

UBVRI PHOTOMETRY OF SOUTHERN BRIGHT STARS*

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Sumario

Se han obtenido observaciones fotoeléctricas en el sistema R,I de Johnson para 195 objetos del Hemisferio Sur y listados en el Catálogo de Estrellas Brillantes.

Los pequeños errores probables encontrados en este trabajo indican que la presente fotometría es de la misma calidad que la realizada por el grupo de Johnson en el Laboratorio Lunar y Planetario de la Universidad de Arizona.

Los resultados obtenidos se han utilizado para formar, la primera parte (de dos) de un catálogo UBVRI para el Hemisferio Sur y así completar este sistema para todas las estrellas más brillantes que $V = 5.0$.

At the present time a large number of the Northern Bright Stars have been observed in the UBVRI system (Johnson, Mitchell, Iriarte, and Wisniewski, 1966). However, most of Southern Bright Stars lack of R and I observations. A small number of them have been observed in the red and infrared by Kron, Gascoigne, and White (1953, 1957), by Iriarte (1965), and by Mendoza (Mendoza and Johnson, 1965 and Johnson *et al.*, 1966).

We have made R and I measurements of 195 southern objects contained in the Catalogue of Bright Stars (Hoffleit, 1964) using exactly the same detector and filters (R, I photometer) of the Catalina observers (Lunar and Planetary Laboratory, University of Arizona; Johnson *et al.*, 1966.) These observations were obtained with the 16-inch telescope of Cerro Tololo Inter-American Observatory.

The standard stars are also the same used at the Tonantzintla Observatory (BVRI system) and they are listed in Table 1. The columns of Table 1 contain: first, the Bright Star (BS) Catalogue number (Hoffleit, 1964); second, the name of the star; third, the MK-type; fourth through eighth, the V magnitude and the B-V, U-B, V-R and R-I color indices, respectively; and, lastly, the number of independent observations made at Tololo in February 1966.

The new observational data have been combined with the UBVR photometry given by Johnson *et al.* (1966) and listed in Table 2. The columns in Table 2 contain: first, the BS number; second, the name of the star; third, the MK-type (except for those spectral types given in parenthesis, which are taken from the Bright Star Catalogue — Hoffleit, 1964); fourth through eighth, the V magnitude and B-V, U-B, V-R, R-I color indices, respectively; ninth, the number of different nights in which R and I were obtained; tenth, remarks.

A number of stars in Table 2 are variable or suspected of variability (see per example, Cousins and Stoy, 1963). The individual observations of this kind of stars are found in Table 3. The columns in Table 3 contain: first, the BS number; second, the R-I color index; and, lastly, the Julian Day.

The estimated probable errors of a single observation at 1.0 air mass are:

$$R = \pm 0.015 \text{ mag. and } R-I = \pm 0.010 \text{ mag.}$$

The comparison of Tololo and Tonantzintla R magnitudes and R-I colors is shown in Figures 1 and 2. The result is very satisfactory.

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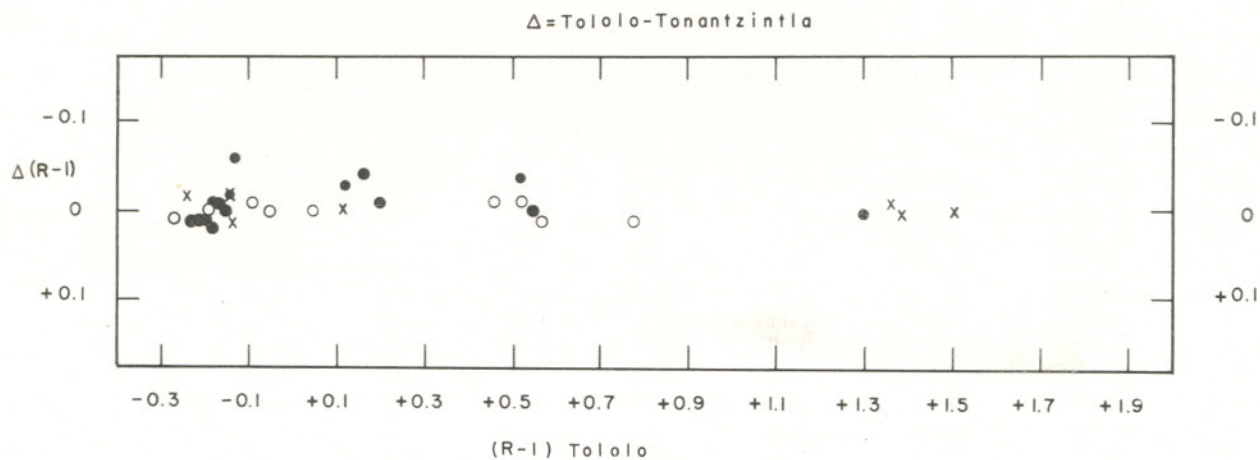


Fig. 1.—The comparison of Tololo and Tonantzintla $R-I$ colors. Open circles represent the stars from Table 1; filled circles represent the stars from Table 2, and crosses represent the stars from Table 3.

