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JOHNSON BVR MAGNITUDES FOR SELECTED COMPARISON STARS

In the period 1969 to 1973 a number of variables were observed photoelectrically at Stephanion Observatory in Greece with a 40 cm reflector. The filters used were sufficiently close to the Johnson BVR passbands that the measurements could be converted to Johnson magnitudes by suitable linear transformations. A description of the photometer and the reduction-method will be published by Heintze and Provoost (1983), together with a complete light curve for the eclipsing binary *u Her* and the comparison star magnitudes for this variable. An interpretation of the light curve of *u Her* has been published by Provoost (1980). For the eclipsing binaries *U CrB*, *u Her* and *U Oph O-C* values have been published by Van Gent et al. (1978). As a final spin-off from these observations the B, V and R magnitudes of the comparison stars used are presented, as they may be of use to future observers.

The Johnson magnitudes of the adopted reference stars will be fully documented by Heintze and Provoost (1983). For each night the instantaneous extinction coefficients (assumed to vary linear with respect to time) were determined from these reference stars, from which in turn the Johnson magnitudes of the comparison stars were calculated. Nights with significant spatial or non-linear temporal variations were excluded. The yearly means are given in Table I. Each star is identified by its HD, BD and SAO number; the mean epoch and the number of independent measurements (*n*) used in forming the yearly means are also given. Figures between brackets denote the inferred external standard deviations in units of 0.01 magnitude. For means determined from less than 5 observations no meaningful standard deviations can be inferred. The observations indicate that the internal standard deviation for one magnitude determination varied from 0.04 to 0.07 magnitude for 5th to 10th magnitude stars when measured in the B and V passbands. For the R passband the internal standard deviation of one observation varied from 0.03 to 0.10 magnitude. In the final column B, J and S denote refer-

Table I

	HD	BD	SAO	Epoch	n	V	B-V	V-R	
	92278	+47 ^o 1797	43423	1970.38	7	7.28(2)	0.19(3)	0.20(4)	
				1972.37	16-18	7.29(1)	0.20(2)	0.14(1)	
				mean	23-25	7.29(1)	0.20(1)	0.14(1)	B,J,S
γ Crv	106625	-16 3424	157176	1970.37	3	2.60	-0.10	-0.06	B,J,S
β Lib	135742	- 8 3935	140430	1970.38	4	2.61	-0.11	-0.04	B,J,S
	136654	+31 2724	64647	1969.39	3	6.85	0.56	0.33	
				1973.34	22	6.89(2)	0.55(3)	0.45(5)	
				mean	25	6.89(2)	0.55(3)	0.42(6)	J
	136954	+32 2575	64660	1969.39	2	8.16	1.35	0.95	
UU CrB	137050	+32 2577	64671	1969.39	14	8.63(1)	0.55(2)	0.41(2)	
				1973.34	17-20	8.64(2)	0.56(3)	0.49(3)	
				mean	31-34	8.63(1)	0.55(1)	0.43(4)	
	137147	+32 2578	64675	1969.39	7	8.05(1)	0.31(3)	0.24(3)	
				1970.38	12-13	8.07(1)	0.34(2)	0.25(2)	
				mean	19-20	8.06(1)	0.33(1)	0.25(2)	B,S
	156208	+ 2 3283	122224	1970.36	15-16	6.18(1)	0.23(1)	0.20(1)	B,S
		+39 3480	67207	1973.39	1	9.19	1.04	0.81	
	172692	+39 3485	47678	1973.39	2	7.79	0.94	0.68	
	174064	+33 3205	67382	1973.39	1	7.03	1.16	0.82	
	174296	+33 3209	67407	1973.39	2	7.05	1.37	1.02	
	174435	+23 3469	86471	1969.39	35-40	8.43(1)	0.55(1)	0.48(2)	
	174621	+43 3085	47831	1973.36	8-9	6.58(2)	0.81(3)	0.67(3)	
	174880	+43 3094	47847	1973.35	6-8	7.04(1)	1.16(2)	0.93(2)	
		+26 3479	86925	1973.39	1	8.61	1.16	1.04	
		+26 3485	86940	1973.39	2	8.10	0.99	0.78	
22 Aql	180482	+ 4 4045	124455	1970.39	10-12	5.59(1)	0.11(2)	0.08(1)	B,S
	184498	+46 2716	48573	1973.39	1	7.94	1.02	0.69	
	184938	+46 2727	48608	1973.39	1	7.17	1.06	0.71	
		+33 3625	68978	1973.39	1	7.38	1.07	1.04	
	188484	+33 3642	69052	1973.39	1	6.66	1.10	1.12	
	191998	+48 3066	49276	1973.39	1	6.60	1.14	0.84	
	192830	+47 3037	49367	1973.39	1	8.56	0.76	0.64	

ences to independent photoelectric measurements in the catalogues of Blanco et al. (1968), Jaschek et al. (1972) and the Sky Catalogue 2000.0 (Hirshfeld and Sinnott, 1982).

In general, the differences between the values given in Table I and those given in the catalogues quoted above are insignificant (less than 0.02 in V and 0.04 in B-V). The only exception is the star HD 137147 (a comparison star for U CrB) where $V = 7.95$ and $B-V = -0.29$ is quoted.

The original reference for these values (mean epoch 1957.6) is Wood (1958). The discrepancy in B-V has already been noticed by Heintze and Provoost (1983) who assume that this may either be a simple typographical error or may indicate variability. An independent determination of the colour index (c.i.) in the old Harvard Photometrical System (practically equivalent with B-V) by Wright (1937) results in $c.i. = +0.37$, presumably measured around 1935. The c.i. value from the Henry Draper Catalogue (Cannon and Pickering,

1921) is not based on independent measurements, but is derived from an assumed colour index - spectral type relation (Pickering, 1917). By comparing the B and V light curves with his quoted B-V values for U CrB it is evident that Wood (1958) intended a B-V value of +0.29 for HD 137147. Furthermore, this value, together with the observed V-R value, closely confirm to the values of $(B-V)_0$ and $(V-R)_0$ as given by Schmidt-Kaler (1965) and Johnson (1966) for the spectral type F0 of this star (Cannon and Pickering, 1921).

Small (irregular?) variations up to 0.05 magnitude have recently been noted by Olson (1980) for HD 137147. Our own data are not sufficiently precise to either confirm or negate Olson's conclusions, but the 0.1 magnitude loss in V between 1958 and 1970 seems to be real. Due to the paucity in data it is uncertain whether this decrease is secular or irregular. The photovisual magnitudes determined in the Harvard Photometrical System indicate $V = 7.9$ around 1900 and 1935, but these are of little value as the Harvard magnitudes, when reduced to the UBV system, have internal errors of 0.3 magnitude or more (Ochsenbein, 1974). It is clear that more photometrical data on HD 137147 is needed and that it should not be used anymore as a comparison star for U CrB.

For HD 137050 (another frequently used comparison star for U CrB) flare activity has been reported by Olson (1980). No flare activity was seen in our data which in total amounted to only 10.5 hours (1 night in 1969 and 3 nights in 1973). This star has recently received the designation UU CrB (Kholopov et al., 1981).

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