COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4958

Konkoly Observatory
Budapest
20 September 2000

HU ISSN 0374 – 0676

ON THE VARIABILITY OF EARLY K STARS

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Adelman & Albayrak (1997), Adelman, Cay, Cay & Kocer (2000), Adelman, Yüce & Engin (2000) using the Hipparcos photometry (ESA 1997) of the O, B, A, and F supergiants in the Bright Star Catalogue, 5th edition (Hoffleit & Warren 1991) and the Supplement of the 4th edition (Hoffleit et al. 1983), confirmed that the variability of supergiants increase with luminosity (Maeder 1980) and identified some apparently quiescent stars particularly among those of luminosity class II. To more completely examine the domains of stellar variability, this study is being extended. Here I study the K0–K4 stars which include BY Draconis stars, Cepheids, Algols, β Lyrae type binaries, rotating ellipsoidal variables, FK Comae Berenices type variables, RS Canum Venaticorum stars, slow irregular variables, RV Tauri stars, and semiregular variables as well as microvariables and many stars which need additional observations to determine their variability type as well as constant stars.

Table 1 gives the mean amplitudes of various spectral types which have at least 3 class members. I excluded stars with spurious variability due to duplicity. These values are indicative of the mean variability and useful for determining the relative variability when comparing with other spectral types. For example, the luminosity class II values are similar to those for A and F II stars given by Adelman, Cay, Cay & Kocer (2000). At the top are supergiant class averages. Maeder (1980)'s peak to peak V amplitudes are $0\overset{\mathrm{m}}{.}066$ for K0–K9 Iab stars, $0\overset{\mathrm{m}}{.}028$ for K0–K9 Ib stars, and $0\overset{\mathrm{m}}{.}028$ for K0–K9 II stars, values in good agreement for the luminosity II stars with poorer agreement for the remaining stars.

Table 2 (available electronically from the IBVS Web-site as 4958-t2.txt and 4958-t2.tex) lists the values for the individual stars including those which were not used in compiling these values. It gives for each star the HR Number (if any), Names (Bayer, Flamsteed, and variable star designations), the V magnitude from the Bright Star Catalog and its Supplement, the spectral type, the Hipparcos number, the standard error (mag), the amplitude (mag), and comments (type of variable and some NSV numbers if there was not space in the second column). The Hipparcos photometry does not confirm the reported variability of some stars. In some cases this might indicate a change in the stellar behavior while in others it might reflect the quality of the previous photometry.

Table 3 contains selected stars whose amplitudes of variability are significantly larger than those of stars with the same spectral types, usually a factor of two larger than the type mean. Some are well-known variables. The K0–K4 stars are not particularly variable. There are a fair number of microvariables. Among the supergiants some are definitely

variable, but most luminosity class II stars are about as variable as those of luminosity class III. The K4 Ib, II, and II–III class stars appear to be slightly more variable than the K0–K3 stars. Over time spans of longer than 3 years a larger fraction of the stars may well show variability. Still a fair percentage show amplitudes of $0\overset{m}{.}01$ and $0\overset{m}{.}02$ which is suggestive of constancy. The unresolved variables with amplitudes of order typically $0\overset{m}{.}05$ need additional photometry to determine their type of variability.

