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LSS2854 AND LSS2895 : TWO REDDENED β LYRAE SYSTEMS

A recent note by Kilkenny et al. (1991) described a new β Lyrae type binary, LSS1160, discovered in a photometric study of reddened OB stars from the Stephenson & Sanduleak (1971) catalogue of Luminous Stars in the Southern Milky Way. This note reports two further eclipsing binaries found in the same programme.

The two binaries, LSS2854 and 2895, were observed during 1989–92 with UBV filters in the Modular photometer on the 0.5 m telescope at the Sutherland site of the South African Astronomical Observatory (SAAO). Three nearby reddened OB stars from the Stephenson & Sanduleak (1971) catalogue, LSS2571, 2863 and 3014, were used as local comparison stars. All data were reduced to the E-region system of Cousins (see Menzies et al., 1989) and the mean UBV values for the comparison stars during the 1989–90 and 1990–91 seasons are given in Table 1 together with their standard deviations and adopted (weighted) values. LSS3014 shows a rather large standard deviation for the 1990–91 data and may be a small amplitude variable; the V-magnitudes of this star were not used to correct the data for LSS2854 and 2895.

A phase-dispersion minimisation program was used to find periods for the two stars of 5.35875 ± 0.00005 day (2854) and 10.6043 ± 0.0002 day (2895) and provisional ephemerides are:

LSS2854	HJD (primary min.) = 2447958.065 + 5.35875 E
LSS2895	HJD (primary min.) = 2447954.141 + 10.6043 E

The V-magnitude data phased with these ephemerides are shown in Figure 1. The continuously variable light curves, relatively long periods and the early-type nature of the stars indicate that both systems are β Lyrae-type eclipsing binaries. From the data available so far, it appears that both systems exhibit total eclipses. Preliminary uvbyβ photometry of the combined light of the systems indicates that both are composed of early B stars and that the reddening is E(b–y) $\sim$ 1.04 equivalent to $A_V \sim 4.5$ mag, in both cases.

Neither binary appears in the Wackerling (1970) list of Hα emission objects, but low dispersion (210Å/mm) spectroscopy shows that Hα is very weak in LSS2895, presumably partly filled by emission; the other Balmer series lines appear normal. LSS2854 shows no obvious signs of emission.

Although both systems are of very similar apparent brightness, the photometry for LSS2895 appears to show more scatter that for LSS2854, even though the stars were observed more-or-less consecutively. Examination of plates of the fields reveals that both stars have faint nearby "companions"; in the case of LSS2854 about 15 arcsec SE and in the case of LSS2895 about 15 arcsec South. Although these stars would have been excluded from the aperture, it is possible that some mild contamination may have

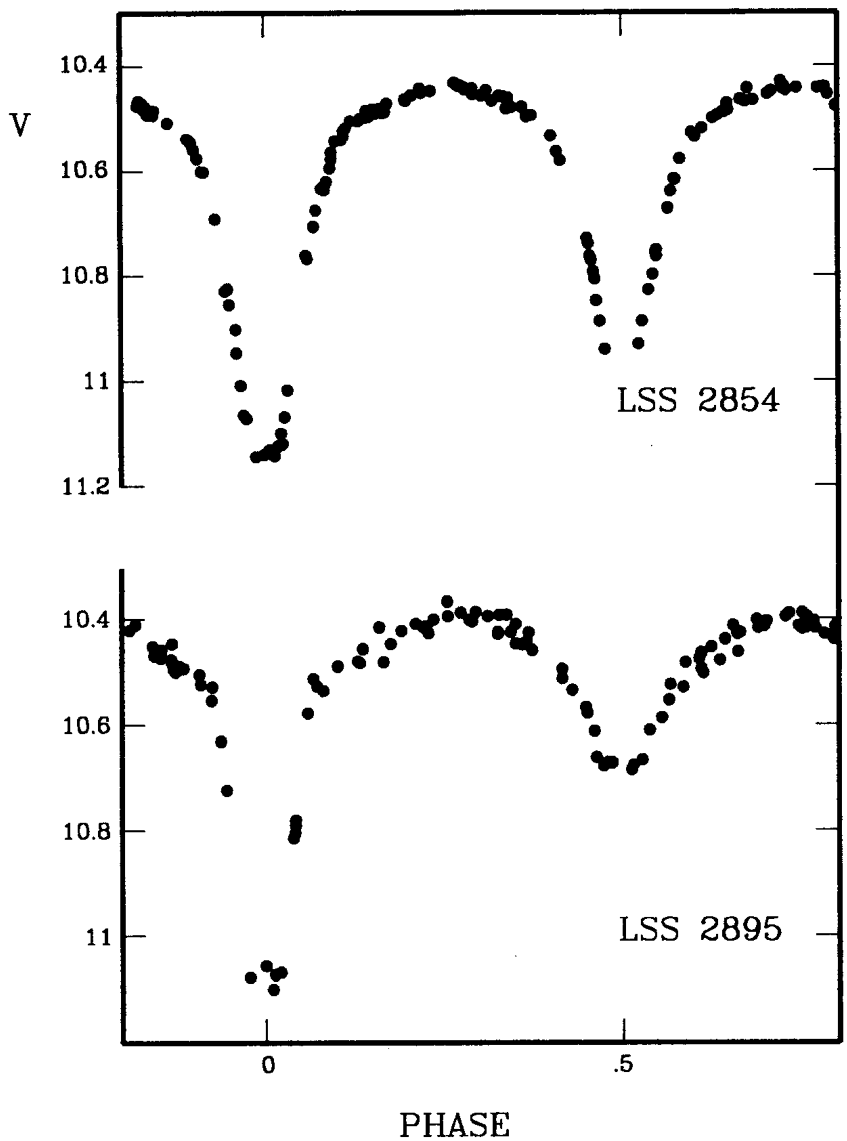

Figure 1. Light curves for LSS2854 and LSS2895 phased according to the ephemerides given in the text.

Table 1. Mean UBV photometry of comparison stars

		V	(B−V)	(U−B)	n
LSS 2571	1989-90	7.334	+0.049	−0.763	20
		±0.005	±0.005	±0.006	
	1990-91	7.330	+0.054	−0.752	63
		7	7	7	
	adopted	7.331	±0.053	−0.755	
LSS 2863	1989-90	10.341	+1.238	+0.186	18
		7	7	12	
	1990-91	10.354	+1.249	+0.196	62
		12	9	11	
	adopted	10.350	+1.246	+0.194	
LSS 3014	1989-90	7.782	+0.621	−0.458	17
		8	5	4	
	1990-91	7.790	+0.626	−0.451	60
		20	6	7	
		var?			
	adopted	7.788	+0.625	−0.453	

occured and since the star near LSS2895 appears (photographically) somewhat brighter than that near LSS2854, this may have contributed to the observed scatter.

Photometry of both systems is continuing and a programme of spectroscopy for radial velocity determination has been started.

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THE VARIATION OF THE LIGHT CURVES OF AU Ser

The binary AU Ser was observed visually and photographically by Soloviev (1951) and Huth (1964) respectively. The first photoelectric observations were performed by Binnendijk (1972). The light curves show different heights of the primary and secondary maximum and rather rapid variation in the shape. Kaluzny (1986) analysed Binnendijk's data and found this binary to be poor thermal contact system although the uniqueness of the solution was not sufficiently discussed. It is important to monitor such an interesting binary. Unfortunately, because AU Ser is rather faint, there is few photometric observation carried out for this system since 1970.

We observed this star photoelectrically, using the 1−meter reflector of the Yunnan Observatory, China, on two nights, 9−11 April 1991. The coordinates (1950) of the binary, the comparison and the check star are $15^h54^m39^s+22°24'.3$, $15^h55^m01^s+22°17'.5$ and $15^h54^m33^s+22°24'.9$, respectively. A finder chart is given in Fig. 1 where 1, 2 and 3 represent the variable, the comparison and the check star. A total of 264 yellow (Table 1) and 264 blue (Table 2) observations were obtained. The probable error of a single observation was estimated to be ±0.015 mag. The moment of the primary minimum is JD 2448356.3364±0.0003 which corresponds to phase of 0.93 according to Binnendijk's ephemeris

$$\text{Min. I} = \text{JD}2440748.8592 + 0.38650124E.$$

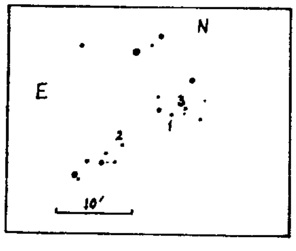

Figure 1. Finder chart for AU Ser(1), the comparison(2) and the check star(3)

The light curves are plotted in Figure 2 where zero point corrections of +1.538 for V light and +2.000 for B light were introduced so that the maximum of magnitude difference in V band is equal to zero. Figure 2 shows that the maximum following secondary minimum is 0.05 mag higher than the other one in contrast with the light curves obtained by Binnendijk in 1969 where the maximum following the primary minimum is 0.05 mag higher than the other. Regarding the displacement of the minimum time, we are not sure if it suggests the change of the period.

Table 1. Yellow observations of AU Ser

JD 2448000+	ΔV	JD 2448000+	ΔV	JD 2448000+	ΔV	JD 2448000+	ΔV	JD 2448000+	ΔV
356.1665	-1.183	356.2679	-1.450	356.3896	-1.356	357.2179	-1.495	357.3088	-0.885
356.1678	-1.212	356.2691	-1.429	356.3906	-1.357	357.2212	-1.496	357.3122	-0.962
356.1688	-1.214	356.2693	-1.438	356.3941	-1.387	357.2221	-1.497	357.3136	-0.981
356.1700	-1.239	356.2706	-1.420	356.3954	-1.406	357.2224	-1.490	357.3139	-0.997
356.1724	-1.237	356.2733	-1.412	356.4002	-1.406	357.2233	-1.501	357.3152	-0.974
356.1733	-1.256	356.2744	-1.417	356.4017	-1.415	357.2254	-1.497	357.3179	-1.064
356.1735	-1.251	356.2747	-1.428	357.1485	-1.223	357.2265	-1.492	357.3191	-1.089
356.1744	-1.274	356.2757	-1.409	357.1491	-1.223	357.2307	-1.502	357.3194	-1.097
356.1768	-1.307	356.2856	-1.349	357.1500	-1.226	357.2317	-1.500	357.3229	-1.147
356.1777	-1.313	356.2867	-1.332	357.1502	-1.211	357.2320	-1.502	357.3256	-1.168
356.1779	-1.318	356.2869	-1.327	357.1522	-1.247	357.2333	-1.493	357.3265	-1.192
356.1788	-1.327	356.2880	-1.331	357.1531	-1.247	357.2360	-1.481	357.3267	-1.190
356.1853	-1.387	356.2921	-1.284	357.1533	-1.248	357.2370	-1.471	357.3275	-1.198
356.1862	-1.402	356.2932	-1.280	357.1542	-1.254	357.2372	-1.476	357.3341	-1.296
356.1864	-1.390	356.2936	-1.282	357.1576	-1.296	357.2381	-1.469	357.3349	-1.309
356.1873	-1.404	356.2948	-1.262	357.1584	-1.318	357.2406	-1.461	357.3352	-1.310
356.1902	-1.427	356.3050	-1.173	357.1586	-1.312	357.2415	-1.470	357.3396	-1.314
356.1912	-1.439	356.3060	-1.155	357.1595	-1.323	357.2417	-1.464	357.3407	-1.335
356.1914	-1.434	356.3062	-1.157	357.1628	-1.326	357.2427	-1.456	357.3409	-1.340
356.1926	-1.437	356.3074	-1.132	357.1637	-1.332	357.2496	-1.436	357.3418	-1.360
356.2069	-1.502	356.3104	-1.038	357.1639	-1.328	357.2506	-1.444	357.3476	-1.407
356.2079	-1.507	356.3113	-1.042	357.1647	-1.333	357.2508	-1.440	357.3478	-1.401
356.2081	-1.499	356.3116	-1.021	357.1668	-1.373	357.2548	-1.424	357.3487	-1.400
356.2090	-1.510	356.3128	-1.019	357.1674	-1.377	357.2550	-1.421	357.3522	-1.465
356.2116	-1.504	356.3161	-0.961	357.1676	-1.380	357.2559	-1.424	357.3539	-1.464
356.2126	-1.528	356.3174	-0.937	357.1686	-1.393	357.2586	-1.400	357.3542	-1.453
356.2129	-1.531	356.3177	-0.931	357.1714	-1.366	357.2595	-1.397	357.3566	-1.482
356.2141	-1.520	356.3191	-0.918	357.1722	-1.378	357.2598	-1.391	357.3579	-1.491
356.2168	-1.520	356.3286	-0.724	357.1724	-1.385	357.2611	-1.377	357.3582	-1.482
356.2236	-1.535	356.3295	-0.717	357.1733	-1.373	357.2641	-1.338	357.3592	-1.488
356.2239	-1.528	356.3298	-0.685	357.1808	-1.418	357.2650	-1.324	357.3685	-1.520
356.2248	-1.541	356.3307	-0.683	357.1819	-1.406	357.2653	-1.331	357.3693	-1.515
356.2271	-1.524	356.3341	-0.630	357.1821	-1.404	357.2662	-1.323	357.3696	-1.526
356.2281	-1.535	356.3359	-0.624	357.1831	-1.395	357.2685	-1.300	357.3704	-1.531
356.2283	-1.533	356.3363	-0.634	357.1860	-1.434	357.2696	-1.284	357.3731	-1.513
356.2293	-1.535	356.3379	-0.631	357.1870	-1.434	357.2699	-1.277	357.3739	-1.536
356.2318	-1.534	356.3419	-0.657	357.1873	-1.447	357.2707	-1.272	357.3741	-1.526
356.2428	-1.520	356.3430	-0.670	357.1884	-1.447	357.2740	-1.260	357.3749	-1.522
356.2430	-1.524	356.3432	-0.672	357.1918	-1.464	357.2749	-1.244	357.3862	-1.532
356.2438	-1.533	356.3442	-0.687	357.1927	-1.448	357.2751	-1.236	357.3870	-1.536
356.2465	-1.522	356.3471	-0.734	357.1936	-1.476	357.2759	-1.232	357.3872	-1.534
356.2477	-1.514	356.3485	-0.752	357.1938	-1.473	357.2828	-1.124	357.3882	-1.543
356.2480	-1.515	356.3487	-0.769	357.2007	-1.474	357.2841	-1.093	357.3916	-1.536
356.2490	-1.507	356.3499	-0.772	357.2016	-1.481	357.2846	-1.084	357.3924	-1.548
356.2517	-1.496	356.3535	-0.868	357.2018	-1.487	357.2862	-1.047	357.3997	-1.527
356.2575	-1.500	356.3549	-0.888	357.2026	-1.486	357.2924	-0.931	357.4005	-1.530
356.2584	-1.495	356.3552	-0.906	357.2046	-1.491	357.2926	-0.898	357.4007	-1.531
356.2586	-1.511	356.3566	-0.923	357.2058	-1.509	357.2937	-0.882	357.4017	-1.521
356.2597	-1.492	356.3599	-0.980	357.2060	-1.513	357.2996	-0.836	357.4101	-1.518
356.2622	-1.468	356.3610	-1.010	357.2069	-1.494	357.3007	-0.819	357.4109	-1.530
356.2635	-1.469	356.3615	-1.016	357.2156	-1.492	357.3010	-0.819	357.4111	-1.527
356.2637	-1.462	356.3867	-1.321	357.2167	-1.511	357.3063	-0.871	357.4119	-1.530
356.2649	-1.460	356.3892	-1.349	357.2170	-1.507	357.3074	-0.885		

Table 2. Blue observations of AU Ser

JD 2448000+	ΔB	JD 2448000+	ΔB	JD 2448000+	ΔB	JD 2448000+	ΔB	JD 2448000+	ΔB
356.1671	-1.303	356.2642	-1.578	356.3961	-1.506	357.2229	-1.632	357.3143	-1.078
356.1674	-1.291	356.2646	-1.581	356.3964	-1.526	357.2257	-1.616	357.3146	-1.060
356.1694	-1.348	356.2683	-1.553	356.4009	-1.514	357.2259	-1.612	357.3184	-1.159
356.1697	-1.346	356.2688	-1.539	356.4010	-1.517	357.2269	-1.606	357.3186	-1.178
356.1773	-1.428	356.2697	-1.533	356.4025	-1.537	357.2271	-1.600	357.3197	-1.194
356.1782	-1.427	356.2699	-1.520	356.4027	-1.535	357.2314	-1.623	357.3199	-1.205
356.1784	-1.448	356.2859	-1.427	356.4144	-1.634	357.2326	-1.605	357.3260	-1.280
356.1813	-1.485	356.2862	-1.428	356.4146	-1.641	357.2363	-1.589	357.3262	-1.300
356.1816	-1.478	356.2874	-1.416	357.1487	-1.344	357.2365	-1.589	357.3270	-1.296
356.1824	-1.492	356.2876	-1.411	357.1489	-1.311	357.2375	-1.591	357.3272	-1.292
356.1827	-1.482	356.2926	-1.378	357.1495	-1.353	357.2377	-1.579	357.3301	-1.340
356.1856	-1.518	356.2928	-1.382	357.1497	-1.353	357.2409	-1.584	357.3303	-1.361
356.1859	-1.517	356.2940	-1.359	357.1525	-1.337	357.2411	-1.598	357.3312	-1.363
356.1867	-1.522	356.2944	-1.359	356.1527	-1.347	357.2420	-1.598	357.3314	-1.360
356.1869	-1.530	356.3054	-1.262	357.1579	-1.373	357.2422	-1.589	357.3344	-1.437
356.1905	-1.573	356.3056	-1.243	357.1581	-1.376	357.2542	-1.550	357.3346	-1.445
356.1919	-1.577	356.3068	-1.242	357.1590	-1.404	357.2544	-1.549	357.3399	-1.458
356.1921	-1.571	356.3070	-1.226	357.1592	-1.410	357.2553	-1.542	357.3402	-1.471
356.2022	-1.620	356.3107	-1.145	357.1632	-1.467	357.2556	-1.536	357.3413	-1.491
356.2024	-1.617	356.3110	-1.145	357.1634	-1.458	357.2590	-1.532	357.3415	-1.509
356.2120	-1.646	356.3121	-1.133	357.1642	-1.461	357.2592	-1.519	357.3451	-1.507
356.2122	-1.662	356.3123	-1.124	357.1644	-1.465	357.2606	-1.515	357.3455	-1.503
356.2134	-1.655	356.3166	-1.042	357.1671	-1.481	357.2608	-1.508	357.3482	-1.532
357.2137	-1.651	356.3169	-1.041	357.1679	-1.503	357.2645	-1.487	357.3484	-1.522
356.2230	-1.681	356.3182	-1.012	357.1681	-1.499	357.2647	-1.482	357.3514	-1.572
356.2233	-1.682	356.3186	-0.994	357.1683	-1.497	357.2656	-1.474	357.3518	-1.582
356.2243	-1.686	356.3289	-0.776	357.1716	-1.484	357.2658	-1.475	357.3530	-1.552
356.2245	-1.697	356.3292	-0.760	357.1719	-1.490	357.2688	-1.410	357.3535	-1.576
356.2275	-1.674	356.3301	-0.740	357.1726	-1.483	357.2693	-1.409	357.3572	-1.614
356.2277	-1.684	356.3304	-0.748	357.1728	-1.480	357.2702	-1.395	357.3576	-1.617
356.2287	-1.681	356.3353	-0.677	357.1866	-1.543	357.2704	-1.396	357.3589	-1.622
356.2289	-1.676	356.3371	-0.680	357.1868	-1.542	357.2743	-1.373	357.3591	-1.623
356.2324	-1.667	356.3373	-0.691	357.1875	-1.572	357.2746	-1.365	357.3699	-1.624
356.2328	-1.668	356.3424	-0.723	357.1877	-1.573	357.2754	-1.337	357.3701	-1.636
356.2341	-1.686	356.3426	-0.733	357.1921	-1.579	357.2756	-1.339	357.3733	-1.674
356.2343	-1.680	356.3436	-0.750	357.1924	-1.559	357.2833	-1.214	357.3736	-1.671
356.2423	-1.666	356.3438	-0.752	357.1931	-1.576	357.2835	-1.189	357.3744	-1.684
356.2425	-1.653	356.3476	-0.818	357.1933	-1.567	357.2855	-1.145	357.3746	-1.673
356.2434	-1.652	356.3480	-0.836	357.2010	-1.606	357.2857	-1.133	357.3823	-1.680
356.2436	-1.652	356.3491	-0.851	357.2012	-1.617	357.2918	-1.062	357.3825	-1.688
356.2468	-1.646	356.3494	-0.871	357.2021	-1.613	357.2920	-1.059	357.3865	-1.662
356.2473	-1.630	356.3540	-0.987	357.2023	-1.610	357.2931	-1.028	357.3867	-1.670
356.2483	-1.638	356.3543	-0.990	357.2051	-1.637	357.2934	-1.025	357.3875	-1.669
356.2486	-1.631	356.3555	-1.013	357.2066	-1.635	357.3002	-0.885	357.3878	-1.675
356.2522	-1.632	356.3558	-1.023	357.2096	-1.617	357.3004	-0.891	357.3909	-1.673
356.2526	-1.621	356.3604	-1.081	357.2102	-1.618	357.3013	-0.908	357.3911	-1.676
356.2535	-1.615	356.3607	-1.090	357.2115	-1.612	357.3016	-0.922	357.3919	-1.680
356.2537	-1.610	356.3619	-1.096	357.2118	-1.610	357.3068	-0.962	357.3921	-1.706
356.2578	-1.607	356.3621	-1.087	357.2160	-1.649	357.3070	-0.967	357.4000	-1.686
356.2581	-1.604	356.3885	-1.471	357.2175	-1.640	357.3080	-0.972	357.4002	-1.678
356.2592	-1.614	356.3888	-1.474	357.2216	-1.619	357.3082	-0.980	357.4012	-1.680
356.2627	-1.590	356.3946	-1.496	357.2218	-1.624	357.3130	-1.075	357.4014	-1.685
356.2629	-1.585	356.3949	-1.498	357.2227	-1.631	357.3133	-1.071		

Note that the previous minimum times listed by Binnendijk (1972) seem to indicate no significant variation in period occurred from 1936 to 1970. It is necessary to monitor this object in different wavelenghts. We will continue the photometry for it and a spectroscopic observation has been planned.

