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INTERMEDIATE BAND AND H $\beta$  PHOTOMETRY  
OF ULTRASHORT PERIOD CEPHEIDS

For a discussion published elsewhere (Eggen 1979) of ultrashort period cepheids (USPC) observations of several such objects south of declination  $+30^\circ$  were obtained with the 0.6, 0.9, 1.0 and 1.5 m reflectors at Cerro Tololo. These results are listed in Table 1 and the ephemerides used in computing phases are discussed in the notes to the table. Figures 1-6 show the run of magnitude and color indices with phase for representative stars. The rise from minimum to maximum light of GP And was followed in V on 11 August 1978 with the results shown in Figure 1. This segment of the light curve is shown as a continuous curve in Figure 2. The mean light curve in V for V 567 Oph in Figure 3 is from Clube et al. (1969) after shifting phase by -0.345 periods. The mean visual light curve of TV Lib in Figure 4 is also from Clube et al. SX Phe was also followed in V during the rising branch of the light curve on 15 September 1978 and all of the visual magnitude determined on that date are shown in Figure 5.

The observations of most of these stars have been already been discussed (Eggen 1979) but those of BS Aqr were made subsequent to that discussion because of inconsistencies in the then available data. The present

observations are shown in Figure 6. The difficulties encountered in the previous discussion were (1) the values of  $(b-y)$ ,  $\beta$ , and  $M_1$  were inconsistent and (2) the path traced by the variable in the  $(\beta, [C_1])$  plane was more representative of a low mass, halo cepheid such as RR Lyr, then of a high mass, old disk cepheid such as GP And. However the new observations, between phase 0.1 and 0.65 days, in Figure 7 lie on a path parallel to the main sequence relation and to the path of GP And. From the calibration discussed in the previous paper this leads to a median  $M_V = +0.35$  mag, giving  $(U, V, W) = (+35, -58, -73)$  km sec<sup>-1</sup> and the variable is a high mass, old disk population cepheid. The values of  $(\beta, b-y)$  indicate little or no reddening and  $\delta M_1 = 0.015$  mag, compared with the Hyades stars.

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References:

- Clube, S.V.M., Evans, D.S., and Jones, D.H.P. 1969, Mem.Roy. Astr.Soc., 72, 201  
Eggen, O.J. 1971, Pub.A.S.P., 83, 762  
Eggen, O.J. 1977, Pub.A.S.P., 89, 205  
Eggen, O.J. 1979, Ap.J., (in press)

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TABLE 1  
Observations of USPC

Var	V	b-y	M <sub>1</sub>	C <sub>1</sub>	β	J.D. 244	Phase
GN And*	5 <sup>m</sup> .20	0 <sup>m</sup> .170	0 <sup>m</sup> .165	0 <sup>m</sup> .863	2 <sup>m</sup> .752	2 obs.	
GP And*	10.65	0.098	0.168	1.003	2.848	3727.858	0.137
	10.98	0.214	0.145	0.790	2.727	3728.833	0.529
	10.82	0.172	0.139	0.914	2.789	3729.864	0.323
	10.82	0.162	0.138	0.913	2.806	3730.858	0.265
	11.03	0.201	0.160	0.705	2.712	3731.830	0.618
	10.53	0.093	0.178	1.012	2.862	3731.864	0.051
GP And B	12.50	0.364	0.141	0.439		3 obs.	
V1208 Aql	5.55	0.158	0.190	0.990	2.795	3734.	
	5.53	0.157	0.190	0.990	2.796	3735.	
V 1208 Aql B	9.06	0.245	0.195	0.600		2 obs.	
BS Aqr*	9.57	0.219	0.160	0.846	2.696	3774.672	0.605
	9.57	0.245	0.151	0.846	2.691	3774.679	0.641
	9.60	0.245	0.157	0.829	2.697	3774.686	0.676
	9.62	0.258	0.145	0.822	2.687	3774.696	0.727
	9.28	0.150	0.195	0.925	2.765	3774.740	0.949
	9.19	0.146	0.170	1.049	2.797	3774.754	0.020
	9.23	0.149	0.173	1.032	2.789	3774.767	0.086
	9.29	0.145	0.182	0.999	2.758	3774.778	0.141
	9.33	0.163	0.169	0.984	2.756	3774.788	0.192
- Ari*	6.73	0.168	0.210	0.890	2.771	3727.875	
	6.71	0.184	0.195	0.895	2.778	3728.885	
- Ari* A	6.74	0.187	0.113	0.871	2.738	3727.910	
	6.69	0.183	0.119	0.876	2.726	3728.910	
- Ari B	8.35	0.192	0.160	0.710	2.744	2 obs.	
YZ Cap*	11.36	0.201	0.144	1.075	2.779	3727.754	0.583
	11.41	0.222	0.089	1.157	2.750	3729.733	0.164
	11.09	0.150	0.131	1.203	2.942	3729.722	0.780
	11.60	0.238	0.111	1.020	2.746	3730.743	0.514
	11.49	0.221	0.092	1.106	2.740	3731.757	0.222
V 743 Cen	8.71	0.195	0.159	0.862	2.765	3727.525	
	8.71	0.180	0.168	0.858	2.770	3728.548	
	8.80	0.192	0.164	0.844	2.758	3729.524	
V 753 Cen*	10.64	0.216	0.147	1.034	2.728	3727.510	0.693
	10.29	0.110	0.176	1.187	2.815	3730.469	0.061
	10.65	0.220	0.121	1.038	2.769	3731.476	0.610