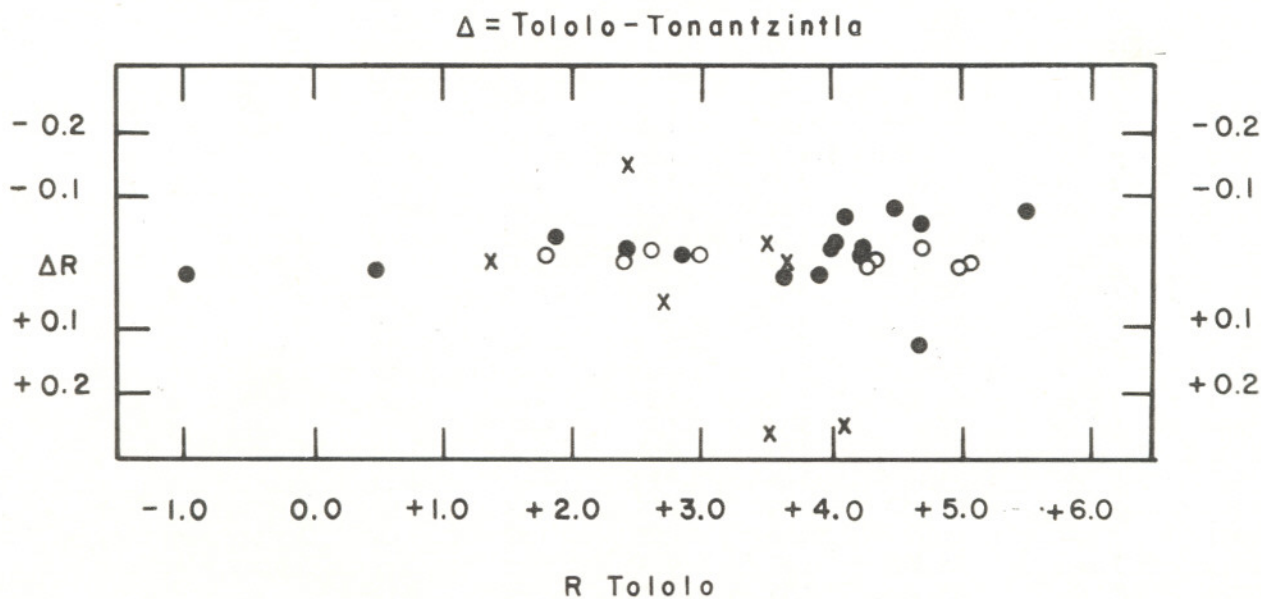


Fig. 2.—The comparison of Tololo and Tonantzintla R magnitude (see Fig. 1).

Table 1

BS	Name	Sp	V	B-V	U-B	V-R	R-I	n
718	ξ^2 Cet	B9 III	4.29	-0.06	-0.11	+0.02	-0.05	10
753	---	K3 V	5.82	+0.97	+0.79	+0.83	+0.53	11
875	---	A1 V	5.17	+0.08	+0.05	+0.11	+0.05	10
1084	ϵ Eri	K2 V	3.73	+0.88	+0.58	+0.72	+0.47	13
1855	ν Ori	B0 V	4.62	-0.26	-1.07	-0.12	-0.26	22
3249	β Cnc	K4 III	3.53	+1.48	+1.77	+1.12	+0.78	30
3454	η Hya	B3 V	4.30	-0.20	-0.74	-0.07	-0.19	30
5685	β Lib	B8 V	2.61	-0.11	-0.37	-0.04	-0.10	16
5854	α Ser	K2 III	2.64	+1.17	+1.25	+0.81	+0.56	16