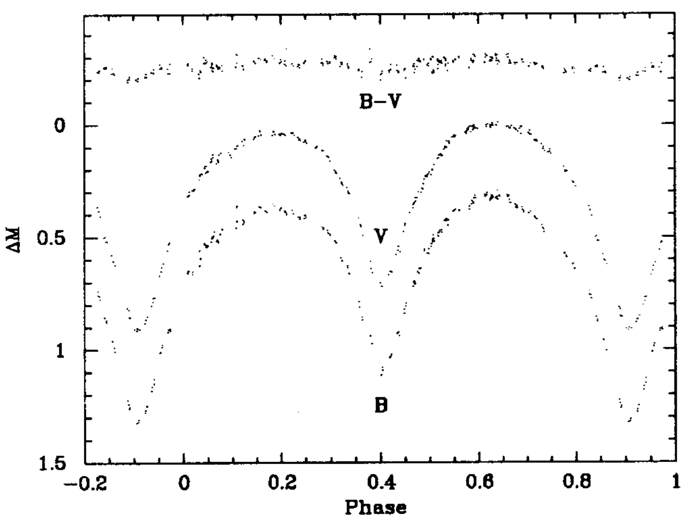

Figure 2. The light and color curves of AU Ser

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NEW PHOTOELECTRIC MINIMA TIMES OF V505 SAGITTARII

In a recent report (Rovithis-Livaniou et al., 1991) the behaviour of the period of the eclipsing binary V505 Sagittarii was studied and new ephemeris formulae were proposed. Since most of the recent minima times were visual - exhibiting large scattering - we had call for new (and especially photoelectric) minima times. This was done during our recent observations of V505 Sgr, which were made using the 48 inch Cassegrain reflector at the Kryonerion Astronomical Station of the National Observatory of Athens, Greece. The star HD 187664 was used for comparison and reduction of the observations was made in the usual way (Hardie, 1962). During our observations three minima times were obtained and are presented in Table I, the successive columns of which give: the Hel. JD; the $(O-C)_C$ according to the linear ephemeris of Chambliss (1972); the $(O-C)_M$ according to Kholopov's et al. (1985) ephemeris formula and finally $(O-C)_{R1}$ and $(O-C)_{R2}$ according to our linear ephemeris formulae. (Equations (1.5) and (1.7) in Rovithis-Livaniou et al., 1991).

Table 1

Hel. JD 2448000.+	$(O-C)_C$ days	$(O-C)_M$	$(O-C)_{R1}$	$(O-C)_{R2}$
432.4871	0.0199	−0.0034	+0.0007	0.0013
442.5402	0.0189	−0.0047	−0.0006	0.0000
804.4984	0.0195	−0.0052	−0.0004	0.0001

From the values of both $(O-C)_{R1}$ and $(O-C)_{R2}$ it is obvious that the proposed new ephemeris formulae hold good. But if one wants to have a more accurate view and adds the 3 new minima times - given in Table I - to those of Chambliss (1972) and Rovithis–Livaniou et al., (1991), then some minor variations are found, thus:

Chambliss' (1972) linear ephemeris formula is improved to:

$$\mathrm{MinI} = 2425501.3811 + 0^{d}182869342 \times E \qquad (1.1)$$

while Kholopov's et al. (1985) to:

$$\mathrm{MinI} = 2444461.5929 + 0^{d}18286938 \times E \qquad (1.2)$$

continuing their changes.

Moreover, since there are only 3 secondary minima times for V505 Sgr in the literature, and the scatter in the primaries is too large, one cannot examine them separately now.

Concluding, we ask for more accurate (photoelectric) minima times - both primaries and secondaries - which together with more data for the third companion (e.g. Khalesseh and Hill, 1991; Tomkin, 1992) will lead to the evaluation of the light–time effect which must be removed from the (O–C) diagram of V505 Sagittarii.

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THE H_α PROFILE VARIATIONS IN THE SPECTRUM OF HD 225094, B3Ia

The great deal of supergiants have variations of light, radial velocity, colour and occasionally in line profiles (see e.g. Abt, 1957; de Jager, 1980). The variations are explained probably by pulsations (Maeder, 1980; Lovy *et al.*, 1984) and/or some other mechanisms.

The star HD 225094 (HR 9097, BD +62°2356) is a member of the association Cas OB5 (Humphreys, 1978), has been classified as B3Ia supergiant and has the magnitude m_v=6.24 in the Bright Star Catalogue (Hoffleit, 1964).

The light variability of this star was discovered by Guinan *et al.* (1982). They detected an irregular brightness variability with the full amplitude of about $0^m_.1$ on a timescale of several days. The observations by Hill *et al.* made in 1976 show the same results. Our recent (1991) observations in the Vilnius photometric system at Mt. Maidanak have resulted in a quite smooth change in the brightness with the full amplitude of about $0^m_.1$ and with possible characteristic timescale of $22–23^d$.

The supergiant HD 225094 has been observed with the 1.5-m telescope of Tartu Astrophysical Observatory at Tõravere / Estonia during 1983–89. We have obtained ten spectra of satisfactory quality using the Cassegrain spectrograph *ASP–32* on Kodak 103-aF plates. These spectra cover the H_α region with the reciprocal dispersion 27 $Å \cdot mm^{-1}$, and are being used to investigate the possibility of H_α profile variations to test the hypothesis that the star has variability in spectral lines.

All the spectrograms were digitized using the computer controlled Microdensitometer *PDS 1010* of Tartu Astrophysical Observatory and elaborated using the spectrum-processing system *KASPEK*. Reduction routine steps are described by Annuk (1986).

Despite the fact that the spectrograms have a quite high noise-level, the comparison of several spectra has shown that the profile of H_α line is

Table 1. List of H_α profile observations for HD 225094

JD	*Date*	$W(m\text{Å})$	V_{rad}
2445424.346	30. Mar. 83	—	—
6509.292	19. Mar. 86	480*(abs)*	42.8*(abs)*
509.346	19. Mar. 86	307*(abs)*	23.3*(abs)*
707.604	04. Oct. 86	−390*(em)*	−8.5*(em)*
871.336	16. Mar. 87	−582*(em)*	−26.06*(em)*
909.519	23. Apr. 87	—	—
7270.475	19. Apr. 88	—	—
452.420	17. Oct. 88	−146*(em)*	6.7*(em)*
566.302	08. Feb. 89	—	—
571.323	13. Feb. 89	—	—

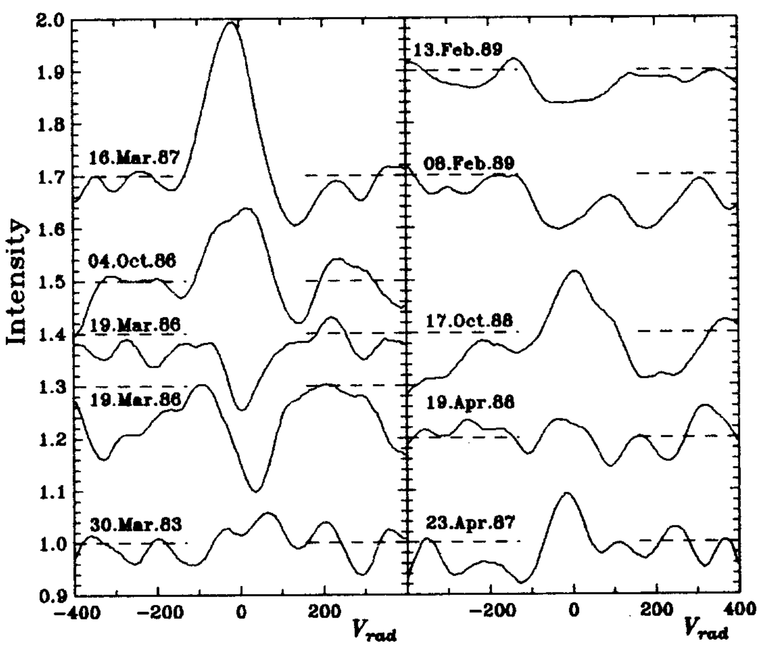

Fig. 1. Variability of H_α line profile in the spectrum of HD 225094

variable on long timescale. The log of observations is presented in Table 1. The third and fourth columns give the values of equivalent width and radial velocity (when they were measurable) of H_α line, respectively. In Figure 1 the shapes of the profile are presented. One can see that the profile has mainly a "flooded" shape, but it is sometimes changing to either absorption or emission. The mechanism that might be responsible for the observed variations is the growth of the envelope with a following throw off of matter contained in it and/or "puffs" lacking spherical symmetry.

Unfortunately our sequence of observations is irregular and we could not trace all the course of changing. Therefore more observations are needed to investigate this interesting supergiant.

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MINIMUM TIMES
FOR SEVERAL SOUTHERN EARLY-TYPE ECLIPSING BINARIES+)

During two observing periods with the 50 cm ESO telescope at La Silla in February/March and May 1992, several early-type eclipsing binaries were measured in the UBV system. Here the minimum times - and, in some cases, new ephemeris - are reported for FZ CMa, QZ Car, V606 Cen and MY Ser.

FZ CMa (HD 52942, B2.5 IV-Vn): for this variable, a light time effect due to a third body was reported by Moffat et al. (1983). The secondary minimum time measured by us is JDhel. 2448688.6343 ± 0.0004^d. The depths of this minimum were 0.39^m, 0.37^m and 0.36^m in U,B and V, respectively. From the light curve published by Moffat et al. (1983) a secondary minimum depth of about 0.36^m is apparent (in Strömgren v colour); this may indicate that the minima have meanwhile deepened. Such change can be due to a change of the orbital inclination, as has been demonstrated in the case of the eclipsing triple system IU Aur by Mayer and Drechsel (1987). Time-dependent variations of the orbital inclination and corresponding changes of the depth of eclipse minima are to be expected in a three-body system, where the orbital planes of the eclipsing binary and that of the third body orbiting around the mass center of the triple system are non-coplanar.

QZ Car (HD 93206, O9 III): a spectroscopic and photometric multiple system. The eclipse minimum for this star was not completely covered, however from the measured parts of the light curve, a minimum time can be estimated. The ephemeris of this star was given by Morrison and Conti (1980) as

+) Based on observations collected at the European Southern Observatory, La Silla, Chile

$$\text{Pri.Min.} = \text{JDhel. } \underset{\pm 2}{2443192.4} + \underset{\pm 9}{5.9981^{d}}.E \; .$$

Using an additional minimum given by Walker and Marino (1972), we obtained the improved ephemeris

$$\text{Pri.Min.} = \text{JDhel. } \underset{\pm 2}{2448687.16} + \underset{\pm 10}{5.99857^{d}}.E \; .$$

The period is very close to six days, which means, that in subsequent years, the minima are observable from limited geographic longitudes only:

1993: Australia
1994: New Zealand
1997, 1998: South America
2001: South Africa

The comparison and check stars were HD 93131, 93695 and 92740, which match the colours of QZ Car well, and no variability was found. The V light curve resulting from a preliminary reduction of our data is plotted in Fig. 1. Both maxima seem to be of different height. When the light curve is compared with the one

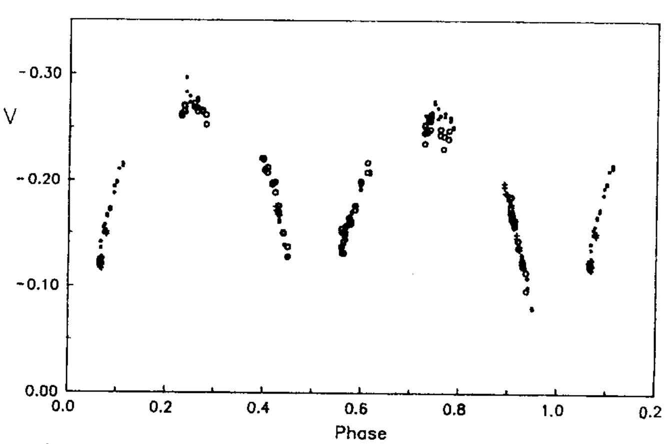

Fig. 1. V light curve of QZ Car. Differences Var-HD 93131 are plotted. Points - data from JD 2448682 to 2448687, open circles - data from JD 2448688 to 2448692, crosses - data from JD 2448749 to 2448753.

of Walker and Marino, the amplitude appears to be smaller than given in the GCVS: the depths of the primary and secondary minima can be estimated to be 0.25^m and 0.20^m, respectively.

V606 Cen (HD 115937, B1-2 Ib-II): the spectral type as given in the GCVS is, however, doubtful due to the short period, which probably excludes a supergiant nature of the star. The only data published so far for this variable is an ephemeris given by Hertzsprung (1950):

$$\text{Pri.Min.} = \text{JDhel. } 2427952.354 + 1.495093^d.E .$$

We observed three secondary minima:

JDhel	Error	O - C
2448684.8118	$\pm.0004^d$	$+.0002^d$
687.8020	±.0003	+.0002
690.7916	±.0002	-.0004

The resulting new ephemeris is

$$\text{Pri.Min.} = \text{JDhel. } \underset{\pm 2}{2448687.8018} + \underset{\pm 2}{1.4950931^d}.E .$$

The O - C values in the preceding table were calculated using our new ephemeris. The comparison star was HD 116003, check HD 115223. The depths of the secondary minimum are: U: 0.85, B: 0.80, V: 0.80. Due to the particularly difficult period of the star, we were unable to observe the light curve around the primary minimum.

MY Ser (HD 167971, sp. type O8 Ib(f)p according to Walborn, 1972): spectroscopic and photometric evidence exists that this is a multiple system. Lorenz et al. (1991) gave the ephemeris

$$\text{Pri.Min.} = \text{JDhel. } 2446232.612 + 3.32160^d.E$$

(unfortunately there was an error in JD in the above cited paper). Now a new primary minimum was observed at JDhel. $2448753.7130 \pm 0.0010^d$. The comparison and check stars were HD 168112 and BD $-12^\circ 4282$, respectively. Again, some asymmetry in the shape of the minimum is apparent, hence the real error of the minimum time might be somewhat larger than the formal one. The new ephemeris

$$\text{Pri.Min.} = \text{JDhel. } 2446232.6125 + 3.321609^{d}.E$$
$$\qquad\qquad\qquad\qquad \pm 10 \qquad\qquad \pm 2$$

has been calculated using times of primary minima only.

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Flickering activity in CH Cyg

CH Cyg is a long-period (~ 5700^d) symbiotic binary, consisting of a late red giant semiregular variable (with pulsation period ~ 100^d) and a white dwarf probably possessing strong magnetic field (Mikołajewski, Mikołajewska and Khudyakova 1990). At least four high-activity periods of CH Cyg have been observed since 1963. The last outburst ended in 1987, but since 1989 the star shows again erratic intermittent activity (Mikołajewski *et al.* 1992 and references therein). The erratic character of activity of CH Cyg is clearly visible in Figure 1, where the *U* band light curve reveals many irregular rises and deep local minima. Such sudden unexpected drop of *U, B* magnitudes occurred in mid September 1992, followed by deep minimum at the beginning of October 1992. We expect it is a temporary gap in activity. Such events are not expected in the framework of normal steady accretion. We surmise that highly unstable accretion from the giant's wind (Livio et al. 1991, Matsuda et al. 1991) could be responsible for the irregular behavior.

At the same time, the brightness of the M giant continued to increase in the *I* and *R* bands (see Figure 1 for the *R* light curve), which can be explained by rotation ($P = 770^d$) of the giant's photosphere covered with a large dark spot, presently turning away from us (Mikołajewski, Mikołajewska and Khudyakova 1992). The next maximum of this cycle we predict for the end of 1993.

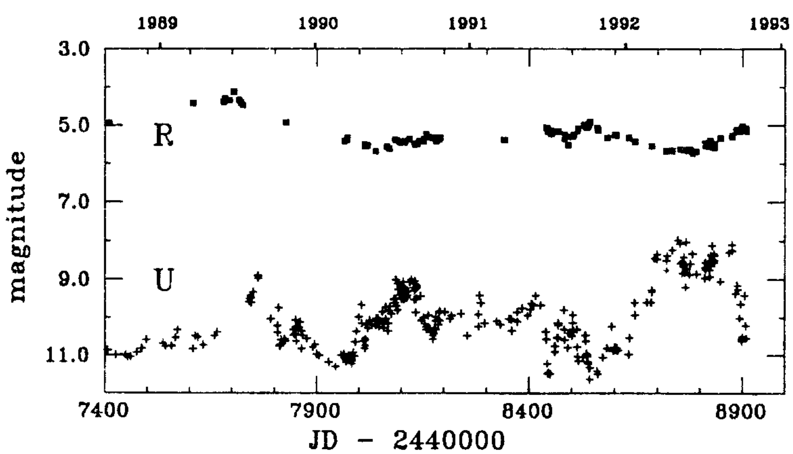

Figure 1. The *UR* light curves of CH Cyg during 1989–1993, mostly based on data obtained at Torun and Tartu Observatories (Tomov et al. 1992, in preparation).

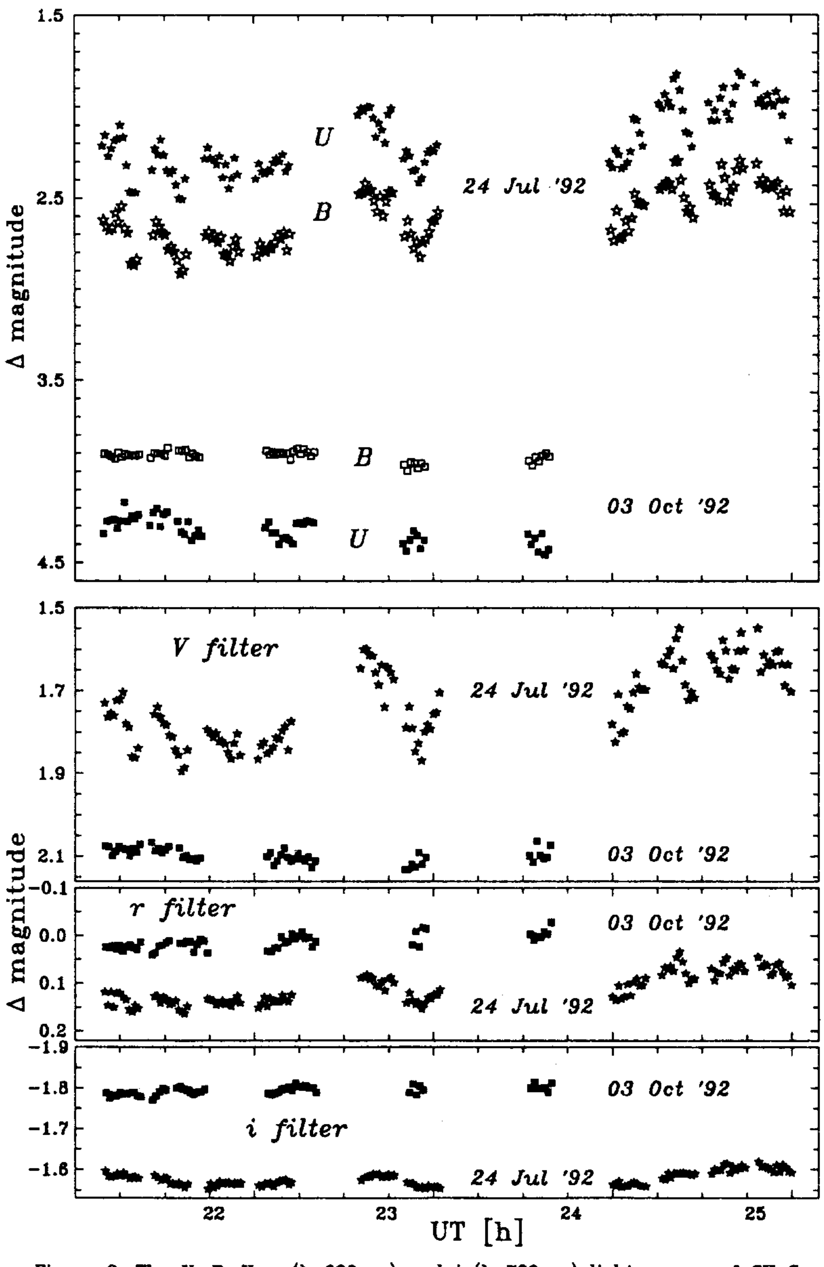

Figure 2. The U, B, V, r (λ=690nm) and i (λ=780nm) light curves of CH Cyg (in instrumental system), observed with 60cm telescope at Torun Observatory.