TABLE 1 (Continued)

Var	V	b-y	M <sub>1</sub>	C <sub>1</sub>	β	J.D. 244	Phase
V 668 Cr A*	8.70	0.118	0.212	1.002	2.885	3727.625	
	8.71	0.112	0.206	1.011	2.878	3728.663	
	8.71	0.111	0.210	1.011	2.875	3729.670	
	8.71	0.101	0.216	1.010	2.870	3730.719	
V 648 Her	6.86	0.096	0.218	0.869	2.844	3727.555	
	6.86	0.109	0.215	0.855	2.846	3728.555	
	6.86	0.103	0.213	0.870	2.833	3729.503	
TV Lib*	11.66	0.123	0.132	1.036	2.833	3727.525	0.094
	12.39	0.316	0.141	0.775	2.662	3729.538	0.560
	12.13	0.237	0.138	0.926	2.764	3730.555	0.332
	11.26	0.070	0.121	1.196	2.862	3731.545	0.004
V 747 Mon	6.11	0.200	0.190	0.800	2.738	2 Obs.	
ZZ Mic*	9.38	0.133	0.189	0.893	2.814	3728.767	0.668
	9.30	0.109	0.165	1.002	2.864	3729.788	0.865
	9.31	0.109	0.171	0.979	2.842	3730.795	0.854
	9.57	0.157	0.161	0.868	2.762	3731.778	0.486
BP Oct	6.46	0.190	0.205	0.722	2.780	3 Obs.	
V 567 Oph*	11.38	0.439	0.140	0.833	2.757	3727.566	0.830
	11.19	0.395	0.103	1.030	2.817	3728.569	0.544
	11.31	0.434	0.113	0.914	2.757	3729.552	0.103
	11.41	0.450	0.125	0.934	2.762	3730.566	0.902
	11.24	0.408	0.115	0.978	2.811	3731.569	0.616
NZ Pav	6.05	0.185	0.185	0.800	2.745	3 Obs.	
DH Peg*	9.75	0.248	0.101	1.095	2.756	3702.830	0.388
	9.31	0.163	0.121	1.277	2.837	3719.778	0.804
	9.70	0.212	0.110	1.218	2.794	3727.796	0.098
	9.34	0.158	0.119	1.321	2.826	3728.750	0.831
	9.35	0.163	0.131	1.248	2.844	3729.775	0.843
	9.30	0.174	0.109	1.255	2.857	3730.778	0.768
	9.37	0.166	0.129	1.256	2.842	3731.764	0.627
DY Peg	10.58	0.251	0.110	0.793	2.750	3728.803	0.560
	10.05	0.130	0.164	1.027	2.893	3729.778	0.930
	10.27	0.153	0.143	0.991	2.862	3730.810	0.081
	10.62	0.235	0.130	0.803	2.762	3731.792	0.547

TABLE 1 (Continued)

