

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

Number 4053

Konkoly Observatory
Budapest
27 July 1994

HU ISSN 0324 0676

PHOTOMETRY FOR STARS IN THE FIELD OF V BOÖTIS

V Boötis (HD127335) is a bright and well-studied semiregular variable located near the naked-eye star γ Boötis. The extreme visual magnitude range is 7.0 to 11.3. I made photoelectric measurements of several stars near the variable in order to provide a check on the comparison sequence on an AAVSO chart for the star. The existing sequence, although tried-and-true, has not been re-evaluated since photometric scales became standardized in the post-War era. In this particular instance, the AAVSO chart magnitudes are close to the V scale for the stars I have measured.

I observed the stars using the Lowell 53cm photometric telescope on two nights with strong Moonlight, 24 & 25 June 1994 UT. Strömgren y and b filters were used through a 29-arcsec diaphragm. Each observation consisted of at least three 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers for stars fainter than about 9^m . The bright Moonlight especially necessitated additional 'sky' readings to maintain proper signal-to-noise. Photon statistical noise was maintained above $S/N = 150$ for the faintest stars.

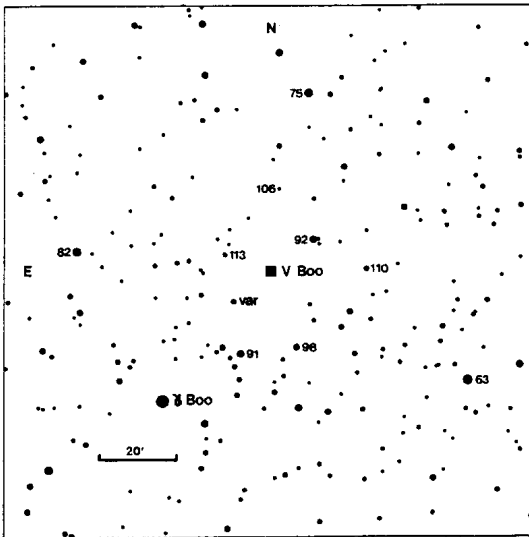


Figure 1. The field of V Boötis showing stars from the GSC brighter than 13^m . V magnitudes are indicated to the nearest tenth with the decimal point omitted.

Table 1. Standard Star Observations

Name	V (std)	$b - y$ (std)	V (obs)	$b - y$ (obs)	n	source
HD 113865	6.520	0.033	6.529	0.041	2	CP89
HD 120086	7.872	-0.083	7.879	-0.089	1	AT91/SP65
HD 122563★	6.206	0.633	6.208	0.644	2	POC/CB70
HD 122742★	6.273	0.452	6.284	0.441	1	O93
HD 123825	7.254	0.984	7.258	(1.007)	2	O83
HD 130970	6.165	0.868	6.163	0.885	1	O83
HD 131597★	8.429	0.473	8.432	0.466	2	O93
HD 136028	5.862	0.943	5.852	0.954	1	O83
HD 137006	6.113	0.155	6.110	0.166	2	O83/SP65
HD 143761★	5.403	0.394	5.408	0.388	4	O83/CB70
HD 145852	7.070	0.750	7.068	0.743	2	O83
HD 145936	6.452	0.617	6.447	0.608	1	O83
HD 149382	8.944	-0.142	8.937	-0.145	1	L83a/Kil
HD 154029★	5.283	0.002	5.287	0.005	3	O83/O93/CB70
HD 157373★	6.365	0.290	6.365	0.288	1	O93/O83
HD 157214★	5.385	0.409	5.387	0.393	2	O83/CB70
HD 160365★	6.128	0.374	6.130	0.367	2	O93/O83
HD 160314	7.748	0.270	(7.716)	0.277	1	O83
HD 160315	6.259	0.636	6.249	0.630	3	AT91
HD 160471	6.155	1.162	(6.182)	1.168	4	O83
HD 161817	6.982	0.137	6.977	0.132	1	L83b/CB70
HD 178233★	5.532	0.176	5.526	0.184	3	O83/CB70
HD 186408★	5.976	0.410	5.975	0.399	2	O83/CB70
HD 186427★	6.230	0.416	6.221	0.412	1	O83/CB70
HD 187203	6.448	0.614	(6.429)	0.617	1	O83
HD 188728★	5.293	0.002	5.285	0.008	2	O83/CB70
HD 190323	6.847	0.538	6.846	0.531	1	O83
HD 201094	8.250	0.804	(8.219)	0.800	1	O93

The values for the standard stars were taken mostly from the work of E. H. Olsen, supplemented by the sources cited in Table 1. Dr. Olsen has provided me with revised values for the primary four-color standards (marked with ★ by the star name) derived from the original standard-star list of Crawford & Barnes (1970). Table 1 shows the adopted and observed mean V and $b - y$, the number of observations 'n', and the source for the standard values. The stars are listed in RA order for equinox 2000. The data in parentheses were omitted from the transformations, mostly involving the slightly variable red stars. The mean deviations of the observed averages from the assumed values in this group of data are: $V = -0.001 \pm 0.006$; $b - y = -0.001 \pm 0.008$.