The increase in the hot component brightness is usually accompanied by flickering activity. This time, however, the flickering surprisingly appeared at wavelengths as long as $\lambda = 690$ nm and $\lambda = 780$ nm, corresponding to the effective wavelengths in r and i bands of our instrumental photometric system. The flickering in the r, i bands showed the same features as the flickering in the U, B, V filters (Figure 2). Typical amplitudes of flickering in summer 1992 were similar to those observed on 24 July : $\Delta U \approx 0.^m7$, $\Delta B \approx 0.^m7$, $\Delta V \approx 0.^m35$, $\Delta r \approx 0.^m15$, $\Delta i \approx 0.^m07$. The flickering in the r, i bands

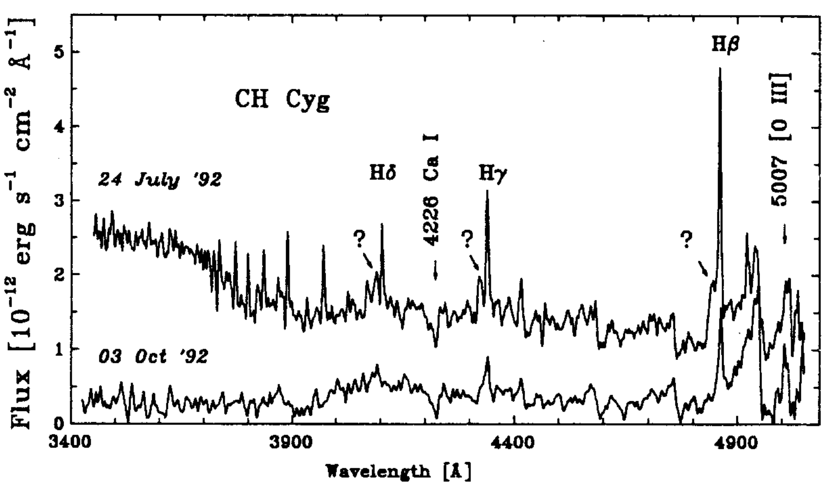

Figure 3. Low resolution (2–3Å) spectra of CH Cyg obtained with the Canadian Copernicus Spectrograph mounted at the Cassegrain focus of the 90cm telescope of Torun Observatory.

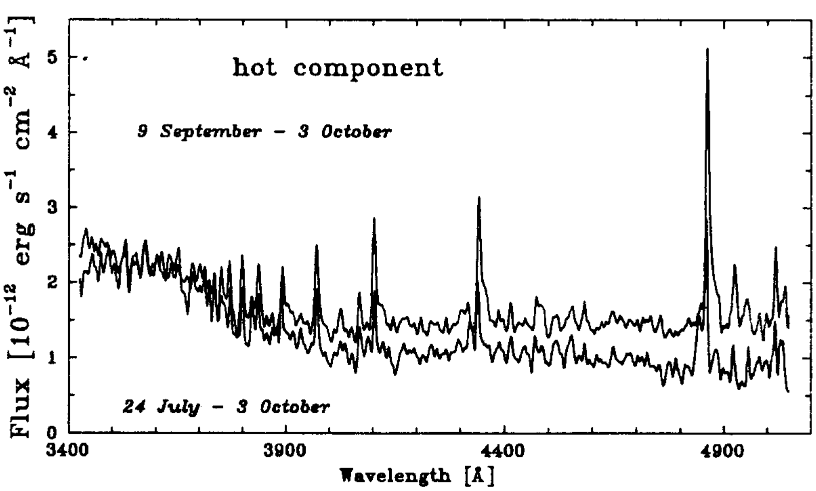

Figure 4. The spectrum of the hot component obtained by subtraction of the spectrum during minimum (3 October) from the spectra obtained during an active phase (9 September and 24 July).

has not been thus far observed for CH Cygni, and we were skeptical whether it is real or not. Subsequent observations, carried out with the same instrument at the beginning of October i.e. during the local minimum of activity, did not show such fluctuations. They show only noise without any correlation between respective filters (Figure 2). So, the only explanation is that the previously observed flickering in *r, i* bands was real. The *r, i* magnitudes during the gap of activity (3 October) has increased comparing to brightness on 24 July, which can be explained by a larger contribution of the M giant's flux (see the *R* light curve in Figure 1). Thus, during active phase the flux originating from the hot companion can change by 50% on timescales of tens of minutes, at all wavelengths starting from 355 nm up to 780 nm.

Such conclusion is also supported by our spectroscopic observations. In particular, the energy distribution obtained during recent maximum shows significant contribution of the hot component also longward of the Balmer jump (Figure 3). On the spectrum obtained on 3 October all permitted emission lines decreased in strength, following the decline of the hot continuum, while the forbidden lines ([O III], [Ne III], [S II]) remained clearly visible. So, we can expect that the spectrum observed during the minimum consists of the M giant photosphere and weak hydrogen continuous emission originating from a large extended nebula. To obtain the spectrum of the active component, we have neglected the variability of the M giant and subtracted the spectrum made on 3 October from the spectra obtained on 24 July and 3 September (maximum). The resulting spectra (Figure 4) show the expected H II continuum (typical for this star in 1989-91) and an F-type supergiant pseudophotosphere. It must originate from a large amount of accreted matter, accumulated around the magnetic white dwarf, and already beginning to be optically thick. It is consistent with the model of three step accretion onto an oblique rotator (for details see Mikołajewski *et al.* 1990). It is a contribution of the F-pseudophotosphere that is responsible for the prominent maximum on 9 September (compare to the spectrum obtained on 24 July in Figure 4), whereas the H II emission remains practically constant.

4 spectra made between 19 and 29 July revealed the presence of puzzling emission structures, possibly associated with H I Balmer emission lines (question marks in Figure 3). If they are blueshifted components of H I Balmer lines, their formation region approaches us with $V_{rad} \sim 1000$ km/s, which is comparable to the escape velocity from the white dwarf's surface or magnetosphere. Similar, but redshifted components in Balmer emission lines seem to be visible on the spectrum obtained on 9 September (Figure 4). Would it be caused by ejection of fast (precessing ?) jets, similar to that in July 1984 (Taylor *et al.* 1986, Solf 1987)?. High resolution spectra would explain the nature of these features.

Since one can expect new active phases, further optical, X-ray and UV observations are strongly needed.

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Mu Serpentis: A Doubled-Lined Spectroscopic Binary

For high dispersion spectroscopists who are studying elemental abundances, the discovery that a star one is studying is a double-lined spectroscopic binary can substantially increase the difficulty of analysis. But to those researchers who are more concerned about other stellar properties, the star then gains a new usefulness. With the use of electronic detectors capable of obtaining high signal-to-noise spectra, the discovery of the lines of companions to many known single-lined spectroscopic binaries should be possible. This is important for understanding the frequencies of systems with large mass ratios.

The Bright Star Catalogue (Hoffleit 1982) indicates that μ Ser (= HR 5881 =HD 141513) (spectral type A0 III; Gray and Garrison 1987) is a spectroscopic binary. Campbell and Moore (1928) suspected that this star might be double-lined. Frost, Barrett, and Struve (1929) found a variable radial velocity and noted that μ Ser might be a spectroscopic binary.

Lambert, McKinley, and Roby (1986) noted that their spectrum of μ Ser shows "C I profiles to contain a sharp and a broad component, a likely signature of a double-lined spectroscopic binary". Our spectra confirm this result. In Figure 1 we illustrate one section from the three spectra we obtained with the coudé spectrograph of the 1.4-m telescope of the Dominion Astrophysical Observatory with a reciprocal dispersion of 4.3 Å mm^{-1} using a 1872 element bare Reticon. We estimate that the rotational velocities of the two components are 8 and 90 km s^{-1}. By comparison Slettebak (1954) found v sin i = 80 km s^{-1}. We hope that this example will encourage other high dispersion spectroscopists to report their discoveries of lines due to companions.

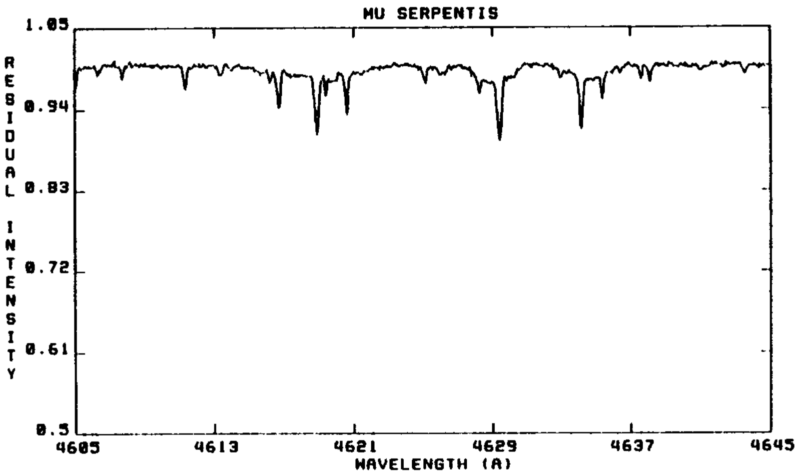

Fig. 1. A section of the spectrum of μ Ser obtain with the coudé spectrograph of the DAO at 4.3 Å mm^{-1}. Lines of two different widths produced by the components of this spectroscopic binary are evident.

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THE PHOTOMETRIC RANGE OF EX LUPI: a correction to IBVS 3755

In IBVS 3755, Herbig, Suntzeff and Blanco reported Johnson BV photometry carried out at CTIO of the comparison star sequence for EX Lupi, the V magnitudes being intended to replace the visual estimates that had been in use by the observers of the Royal Astronomical Society of New Zealand, Variable Star Section. Shortly after the appearance of IBVS 3755, one of the authors of the present note (A. C. Gilmore) called to the attention of Herbig *et al.* that a serious discrepancy existed between their data in IBVS 3755 and photometry of the same stars that had been carried out, quite independently, by Gilmore. It was then discovered that in the final stage of the reduction of the CTIO measures, there had been a shuffling of the data with the result that the 'B' magnitudes of IBVS 3755 were actually V magnitudes, and that while the B–V values were correct, those 'V' magnitudes were spurious, being simply 'B' minus B–V. The present *Information Bulletin* is intended to set the record straight.

The observations by Gilmore were made in 1992 September and October at Mount John University Observatory, with photometer no. 1 on the 0.6-m Boller and Chivens Cassegrain reflector. Standard Johnson–Cousins filters were used with a cooled EMI 9558B (S-20) photomultiplier and pulse–counting electronics. The measures were made differentially with respect to HR 5952, 27′ WSW of EX Lupi, and checked against HR 5945, 42′ SW of the variable. *Bright Star Catalogue* (4th ed.) magnitudes were adopted for both stars, and a V–R = –0.03 assumed for HR 5952. The details of the CTIO photometry are given in IBVS 3755.

Table 1
Magnitudes of Comparison Stars for EX Lupi

	CTIO		Gilmore					
star	V	B–V	V	B–V	U–B	V–R	Ptg. mag.	Vis. mag.
W	8.21	+0.16	8.19 (2)	+0.13 (3)	–0.09 (4)	+0.09 (1)	—	8.4
X	8.56	0.62	8.54 (1)	0.60 (1)	+0.24 (1)	0.43 (2)	—	8.9
Y	9.56	0.55	9.56 (1)	0.54 (1)	–0.03 (1)	0.33 (1)	—	9.8
a	10.31	0.29	10.29 (1)	0.29 (0)	—	0.15 (2)	10.9	10.6
c	10.95	0.65	10.94 (1)	0.62 (3)	—	0.40 (2)	11.4	11.3
d	10.70	0.56	10.67 (0)	0.51 (1)	—	0.31 (1)	11.4	11.5
b	10.66	0.71	10.63 (1)	0.66 (4)	—	0.41 (1)	11.4	11.7
f	11.14	1.33	11.15 (1)	1.28 (0)	—	0.73 (2)	12.3	12.2
h	—	—	11.45 (0)	1.39 (1)	—	0.81 (2)	12.6	—
e	11.80	0.54	11.82 (0)	0.51 (1)	—	0.32 (1)	12.2	12.4
g	12.06	0.71	12.06 (1)	0.73 (2)	—	0.43 (2)	12.4	12.6
i	12.26	0.78	12.22 (0)	0.72 (2)	—	0.40 (0)	12.8	13.0
k	12.67	0.98	12.62 (1)	0.98 (1)	—	0.58 (1)	13.1	13.3
u	12.35	1.91	—	—	—	—	—	13.5
l	13.23	0.80	13.16 (1)	0.83 (2)	—	0.42 (6)	13.3	13.8
m	—	—	14.09 (0)	1.1 (30)	—	0.4 (20)	14.1	—
n	—	—	—	—	—	—	14.2	—
EX	12.60	0.71	13.03 (6)	1.18 (3)	—	0.88 (6)	—	—

Table 1 contains both the CTIO data (B magnitudes are not tabulated), now properly labelled, as well as the photometry by Gilmore. The figures in parentheses following the Mt. John data are standard deviations in hundredths of a magnitude.

The "ptg. mag." of the next-to-last column is from McLaughlin (1946), while the "vis. mag." of the last column is from Bateson and Jones (1957). The mean B from the CTIO and Mt. John observations, but disregarding star *m*, can be related to McLaughlin's magnitudes by

$$B = 1.334\,(\text{ptg. mag.}) - 3.88 \quad , \qquad (1)$$

so that McLaughlin's range of 11.4–13.9 converts to 11.3–14.7 on the B scale, although it must be noted that this minimum magnitude represents an extrapolation of 0.7 mag. beyond the limit of the data to which (1) was fitted. Similarly, the means of the two series of V's relate linearly to the visual estimates, if the very red star *u* is omitted, by

$$V = 0.895\,(\text{vis.mag.}) + 0.63 \quad . \qquad (2)$$

This expression converts the original Bateson-Jones visual range of 8.7–14.0 for EX Lupi to 8.4–13.2 on the V scale.

The observations of EX Lupi itself in the last line of Table 1 were obtained on 1989 Sept. 15.1 at CTIO and on 1992 Oct. 17.4 at Mt. John, the latter at an air mass of 2.2. As noted in IBVS 3755, observations by Bastien and Mundt in 1977 and 1979 gave a mean B–V of +1.11 when EX Lupi had a mean V of 13.2. The Mt. John observation is quite near those values; the CTIO observation was apparently obtained at a time when the star was somewhat brighter and bluer. The B and V minima of EX Lupi inferred from eqs. (1) and (2) are of course less reliable; they correspond to a B–V at minimum light (V = 13.2) of about +1.5.

However, the B–V color of EX Lupi at maximum light inferred in the same way is +2.9. It was suggested in IBVS 3755 that this quite unreasonable value is the result of incomplete photographic coverage of the light curve, with the consequence that bright maxima such as the one observed visually in 1955–56 were simply missed on the Harvard plate series.

For this reason, the V range of 8.4–13.2 is to be preferred to the B value. This V range of 4.8 mag. is not very different from the original Bateson-Jones value of 5.3 mag. Thus EX Lupi and PV Cephei continue to have the largest ranges among the known EXors, although the photometric information on PV Cephei is less extensive.

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A Detection of Rapid Infrared Oscillations in HR 1217=DO Eri

The rapidly oscillating Ap (roAp) star HR 1217 was observed through a Johnson *K* filter for 2.4 hr on the night 17/18 August 1992 (JD 2448852) with the SAAO 1.9-m Radcliffe telescope and Mk III InSb photometer. The *f*/50 secondary mirror chops between two apertures to measure the quantities *(star + sky1)-sky2* and *sky1-(star + sky2)*. Subtraction of these quantities yields twice the stellar signal minus the sky background contribution. Since we were searching for rapid oscillations with periods around 6 min., no standard stars were observed and we did not attempt to put the observations on the standard system. The resulting instrumental magnitudes were corrected for mean extinction.

Figure 1 is the light curve of these data which shows that there was a gradual improvement in sky transparency during this run. Fig. 2 shows the Fourier transform of those data up to the Nyquist frequency of 6.0 mHz. The peaks at low frequency are caused by sky transparency variations. Normally we would remove these frequencies, but for illustrative purposes we show them in Fig. 2 to convince the reader that we have a credible detection of oscillations at the known optical oscillation frequency even in the presence of the sky transparency variations.

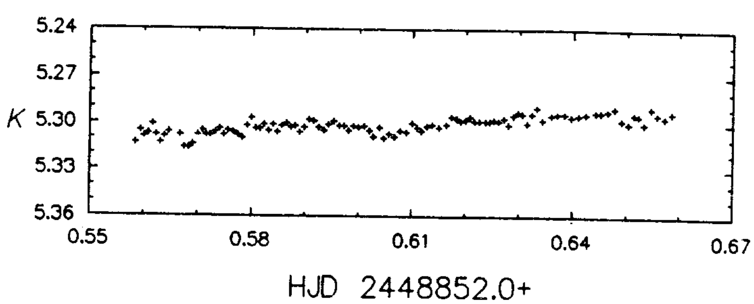

Fig. 1

The peak labeled 'ν_1' lies at 2.73 mHz, exactly the frequency of the well-studied *B*-band oscillations (Kurtz *et al.* 1990). Removing the low-frequency noise lowers the general level of the peaks but does not otherwise change the appearance of the spectrum much. When the 4 highest peaks in the frequency range 0 - 0.92 mHz are removed the highest peak remaining is at 2.72 mHz. A least squares fit of ν_1 = 2.72 mHz to the prewhitened data yields an amplitude of 1.3±0.4 mmag for ν_1.

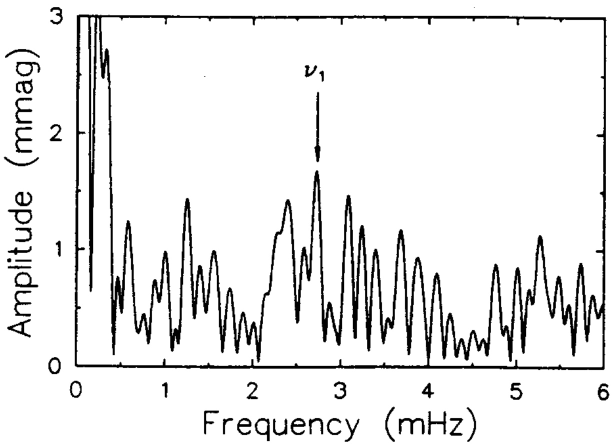

Fig. 2

Without prior knowledge of the optical oscillations at 2.72 mHz, this peak would be statistically insignificant. However, the chance of finding a peak of z signal/noise in power at exactly the right frequency is $\sim e^{-z}$ (Scargle 1982). Taking A_I = 1.3±0.4 mmag and the level of the noise in the amplitude spectrum of the prewhitened data as a conservative 0.8 mmag, $z = (1.3/0.8)^2$ which yields a False Alarm probability of 7% for this peak; *i.e.* the peak ν_1 is significant at the 93% level.

Unfortunately, the beating of the principal oscillation modes in HR 1217 does not allow us to predict the instantaneous B amplitudes on any given night. Thus we cannot compare our tentative measurement of A_K to any expectations of the K amplitude. For this, simultaneous multicolour photometry will be necessary.

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CCD Photometry of the Cataclysmic Variable HV Virginis

HV Virginis was originally thought to be a classical nova (Duerbeck 1987) until the recent outburst first detected by Schmeer (1992). The original outburst of this system occurred in 1929 when Schneller (1931) reported that the system had reached a *V* magnitude of 11 on 1929 Feb 1. In addition, Schneller reported a magnitude of 12.5 on 1929 Feb 3 and then noted that by 1929 Feb 9, the system was no longer observable. The normal quiescent magnitude of the system is 19.1 (Howell, et al 1992). The current outburst also shows a rise in magnitude up to an observed maximum of about 11.5 on 1992 April 21. The outburst light curve compiled from IAU circulars, Bruch (1992), and our own observations is presented in Figure 1.