Table 2

UBVRI Photometry of Southern Bright Stars

BS	Name	Sp	V	B-V	U-B	V-R	R-I	n	Notes
304	—	(M4)	6.21	+1.64	+1.90	+1.46	+1.33	1	1.
338	ζ Phe	F6 V	4.86	+0.47	+0.03	+0.04	+0.22	1	3.7.
377	α Tuc	(gM4)	4.61	+1.66	+1.86	+1.70	+1.39	1	1.
435	—	B6 V	3.91	-0.08	-0.41	-0.07	-0.12	1	1.2.6.7.
472	α Eri	B5 IV	0.47	-0.15	—	-0.04	-0.14	1	
555	ψ Phe	M4 III	4.41	+1.59	+1.70	+1.67	+1.52	1	1.6.
566	χ Eri	G5 IV	3.70	+0.85	+0.46	+0.65	+0.45	1	1.7.
570	η^2 Hyi	G8 III	4.69	+0.95	+0.64	+0.71	+0.49	1	
591	α Hyi	F0 V	2.87	+0.28	+0.14	+0.28	+0.13	1	
674	ϕ Eri	B8 V	3.56	-0.12	-0.39	-0.06	-0.11	3	
705	δ Hyi	A2 V	4.09	+0.03	+0.05	+0.04	+0.01	3	
722	—	(M4)	6.41	+1.54	+1.45	+1.94	+1.74	3	1.
806	ε Hyi	B9 III	4.11	-0.06	-0.14	-0.03	-0.07	3	
837	ζ Hyi	(A3)	4.84	+0.06	+0.09	+0.04	+0.07	3	
868	R Hor	(gM7e)	3.91	—	—	-1.05	+3.44	3	1.4.
872	ν Hyi	(gK4)	4.75	+1.33	+1.56	+0.89	+0.66	3	
909	β Hor	A5 V	4.99	+0.13	+0.15	+0.13	+0.05	3	
977	—	(N)	5.74	+2.27	—	+1.63	+1.38	3	1.
1083	α Ret	F5 V	4.71	+0.39	-0.04	+0.35	+0.18	3	
1175	β Ret	K0 IV	3.85	+1.13	+1.10	+0.80	+0.56	3	6.
1208	γ Hyi	M0 III	3.25	+1.62	+1.98	+1.34	+1.09	3	
1247	δ Ret	M2 III	4.56	+1.62	+1.95	+1.34	+1.03	3	
1264	γ Ret	(gM5)	4.51	+1.64	+1.80	+1.66	+1.44	3	1.
1266	ι Ret	(gK4)	4.97	+1.42	+1.70	+1.04	+0.73	3	
1336	α Ret	G6 II	3.35	+0.91	+0.62	+0.66	+0.44	3	
1338	γ Dor	F5 V	4.25	+0.30	+0.03	+0.28	+0.16	3	1.
1355	ε Ret	(K5)	4.44	+1.08	+1.07	+0.80	+0.51	3	7.
1465	α Dor	A0 III	3.27	0.10	-0.35	0.00	-0.09	3	
1492	R Dor	(gM7)	4.41	—	—	+2.68	+3.12	3	1.4.7.
1674	ζ Dor	F8 V	4.72	+0.52	-0.04	+0.49	+0.28	3	
1695	—	(gM4)	5.15	—	—	+1.60	+1.42	3	4.
1744	θ Dor	K2 III	4.82	+1.29	—	+0.93	+0.63	3	
1836	λ Dor	(G5)	5.14	+1.00	—	+0.73	+0.48	3	
1893-6	Trapezium	—	4.58	+0.05	-0.86	+0.26	+0.20	2	5.7.
1922	β Dor	F8 Ia	3.40	+0.80	—	+0.22	+0.43	3	1.4.6.
1953	γ Men	K4 III	5.19	+1.13	+1.18	+0.86	+0.55	3	7.
1964	—	(M4)	5.79	+1.71	+1.83	+1.69	+1.53	3	1.
2015	δ Dor	A6 IV	4.35	+0.21	+0.12	+0.27	+0.17	3	
2020	β Pic	A3 V	3.85	+0.17	+0.10	+0.13	+0.16	3	
2042	γ Pic	K1 III	4.51	+1.10	+0.98	+0.82	+0.54	3	
2049	—	G8 III	5.17	+0.99	+0.72	+0.91	+0.42	3	
2102	—	(gK3)	4.65	+1.05	+0.96	+0.81	+0.50	3	
2196	—	(gK0)	4.96	—	—	+0.82	+0.64	4	1.4.
2212	δ Pic	(B1)	4.75	—	—	-0.11	-0.26	4	1.4.6.
2245	η^2 Dor	(gM3)	5.01	+1.61	+1.85	+1.50	+1.24	4	1.
2326	α Car	F0 Ib	-0.75	+0.15	—	+0.22	+0.16	4	
2435	—	B9 III	4.39	-0.02	-0.15	+0.05	+0.14	2	
2550	α Pic	A5 V	3.27	+0.21	+0.13	+0.24	+0.13	4	
2553	τ Pup	K0 III	2.93	+1.20	+1.21	+0.84	+0.60	4	6.
2554	—	(gG3)	4.40	+0.92	+0.61	+0.69	+0.45	3	6.
2591	—	C8.2	6.32	+2.24	—	+1.63	+1.30	3	
2652	—	(M1)	4.93	—	—	+1.21	+1.15	2	4.
2662	—	(K2)	5.17	+1.40	+1.65	+1.01	+0.70	3	
2735-6	γ Col	G8 III	3.62	+0.91	+0.60	+0.72	+0.48	4	1.3.6.7.
2743	L ² Pup	(gM5e)	5.10	+1.56	—	+2.59	+2.46	2	1.
2803	δ Col	F8 II	3.98	+0.79	+0.45	+0.67	+0.38	4	
2934	—	(gK2)	4.94	+1.40	+1.63	+1.07	+0.73	3	1.
3021	ζ Col	K0 III	3.95	+1.04	+0.83	+0.79	+0.53	4	7.

Table 2 (cont.)