Var	V	b-y	M <sub>1</sub>	C <sub>1</sub>	$\beta$	J.D. 244	Phase
SX Phe*	7.42	0.169	0.142	0.756	2.754	3766.705	0.691
	7.15	0.086	0.178	0.921	2.858	3766.726	0.073
	7.20	0.101	0.160	0.911	2.827	3766.731	0.164
	7.20	0.130	0.151	0.853	2.800	3766.734	0.218
	7.33	0.132	0.152	0.848	2.787	3766.736	0.255
	7.36	0.149	0.144	0.821	2.763	3766.740	0.327
	7.40	0.155	0.238	0.807	2.758	3766.742	0.370
	7.44	0.163	0.133	0.774	2.746	3766.747	0.455
	7.05	0.081	0.168	0.948	2.863	3773.705	0.046
	7.25	0.120	0.155	0.868	2.800	3773.712	0.173
	7.35	0.148	0.136	0.829	2.776	3773.715	0.228
	7.36	0.155	0.141	0.806	2.762	3773.717	0.264
	7.40	0.165	0.132	0.800	2.744	3773.719	0.301
	7.43	0.170	0.135	0.779	2.740	3773.722	0.355
	7.45	0.184	0.122	0.771	2.740	3773.724	0.392
	7.46	0.181	0.135	0.739	2.739	3773.727	0.446
V 703 Sco*	7.88	0.248	0.165	0.793	2.738	3727.618	
	7.84	0.222	0.161	0.888	2.747	3728.597	
	7.86	0.228	0.157	0.858	2.741	3729.635	
	7.91	0.225	0.165	0.836	2.738	3730.680	
	7.91	0.243	0.150	0.848	2.739	3731.608	
- Sco (HD 153747)	7.41	0.090	0.171	1.033	2.867	3727.611	
	7.43	0.091	0.161	1.044	2.879	3728.590	
	7.42	0.093	0.163	1.029	2.851	3729.583	
	7.64	0.102	0.160	1.029	2.862	3730.594	
XX Scl	8.92	0.130	0.201	0.944	2.815	3727.924	
	8.92	0.140	0.180	0.958	2.824	3728.851	
	8.93	0.144	0.180	0.942	2.820	3729.903	
	8.93	0.124	0.202	0.929	2.808	3730.910	
V 369 Sct	9.38	0.311	0.153	0.868	2.730	3728.625	
	9.39	0.324	0.144	0.826	2.718	3729.639	
	9.42	0.312	0.160	0.848	2.712	3730.691	
	9.43	0.327	0.156	0.825	2.740	3731.614	
AP Ser A*	11.38	0.219	0.111	0.961	2.742	3727.465	0.953
	11.41	0.252	0.084	0.924	2.691	3728.479	0.943
	11.41	0.228	0.086	0.967	2.702	3729.476	0.867
	11.38	0.216	0.092	0.982	2.717	3730.479	0.814
	11.37	0.227	0.093	0.999	2.685	3731.496	0.816

TABLE 1 (Continued)

Var	V	b-y	M <sub>1</sub>	C <sub>1</sub>	β	J.D. 244	Phase
CW Ser*	11.95	0.206	0.180	0.852	2.720	3727.496	0.387
	12.08	0.265	0.142	0.861	2.714	3729.496	0.674
	11.75	0.207	0.153	0.934	2.789	3729.489	0.923
	11.89	0.192	0.193	0.878	2.796	3730.507	0.305
	12.15	0.242	0.178	0.846	2.707	3731.510	0.608
V 479 Tau A	7.39	0.239	0.193	0.846	2.730	3 Obs.	
	BC	8.88	0.205	0.199	0.800	2.807	3 Obs.
BS Tuc	7.50	0.150	0.144	0.814	2.750	2 Obs.	
FG Vir	6.55	0.160	0.175	0.855	2.755	1 Obs.	