Using the High Resolution Imaging CCD camera on the 1.8 meter ARC telescope, we observed HV Vir on April 30 and May 1 with 20 second integrations in the *V* band (Figure 2). Unfortunately, no other stars were visible in the CCD frame to enable differential photometry. The light curves were corrected for extinction and calibrated with the standard star G 21-15. The extinction coefficient was obtained by matching the magnitudes of the three minima seen on May 1 (on each night, the raw light curve showed a clear linear relationship to the airmass over time). Our observations indicate the presence of superhumps of 0.2 mag amplitude in the *V* band and a superhump period of 84.1 ± 0.4 minutes.

The arrows in Figure 2 indicate timings of the measured superhump maxima, which were measured by bisecting the full width at half maximum. The superhump timings are given in Table 1. Except for the

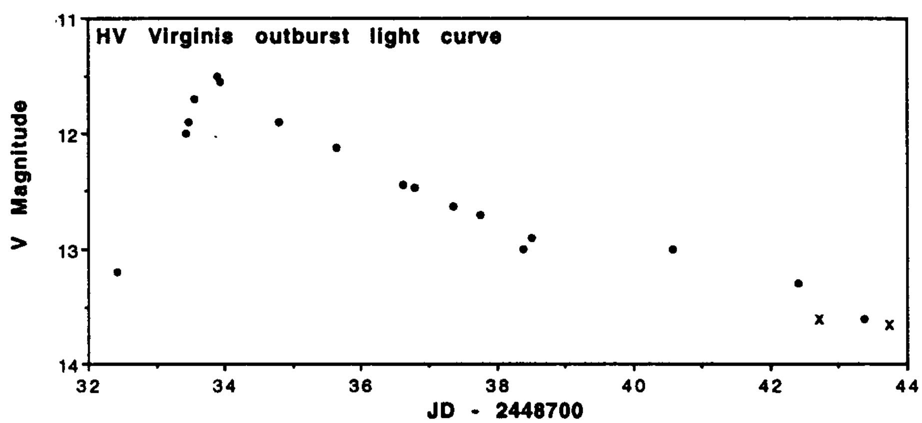

Figure 1 - The outburst light curve for HV Vir compiled from IAU circulars, Bruch (1992) and our data. Our observations are indicated with an "x."

maximum at the end of the 1st half of the May 1 data (which appears to be undergoing a second peak), all of the superhumps appear to be the same amplitude and width.

Table 1: Photometric data on HV Vir

Date (1992)	Time of Maximum(UT)	H.J.D. (2448700+)	*V* Mag (at half max)
April 30	8:49 ± 0:05	42.8728 ± .0033	13.60 ± 0.10
May 1	5:45 ± 0:03	43.7448 ± .0021	13.62 ± 0.10
May 1	8:38 ± 0:02	43.8653 ± .0013	13.65 ± 0.10
May 1	9:57 ± 0:05	43.9198 ± .0033	13.65 ± 0.10

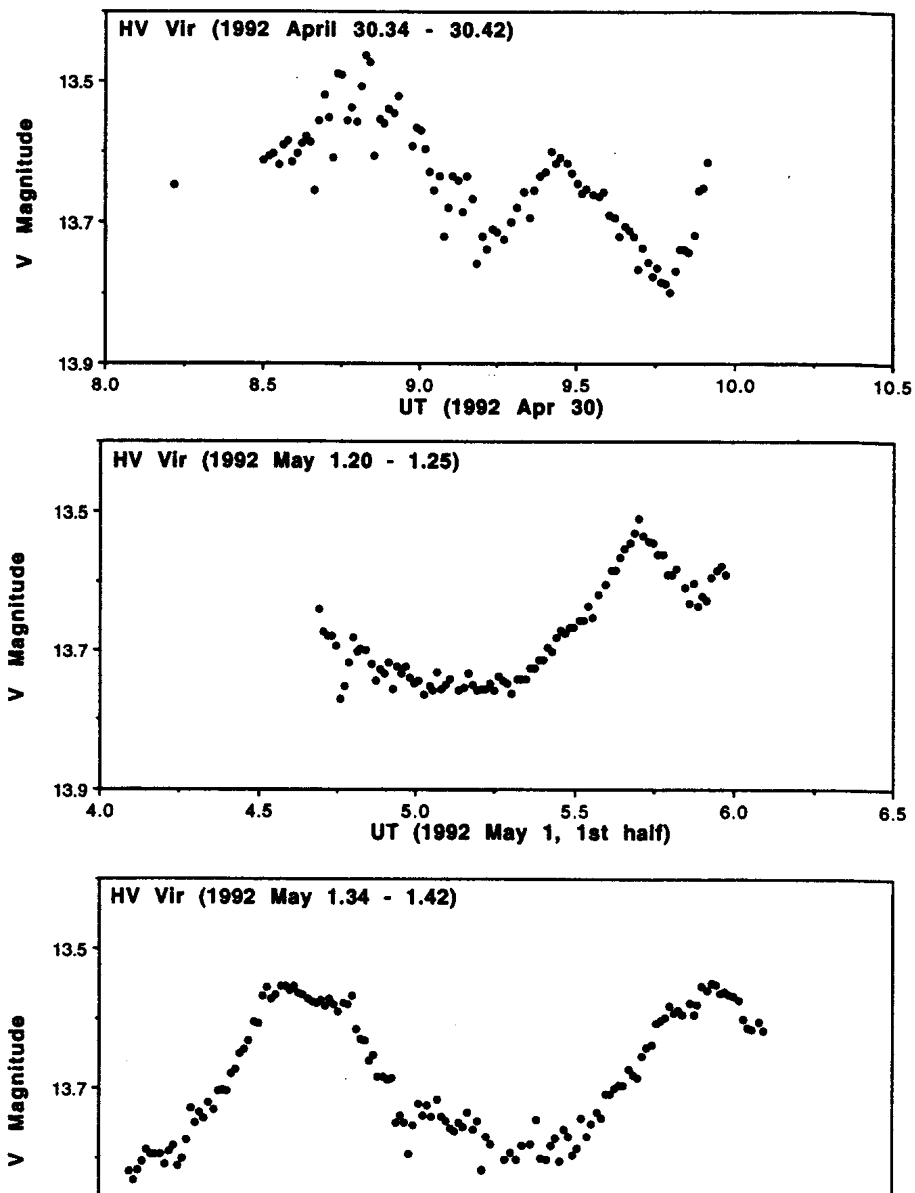

Figure 2 - Light curves from the two nights of CCD photometry.

The smaller hump feature apparent in the April 30 observations may be a manifestation of a beat phenomenon between the orbital and superhump periods reported by Mantel, et al (1992), but the evidence for a similar feature is not apparent in the May 1 data. The small uptum at the end of the first half of the May 1 observations does not match up with an extrapolation of the orbital period from the April 30 "beat hump."

The very large outburst amplitude (8 magnitudes) of HV Vir and its high galactic latitude (65°) are of note. Howell and Szkody (1990) are finding a large number of large amplitude (> 6 mag) dwarf novae out of the galactic plane, as compared to those in the plane, and most of the large amplitude systems have orbital periods below the period gap.

HV Vir adds to this correlation; 11 of the 12 known high galactic latitude, large outburst amplitude dwarf novae now have orbital periods below the gap.

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PERIOD REFINEMENT OF THE NEWLY DISCOVERED W UMa SYSTEM EF Dra

The W UMa system EF Dra was detected serendipitously by the Einstein Observatory Imaging Proportional Counter (Gioia et al., 1987) as x-ray source 1E1806.1+6944. Fleming et al. (1989) suspected the object to be an eclipsing binary on base of x-ray observations. Photometric data obtained from June to August 1989 by Robb and Scarfe (1989) confirmed the supposition and yielded the preliminary elements:

$$\text{JD hel. Min.} = 2447700.7602 + 0.42400 \cdot E \qquad \text{(I)}$$

To refine the period of the system in order to enable a long-time running ephemeris we observed the binary in V and B colour. The data were obtained with the 0.34 m Cassegrain telescope at Nürnberg Observatory, using a 1P21 phototube, and the 0.35 m Schmidt-Cassegrain telescope at F. Agerer's private observatory, using an EMI 9781A tube.

As a result we present the following elements, calculated by the method of least squares from all available times of minima:

$$\text{JD hel. Min.} = \underset{\pm 70}{2447700.75868} + \underset{\pm 22}{0.42402394} \cdot E \qquad \text{(II)}$$

Since the light curve shows indeed a significant night to night variation regarding the depth of the minima, as noted by Robb and Scarfe (1989), in combination with some asymmetry, we determined the times of the minima using the tracing paper method. Table 1 lists all known minima and the corresponding O-C residuals against the elements (II).

Table 1: Photoelectric minima of EF Draconis.

JD hel.	Epoch	O-C(II)	Filt.	Observer	Instr.	Reference
2447701.8201	2.5	+.0014				Robb & Scarfe
7715.8125	35.5	+.0010				Robb & Scarfe
7716.8710	38.0	-.0006				Robb & Scarfe
7727.8971	64.0	+.0009				Robb & Scarfe
7730.8650	71.0	+.0006				Robb & Scarfe
7734.8902	80.5	-.0024				Robb & Scarfe
8467.3956	1808.0	+.0016	V	Ls/Sg/Wk/Wu	34	this paper

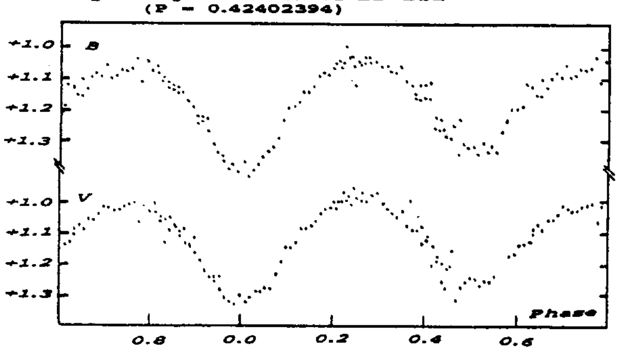
Table 1 (cont.): Photoelectric minima of EF Draconis.

JD hel.	Epoch	O-C(II)	Filt.	Observer	Instr.	Reference
2448475.4498	1827.0	-.0006	V,B	Ag	35	Hübscher et al.
8488.3835	1857.5	+.0004	V,B	Ag	35	Hübscher et al.
8491.5634	1865.0	+.0001	V,B	Ag	35	Hübscher et al.
8502.3729	1890.5	-.0030	V	Rz/Sg/Wk/Wu	34	this paper
8624.2819	2178.0	-.0009	V	Wk/Wu	34	this paper
8775.446 :	2534.5	-.0014	V,B	Ag	35	this paper
8909.4420	2850.5	+.0031	V,B	Ag	35	this paper

Abbreviations of the observer's names:

Ag = F. Agerer
Ls = G. Lichtschlag
Rz = R. Rosenzweig
Sg = S. Schurig
Wk = M. Wieck
Wu = E. Wunder

Fig.1: Light curves of EF Dra
(P = 0.42402394)



B and V light curves of EF Dra are shown in Figure 1. SAO 017740 was chosen as the comparison star.

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RX Cam IS A SPECTROSCOPIC-BINARY CEPHEID

The bright Cepheid variable RX Cam (HD 25361 = BD+58°694) turned out to have a blue companion with the help of IUE spectra quite recently (Evans, 1992). Prior to this discovery the only piece of information on its duplicity was given by the O−C diagram of this Cepheid (Szabados, 1980), for the O−C residuals show a wave-like pattern, as if RX Cam were a component in a long-period binary system (see Figure 1).

Unfortunately this bright Cepheid had long been a neglected object from spectroscopic point of view. In addition to Joy's (1937) classical radial velocity study, only one more series of v_{rad} data (Barnes et al., 1988) had been available before the major radial velocity survey carried out quite recently by Gorynya et al. (1992). Since RX Cam had never been suspected to belong to a spectroscopic binary, the authors of this latter paper did not compare their new data with the earlier ones. As a matter of fact, a simple comparison indicates variability in the γ-velocity of RX Cam, and a closer look at the previously published data also refers to the spectroscopic-binary nature of this Cepheid.

Figure 2 shows all radial velocity data plotted against the phase of the pulsational period. The value of this period (7.912024 days) was taken from Szabados (1980), zero phase was arbitrarily chosen at J.D. 2,440,000. The O−C diagram constructed for RX Cam indicates that there is no phase shift between the older-epoch and the more recent radial velocity data. Thus assuming a constant period gives a correctly phased radial velocity curve. Nevertheless, the scatter is very wide in Figure 2 indicating that the mean radial velocity averaged for one pulsational cycle shows temporal variation. Presumably, this is due to the orbital motion of the Cepheid component in a binary system.

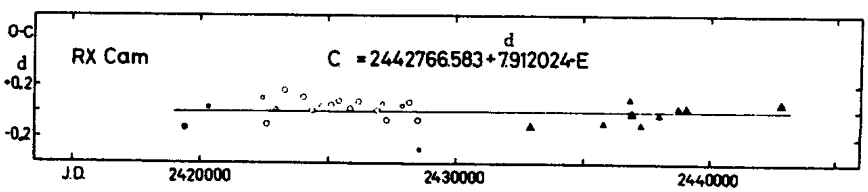

Figure 1. The O−C diagram of RX Cam taken from Szabados (1980).

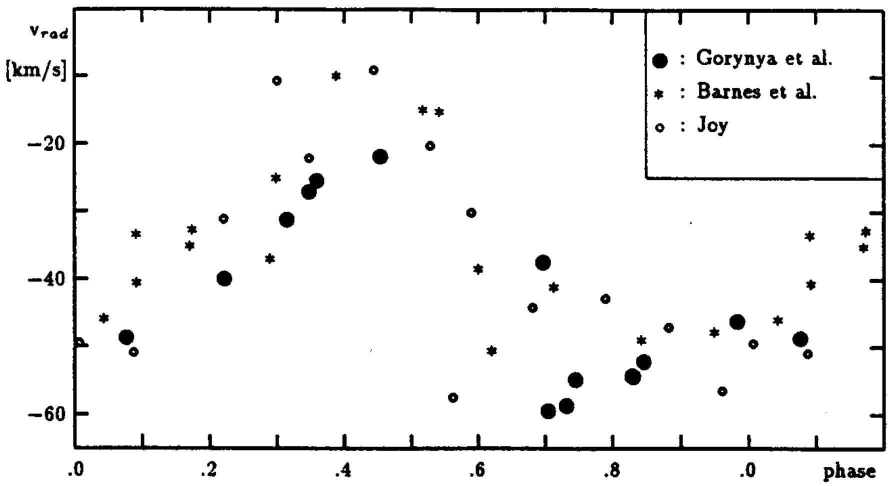

Figure 2. The phase diagram for the radial velocity data of RX Cam based on the whole sample.

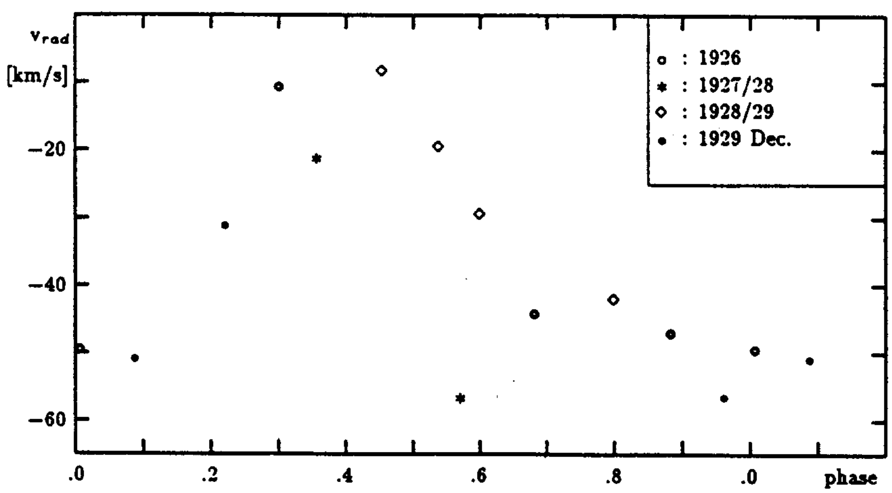

Figure 3. The phase diagram of Joy's (1937) radial velocity data separated into four groups.

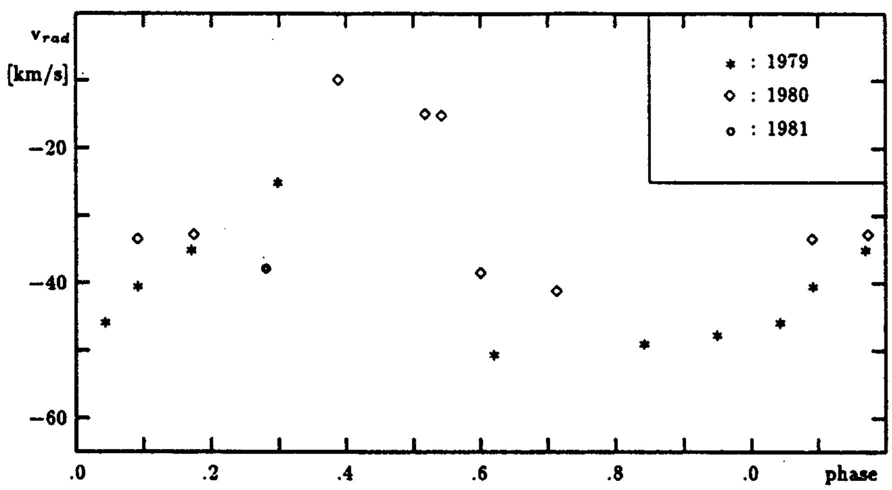

Figure 4. The phase diagram of the radial velocity data obtained by Barnes et al. (1988) separated into three groups.

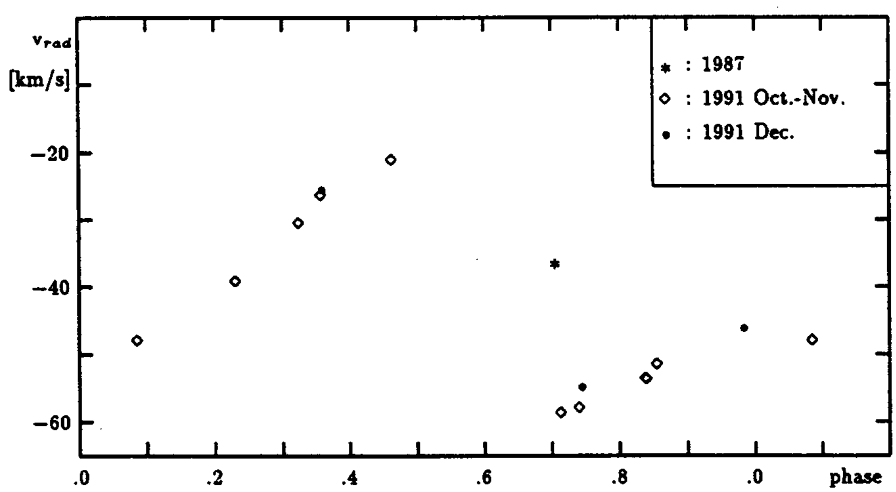

Figure 5. The phase diagram of the radial velocity data obtained by Gorynya et al. (1992) separated into three groups.

A closer look at the individual observational series also gives evidence for variable γ-velocity in each case. Joy's (1937) data were obtained in four consecutive observational seasons, and the radial velocities obtained during the second and the fourth runs are systematically more negative than the data obtained in the other two years. This is clearly seen in Figure 3. Barnes et al. (1988) observed RX Cam in three consecutive years. Their data plotted in Figure 4 clearly indicate that the γ-velocity was largest in 1980, while the single point obtained in 1981 is shifted to an even smaller value of γ-velocity than the 1979 data. Finally, Figure 5 shows the high-precision radial velocity data published recently by Gorynya et al. (1992). The single point obtained in 1987 deviates strongly from the bulk of data. Although the observers made a remark on this anomaly, commenting that the star might have been misidentified, in my opinion it is more probable that this shift also reflects the orbital motion. Moreover, the variation in the γ-velocity can be detected even during a single season: the data obtained in December 1991 are less negative than those observed in October – November 1991.

Rapidity of the change in the γ-velocity can also be suspected on the basis of the data obtained by Barnes et al. (1988). The first point measured in both 1979 and 1980 seasons deviates toward more negative values. These points (near phase 0.6 in Figure 4) are separated in time by more than one month from the other observations carried out in the respective years.

Various methods of period analysis applied to the whole sample (i.e. data plotted in Figure 2) failed to give a reliable single value for the orbital period. For the time being it can only be stated that the total variation in the γ-velocity exceeds 20 km/s and the orbital period is rather short for a binary system containing a classical Cepheid component. It is worthy of note that at present the shortest value of the reliably determined orbital periods for classical Cepheids just exceeds 500 days (S Mus – Evans, 1990). In view of the rapid variations detected in RX Cam, this Cepheid is a promising candidate to be an even closer system. As a consequence, the wave-like pattern in the O$-$C diagram cannot be explained with the recently discovered spectroscopic-binary nature and, the light-time effect caused by such a short orbital period cannot be pointed out from the photometric observations of typical accuracy. In order to make a more complete description of the system containing RX Cam, further spectroscopic and photometric data are extremely necessary.