BS	Name	Sp	V	B-V	U-B	V-R	R-I	n	Notes
3117	χ Car	B2 IV	3.47	-0.18	-0.65	-0.05	-0.18	4	
3153	---	M0 II	5.17	+1.72	---	+1.49	+1.19	3	
3159	---	B3 IV	4.82	-0.17	-0.62	-0.04	-0.20	3	
3220	---	(dF7)	4.76	+0.43	-0.03	+0.42	+0.25	3	
3223	ε Vol	B5 III	4.35	-0.11	-0.46	-0.03	-0.09	3	6.7.
3280	---	(K0)	5.07	+1.15	+1.19	+0.82	+0.58	3	
3307	ε Car	K0 II + B	1.86	+1.27	+0.19	+0.17	+0.89	4	1.
3318	α Cha	F6 IV	4.07	+0.39	-0.02	+0.40	+0.23	2	
3340	θ Cha	K0 III-IV	4.35	+1.16	+1.19	+0.84	+0.57	3	7.
3347	β Vol	K2 III	3.77	+1.13	+1.13	+0.84	+0.56	4	1.
3359	---	(dB3)	5.13	---	---	-0.19	-0.17	1	4.7.
3371	---	B5 IV	6.31	-0.02	-0.51	+0.14	-0.06	3	4.7.11.
3414	---	(gG9)	4.86	+1.00	+0.81	+0.76	+0.49	3	
3415	---	B3 Vn	5.26	-0.14	-0.62	-0.04	-0.16	4	12.
3447	o Vel	B3 III	3.60	-0.18	-0.62	-0.06	-0.17	4	1.
3457	---	B1 III	4.33	-0.11	-0.80	-0.02	-0.13	4	1.7.
3467	---	B4 IV	4.85	-0.17	---	-0.04	-0.19	4	
3485	δ Vel	A0 V	1.96	+0.04	+0.07	+0.09	+0.01	4	3.7.
3498	---	B2 Vne	4.54	---	---	-0.03	-0.19	4	1.4.
3539	---	B6 ? Vn	5.91	-0.15	-0.59	-0.05	-0.16	4	12.
3571	---	B8 II	3.84	-0.10	-0.45	0.00	-0.11	4	7.
3574	---	B5 V	4.69	-0.12	-0.47	-0.02	-0.14	4	6.7.
3582	---	B3 IV	4.99	---	---	-0.01	-0.24	4	4.
3615	α Vol	A5 V	4.01	+0.14	+0.13	+0.16	+0.06	3	6.
3642	---	B2 Ve	4.71	-0.15	-0.80	+0.06	-0.15	3	1.
3643	---	F6 II-III	4.48	+0.61	+0.22	+0.55	+0.31	3	
3659	α Car	B2 IV	3.44	-0.19	-0.69	-0.05	-0.19	3	1.6.
3663	---	B3 IV	3.97	-0.18	-0.66	-0.05	-0.18	4	
3671	NGC 2808	---	6.8	+0.93	+0.28	+0.44	+0.65	4	8.9.
3685	β Car	A1 V	1.68	0.00	+0.03	+0.06	+0.02	4	
3691	---	B7 IV	6.02	-0.10	-0.43	-0.03	-0.11	4	12.
3696	---	(gK5)	4.34	+1.63	+1.98	+1.34	+1.03	3	1.
3699	ι Car	F0 I	2.25	+0.18	+0.16	+0.25	+0.20	4	1.
3717	---	B7 IV	6.28	-0.10	-0.55	0.00	-0.06	3	12.
3728	---	(gG7)	4.81	+0.94	+0.62	+0.71	+0.54	3	
3734	κ Vel	B2 IV	2.50	-0.18	-0.75	-0.05	-0.18	4	6.
3803	\mathcal{N} Vel	K5 III	3.13	+1.55	+1.88	+1.20	+0.89	4	1.
3816	R Car	(gM5e)	3.91	---	---	+0.67	+2.51	3	1.4.7.
3825	---	B5 II	4.08	+0.01	-0.56	+0.09	+0.01	3	
3856	---	B9 V	4.52	-0.07	-0.20	-0.01	-0.08	3	1.
3860	ζ Cha	B5 IV	5.11	-0.14	-0.57	0.00	-0.18	4	1.
3875	---	A0 V	5.56	-0.04	-0.08	+0.05	-0.07	3	12.
3884	I Car	(cC2)	3.40	+1.20	---	+0.36	+0.68	3	1.4.
3886	---	B3 V	5.55	-0.18	-0.72	-0.11	-0.15	4	12.
3890-1	v Car	A9 II	2.97	+0.27	+0.13	+0.35	+0.29	4	7.
3925	---	B4 V	5.71	-0.11	-0.57	-0.04	-0.11	4	7.12.
3940	ϕ Vel	B5 II	3.54	-0.08	-0.63	+0.04	-0.08	4	7.
3990	---	B2 V	4.86	-0.12	-0.68	-0.04	-0.09	4	12.
3999	S Car	(gK5e)	5.31	---	---	+0.52	+1.54	3	1.4.
4007	---	(M4)	6.40	+1.66	---	+2.04	+1.52	3	1.
4037	ω Car	B7 IV	3.32	-0.08	-0.33	+0.05	-0.03	3	
4045	---	(gM5)	6.30	+1.54	---	+2.11	+1.75	4	1.
4050	---	K5 Ib	3.35	---	---	+1.07	+0.78	3	1.4.
4063	---	(cK)	4.57	+1.62	+1.81	+1.07	+0.87	3	1.
4074	---	B3 IV	4.50	-0.12	-0.58	-0.02	-0.09	3	3.7.
4102	---	F3 IV-V	4.00	+0.35	-0.01	+0.35	+0.19	3	1.
4110	---	F0 Ia	4.65	+0.51	+0.01	+0.50	+0.48	3	1.
4114	---	F0 II	3.82	+0.31	+0.24	+0.37	+0.24	3	1.
4134	---	(dF7)	4.89	+0.50	---	+0.44	+0.29	3	7.
4138	---	Am	4.74	+0.04	+0.07	+0.10	+0.02	3	