## Notes to Table 1

GN And Replaces the misprinted results in Eggen (1977)  
 GP And Max=J.D.2433861.430+0<sup>d</sup>07868270. Epoch modified to fit present maximum.  
 BS Aqr Max=J.D.2443774.750+0<sup>d</sup>197822776. Present epoch of max.  
 - Ari HD11285  
 - Ari B HD1516514. Cpm companion, 74 arcsec.  
 YZ Cap Max=J.D.2439025.749+0<sup>d</sup>2734585. The period needs correction.  
 V 753 Cen Max= J.D. 2441386.144+0<sup>d</sup>221349.  
 V 668 CrA Replaces less accurate photometry with an 0.4 m reflector (Eggen 1971).  
 TV Lib Max= J.D. 2420017.3015+0<sup>d</sup>269624031.  
 ZZ Mic Max= J.D. 2440442.8443+0<sup>d</sup>0671835.  
 V 567 Oph Max= J.D. 2438641.315 +0<sup>d</sup>1300305.  
 SX Phe Max= J.D. 2443766.722 +0<sup>d</sup>054964379.  
 DH Peg Max= J.D. 2427695. +0<sup>d</sup>25551267.  
 V 703 Sco The light amplitude is strongly variable and evidently near minimum at the time of the observation.  
 AP Ser A Max= J.D. 2428334.279 +0<sup>d</sup>254118.  
 CW Ser Max= J.D. 2431212.280 +0<sup>d</sup>1891505.  
 BS Tuc Replaces less accurate photometry with an 0.4 m reflector (Eggen 1971).

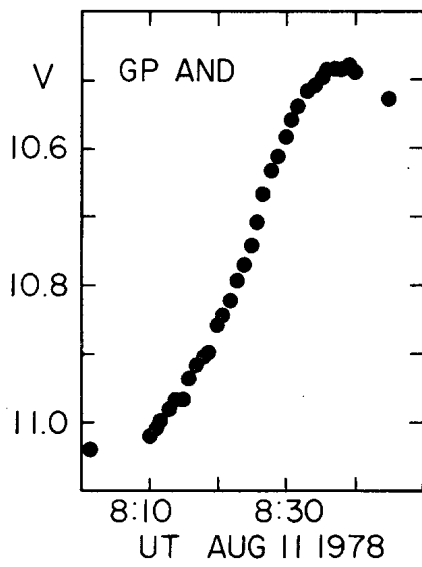


Fig. 1 - The rise to maximum light of GP And on 11 August 1978.

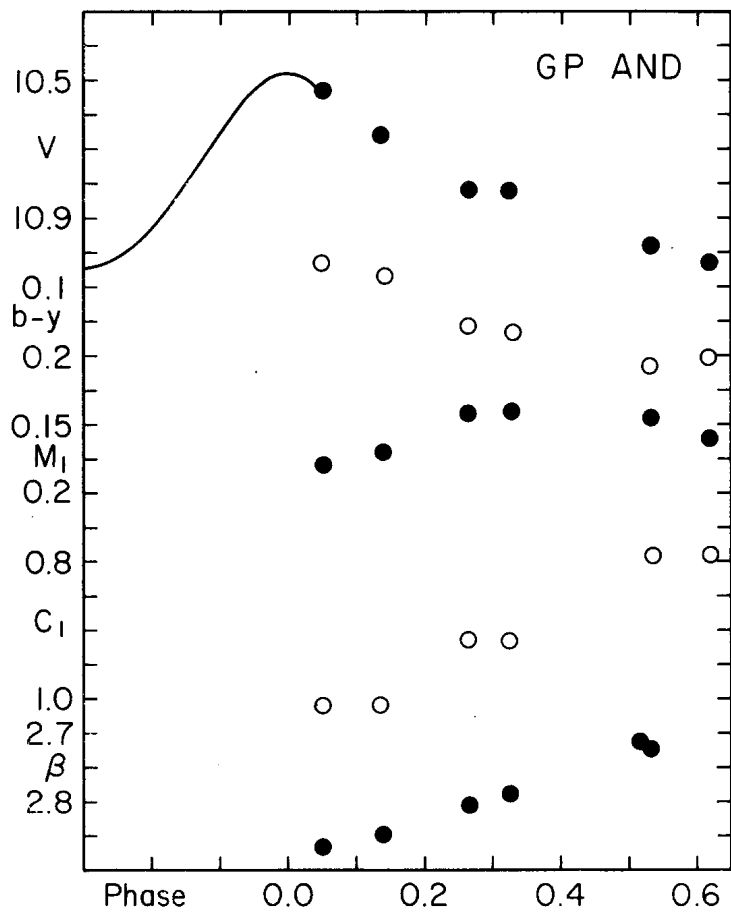


Fig. 2 - The light and color curves of GP And. The continuous curve represents the observations in Figure 1.