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HD 54549: A NEW DOUBLE-LINED ECLIPSING BINARY

HD 54549 (BD -22° 1714, CD -22° 4063, $\alpha_{2000} = 7^h08^m21^s.8$, $\delta_{2000} = -22°24'11''$) is a ninth-magnitude A star in Canis Major. Houk & Smith-Moore (1988) classify it as A1 III, but both our spectra and *uvby* photometry show it to be a main-sequence star near A8. It is only $\sim 2'$ distant from the double-lined eclipsing binary SW CMa (HD 54520) of similar magnitude and spectral type, and, in fact, on the AAVSO chart of the field HD 54549 is erroneously identified as SW CMa itself. Thus, during a program in 1988-89 to determine the spectroscopic orbit of SW CMa with the Center for Astrophysics echelle system (Latham 1985) on the 1.5-m Wyeth reflector of the Oak Ridge Observatory in Harvard, Massachusetts, several spectra of HD 54549 were inadvertently obtained by those conscientious observers who consulted the chart.

The confusion was not immediately obvious since HD 54549 turned out also to be a double-lined spectroscopic binary of almost identical spectral type, luminosity ratio (close to unity), rotation, and velocity variation as SW CMa. Only the steadfast refusal of HD 54549 to follow the radial-velocity variations of SW CMa led to a determined search for the cause of this unusual dynamical phenomenon and eventually to the correct explanation. Observations then continued until the spectroscopic orbits had been determined as shown in Fig. 1.

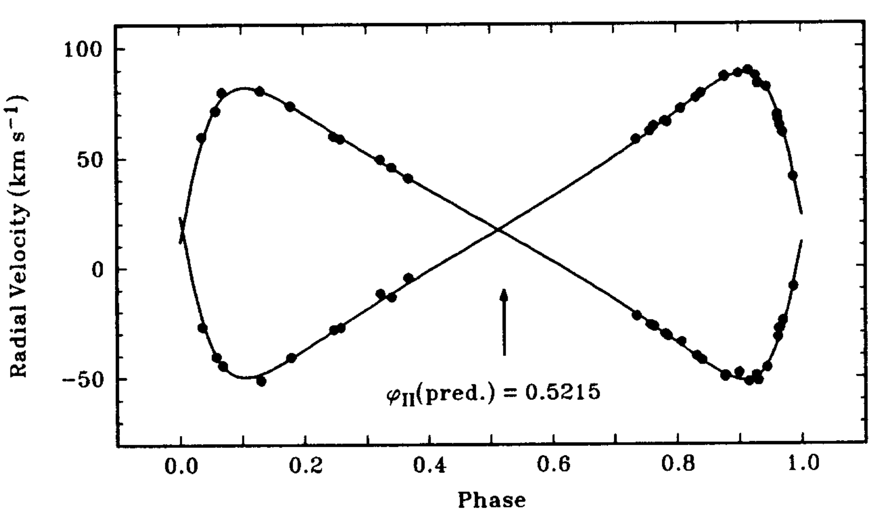

Fig. 1. Preliminary spectroscopic orbit for HD 54549 (Oak Ridge echelle spectra).

From these observations, we determine a period of 21.1175±0.001 days. The orbital eccentricity is rather high ($e = 0.500 \pm 0.003$, $\omega = 86.^{\circ}8 \pm 0.^{\circ}7$), and $a\sin i = 48.7\ R_{\odot}$. The mass ratio is $q = 1.034 \pm 0.008$ and the minimum masses, 1.74 and 1.80 $M_{\odot}$, close enough to those expected for unevolved late A stars (e.g. Andersen 1991) that a search for eclipses was deemed worthwhile. From the spectroscopic orbit, the time of a possible eclipse during the first observed orbital cycle was computed to be JD 2 447 507.051. Since the orbit is seen almost exactly along the major axis, conjunction occurs at an orbital phase only $0.^{P}0027$ after periastron when the stars are closest together, and eclipses should occur for $i \geq 83°$. At apastron, the separation is three times as large; $i \geq 88°$ is required, and (secondary) eclipses thus much less likely to occur; their predicted phase is $0.^{P}5215$.

During the course of several photometric campaigns in 1989-91 with the Danish 50-cm Strömgren Automatic Telescope (SAT) located at ESO, La Silla, Chile, HD 54549 was observed in the *uvby* system, using the SAT six-channel photometer and the comparison stars (HR 2755 and HD 53123) selected earlier for the nearby SW CMa. Finally, on March 8, 1992, an eclipse was predicted at UT 3.14 ($\pm 1^{h}20^{m}$); it obliged by promptly occurring at UT 3.55, reaching a depth of $0.^{m}13$ in all four colours and a duration of ~5 hours (see Fig. 2). The star has so far been found constant at all other times. ~80 points on the light curves have been obtained up to now, with typical photometric errors of $0.^{m}005$ in *vby* and $0.^{m}007$ in *u*.

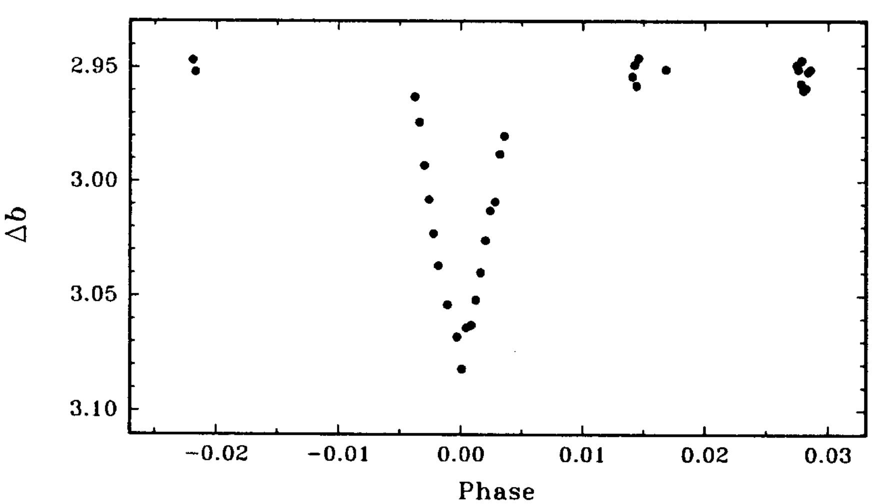

Fig. 2. *b* light curve of HD 54549 near the time of the predicted eclipse (SAT data).

The shape and phasing of the observed light variation leave no doubt that HD 54549 is an eclipsing variable. In order to better understand the properties of the system, preliminary solutions of the incomplete light curve have been made for a set of fixed values of inclination i and ratio of the radii, k, and adopting the spectroscopic values of q, e, and ω.

The resulting luminosity ratio is a steep function of i; the spectroscopic line ratio ($W_B/W_A \approx 0.9$) therefore is a strong constraint on the photometric solution. We find $i \sim 85°$ and relative radii $r_A \approx r_B \approx 0.034$; *no* secondary eclipse is predicted to occur for these parameters. With these elements, the stars are unevolved (log $g \sim 4.25$). The classification A1 III by Houk and Smith-Moore (1988) was probably caused by unrecognized double lines. Combining the observed time of minimum (1992) with the early (1988) spectroscopic prediction, we derive the following ephemeris for primary eclipses (only):

$$\text{Min(I)} = \text{HJD } 2\,448\,689.648 + 21^{\text{d}}.1178 \cdot E \qquad (1)$$
$$\pm\ 2 \qquad \pm\ 5$$

$uvby\beta$ indices of HD 54549 on the standard system were determined in 1989 as follows (phase interval $0^{\text{P}}.75$ - $0^{\text{P}}.85$):

$y = 9.188$;	$b\text{-}y = 0.130$;	$m_1 = 0.220$;	$c_1 = 0.848$;	$\beta = 2.835$
± 3	± 2	± 2	± 10	± 10

These correspond to stars of spectral type near A8 and effective temperatures of ~8000 K.

Observations of HD 54549 will continue for a full determination of the absolute dimensions of its components; given the rather long period, this is likely to take a few more years.

L.Q. thanks the Carlsberg Foundation for a travel grant for these observations.

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TWELVE NEW OR UNDESIGNATED VARIABLES

A continuing photographic patrol has resulted in the discovery of 12 more variable stars that are not included in the General Catalogue of Variable Stars (Kholopov et al. 1985) or the subsequent Name Lists of Variable Stars (Kholopov et al. 1985, 1987, 1989; Kazarovets and Samus 1990). Five of these stars are listed in the New Catalogue of Suspected Variable Stars (Kholopov et al. 1982), and this report represents independent confirmation of their variability. Positions and preliminary magnitude ranges, types, and periods are given in Table I, which continues the list in Kaiser (1991).

David B. Williams has examined DHK 25-28 and 30-36 on the Harvard patrol plates and confirmed variability within the stated photographic magnitude ranges. These observations will be published when analysis is completed. I have used the Harvard plates to find the period of the new eclipsing binary DHK 29 (Kaiser and Baldwin 1992).

I am grateful to Dr. Martha Hazen, curator of astronomical photographs at Harvard College Observatory, for use of the Harvard patrol plates. I would also like to thank Marvin E. Baldwin and David B. Williams for helping to confirm the variability of these stars. The variables were detected using a projection blink comparator (PROBLICOM) as described by Mayer (1977).

TABLE I.

Var. Designation	RA (1950)	Dec (1950)	Range	Type	P (days)
DHK 25 = NSV 1040 BD +59°594 IRC +60111	$03^h\ 03^m\ 39^s$	+60° 17.8′	11.4-12.1 pg	SR	350:
DHK 26 = NSV 5949	12 45 23	+34 40.0	11.9-12.8 pg	SR	300:
DHK 27 = BD +38°780 HD 275647 SAO 56620	03 37 24	+38 50.4	10.5-11.4 pg	Lb	Irreg.
DHK 28 = BD +26°4660 SAO 91369	23 33 37	+27 24.6	10.6-11.3 pg	SR	150:
DHK 29 = BD +33°4070 SAO 70629	20 51 10	+33 55.7	8.9- 9.5 V	EA	1.9021
DHK 30 = GSC 1859:0163	05 22 29	+29 35.8	11.1-11.8 pg	SR	250:

TABLE I (cont.)

DHK 31	BD +32°996 HD 35816 SAO 58083	05 25 36	+32 26.3	9.6-10.1 pg	SR:	70:
DHK 32 =	GSC 2407:0390	05 25 33	+32 23.1	11.1-11.7 pg	SR	80:
DHK 33 =	GSC 4767:0829	05 35 22	-01 39.2	12.1-13.0 pg	Ib:	Irreg.
DHK 34 =	NSV 3288	06 53 43	+14 23.0	11.1-12.2 pg	SR	130:
DHK 35 =	NSV 13854 BD +54°2603 HD 206695 IRC +50393	21 40 30	+54 36.0	11.1-12.2 pg	Ib:	Irreg.
DHK 36 =	NSV 13889 BD +12°4694	21 47 23	+12 28.7	10.7-11.2 pg	SR	60:

Note: In the absence of other catalogue designations, variables are identified by their Guide Star Catalogue numbers (Space Telescope Science Institute, Baltimore, 1989, CD-ROM). In these cases, finding charts will be published with the analysis of observations.

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A PERIOD FOR THE NEW ECLIPSING BINARY DHK 29 = BD +33°4070

Kaiser (1992) reported that the star BD +33°4070 = SAO 70629 is an eclipsing binary, which he designated DHK 29 in his discovery list. His patrol photos show the star near minimum on two nights. Following discovery, Baldwin began regular visual monitoring. Another minimum was soon detected, and on the same night Kaiser was able to obtain a few photoelectric measures of the final portion of the eclipse light curve. The star varies from 8.9-9.5: V, and the eclipses are 5 hours in duration.

To determine the period, Kaiser examined the variable on 320 Harvard patrol plates from the years 1918-1952 and 1968-1989 and found 16 additional minima. Table I lists all 18 photographic minima and the estimated times of two minima from Baldwin's visual observations.

TABLE I.

HJD 2400000+	E	O-C		HJD 2400000+	E	O-C	
21859.604	-14221	-0ᵈ058	H	31750.606	-9021	-0ᵈ025	H
22228.626	-14027	-0.046	H	41951.657	-3658	+0.014	H
22698.590	-13780	+0.097	H	42693.517	-3268	+0.052	H
26479.827	-11792	-0.059	H	45525.690	-1779	-0.016	H
26559.799	-11750	+0.025	H	45563.724	-1759	-0.024	H
28366.778	-10800	0.000	H	45645.573	-1716	+0.034	H
28448.554	-10757	-0.015	H	47081.596	- 961	-0.036	K
29456.711	-10227	+0.024	H	48479.683	- 226	+0.001	K
30173.805	-9850	+0.023	H	48909.547	0	-0.012	B
30605.588	-9623	+0.027	H	48924.768	+ 8	-0.008	B

H = Harvard ptg., K = Kaiser ptg., B = Baldwin visual.

The following light elements result when these minima times are introduced into a least squares solution:

$$\text{Min.} = \text{HJD } 2\,448\,909.558 + 1^{d}.9021093\ E \qquad (1)$$
$$\pm 15 \qquad\qquad \pm 17$$

The cycle numbers and O-C residuals in Table I are calculated from Equation 1. After this ephemeris was derived, Baldwin was able to confirm it by observing a predicted minimum (E = 8) visually.

The interval 1.9 days between eclipses is probably half of the orbital period. A photoelectric measure at phase 0.52 of Equation 1 shows no decrease from maximum light. The spectral type is F8 (AGK3, 1975), so it is quite likely that the two components of the binary system are similar in spectral type and produce primary and secondary eclipses of nearly equal depth. Our visual and photographic estimates are not precise enough to distinguish between primary and secondary minima of similar depth. Photoelectric observations in B and V are continuing and will eventually establish precise values for the depths of the alternate minima.

We wish to thank Dr. Martha Hazen, curator of astronomical photographs at Harvard College Observatory, for use of the Harvard patrol plates. We are also grateful to Dr. Dorrit Hoffleit of the Yale University Department of Astronomy for checking the literature on this star's spectral type.

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INVESTIGATION OF FOUR ERUPTIVE STARS ON SONNEBERG PLATES

GRO J0422+32 Per

The locality of this Compton Gamma Ray Observatory transient (first announcement by Paciesas et al. 1992) has been checked on 888 Sonneberg Sky Patrol plates taken between 1928 and 1992 mainly by P. Ahnert, H. Huth and B. Fuhrmann. No further eruption could be detected. The threshold of the examined exposures is between $12^{\rm m}5$ and $14^{\rm m}0$ pg. Apart from the seasonal sun gaps the plates are fairly uniformly distributed over the time interval quoted. Especially the gaps of the Harvard material (Shao 1992) are filled by good-quality exposures.

V 360 Her

In continuation of my earlier observations (Wenzel 1961) I checked the candidate of the compilation of Duerbeck (1987) on 256 plates taken mainly with astrographs of an aperture of 40 cm by C. Hoffmeister, G. A. Richter, G. Hacke and W. Wenzel. Duerbeck's star does not show any variations larger than the normal scattering of a near-threshold object, nor are there indications of the presence of a variable in the vicinity. The plates are scattered over the years 1938 to 1992. The remark of Parenago (1947), the supposed nova image might be a defect on the Paris discovery plate of 1892, is unfounded because obviously the photographs taken for the Catalogue du Ciel consist of triple exposures, where blemishes can easily be excluded.

V 2109 Oph

There are 9 Sonneberg plates of the time before the date of the discovery plate (1969 June 21, $m_r = 10^{\rm m}8$–MacConnell 1977), showing the star at the following photographic (blue) magnitudes (system of Harvard Selected Area 157):

1969 May	17.9	UT	invis. $>12^{\rm m}$pg	
June	8.9		8.9	(2 plates)
	9.9		9.5	(2 plates)
	10.9		9.2	
	11.9		10.0	
	12.9		10.2	
	17.9		10.8	(2 plates)

V 1274 Sgr

A fairly slow course of the discovery maximum is shown by four additional plates of our collection, as given in the following table; the observations of the discoverer Wild (1954) are designated by W:

1954	Aug. 2 UT		12^mpg	W
	Aug. 3		12	W
	Aug. 4.9	invis.≥	11	
	Aug. 26.9		10.4	
	Aug. 30		10.5	W
	Sep. 1.9		10.4	
	Sep. 23.9		10.4	
	Oct. 3.9		10.4:	

(system of Harvard SA 134). It should be noted that the map of Li Jing et al. (1984) places the object at a wrong position, whereas the position of the variable on Duerbeck's (1987) chart coincides with our findings.

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RENEWED ACTIVITY ON CH Cyg

Since 1962 CH Cyg exhibited a series of major outbursts - in 1963, 1965, 1967–70, and in 1977–86 (see Mikolajewski et al., 1990). The last outburst of CH Cyg ended in 1986. Photometry shows a pronounced minimum in 1988 and this is consistent with our observations. From our data, the mean values for the magnitude and the colours of CH Cyg in July, 1988, are: V=8.50, B−V=1.39, and U−B=1.48. The emission lines and the rapid light variability (flickering), which were very pronounced during the active phase in 1977–1984, also disappeared in 1988 (Skopal, 1988). According to the binary model of CH Cyg (M7 giant and a compact companion), the rate of the mass flow of the M7 stellar wind onto the compact star decreased during 1985–88, and in 1988 only the M7 star was observed.

Table 1
Photometry of CH Cyg in August, 1992

JD= 2400000+	V	B-V	U-B
48837.430	8.09	0.65	-0.74
48837.460	7.87	0.76	-0.71
48845.414	8.35	1.07	-0.59
48847.349	8.35	1.03	-0.64
48855.357	8.16	0.94	-0.63
48857.365	8.22	0.96	-0.67
48860.465	8.28	1.17	-0.46
48861.328	8.19	1.03	-0.63
48862.327	8.17	1.03	-0.54
48862.480	8.29	1.12	-0.55
48863.327	8.14	0.93	-0.58
48863.459	8.12	0.95	-0.54
48864.456	8.06	0.91	-0.54
48865.302	8.20	1.06	-0.60
48865.320	8.15	1.04	-0.51

During the last years, photometric UBV observations of CH Cyg were obtained at the Bulgarian National Astronomical Observatory, using the 60 cm telescope and the computer controlled photometer. This report (Table 1) contains UBV photometry of CH Cyg, obtained in August, 1992. The comparison star was HD 182691 (V=6.52, B−V= −0.08, U−B= −0.23). The observational procedure and the reductions will be described elsewhere. From Table 1, it is apparent that CH Cyg exhibited a strong ultraviolet continuum again. The U−B colour is comparable with the respective colour observed during the active phase in 1982–84 and the U mag of CH Cyg brightened by some 2.7 mag with respect to its 1988 value. Pronounced rapid light variations were observed in the U filter during the same period. In Fig 1 is shown the CH Cyg flickering on August 29, 1992, with an amplitude of $\Delta U \approx 0.4$ mag. (the integration time was 1 s). Again, this amplitude is comparable with the flickering during the active phase. From our data, the average U−B colour of CH Cyg in Sept.–Oct., 1990, was: −0.10 mag, and in Sept., 1991: +0.24 mag. Our data also show that the 1992 B−V colour is some 0.7 mag bluer than in 1991. Therefore, the U−B colour shows the presence of the blue continuum again in 1990–91, which has also been reported by Leedjarv (1990). Flickering was observed in Sept.,1990, and Sept., 1991, but it was definitely absent on 9/10 July, 1991. The V mag of CH Cyg, however, remained in the range 8.8–8.1 during 1990–92.