Table 1: The mean amplitudes of various types of K0–K4 stars

Spectral Classes	Number	Mean Amplitude (mag)	Comment
K0Ib–K2Ib	12	0.129 ± 0.328	
	11	0.035 ± 0.009	without stars in Table 3
K2.5Ib–K4.5Ib	25	0.049 ± 0.031	
	22	0.039 ± 0.012	without stars in Table 3
K0Ib	3	0.590 ± 0.970	affected greatly by R Scl
K2Ib–II	4	0.035 ± 0.013	
K3Ib	11	0.040 ± 0.012	
K4Ib	3	0.057 ± 0.038	
K0II	9	0.019 ± 0.006	
K1II	10	0.024 ± 0.012	
K2II	12	0.026 ± 0.008	
K3II	16	0.027 ± 0.012	
K4II	3	0.043 ± 0.006	
K0II–III	23	0.026 ± 0.009	
K1–III	4	0.025 ± 0.010	
K2II–III	9	0.023 ± 0.009	
K3II–III	8	0.023 ± 0.005	
K4II–III	4	0.045 ± 0.913	
K0–III	11	0.018 ± 0.008	
K0III	327	0.025 ± 0.015	
K0.5III	31	0.024 ± 0.009	
K1–III	4	0.025 ± 0.010	
K1III	270	0.025 ± 0.008	
K1+III	7	0.020 ± 0.010	
K1.5III	23	0.023 ± 0.010	
K2–III	7	0.017 ± 0.005	
K2III	239	0.027 ± 0.015	
K2+III	3	0.017 ± 0.006	
K2.5III	50	0.024 ± 0.007	
K3–III	9	0.019 ± 0.006	
K3III	206	0.026 ± 0.008	
K3.5III	20	0.027 ± 0.008	
K4–III	4	0.025 ± 0.006	
K4III	152	0.029 ± 0.010	
K4.5III	15	0.031 ± 0.007	
K0III–IV	24	0.025 ± 0.007	
K1III–IV	17	0.026 ± 0.011	
K2III–IV	10	0.026 ± 0.007	
K0IV	33	0.025 ± 0.007	
K1IV	21	0.028 ± 0.014	
K0V	19	0.034 ± 0.019	
K1V	10	0.044 ± 0.021	
K2V	14	0.037 ± 0.015	
K3V	12	0.045 ± 0.050	
	11	0.031 ± 0.009	without BB Scl
K4V	4	0.040 ± 0.014	

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

Name	HD No.	Spectral Type	HIP Number	SE (mag)	Amp. (mag)	Comments
QY Pup	63302	K1Ia–Iab	38031	0.0037	0.18	SRD
R Scl	173819	K0Ibp	92202	0.0417	1.17	RVA
BM Sco	160371	K2.5Ib	86527	0.0126	0.14	SRD
V340 Sge	185622	K4Ib	96688	0.0049	0.10	U
V809 Cas	219978	K4.5Ib	115141	0.0060	0.13	L
ζ And	4502	K1IIe	3693	0.0025	0.07	EB/GS
NSV 5068	95725	K1II	54024	0.0011	0.05	
	207119	K2.5II Ba0.2	107398	0.0019	0.05	U
NSV 6706	127753	K3II	71326	0.0020	0.05	
16 α Boo	124897	K1.5IIIFe-0.5	69673	0.0020	0.05	NSV 6603, U
	14890	K2III	11121	0.0014	0.06	U
QU Gem	49500	K2III*	32743	0.0102	0.18	U
	61026	K2III	36987	0.0012	0.05	
EE UMa	99967	K2IIICN-1	56135	0.0020	0.09	P
	128902	K2III	71568	0.0013	0.05	U
V350 Lac	213389	K2IIIe	111072	0.0047	0.13	ELL
	68763	K3III:	40160	0.0018	0.05	U
43 Leo	89962	K3III	50851	0.0019	0.05	
22 φ^3 Cet	5437	K4III	4371	0.0015	0.05	MV
	37171	K4III	26386	0.0021	0.06	U
V520 Car	93070	K4III	52468	0.0039	0.07	L
	126307	K4III	70385	0.0053	0.08	I
	161369	K4III	86713	0.0017	0.05	U
	178717	K4III:Ba4	94103	0.0017	0.05	MV
V1762 Cyg	179094	K1IV	94013	0.0037	0.08	NSV 11775, RS
V1386 Ori	41593	K0Ve	28954	0.0022	0.06	U
DX Leo	82443	K0V	46843	0.0065	0.09	BY
V762 Cas	7389	K1V	5926	0.0048	0.10	SR
DE Boo	131511	K2V	72848	0.0019	0.07	U
BB Scl	9770	K3V	7372	0.0024	0.20	EA

Acknowledgements. I wish to thank the Citadel Development Foundation for their support.

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