Table 2 (cont.)

BS	Name	Sp	V	B-V	U-B	V-R	R-I	n	Notes
4140	---	B5 Ve	3.49	---	---	+0.23	-0.08	3	1.4.
4142	---	(gK5)	4.93	+1.68	+1.82	+1.29	+0.93	3	1.7.
4153	U Ant	(Nb)	5.38	+2.88	---	+1.85	+1.36	3	1.
4159	---	(gK3)	4.45	+1.62	+1.79	+1.15	+0.84	3	1.
4174	γ Cha	M0 III	4.11	+1.58	+1.94	+1.26	+0.97	3	3.
4177	---	(cK)	4.66	+1.48	+0.79	+1.19	+0.90	3	1.7.
4179	---	(gM1)	5.87	+1.44	---	+1.42	+1.22	3	7.
4180	---	G2 II	4.28	+1.04	+0.75	+0.75	+0.48	3	
4199	θ Car	09.5 V	2.76	-0.22	-1.00	-0.10	-0.24	4	
4200	---	(cK)	4.57	+1.71	+1.87	+1.33	+0.99	3	1.
4204	---	B3? V	5.77	+0.01	-0.56	+0.12	-0.03	4	12.
4205	---	B5 Vn	4.82	-0.13	---	-0.01	-0.14	4	
4210	η Car	Pec.	6.22	+0.62	-0.46	+1.32	+0.49	5	1.5.7.10.
4222	---	B3 IV	4.85	-0.15	-0.64	-0.05	-0.18	4	
4234	δ^2 Cha	B3 V	4.45	-0.19	-0.70	-0.07	-0.20	4	
4257	---	K0 III-IV	3.78	+0.95	+0.65	+0.72	+0.49	3	1.
4325	---	(sgG5)	4.61	+1.13	+0.81	+0.75	+0.45	3	
4337	---	G0 Ia ⁺	3.91	+1.24	+0.94	+0.87	+0.60	3	1.6.
4352	---	F0 Ia	4.60	+0.55	+0.05	+0.57	+0.45	3	1.7.
4390	π Cen	B5 Vn	3.89	-0.15	-0.59	-0.04	-0.17	4	3.7.
4406	---	B3 III	5.59	+0.06	-0.57	+0.16	0.00	4	
4415	---	B5 IV	5.28	-0.08	-0.57	+0.20	-0.06	4	4.7.11.
4441	σ^1 Cen	G0 Ia	5.13	+1.08	+0.77	+0.83	+0.66	10	1.7.
4442	σ^2 Cen	A2 Ia	5.14	+0.49	-0.11	+0.54	+0.46	10	
4460	---	B9 V	4.62	-0.08	-0.21	+0.03	-0.53	3	
4467	λ Cen	B9 II	3.13	-0.04	-0.19	+0.05	-0.01	3	7.
4492	---	(G0 + A0)	5.17	+0.80	+0.36	+0.79	+0.63	3	1.6.7.
4499	---	(cG6)	4.94	+1.15	+0.81	+0.87	+0.57	3	6.
4520	λ Mus	A7 II-III	3.64	+0.16	+0.15	+0.15	+0.08	3	
4522	---	G3 III	4.11	+0.90	+0.58	+0.68	+0.44	3	
4530	μ Mus	(gK3)	4.62	---	---	+1.09	+0.88	3	1.4.
4537	---	B3 Vnc	4.32	-0.15	-0.62	-0.07	-0.14	4	
4538	---	(cG)	4.97	+1.40	+1.22	+0.99	+0.75	3	
4549	---	B4 IV	4.90	-0.11	-0.53	-0.03	-0.13	4	7.
4573	---	B3 V	5.57	-0.15	-0.67	-0.03	-0.23	4	1.12.
4583	ϵ Cha	B9 Vn	4.91	-0.06	-0.16	+0.03	-0.05	3	3.7.
4599	θ^1 Cru	Am	4.33	+0.27	+0.04	+0.32	+0.17	4	6.7.
4603	θ^2 Cru	B3 IV	4.72	-0.08	-0.61	-0.02	-0.10	2	1.6.
4605	κ Cha	(gK3)	5.04	+1.49	+1.78	+1.06	+0.76	3	
4616	η Cru	F0 III	4.15	+0.34	+0.03	+0.34	+0.16	3	
4618	---	B6 III	4.47	-0.15	-0.67	-0.01	-0.18	4	
4621	δ Cen	B2? V?pe	2.65	-0.09	---	+0.19	-0.14	4	1.7.
4638	ρ Cen	B4 V	3.96	-0.15	-0.61	-0.07	-0.17	4	
4656	δ Cru	B2 IV	2.82	-0.24	---	-0.08	-0.24	4	1.4.
4671	ϵ Mus	(gM5)	4.16	---	---	+1.90	+1.74	3	1.4.
4674	β Cha	B6 V	4.26	-0.12	-0.51	-0.02	-0.11	3	1.
4679	ζ Cru	B3 IV	4.04	-0.17	-0.68	-0.07	-0.19	4	
4682	---	(gM3)	5.00	+1.59	+1.95	+1.29	+1.06	3	6.7.
4700	ϵ Cru	(gK3)	3.59	+1.42	+1.63	+1.03	+0.74	3	1.
4730-1	α Cru	B1IV + B3n	0.96	---	---	+0.08	-0.24	3	4.6.7.
4732	---	B4 IV	4.82	-0.14	---	-0.01	-0.17	4	7.
4739	---	(gM4)	5.34	---	---	+1.71	+1.88	3	4.
4743	σ Cen	B2 V	3.91	-0.19	-0.77	-0.09	-0.21	2	
4763	γ Cru	M3 II	1.63	+1.58	+1.77	+1.66	+1.41	3	1.
4773	γ Mus	B5 V	3.87	-0.15	-0.61	-0.02	-0.17	4	
4798	α Mus	B3 IV	3.71	-0.20	---	-0.07	-0.24	4	1.4.
4823	---	B7 IV	4.93	---	---	+0.09	-0.01	4	1.4.
4842	ι Cru	K1 III	4.69	+1.05	-0.93	+0.78	+0.52	3	7.
4844	β Mus	B2.5 V	3.05	-0.18	-0.74	-0.08	-0.21	5	3.7.
4848	---	B3 IV	4.65	-0.16	-0.63	-0.05	-0.16	4	