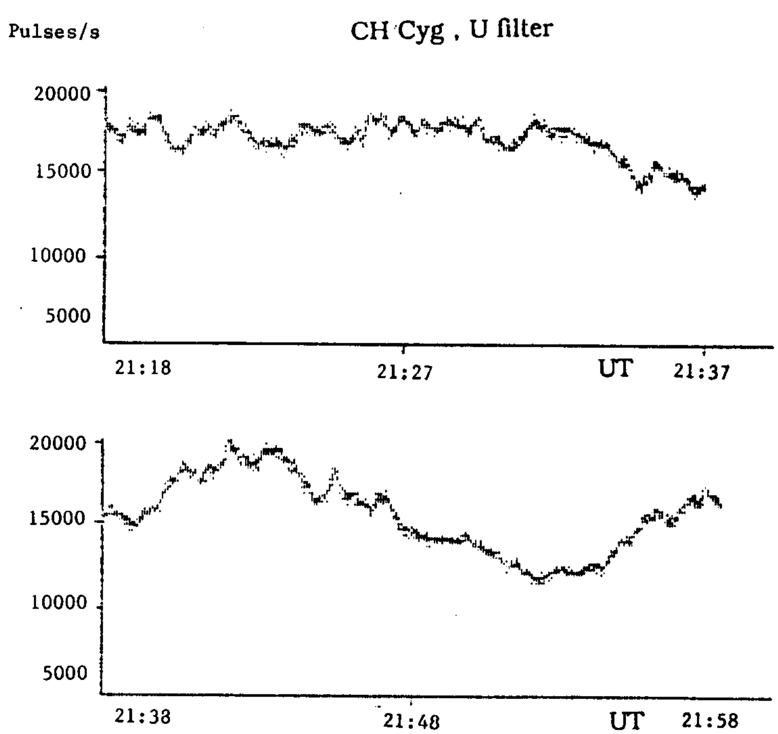

Figure 1

H_α spectroscopy of CH Cyg in 1989–90 shows H_α in emisson again (Bopp, 1990). Thus evidence from the 1990–92 observations of CH Cyg suggests that there is a renewed activity, especially the strong blue continuum in Aug., 1992. This could be another episode of activity, but it could also be an indication of the start of a new major outburst.

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UBV LIGHT CURVE OF RT And FOR 1991

The continuation of a long term project of photometry of the short period RS CVn system RT And is reported here.

Photometric observations for this star have been made previously by several authors listed by Dapergolas et al. (1988, 1991).

The star was observed photometrically for a total of 5 nights with the 1.2m Kryonerion telescope from 10 Sep. 1991 to 16 Sep. 1991 using a single-channel photon counting photometer described by Dapergolas and Korakitis (1987). The photometer employs a high gain 9789QB phototube and UBV conventional filters. Its output is fed directly to a microcomputer enabling rapid data access.

The data reduction method is the standard one. Comparison and check stars are BD +52°3384 and BD +52°3377 respectively and the accuracy of the observations presented here is ±0.015 mag for V, B and ±0.025 for U.

Table I lists the dates of observations and the corresponding phases covered.

The derived light curves for U, B, V colours are illustrated in Figures 1, 2, 3.

Table I

Date	Phase
10 September 1991	.77−.30
11 September 1991	.35−.89
12 September 1991	.92−.48
14 September 1991	.14−.67
16 September 1991	.49−.83

In Table II the times of minima and the O−C values are listed for the V, B, and U bands respectively. Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O−C values were determined from the linear ephemeris

$$T=2441141.88902+0^{d}.628929513\times E$$

given by Kholopov (1982).

From Figures 1, 2 and 3, it can be seen that the light curves show asymmetry in the secondary minima that gets larger in short wavelengths.

The variability in the levels of maxima noticed previously by Mancuso et al. (1979), Dapergolas et al. (1988, 1991) is also present here (see Figure 4), where the light curves for the years 1989, 1990 and 1991 in V are superimposed.

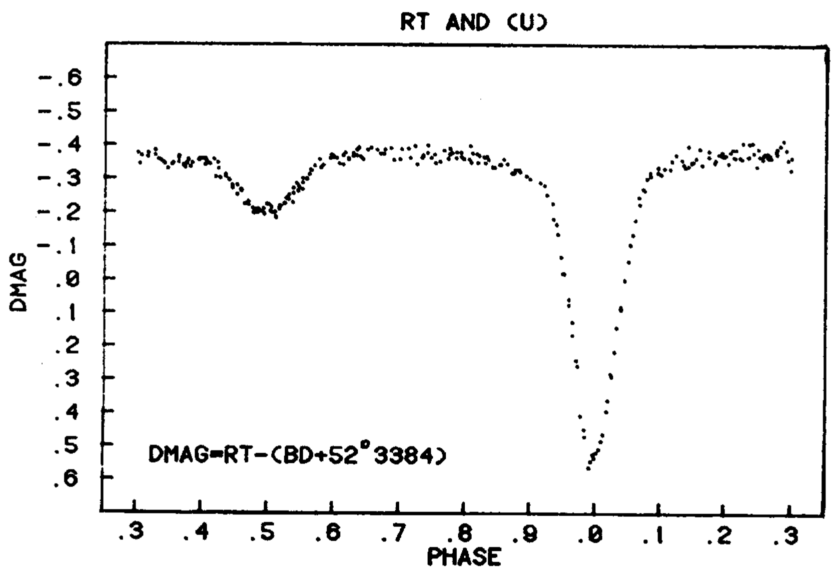

Figure 1

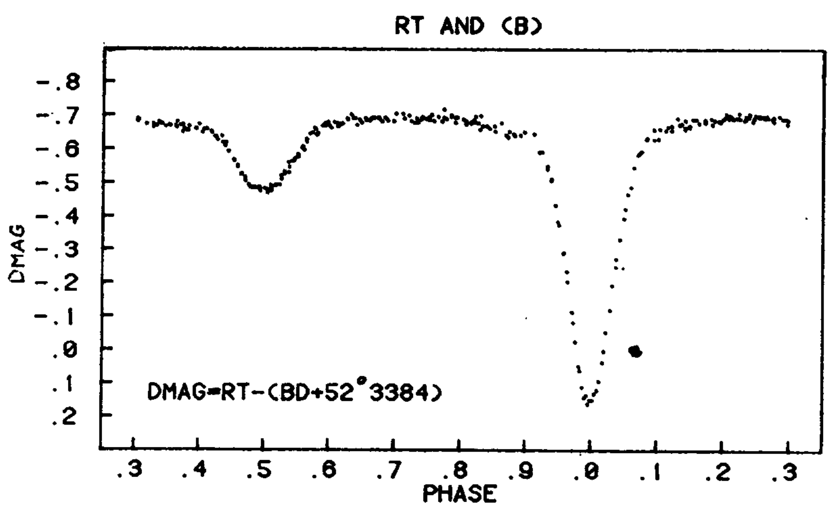

Figure 2

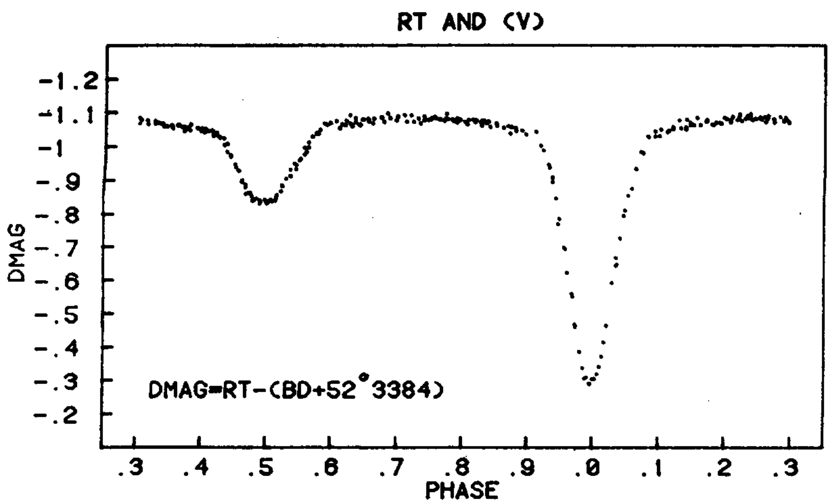

Figure 3

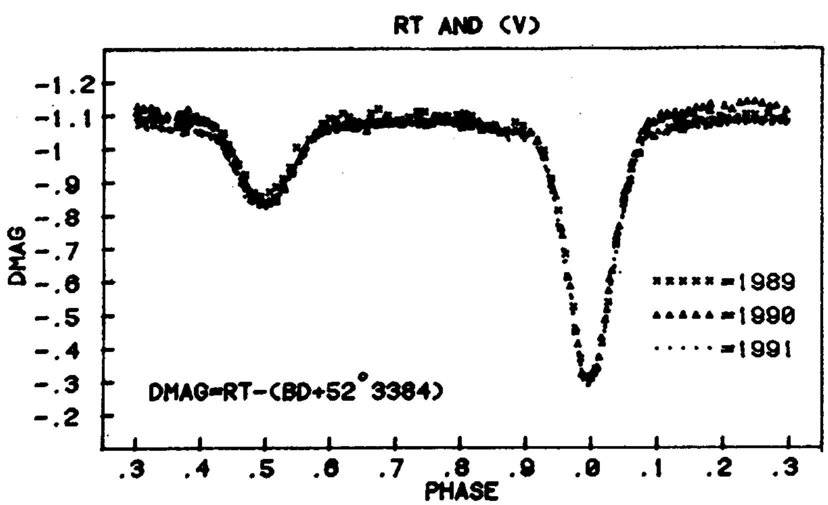

Figure 4

Table II

Date	Type	V colour Heliocen. J.D. 2440000+	O−C phase	B colour Heliocen. J.D. 2440000+	O−C phase	U colour Heliocen. J.D. 2440000+	O−C phase
10 Sep. 91	I	8510.4262 ±0.0001	0.998	8510.4262 ±0.0001	0.998	8510.4257 ±0.0002	0.998
11 Sep. 91	II	8511.3688 ±0.0003	0.497	8511.3696 ±0.0004	0.498	8511.3688 ±0.0007	0.497
12 Sep. 91	I	8512.3124 ±0.0001	0.998	8512.3126 ±0.0001	0.998	8512.3123 ±0.0001	0.997
14 Sep. 91	II	8514.5131 ±0.0004	0.497	8514.5137 ±0.0004	0.498	8514.5143 ±0.0005	0.499

This variability is probably due to the photospheric activity of the system as it is assumed by Dapergolas et al. (1988, 1991), Zeilik et al. (1989) and Gordon et al. (1990). This activity derived from the distortion in the light curve outside the eclipse is probably due to the presence of dark spots on the surface of the active star.

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A NEW EPHEMERIS FOR TX URSAE MAIORIS

From a preliminary analysis of observed primary minima, Plavec (1960) has determined U≈ 50 years for the assumed apsidal period. In fact, TX UMa is the only semi-detached binary system in which apsidal motion could still be postulated, as it was emphasized by Semeniuk (1968).

Moreover, the new primary minima, observed after Plavec's (1960) paper was published, show that a new study of the corresponding orbital period may be undertaken. In order to do so, we have used Plavec's table of primary minima, which was completed with observed minima obtained subsequently. Then we have constructed the O−C diagram where the O−C differences refer to the linear formula:

Min. hel. = J.D. 2416426.783 + $3\overset{d}{.}0633175 \times E_1$.

As it is shown in Figure 1, the run of the normal residuals clearly puts in evidence the fact that the corresponding diagram could not be caused only by apsidal motion. It was impossible for Plavec to reach this conclusion in 1960 because the time interval covered by observed minima was too short.

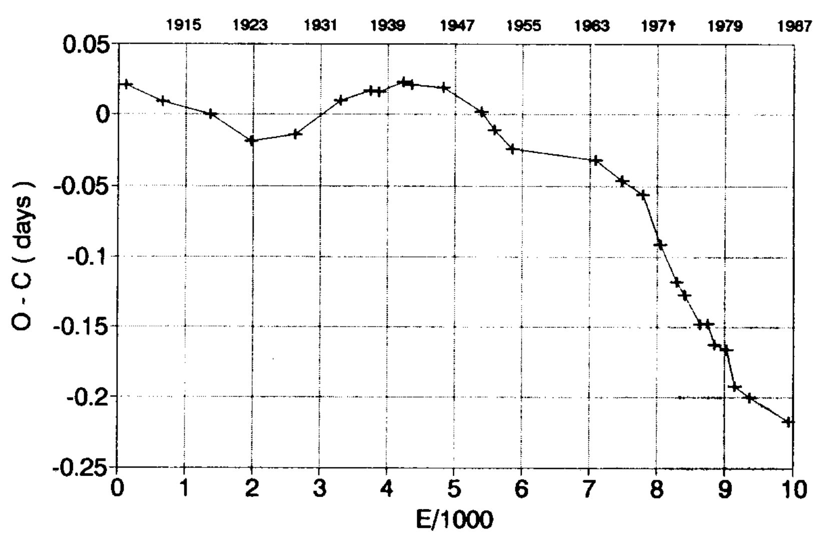

Figure 1.

Anyhow, TX UMa could have an apsidal motion superimposed on the light–time effect or strong period variations due to the mass exchange. This is why this binary system needs new observed minima, especially some secondary minima in order to remove the contribution of the apsidal motion effect.

For the near future the following ephemeris can be used for the prediction of the primary minima:

Min. hel. = J.D. 2441766.427 + $3^{d}.0632455 \times E_2$.

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θ^2 Sgr, NOT AN Am STAR

Owing to an undetected punch-card error during the preparation of the 1964 version of the Bright Star Catalogue the spectral type that was intended for HR 6724 (Hoffleit 1950) was inadvertently attributed to HR 7624, θ^2 Sgr. The most recent class for θ^2 Sgr is A4/5IV (Houk 1982). Regretably this refutes Anders'(1992) conclusion that his discovery of the variability of this star constitutes an unusual discovery of the variability of an Am type star. As he indicated, there are no previous discoveries of the variability of θ^2 Sgr. Anders' "target star", HR 7631 was originally reported by Corben et al (1972) as varying by 0.07V, but they did not indicate any specific comparison star, nor the time-span of their observations. Superimposed on Anders' steady increase in the difference between HR 7631 and 7624 a 0.07V flare is indicated, the same range as previouly reported for HR 7631 = NSV 12655, based on only six observations. Table I gives data for these stars as listed in the current tape version of the Bright Star Catalogue (BS5).

Table I. Potential Variables and Comparison Star

HR	HD	RA (1950) h m	Dec ° '	M_V	Sp	Remark
7624	189118	19 56.6	-34 50	5.30	A4/5IV	VAR
7631	189245	19 57.1	-33 50	5.66	F7V	NSV 12655
7585	188158	19 51.9	-33 11	6.46	K2/3III	Comparison

A comparison of the differences between the photoelectric V magnitudes and those read from Anders' Figures 1a and 1b is given in Table II, showing reasonably consistent results. It is intriguing that the flare of θ^2 Sgr has the same amplitude as that reported for HR 7631. Both stars need to be extensively monitored against comparison sources that have not yet been suspected of variability.

Table II. Comparisons

HR	BS5 V	Anders V	"Flare" Amp V
7631 - 7585	-0.80	-0.88	0.07
7631 - 7624	+0.36	+0.03 to +0.28	0.07

The star previously classified Am, HR 6724, has been variously classified, as shown in Table III. Could this be a spectrum variable?

Table III. HR 6724

Sp.	Source
A5	Cannon, HD 164584, 1922
A8s	Adams et al, Ap.J., 81, 187, 1935.
Am, A8+F4	Hoffleit,"Dually classified", Harvard Ann., 119, 1950.
F0II	Herbig, in M.F. Walker, Ap.J., 125, p. 636, 1957.
F5II	Bidelman, Idem, p. 636.
F3III	Morgan and Abt, A.J., 77, 36, 1972
F5II-III	Malaroda, A.J., 80, 637, 1975
F2/3II/III	Houk, Michigan Sp. Cat., 3, 1982

I wish to thank Dr. W. Bidelman for calling my attention to the error in attributing class Am to θ^2 Sgr.

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Erratum:
In I.B.V.S. 3768, first ref., for Ap.J. read Ap.J. Supp.

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THE NEW PRIMARY MINIMUM OF OW Gem

The long-period eclipsing binary OW Gem (SAO 095781) was first listed as a possible variable by Hill and Schilt (1952), preliminary period was determined by Kaiser (1988b) as $1258\overset{d}{.}56$ and the next time of primary eclipse was predicted to occur on September 2, 1991. First photoelectric photometry was reported by Williams (1989).

The present observations were obtained at three observatories at the High Tatras and Brno and are analysed together with CCD observations by Pravec (1992). The uncooled single channel photometers mounted in Cassegrain focus of the 60 cm telescope at Skalnaté Pleso Observatory with an EMI 6295B photomultiplier (abbr. SP), in Nasmyth focus of the 40 cm telescope with an EMI 6256B photomultiplier at Copernicus Observatory in Brno (abbr. B1), and in Newton focus of the 60 cm with an EMI 6256S photomultiplier telescope at University Observatory in Brno (abbr. B2), and standard UBV filters were used. The integration time of one measurement was ten seconds. The observations were corrected for the influence of differential extinction and transformed to the international UBV system. Table 1 contains the photometric data for all comparison and check stars. These photometric data were derived from the observations of 20 Gem (V=5.81, B−V=+0.475, U−B=+0.065) in two nights and compared with the data from photometric catalogues. The accuracy of these photometric data is about 0.01 mag.

Table 1. Photometric data for OW Gem, comparison and check stars

STAR	SAO	RA 1950.0	DEC 1950.0	V	B−V	U−B
comparison	95810	$6^h29^m47^s$	$+17°04\overset{'}{.}0$	7.925	+0.445	+0.415
check1	95819	6 30 12	+16 59.2	7.650	−0.040	−0.550
check2	95777	6 28 44	+17 10.5	9.050	+0.230	+0.080
check3		6 29 02	+17 08.1	9.90	+0.30	+0.02
OW Gem*	95781	6 28 48	+17 07.1	8.270	+0.650	+0.570

*at maximum light

The differences ΔU, ΔB, ΔV between the variable and comparison stars and their errors are given in the Table 2 for all observatories. The number of observations is in the fifth column.

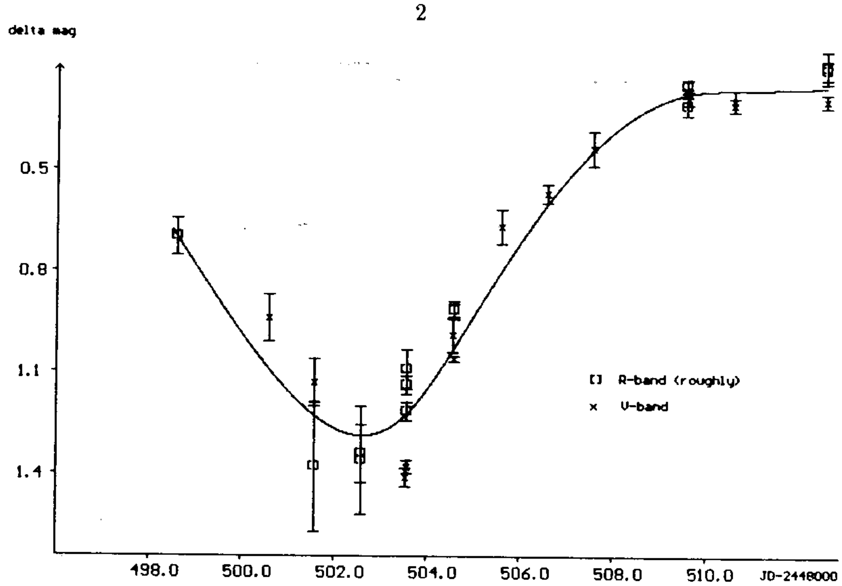

Figure 1. CCD and V differential photometry of OW Gem

Table 2. The observed magnitude differences for OW Gem

JDhel 2448000+	ΔV	ΔB	ΔU	N	Obs
491.582	0.31±0.01	0.50±0.02	0.66±0.03	10	SP
500.604	0.94 0.07	1.17 0.09	1.51 0.10	5	B1
501.598	1.13 0.07	1.20 0.13	1.50 0.17	8	B1
503.554	1.41 0.03	1.79 0.04	1.99 0.08	12	SP
503.593	1.38 0.02	1.76 0.04	1.97 0.08	12	SP
504.565	0.99 0.05	1.36 0.06	–	10	B1
504.591	1.06 0.01	1.38 0.01	1.57 0.05	12	SP
505.608	0.67 0.05	1.13 0.05	1.30 0.05	4	B1
506.604	0.57 0.03	0.80 0.03	1.12 0.03	14	B1
507.573	0.44 0.05	0.68 0.05	1.02 0.05	3	B1
509.596	0.29 0.02	0.48 0.03	0.75 0.03	14	B1
510.592	0.30 0.03	0.44 0.01	–	6	B2
510.604	0.31 0.02	0.47 0.05	0.70 0.04	7	B1
512.607	0.30 0.02	0.51 0.02	0.73 0.02	12	B1
521.636	0.31	0.50 0.01	0.66 0.03	2	SP
531.602	0.31 0.02	0.51 0.01	0.69 0.02	8	SP
573.530	0.32 0.01	0.53 0.01	0.80 0.01	2	SP
600.468	0.33 0.02	0.54 0.01	0.68 0.01	4	B2
619.522	0.31 0.01	0.54 0.02	–	2	B1
625.442	0.33 0.01	0.55 0.01	–	2	B1
625.480	0.34 0.01	0.55 0.03	0.69 0.02	4	B2
677.329	0.33 0.01	0.53 0.01	0.71	2	B2

The large scatter of observations in the nights 2448500–504 was caused by strong interference of the Moon in vicinity of the variable star. Bad coverage of the decreasing branch of the light curve was caused by unfavourable weather conditions. The most interesting part of these data – around primary minimum – is presented in Figure 1.