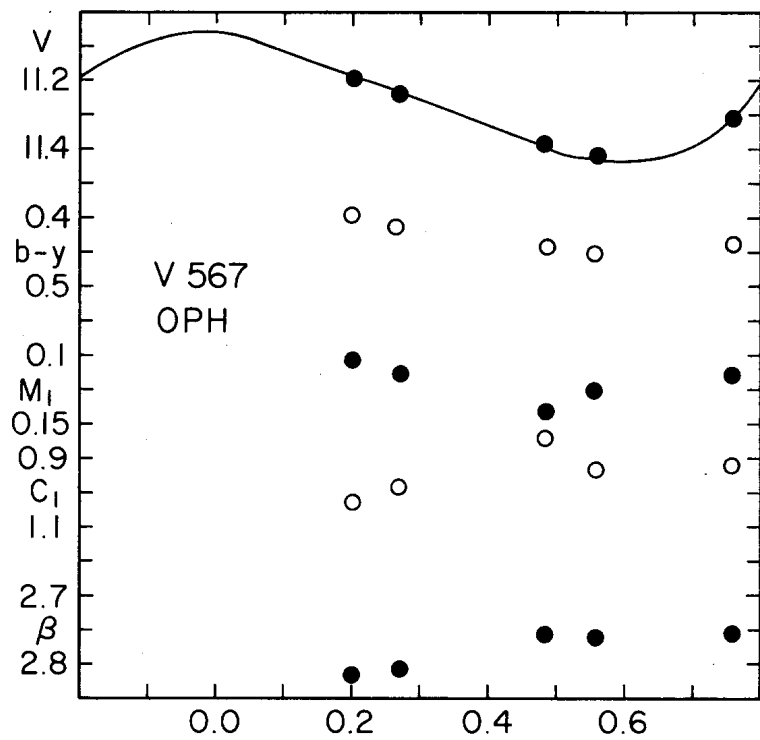


Fig. 3 - The light and color curves for V 567 Oph. The continuous curve represents the mean light curve by Clube et al. (1969) shifted by -0.345 periods.

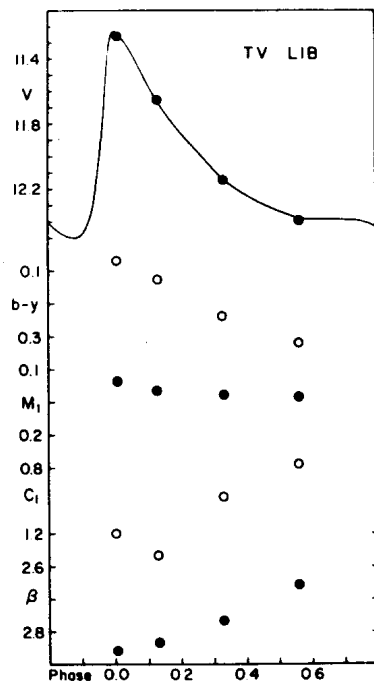


Fig. 4 - The light and color curves for TV Lib. The continuous curve is the mean light curve by Clube et al. (1969).

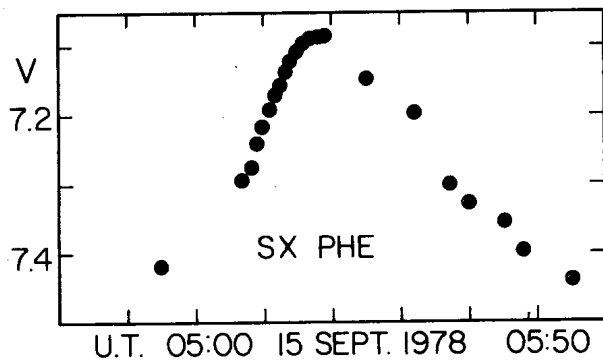


Fig. 5 - Visual magnitudes of SX Phe on 15 September 1978.