Table 2 (cont.)

BS	Name	Sp	V	B-V	U-B	V-R	R-I	n	Notes
4853	β Cru	B0.5 IV	1.25	-0.23	-0.98	-0.13	-0.26	4	1.
4897	λ Cru	B5? Vn	4.62	-0.15	-0.60	-0.05	-0.17	4	
4898	μ^1 Cru	B3 IV	4.03	-0.17	-0.75	-0.07	-0.23	4	
4899	μ^2 Cru	B5 Ve	5.19	-0.11	-0.50	+0.21	-0.06	4	
4923	δ Mus	K2 III	3.62	+1.18	+1.26	+0.88	+0.59	3	6.
4940	---	B5 V	4.71	-0.14	-0.57	-0.04	-0.14	2	7.
4942	ξ^2 Cen	B2 V	4.27	-0.19	-0.77	-0.11	-0.20	2	6.7.
4975	---	B8 V	4.60	-0.08	-0.38	+0.04	-0.09	3	6.7.
4989	---	F8 V	4.92	+0.48	---	+0.46	+0.27	3	7.
4993	η Mus	B8 V	4.80	-0.08	-0.35	-0.02	-0.08	3	6.
5002	---	(gK1)	4.87	+1.50	+1.58	+1.09	+0.75	3	1.
5026	---	B5 III	5.49	-0.13	-0.53	-0.01	-0.15	2	12.
5035	---	B5 V	4.53	-0.13	-0.59	-0.04	-0.15	4	
5041	---	G5 III-IV	4.53	+0.85	+0.47	+0.67	+0.43	3	
5042	ι^1 Mus	(gKO)	5.05	+1.11	+1.01	+0.84	+0.54	3	
5132	ϵ Cen	B1 V	2.30	-0.22	-0.92	-0.13	-0.23	4	
5190	ν Cen	B2 IV	3.41	-0.22	-0.85	-0.09	-0.24	2	1.6.

Notes to Table 2

- 1.—Variable or suspected of variability; see Table 3.
- 2.—Eclipsing Binary.
- 3.—Known physical binary.
- 4.—V and B-V from Catalogue of Bright Stars (Hoffleit, 1964). Harvard photovisual magnitudes are corrected by -0.09 mag. (see Johnson *et al.*, 1966).
- 5.—R, I photometry made with a 1'.0 diaphragm.
- 6.—Spectroscopic Binary.
- 7.—A fainter star included in the diaphragm used.
- 8.—R, I photometry made with a 1'.5 diaphragm.
- 9.—UBV from Van den Bergh (1966).
- 10.—UBV from Feinstein (1963).
- 11.—UBV from Moreno and Moreno (1966).
- 12.—U-B from Moreno and Moreno (1966).