The time of the primary minimum was determined in the following way. The mean light curve was constructed from CCD observations by Pravec (1992) aand our photoelectric V-band differential magnitudes. The time of minimum brightness was determined by Kwee-van Woerden's (1956) method. The time of the primary minimum obtained (JD_{min}=2448502.58±0.12) is shifted by +0.62 day with respect to Kaiser's prediction. Considering data from Kaiser et al. (1988a) and Kaiser (1988b) the new ephemeris for OW Gem is:

$$JD_{min} = 2448502.58 + 1258.583 \times E.$$
$$\pm 0.12 \quad \pm 0.046$$

Observations of the next minimum are highly desirable to improve the ephemeris, which is still uncertain. The next primary minimum is predicted for 1995 February 12.66±0.13. The error resulted mainly from the error of the derived time of the 1991 primary minimum; actual error of the prediction is probably larger.

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NEW RAPID PHOTOMETRY OF BQ Cnc USING CCDs

δ Scuti stars are a well known type of variable stars placed in the instability strip of the HR diagram. Periods are normally between half an hour and five hours. Although many studies have been made on δ Scuti stars (see e.g. Belmonte *et al.* 1991) both theoretical and observational, a lot of questions remain unsolved. κ mechanism is commonly adopted as the excitation mechanism (Chevalier 1971), but the fact that a concrete mode appears and disappears, after its lifetime has passed, is not completely understood. Only a few modes have been detected for each star and in some cases they may disappear before the star is observed again.

In this communication we present the results of new observations of the δ Scuti BQ Cnc. Variability of this star was discovered by Breger (1973), who reported a period of 0.074±0.014 days, with an amplitude of 0.1 magnitude, corresponding to a peak of 150 μHz in the amplitude spectrum. Only three hours of observation were obtained in this occasion.

Our BQ Cnc observations were conducted on 19–22 January 1991 at the 1m Jacobus Kapteyn Telescope at 'El Roque de los Muchachos', (La Palma, Canary Islands, Spain). The detector was a CCD camera, with 400×590 pixel GEC detector. We defocussed the stars to spread the photons over a large number of pixels without reaching saturation, as we wanted to get as many photons as possible in order to increase the signal to noise ratio. We only obtained three nights of data because of bad weather, with a total of 1296 integrations of 50 seconds each, along 80 hours of observations (see Table 1).

Table 1: Journal of observations:

date (1991)	series longitude (hours)	number of integrations	atmospheric quality (1=perfect)
19 Jan	7.1	450	0.8(thin cirrus)
20 Jan	3.5	250	0.5(dust)
22 Jan	9	596	1.

Aperture photometry was used to reduce 1296 CCD frames because of defocussing. We used the aperture photometry part of DAOphot routine (Stetson 1987), although ours was not a crowded field. We applied an Iterative Sinewave fitting algorithm (Ponman 1981) to compute amplitude spectra of residual series since it has been proved to be a goood method of harmonic analysis with non-homogeneous sampling (Belmonte *et al* 1991). Results are shown in Figure 1 (a,b). Three peaks can be distinguished in the amplitude spectrum:

Frequency (mHz) (mHz)	Amplitude millimag.	Phase	Period hours
0.025	11.9	−1.0297	11.11
0.119	4.3	1.7451	2.334
0.174	4.1	0.3314	1.596

The first peak, corresponding to 11.11 hours is probably a harmonic of a day periodicity (1/2 day) due to minor atmospheric transparency and color effects, caused by the comparison star we used. This comparison star was fainter than BQ Cnc and with a different color index (it was the best we could get in the field), so corrections of the transparency are not as accurate as we would have desired. We have eliminated this effect by subtracting the peak from the amplitude spectrum. Pre-whitening of the other two frequency peaks was applied as well. Pre-whitened spectrum is presented in Figure 1c. Maybe some other peaks in the spectrum could be considered as possible real peaks. However they are too close to noise level to be confident on them. Ratio between these two possible oscillation frequencies is 0.68. With a resolution in the spectrum of 0.002 mHz, it could be the ratio $\nu_{0,1}/\nu_{1,1}\simeq 0.73$. Besides, there might be a $1d^{-1}$ aliasign misinterpretation.

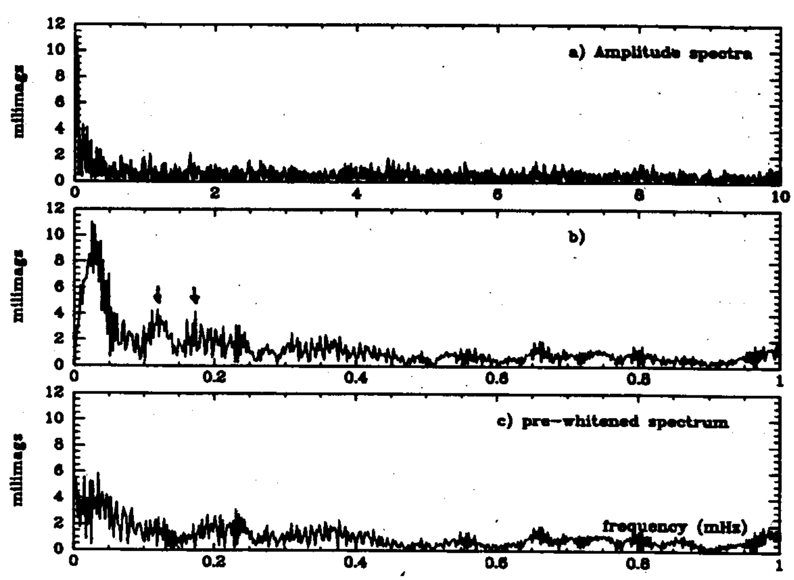

Figure 1: a) and b) Amplitude spectra of BQ Cnc, c) pre-whitened spectrum.

With these new observations, it seems possible that the frequency peak at 150 μHz discovered by Breger were, in fact, two separate peaks that he could not resolve due to the poor sampling. Resolution for this series in the amplitude spectrum was 92 μHz, and the separation between peaks found in this analysis is 68 μHz.

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PERIODIC LIGHT VARIATIONS IN TEN WEAK EMISSION T TAURI STARS IN TAURUS-AURIGA COMPLEX

We present results of BVR photometry of 22 weak emission T Tauri stars (WTTS) discovered in the Lick CaII survey (Herbig et al. 1986) and in the x-ray survey (Feigelson et al. 1987). These WTTS stars are distinguished by the presence of significant Li abundances, strong chromospheric emission, and none of the excesses common to the CTTS. The properties of WTTS have been described by Walter (1987), Walter et al. (1988), Strom et al. (1989), and Skinner et al. (1991).

The observations were obtained with the 48-cm reflector during 40 nights (August-September 1992) on Mt. Maidanak. The mean error of one observation of a program star is typically ± 0.01 mag. in V, B−V, and V−R.

We found rotation periods of 1.5−6.2 days for ten stars. The limits of the light variations, mean colours, number of observations, the period, and full amplitudes in B and V mag. are listed in Table I. Phase diagrams for light curve in the V filter for ten stars are displayed in Figure 1.

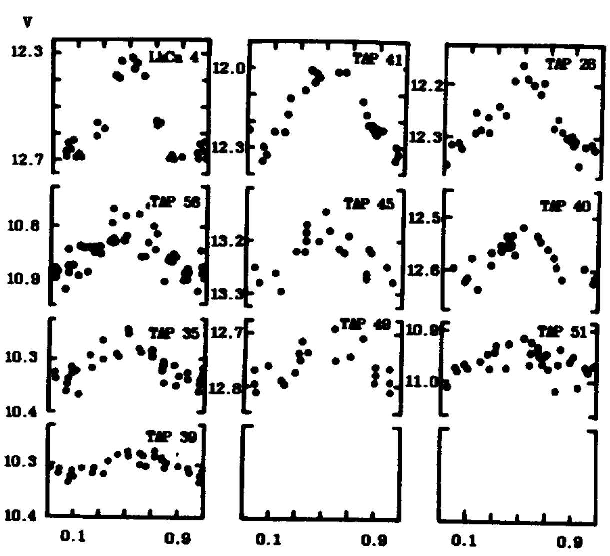

Figure 1. Phase diagrams for light curve in the V filter for ten WTTS

These ten stars, together with the six stars (V819, V827, V830, V836 Tau, HDE 283572, and NTTS 041636+2743) monitored by Rydgren and Vrba (1983), Rydgren et al. (1984), Walter et al. (1987), Bouvier et al. (1988), and Grankin (1992), form a sample of sixteen WTTS stars wtih known rotation periods. Figure 2 shows the dependence of x-ray flux on axial rotation period for this sample WTTS stars and CTTS. The x-ray fluxes and the rotation periods are from Bouvier (1990) for CTTS and the x-ray fluxes from Walter et al. (1988) for WTTS.

Despite a large scatter in the data, there is a trend toward descreasing F_x as the rotational period lengthens. The similar dependence of x-ray flux upon rotational period both in CTTS and in WTTS in Figure 2 points to a common magnetic origin for their x-ray emission.

We do not find any obvious rotational modulation effect in the V magnitude variations of all others stars. In many cases, this may be explained by poor sample of observational sets of the stars. It is necessary to carry out UBVR monitoring of these objects in the future.

Table I. WTTS stars in Tau-Aur.

Star TAP	name NTTS	n	V_{max}	V_{min}	<V>	δV ⋆	<B−V>	n ♯	<V−R>	P days	ΔV	ΔB
4	032641+2420	26	12.06	12.22	12.15	0.046	0.87	8	0.82			
9	034903+2431	22	12.14	12.27	12.19	0.033	1.06	5	1.01			
10NE	035120+3154NE	26	11.91	12.35	12.20	0.111	0.88	–	–			
11	035135+2528 A+B	23	12.31	12.43	12.39	0.026	0.92	5	0.86			
	SAO 76411 A	32	8.86	8.94	8.89	0.018	0.58	32	0.50			
	SAO 76411 B	31	10.39	10.45	10.42	0.028	0.88	31	0.73			
14NE	040012+2545 N+S	22	12.86	12.98	12.91	0.160	1.00	5	0.93			
17	SAO 76428	31	9.46	9.53	9.48	0.017	0.53	31	0.47			
26	041559+1716	25	12.16	12.36	12.27	0.135	1.12	9	0.98	2.52	.14	.18
35	042417+1744	30	10.24	10.37	10.31	0.031	0.78	30	0.66	2.74	.07	.08
39	++	29	10.27	10.34	10.31	0.018	0.78	29	0.70	3.67	.04	.06
40	042835+1700	22	12.52	12.64	12.58	0.032	1.16	8	1.00	1.55	.10	.07
41	042916+1751	22	12.01	12.36	12.17	0.107	1.23	8	1.07	2.43	.25	.28
45	042950+1757	21	13.14	13.30	13.23	0.059	1.46	8	1.29	6.2	.10	.08
49	043124+1824	20	12.69	12.82	12.77	0.063	1.05	7	0.90	3.32	.07	.07
51S	043220+1815	29	10.92	11.02	10.96	0.024	0.83	29	0.73	3.2	.03	.03
56	045226+3013	28	10.75	10.92	10.84	0.040	1.02	28	0.86	2.24	.09	.09
57NW	045251+3016	25	11.53	11.67	11.60	0.050	1.29	20	1.11			
	LkCaII− 3 +	26	12.02	12.17	12.07	0.046	1.50	11	1.53			
	LkCaII− 4 +	25	12.31	12.83	12.57	0.144	1.42	11	1.34	3.37	.35	.38
	LkCaII− 15 +	22	11.98	12.59	12.16	0.173	1.26	7	1.13			
	LkCaII− 16 +	17	12.50	12.71	12.60	0.052	1.54	2	1.40			

Notes:

⋆ – δV is the standard deviation from the mean of the V magnitudes.

♯ – Number of observations for V−R colour.

++ – None exhibit detectable Li I 6707 Å. SB1. No orbit determined yet, $v\sin i \sim 30$ km/s (Walter et al. 1988).

+ – From Herbig et al. (1986), not observed in x-rays.

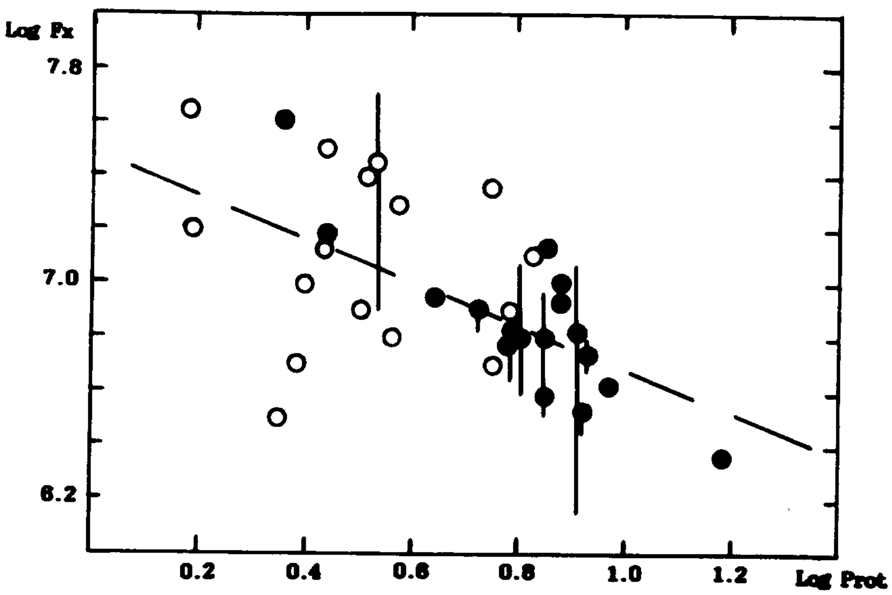

Figure 2. Dependence of x-ray flux on rotation period for TTS. WTTS are shown as empty circles and CTTS as filled circles.

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MWC 560: DETECTION OF A PERIODIC COMPONENT IN THE LIGHT CURVE

According to Michalitsianos et al. (1991), the unique object MWC 560 belongs to a new, previously unknown class of binary systems in a critical stage of interacting binary evolution. It consists of an M giant, a compact star and an accretion disk. The photometric variability of the object was studied by several authors. We have collected all the photometry of the object from the literature (Luthardt 1991, Tomov et al., 1990) and from our own observations. The photographic observations by Luthardt (1991) are the main bulk of the data. They were transformed into stellar magnitudes adding the shift correction $9^{m}_{.}44$ which was obtained by comparing our data with Luthardt's observations.

The combined light curve in the B band is shown in Figure 1 (points). One can see that besides of large scattering there are some peaks of brightness and general tendency to light increasing with time.

The time intervals between peaks force us to suspect a 2000-day periodicity. The data for each night have been averaged to obtain the mean points. The general trend was fitted with a third order polinomial and subtracted from the mean data. Applying the standard Deeming period search procedure to the detrended mean curve reveals three peaks corresponding to 1930, 4570 and 11410 days respectively. The most prominent

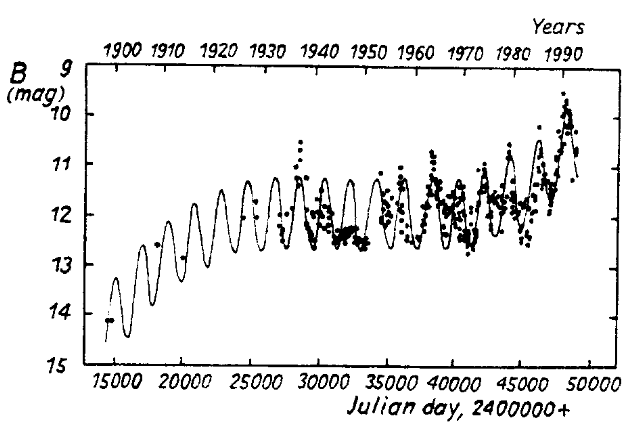

Figure 1. The combined light curve of MWC 560 (points).The solid line is a fit by sinusoidal modulation with amplitude $0^{m}_{.}72$ and ephemeris: JD(Min) =2437455 +1930×E.

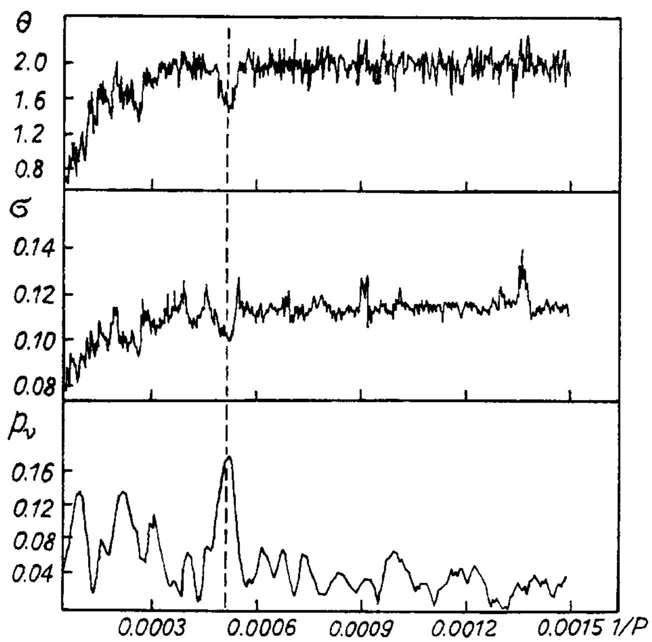

Figure 2. Periodograms of MWC 560 obtained with three different methods. The upper panel is a parameter Θ by Lafler and Kinman. The middle panel is a dispersion parameter by Jurkewich and the lower panel is a Deeming power spectrum (amplitude/2).

peak is that of 1930 days. The length of longest period, 11410 days, is only three times shorter than the whole time interval covered with observations. The nature of the middle (4570 day) period is unclear. But the scattering of points in the phase curve obtained with this period is too large in phases 0.0 and 0.5, and the period is assumed not to be real.

To check the reliability of the peaks we also used the Lafler-Kinman's and Jurkewich's methods. They confirmed the existence of the 1930-day peak and indicated the presence of the double period (Fig.2). Only traces of two low frequency peaks are seen in the periodograms. The phase curve obtained with double wave period, 3860 days, also shows large scattering and its shape is unlike to any phase curve for known binaries.

So, we accept the 1930−day period as real.

The phase curve obtained with the 1930−day period is shown in Figure 3. Large points with error bars denote the mean data in 0.04 phase bins.

In Figure 1 we represent the fit of the original data with the polinomial and sinusoidal modulation with amplitude of $0^m.72$ calculated with the following ephemeris:
JD_{min}=2437455 +1930 ×E (solid line).

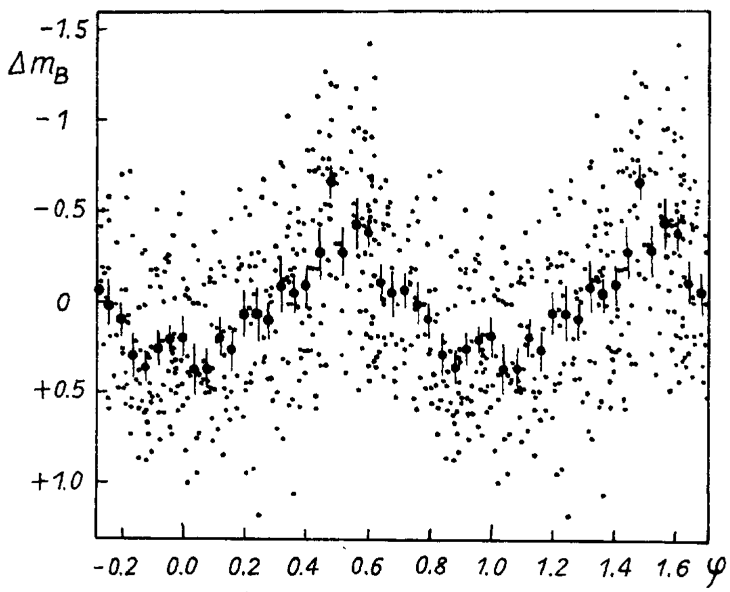

Figure 3. The light curve folded with the 1930 day period. Large points with error bars denote the mean data in 0.^{P}04 bins.

One can see that the fitting is good enough for the time with extensive sets of observations and worse for the time where the observations are scarce. There are some time intervals when the expected light maximum was not observed (JD 2430250–32750), or the light minimum was not reached too. Besides, there are many time intervals in the minima and maxima when the observed brightness exceeds the value expected from the only periodic component. It seems there are irregular light variations due to nonstationary processes in the object which may be responsible for high dispersion of the phase curve.

What is the nature of the periodicity? There are several possibilities: orbital motion, accretion disk precession, the M giant pulsation and periodic outbursts. The period is much longer than any pulsation period known for Mira-type stars and comparable with the 1360-day period which was found for symbiotic binary star BX Mon (Whitelock and Catchpole 1983). MWC 560 is known to be a binary star containing an M giant, which suggest a long orbital period.