Results for the stars near V Boötis are shown in Table 2, listed in order of decreasing brightness. The mean of the two consecutive nights on V Boo itself is shown as the first entry. The stars are identified by HD, BD, or GSC number; positions come from astrometric catalogues via SIMBAD or the GSC; SIMBAD is also the source of the spectral types from the literature. The second line of each entry shows the standard deviation of

Table 2. Photometry of Stars in the Field of V Boötis

Name	RA (2000)	Dec (2000)	V	$b - y$	n	spec	Remarks
HD 127335	14 ^h 29 ^m 45 ^s .2	+38°51' 41"	9.011 .006	1.683 .020	2	M6e	(1)
HD 126597	14 25 29.0	+38 23 36	6.280 .011	0.753 .003	2	K2III:	(2)
HD 127185	14 28 55.2	+39 37 06	7.486 .001	0.746 .000	2	K0	
BD+39°2778	14 33 58.2	+38 56 21	8.239 .009	1.008 .013	2	K5	
BD+39°2774	14 30 24.5	+38 30 40	9.129 .006	0.514 .000	2	dK2	(3)
BD+39°2770	14 28 48.9	+38 59 44	9.166 .006	0.453 .003	2	K0	
BD+39°2771	14 29 12.0	+38 32 12	9.831 .006	0.421 .006	2	G5III	(4)
GSC 3036-0068	14 30 33.4	+38 43 55	10.593 10.623 10.831	1.281 1.278 1.313	(m5)	(5)	
BD+39°2772	14 29 34.0	+39 12 33	10.609 .006	0.336 .006	2	F8	
BD+39°2767	14 27 40.2	+38 52 13	10.954 .001	0.357 .005	2	G5	(6)
GSC 3036-0431	14 30 44.4	+38 55 52	11.327 .004	0.332 .013	2	(f5)	

Remarks:

- (1) - = V Boo, mean values from 24 & 25 June 1994 UT.
- (2) - = HR 5402. V = 6.28 (Häggkvist & Oja 1969); V = 6.27 (Walker 1971).
- (3) - V = 9.124, $b - y$ = 0.508 (Garmany & Ianna 1977); spectral type from Bidelman
- (4) - $b - y$ color implies spectral type near g2, likely a dwarf.
- (5) = IRAS 14285+3857. The three observations were made 24 June, 25 June, and
- (6) $b - y$ color implies spectral type near f8.

the means for the two nights' measures on each star. For two stars, previously published V and $b - y$ are noted in the remarks. Rough 'photometric' spectral types derived from the $b - y$ colors are indicated in lower case letters for a few stars. When the published spectral types differ considerably from those implied by the $b - y$ colors, they are also noted in the remarks.

Two stars deserve special mention: the K dwarf BD+39°2774 is nominally just outside the calibration limits of the standards, which include no dwarfs cooler than G8 ($b - y \leq 0.48$). The present results nevertheless agree closely with those of Garmany & Ianna (1977).

GSC 3036-0068 = IRAS 14285+3857 is evidently a mid-M giant. It is marked as a suspected variable at 11^m3 on the AAVSO chart. My first two observations had larger than normal scatter, but this could be simply due to 'reduction' errors (cf. Manfroid & Sterken 1992) from extrapolating beyond the color range of the standards. (The large uncertainty in the color of V Boo almost certainly arises from this source.) I made a follow-up observation on 11 July 1994, which suggests the star is indeed variable with a range of at least a few tenths of a magnitude. The three observations are listed individually in the table. The three faintest stars in Table 2 should serve as useful comparison stars for visual observers.

For the convenience of observers, a chart derived from the GSC is shown in Figure 1. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth (decimal point omitted) in the style of visual variable- star charts. The new red variable is labelled ‘var’.

I would like to acknowledge the generous assistance provided by Erik Heyn Olsen in selecting an improved set of four-color standards, and helping me define a more consistent set of stars suitable for calibrating red giants. Preparation of this report was facilitated by the use of SIMBAD, maintained by the Centre de Données astronomiques, Strasbourg, France.

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