Table 3

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BS	R	R-I	J.D. 2430000 +	BS	R	R-I	J.D. 2430000 +
304	4.75	+1.33	9164.5135	3447	3.66	-0.17	9157.6385
338	3.98	-0.12	9164.5177	3447	3.64	-0.17	9160.6951
435	4.61	+1.39	9164.5260	3447	3.66	-0.17	9165.6420
555	2.74	+1.52	9164.5358	3447	3.68	-0.17	9177.6008
722	4.48	+1.72	9160.5309	3457	4.33	-0.13	9157.6427
722	4.51	+1.74	9162.5247	3457	4.37	-0.11	9159.6920
722	4.42	+1.75	9163.5222	3457	4.36	-0.13	9162.6302
868	5.02	+3.39	9162.5542	3457	4.35	-0.13	9165.6462
868	4.85	+3.41	9163.5441	3498	4.56	-0.19	9157.6634
868	5.02	+3.50	9164.5603	3498	4.58	-0.16	9160.7049
977	4.12	+1.36	9158.5478	3498	4.51	-0.23	9167.6419
977	4.18	+1.40	9159.5191	3498	4.62	-0.19	9176.5649
977	4.02	+1.36	9165.5152	3642	4.61	-0.09*	9155.7309
1264	2.83	+1.42	9158.5792	3642	4.64	-0.17	9156.6911
1264	2.89	+1.47	9159.5545	3642	4.71	-0.13	9163.6719
1264	2.83	+1.44	9164.5969	3659	3.49	-0.19	9155.7443
1338	3.98	+0.15	9159.5844	3659	3.47	-0.19	9156.7027
1338	3.99	+0.16	9160.5976	3659	3.52	-0.19	9163.6802
1338	3.95	+0.17	9165.5524	3696	2.96	+1.00	9156.7285
1492	1.89	+3.19	9159.5969	3696	3.00	+1.04	9158.7323
1492	1.74	+3.06	9160.6115	3696	3.04	+1.04	9164.6855
1492	1.57	+3.12	9165.5649	3699	1.98	+0.19	9156.7337
1922	3.12	+0.42	9156.5874	3699	2.00	+0.21	9158.7365
1922	3.26	+0.44	9157.5491	3699	2.00	+0.21	9165.6684
1922	3.16	+0.31*	9167.5383	3699	2.03	+0.20	9177.6166
1964	4.05	+1.49	9160.6321	3803	1.94	+0.90	9158.7483
1964	4.13	+1.50	9162.5830	3803	1.92	+0.88	9160.7149
1964	4.12	+1.59	9167.5505	3803	1.91	+0.89	9165.6979
2196	4.14	+0.65	9158.6492	3803	1.97	+0.89	9177.6231
2196	4.18	+0.65	9159.6022	3816	3.38	+2.61	9158.7542
2196	4.13	+0.63	9160.6584	3816	3.31	+2.50	9169.7194
2196	4.11	+0.64	9163.5941	3816	3.04	+2.43	9165.7017
2212	4.84	-0.25	9158.6547	3856	4.51	-0.07	9158.7642
2212	4.88	-0.32	9159.6080	3856	4.53	-0.09	9162.6684
2212	4.94	-0.22	9160.6632	3856	4.55	-0.08	9167.7014
2212	4.89	-0.25	9163.5992	3860	5.13	-0.21	9164.7041
2245	3.53	+1.27	9158.6597	3860	5.11	-0.18	9165.7081
2245	3.56	+1.26	9159.6131	3860	5.09	-0.17	9167.7090
2245	3.50	+1.21	9160.6682	3860	5.13	-0.15	9176.6399
2245	3.46	+1.23	9163.6031	3884	2.96	+0.68	9155.7515
2736	2.94	+0.47	9156.6186	3884	3.04	+0.69	9158.7691
2736	2.89	+0.48	9157.5811	3884	3.11	+0.66	9162.6723
2736	2.88	+0.47	9163.6073	3999	4.72	+1.52	9156.7457
2736	2.93	+0.50	9177.5730	3999	4.77	+1.53	9157.7155
2748	2.51	+2.47	9156.6266	3999	4.88	+1.58	9165.7604
2748	2.51	+2.45	9157.5869	4007	4.37	+1.52	9158.7829
2748	1.97*	+1.83*	9163.6115	4007	4.40	+1.54	9159.7253
2934	3.86	+0.74	9155.6645	4007	4.31	+1.50	9163.7035
2934	3.83	+0.72	9156.6102	4045	4.23	+1.72	9159.8299
2934	3.93	+0.72	9162.6010	4045	4.22	+1.78	9169.7300
3307	0.71	+0.90	9157.6161	4045	4.12	+1.76	9162.6797
3307	0.72	+0.87	9159.6800	4050	2.29	+0.78	9158.7934
3307	0.71	+0.91	9163.6427	4050	2.31	+0.79	9159.7337
3307	0.65	+0.88	9177.5932	4050	2.24	+0.77	9163.7154
3347	2.91	+0.56	9157.6288	4063	3.44	+0.80	9159.7376
3347	2.93	+0.58	9159.6841	4063	3.64	+0.99	9162.6844
3347	2.93	+0.57	9163.6517	4063	3.43	+0.82	9163.7191
3347	2.96	+0.54	9177.5970	4102	3.63	+0.12	9159.7453

Table 3 (cont.)

