016	0.07	GCAS
ξ Oct	215573	B6IV	112781	0.0014	0.05	P
31 o Aqr	209409	B7IVe	108874	0.0248	0.25	GCAS
KQ Mus	100359	B7IV	56246	0.0043	0.08	SPB
V542 Lyr	176318	B7IV	93104	0.0014	0.09	EA
PU Pup	61429	B8IV	37173	0.0028	0.06	EB
V869 Cen	123515	B9IV	69174	0.0030	0.06	NSV 6565, SPB
	135174	B9IV	74657	0.0048	0.05	U
HR 7285	179588	B9IV	94377	0.0024	0.06	U
V817 Tau	24769	B9.5IV	18485	0.0030	0.05	ACV
TZ Men	39780	B9.5IV–V	25776	0.0007	0.14	EA/D
IP Vel	84400	B6V	47694	0.0017	0.14	EA
HR 2360	45796	B6V	30524	0.0018	0.06	U
HZ CMa	50123	B6Vnpe	32810	0.0028	0.07	P
V371 Pup	59215	B6V	36246	0.0017	0.05	SPB
HR 2948	61555	B6V	37229	0.0008	0.08	NSV 3673, U
HR 3745	81753	B6Ve	46329	0.0018	0.05	NSV 4492, U
V964 Cen	115823	B6V	65112	0.0020	0.05	NSV 6190, EB
	210628	B6V	109424	0.0014	0.05	U
4 β Psc	217891	B6Ve	113889	0.0012	0.05	NSV14410, U
AL Scl	224113	B6V	117931	0.0010	0.10	EA/DM
V576 Per	21071	B7V	15988	0.0037	0.05	SPB
HR 2226	43179	B7V	29546	0.0011	0.06	U
V392 Pup	63215	B7V	37915	0.0011	0.11	GCAS, U
GG Lup	135876	B7V	74950	0.0013	0.25	EA
V1466 Aql	187961	B7V	97787	0.0078	0.06	NSV 12496, U
HR 7721	192276	B7V	99539	0.0022	0.05	U
26 β Per	19356	B8V	14576	0.0020	0.14	EA/SD
HU Tau	29365	B8V	21604	0.0012	0.37	EA/SD
	50138	B8e	32923	0.0061	0.10	U

Table 3 (cont.)

Name	HD number	Spectral type	HIP number	SE (mag)	Amp. (mag)	Comments
V410 Pup	66079	B8V	39084	0.0019	0.06	EB
V831 Cen	114529	B8V	64425	0.0053	0.15	NSV 6133, EB
η Mus	114911	B8V	64661	0.0006	0.06	EA
V760 Sco	147683	B8V	80405	0.0037	0.41	EA/DM
V974 Her	164447	B8Vne	88172	0.0049	0.07	GCAS, U
V4407 Sgr	174632	B8V	92649	0.0037	0.09	EB
V822 Her	174853	B8Vnn	92593	0.0056	0.15	NSV 11442, EB
V822 Aql	183794	B8V	96007	0.0067	0.43	EB/DM
2173 Cyg	208727	B8V	108348	0.0026	0.06	SPB
V761 Cas	7157	B9V	5688	0.0018	0.06	ACV
2 ξ Tau	21364	B9Vn	16083	0.0006	0.09	EA,U
NO Pup	71487	B9V	41361	0.0027	0.18	EA/KE
NY Vel	74067	B9V	42540	0.0022	0.05	NSV 4193, BCEP
V402 Lac	210405	B9V:	109354	0.0010	0.07	EA
V397 Pup	63786	B9V	38167	0.0007	0.09	NSV 3756, EA
	104568	B9V	58709	0.0041	0.10	
17 AR Aur	34364	B9.5V	24740	0.0012	0.57	EA
19 δ Lib	132742	B9.5V	73473	0.0059	0.89	EA/SD
RX Her	170757	B9.5V*	90727	0.0017	0.39	EA/DM

Notes:
ACV= α^2 Canum Venaticorum type, BCEP= β Cephei type, EA = Algol type variable, EB = β Lyrae type variable, ELL = rotating ellipsoidal variable, EW = W Ursa Majoris type variable, GCAS = γ Cassiopeiae type, I = irregular, MV = microvariable, P = periodic variable, SPB = slowly pulsating B star, SV = spurious variability due to duplicity, SXARI = SX Arietis type, and U = unresolved variable.

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