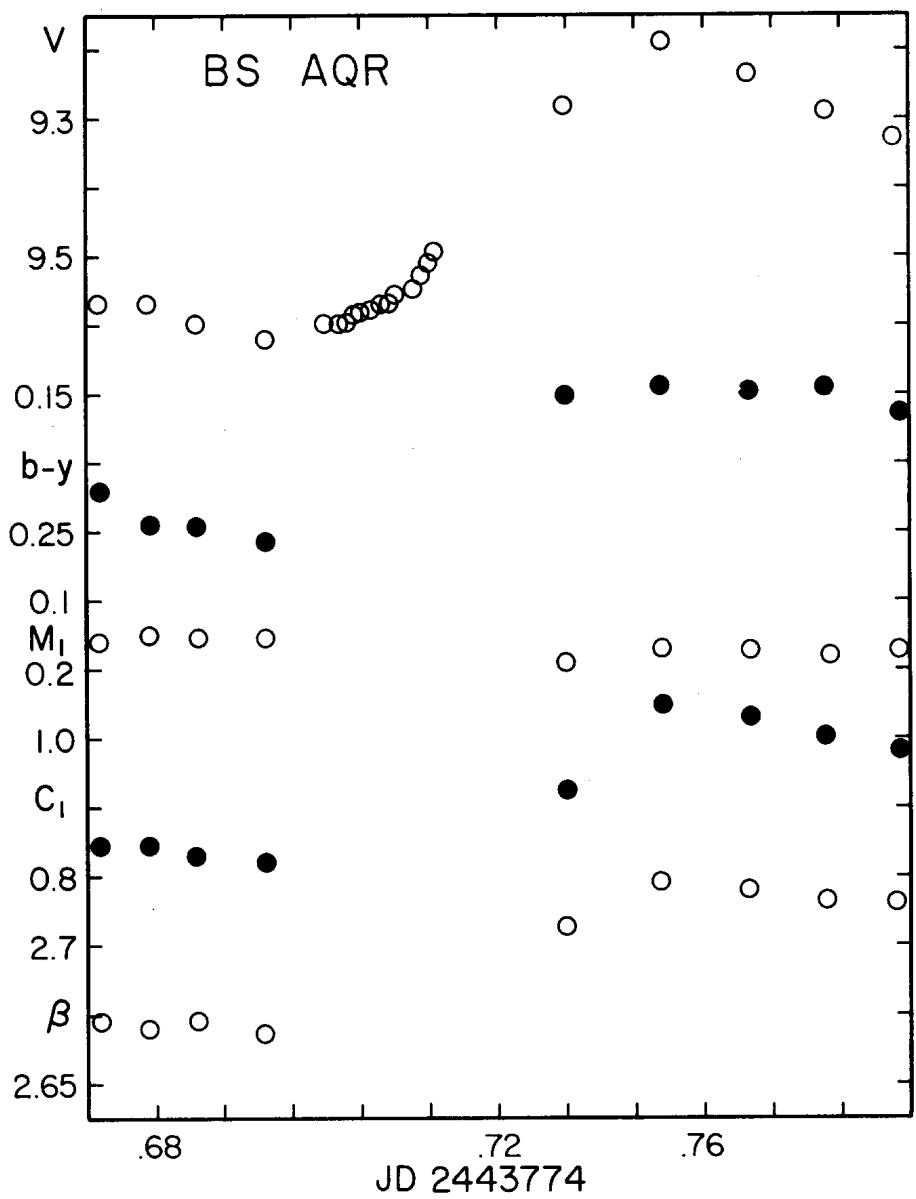


Fig. 6 - Light and color curves for BS Aqr.

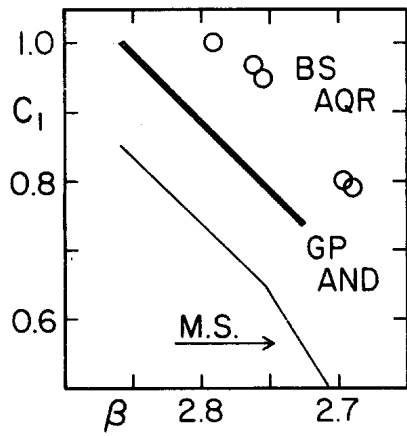


Fig. 7 - BS Aqr and the known, high mass cepheid GP And (Eggen 1979) in the  $(\beta, [C_1])$  plane; the main sequence is also indicated.