BS	R	R-I	J.D. 2430000 +	BS	R	R-I	J.D. 2430000 +
4102	3.67	+0.17	9162.7341	4441	4.34	+0.65	9177.6476
4102	3.65	+0.28	9163.7365	4492	4.36	+0.63	9156.8088
4110	4.16	+0.49	9159.7497	4492	4.37	+0.62	9157.7730
4110	4.18	+0.47	9162.6934	4492	4.42	+0.63	9163.7802
4110	4.11	+0.48	9165.7538	4530	3.50	+0.87	9155.8578
4114	3.51	+0.25	9159.7534	4530	3.52	+0.86	9157.7899
4114	3.36	+0.23	9162.7198	4530	3.56	+0.91	9164.7878
4114	3.49	+0.24	9163.7404	4573	5.57	-0.30	9164.8079
4140	3.28	-0.07	9159.7656	4573	5.66	-0.14	9165.8466
4140	3.25	-0.08	9162.7240	4573	5.36	-0.32	9167.7806
4140	3.25	-0.08	9165.7773	4573	5.63	-0.17	9176.7641
4142	3.67	+0.94	9159.7696	4603	4.75	-0.06	9156.8339
4142	3.66	+0.93	9162.7383	4603	4.73	-0.14	9158.8471
4142	3.60	+0.92	9165.7737	4621	2.42	-0.14	9158.8667
4153	3.52	+1.39	9159.7733	4621	2.48	-0.11	9162.8098
4153	3.53	+1.35	9162.7036	4621	2.47	-0.20	9167.8156
4153	3.55	+1.35	9177.6369	4621	2.46	-0.12	9176.7821
4159	3.32	+0.85	9159.7774	4656	2.88	-0.25	9159.8097
4159	3.33	+0.83	9162.7080	4656	2.90	-0.23	9162.8175
4159	3.25	+0.84	9165.7809	4656	2.92	-0.26	9167.8233
4177	3.53	+0.90	9162.7476	4656	2.89	-0.22	9176.7877
4177	3.45	+0.90	9163.7441	4671	2.30	+1.78	9159.8140
4177	3.43	+0.91	9165.7883	4671	2.24	+1.73	9162.8212
4200	3.21	+0.97	9157.7365	4671	2.22	+1.72	9167.8321
4200	3.34	+1.05	9162.7640	4674	4.26	-0.13	9159.8181
4200	3.17	+0.94	9165.8156	4674	4.29	-0.09	9162.8265
4210	4.89	+0.49	9157.7470	4674	4.28	-0.12	9167.8361
4210	4.90	+0.52	9159.7825	4700	2.55	+0.75	9159.8434
4210	4.92	+0.47	9165.8201	4700	2.55	+0.74	9162.8385
4210	4.88	+0.52	9176.7363	4700	2.57	+0.73	9167.8441
4210	4.89	+0.47	9177.6426	4763	-0.08	+1.38	9156.8601
4257	3.04	+0.47	9157.7587	4763	+0.02	+1.41	9162.8557
4257	3.10	+0.51	9162.7781	4763	-0.02	+1.43	9167.8605
4257	3.04	+0.48	9165.8293	4798	2.79	-0.23	9157.8240
4337	3.04	+0.61	9155.7940	4798	2.76	-0.23	9159.8675
4337	3.04	+0.59	9156.7584	4798	2.77	-0.25	9167.8677
4337	3.05	+0.60	9163.7517	4798	2.80	-0.24	9177.6769
4352	4.02	+0.45	9155.8027	4823	4.84	-0.01	9157.8290
4352	3.99	+0.44	9156.7645	4823	4.89	0.00	9162.8597
4352	4.07	+0.46	9163.7559	4823	4.81	-0.03	9167.8722
4441	4.26	+0.67	9155.8249	4823	4.84	-0.01	9177.6816
4441	4.23	+0.58	9156.7825	4853	1.35	-0.26	9157.8476
4441	4.29	+0.66	9157.7986	4853	1.39	-0.26	9163.8258
4441	4.30	+0.66	9158.8120	4853	1.37	-0.26	9164.8380
4441	4.33	+0.70	9159.7899	4853	1.39	-0.26	9177.6856
4441	4.34	+0.66	9162.7826	5002	3.77	+0.74	9163.8519
4441	4.30	+0.66	9163.7639	5002	3.78	+0.76	9165.8557
4441	4.33	+0.69	9164.7726	5002	3.79	+0.76	9176.8110
4441	4.29	+0.66	9165.8733	5190	3.48	-0.23	9176.8362
				5190	3.52	-0.25	9177.7730

* Not used to form mean values.

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