If the orbital plane is markedly tilted to the line of sight then the periodicity may be caused by reflection effect on the hemisphere of the M giant due to action of short wave radiation and winds from the hot star. A good explanation of such type periodicity is proposed by Kurochkin (As. Ap. Trans., 1992, in the press) for symbiotic variables. He supposes that the hot star is moving on an elliptical orbit, so both the accretion rate and the disk brightness increase in the periastron passage. This mechanism may cause the orbital periodicity at all the possible orbit inclinations.

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PHOTOGRAPHIC PHOTOMETRY OF V 350 Cep

V350 Cep was discovered by Gyulbudaghian and Sarkissian (1977) as a star of about 17^m in U- and pg-lights, and $16^m.5$ in V-light. On the red reproduction of the Palomar Sky Survey Atlas the star is about 21^m but on the blue reproduction it is below the limit. The star is located near the emission nebula NGC 7129. The spectral observations of V350 Cep have shown that the star is a strong H_α -emission star (Gyulbudaghian, Glushkov and Denisyuk, 1978, Magakian and Amirkhanian, 1979, Semkov and Tsvetkov, 1986).

The photographic observations in the UBV system were made with the 50/70/172 cm Schmidt telescope of the National Astronomical Observatory of the Bulgarian Academy of Sciences during the period September 1984–August 1992. The plates taken on J.D. 2444493.4, 2444495.4 and 2444497.4 were obtained with the 100/130/210 cm Schmidt telescope of the Byurakan Astrophysical Observatory of the Armenian Academy of Sciences by M. Tsvetkov. We used the photometric standards in the open cluster NGC 7142 (Hoag et al., 1961).

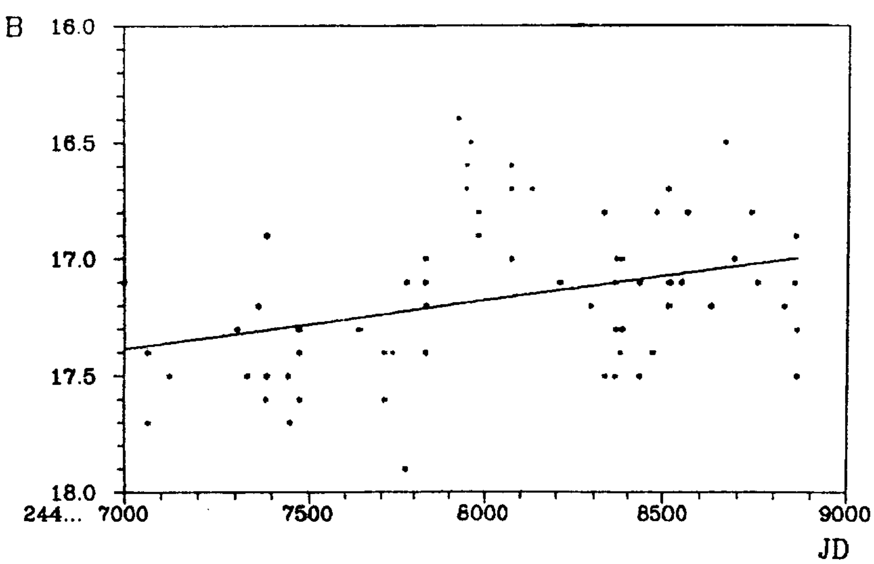

Figure 1. Light curve of V350 Cep during observational period July 1987–August 1992 in B-light

Table 1. Photometric behaviour of V350 Cep in the period 1980-1992

J.D. 244...	U mag	B mag	V mag	J.D. 244...	U mag	B mag	V mag
4493.4	-	17.2	-	8071.5	-	16.7	-
4495.4	-	-	16.3	8072.4	-	17.0:	15.3
4497.4	16.7	-	-	8129.4	-	16.7	-
5960.3	16.9	-	-	8207.3	-	17.1	-
5961.3	-	17.4	-	8291.3	-	17.2	-
6564.5	-	16.5	15.0	8328.7	-	16.8	-
6712.4	-	-	15.6	8329.6	-	-	15.9
7000.4	-	-	15.3	8330.5	-	17.5	16.1
7001.4	-	17.1	-	8363.4	-	17.5	16.0:
7002.4	-	-	15.5	8364.5	-	17.1	-
7065.3	-	17.7	-	8366.5	-	17.3	-
7065.4	17.0	17.4	16.6	8367.5	-	17.0	16.0
7123.4	-	17.5	-	8379.5	-	17.4	-
7305.5	-	17.3	-	8382.5	-	17.0	-
7334.5	-	17.5	-	8385.4	-	17.3	-
7362.4	-	17.2	-	8430.5	16.9	17.1	-
7384.4	-	17.6	16.0	8431.5	-	17.5	-
7385.4	15.9	17.5	16.1	8469.3	-	17.4	-
7386.4	-	16.9:	-	8478.4	-	16.8	-
7388.5	-	17.5	-	8511.4	17.3:	16.7	15.5
7443.3	16.6	17.5	-	8513.3	16.3	17.2	-
7448.4	-	17.7:	-	8515.4	-	17.1	-
7474.3	-	17.3	16.2	8547.4	16.3	17.1	-
7475.2	-	17.6	-	8563.3	-	16.8	15.7
7644.4	-	17.3	-	8629.2	-	17.2	15.6
7707.4	-	17.4	-	8663.6	-	16.5	-
7707.5	-	17.6:	-	8687.6	16.1	17.0	16.0
7733.3	-	17.4	-	8694.5	-	-	15.6
7774.3	16.8	17.9:	16.1	8719.5	-	-	14.8
7777.4	-	17.1	-	8734.4	-	-	15.9
7829.3	17.0	17.1	-	8735.4	-	16.8	-
7830.3	16.7	17.4	-	8753.5	-	17.1	15.8
7831.3	-	17.2	15.9	8825.4	-	-	16.0
7924.3	16.3	-	-	8828.4	-	17.2	-
7926.6	-	16.4	15.5	8855.4	-	17.1	16.4
7947.6	-	16.7	-	8857.4	-	16.9	15.8
7948.6	16.6	16.6	-	8860.4	16.9	17.5:	-
7956.6	-	16.5	-	8861.4	-	17.3	15.8
7979.5	-	16.8	-	8862.4	-	17.5:	-
8071.4	-	16.6	-				

The previous photometric observations of V350 Cep (Gyulbudaghian and Sarkissian, 1978 and Hakverdian and Gyulbudaghian, 1978) did not show noticeable photometric changes after the first observed rise. Our photographic observations suggest that during the last five years a definite increase of brightness in B light is observed (Figure 1). A similar brightness increase is visible also in V light and the B−V colour index has not noticeable changes (Figure 2).

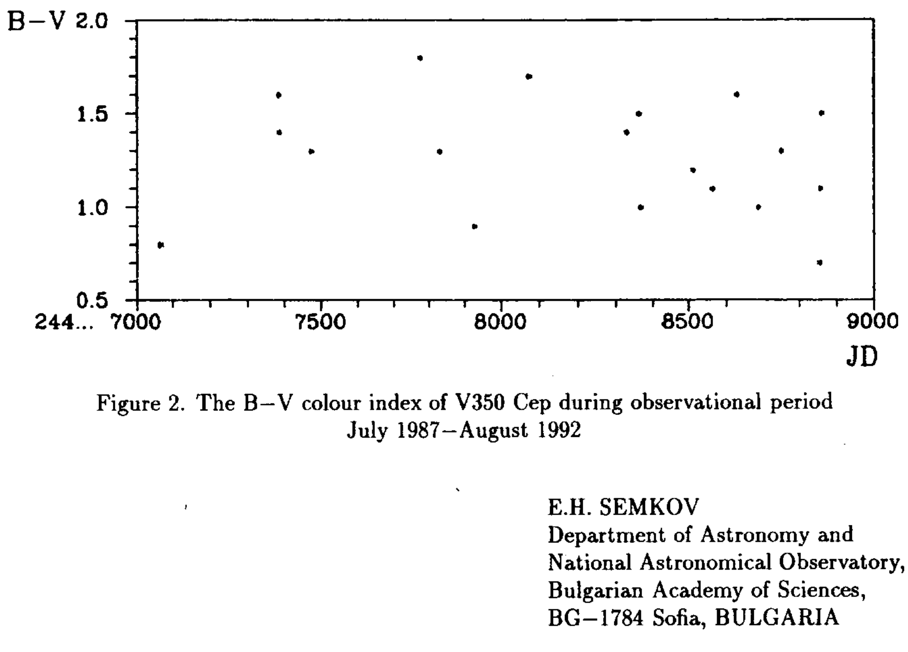

Figure 2. The B−V colour index of V350 Cep during observational period July 1987−August 1992

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POSSIBLE VARIABILITY OF PLEIADES MEMBER HII 263

We report here the observation of anomalous dimming seen in relative photometry of the Pleiades cluster member HII 263. As part of a program to monitor young stars in open clusters to derive rotation periods from the observed light variations due to starspots (Prosser *et al.* 1993), the Pleiades cluster member HII 263 was monitored at the Whipple Observatory 48-inch telescope at Mt. Hopkins, Arizona during late October, early November 1992 (Julian dates: 2448922. - 2448933.). CCD photometry of the field containing HII 263 enabled relative V magnitudes between HII 263 and comparison stars of similar brightness to be obtained from each CCD frame. The data will be discussed more fully in a future paper along with the analysis of other stars.

HII 263 is located at RA = $3^h\ 41^m\ 6.3^s$, DEC = $24°\ 7'\ 8''$(1950), has V$\simeq$ 11.6, spectral type G8 (Soderblom *et al.* 1992a) and an observed $v \sin i$ of 10 km/sec (Soderblom *et al.* 1992b). With such a low $v \sin i$, one would predict that HII 263 would possibly have a variability with a period of several days and an amplitude on the order of a few hundredths of a magnitude, similar to that observed among Hyades members (Radick *et al.* 1987). While our data did not reveal any low-amplitude systematic variations, an anomalous dimming of HII 263 was detected on the night of November 3, 1992 (UT). The accompanying figure plots the relative V magnitudes between HII 263 and each of the two comparision stars (A and B) and the relative V magnitudes between the comparison stars over time. The two comparsion stars used are HII 309 (=A) and HII 239 (=B), both of which are considered not to be Pleiades cluster members. The observed fluctuation in HII 263 was $\sim$ 0.04 mag, while no variation was detected in the comparison stars. The relative photometry is believed to be accurate to about $\pm$0.01 mag. As only one event was observed, no periodicity information for HII 263 could be obtained. Systematic monitoring of HII 263 is recommended in order to determine if the observed variation is periodic, possibly indicating that HII 263 is an eclipsing binary system. If it is an eclipsing system, it must either be a grazing eclipse or the companion must be much smaller than the primary.

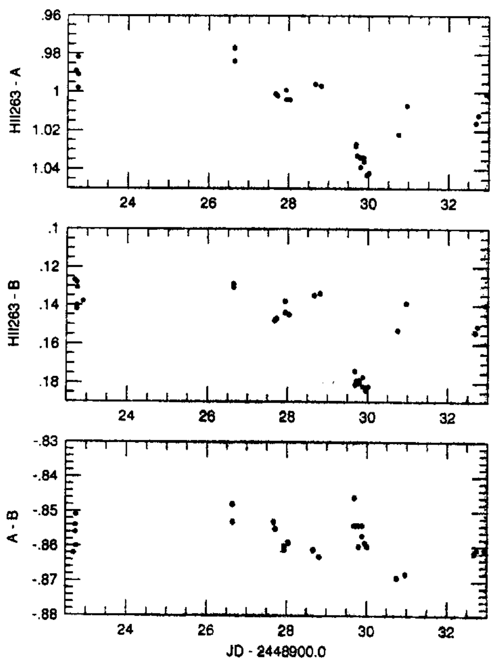

Figure 1

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NEW VARIABLE IN PERSEUS

During the analysis of results from photometric monitoring of members of the Alpha Persei cluster, a new variable star has been found. Located near the cluster member AP125 (Prosser 1991,1992), the new variable was initially chosen as a comparison star to AP125. The variable's position is approximately; RA = $3^h\ 16^m\ 4.6^s$, DEC = $49°56'3''$ (1950). The variable's magnitude is approximately V $\simeq$ 11.4. The accompanying finding chart (north at top, east at left) in Figure 1 is approximately 6.5 arcminutes on a side and identifies the variable (labeled 'A'), AP125, and two other comparison stars, B and C. A check of the GCVS and NSV catalogs did not reveal a previous known variable at the position of star A.

Table 1 provides a listing of the relative V magnitudes between the variable A and the two comparison stars, B & C. Observations at 22.87751, 32.71216, 32.76481, 32.76612, and 32.85307 are considered to be less accurate due to near-saturation counts for the variable A. The CCD photometry was obtained with the Whipple Observatory 48-inch telescope on Mt. Hopkins, Arizona during late October, early November 1992. Period analysis was performed in the same manner as described in Prosser, Schild, Stauffer and Jones (1993). A period of approximately 21.6 hours was found with a minimum occuring near JD = 2448927.937. Comparison star C may also be variable at the level of a few hundredths of a magnitude. Figure 2 illustrates the resulting light curve for the new variable, which may be an eclipsing binary system.

The new variable was not surveyed in the proper motion study of Heckmann, Dieckvoss, and Kox (1956), nor was it recovered as a candidate Alpha Persei cluster member in Prosser (1991,1992). It may have been rejected for consideration by Prosser however due to poor measurements on the Palomar Schmidt plates because of image blending from neighboring stars. It is currently unknown therefore whether the variable 'A' is or is not a member of the Alpha Persei open cluster.

Table 1. Relative Photometry

JD − 2448900.0	A − B	A − C	B − C	JD − 2448900.0	A − B	A − C	B − C
22.74287	-0.737	-0.881	-0.144	29.75503	-0.452	-0.600	-0.148
22.77038	-0.746	-0.897	-0.151	29.78906	-0.483	-0.620	-0.137
22.77309	-0.746	-0.903	-0.157	29.81661	-0.541	-0.692	-0.151
22.81929	-0.755	-0.897	-0.142	29.84480	-0.623	-0.787	-0.164
22.87751	-0.767	-0.906	-0.139	29.87854	-0.690	-0.840	-0.150
22.87851	-0.768	-0.908	-0.140	29.95160	-0.728	-0.891	-0.163
22.91691	-0.767	-0.889	-0.122	29.98456	-0.736	-0.879	-0.143
22.95326	-0.761	-0.901	-0.140	30.00782	-0.735	-0.898	-0.163
22.95444	-0.767	-0.898	-0.131	30.74444	-0.572	-0.697	-0.125
27.60112	-0.759	-0.914	-0.155	30.87095	-0.731	-0.861	-0.130
27.60280	-0.757	-0.919	-0.162	30.94438	-0.746	-0.898	-0.152
27.66138	-0.743	-0.915	-0.172	30.96763	-0.735	-0.883	-0.148
27.68909	-0.741	-0.882	-0.141	30.97064	-0.749	-0.889	-0.140
27.71890	-0.740	-0.889	-0.149	31.02223	-0.760	-0.902	-0.142
27.74883	-0.730	-0.879	-0.149	32.63892	-0.715	-0.878	-0.163
27.78912	-0.720	-0.868	-0.148	32.66943	-0.719	-0.877	-0.158
27.89100	-0.544	-0.700	-0.156	32.71216	-0.723	-0.859	-0.136
27.89508	-0.531	-0.687	-0.156	32.71343	-0.729	-0.863	-0.134
27.95716	-0.462	-0.603	-0.141	32.76481	-0.741	-0.886	-0.145
28.64343	-0.729	-0.892	-0.163	32.85307	-0.746	-0.911	-0.165
28.81252	-0.472	-0.596	-0.124	32.85446	-0.754	-0.922	-0.168
29.00296	-0.720	-0.891	-0.171	32.92785	-0.763	-0.900	-0.137
29.68399	-0.608	-0.745	-0.137	33.01792	-0.762	-0.916	-0.154

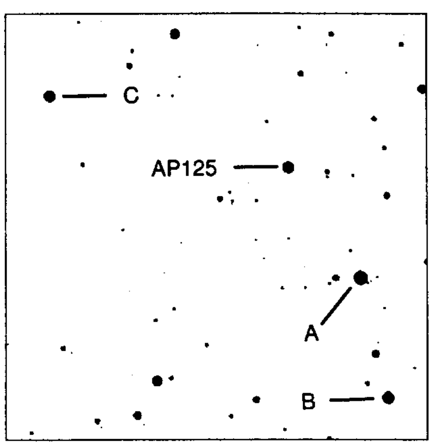

Figure 1

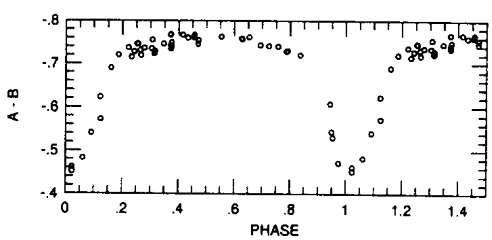

Figure 2

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PHOTOGRAPHIC OBSERVATIONS OF A NEWLY DISCOVERED INTERMEDIATE POLAR RE 0751+14 AND OF THE OBJECT OI 090.4

Mason et al. (1992) discovered a new intermediate polar in the ROSAT Wide Field Camera All-Sky Survey. Its position is RA=$7^h51^m17\overset{s}{.}3$, Dec=$+14°44'23''$(2000). We studied it on 24 archival plates obtained at the 40−cm astrograph on the Crimean Station of the Sternberg State Astronomical Institute (fields 12 Cnc and 3 Cnc).

To make brightness estimates of comparison stars, we used the photoelectric sequence for OI 090.4 (Baumert, 1978). It is worthy to mention that the brightness values for stars *a* and *b* must be interchanged in this latter paper, as one may see from comparison with other stars with known photographic magnitudes.

All plates were measured by using an iris-photometer of the Sternberg State Astronomical Institute. Brightness values for the comparison stars were determined from a parabolic fit by using the 12 best plates. They are listed in Table 1. The finding chart of RE 0751+14 is shown in Fig. 1. An identification chart for OI 090.4 can be found in Baumert's (1978) paper. For all plates, the parabolic fits were computed by using these values of brightness. Results are presented in Table 2 for RE 0751+14 as well as for the object OI 090.4. The amplitude of variability of OI 090.4 reached $1\overset{m}{.}3$ (between $15\overset{m}{.}58$ and $16\overset{m}{.}87$).

Only minor brightness variations of RE 0751+14 between $13\overset{m}{.}65$ and $14\overset{m}{.}17$ were detected, as one may expect for usual 'high' state of intermediate polars. A 'low' state was not detected in the present material. The mean magnitude was $13\overset{m}{.}93$, a r.m.s. deviation from the mean value was $0\overset{m}{.}15$. A possible brightening of the comparison star *p* up to $13\overset{m}{.}47$ was detected on JD 2447615.254 without any significant variations around usual brightness $14\overset{m}{.}56$ at other dates. Star *G* and *H* have close visual companions, thus they were not used for fits, nor the star *p*.

Table 1
Photographic brightness of comparison stars for RE 0751+14

⋆	m_{pg}	⋆	m_{pg}	⋆	m_{pg}	⋆	m_{pg}
a	13.34±.02	g	13.98±.03	n	14.45±.02	t	14.77±.03
b	13.44 .03	G	14.06 .07:	p	14.45 .03	u	14.78 .01
c	13.54 .02	h	14.20 .02	H	14.56 .04:	w	15.55 .02
d	13.59 .02	k	14.28 .02	q	14.68 .02	x	15.64 .02
e	13.64 .02	l	14.32 .02	r	14.71 .03	y	15.74 .02
f	13.77 .02	m	14.35 .02	s	14.72 .03	z	16.13 .03

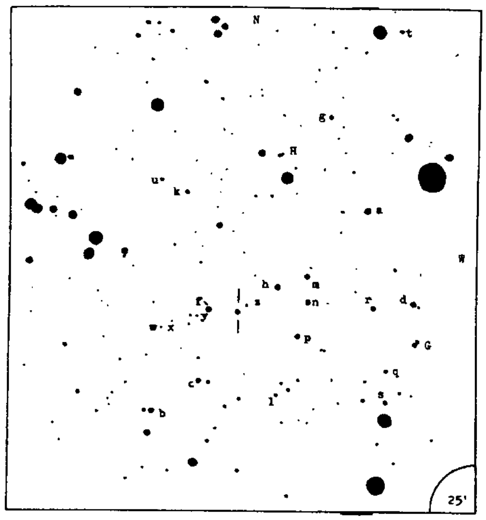

Figure 1. Finding chart for RE 0751+14

Table 2
Brightness of RE 0751+14 and OI 090.4

JD 24....	RE	OI	JD 24....	RE	OI
45328.516	13.91	–	47883.480	13.90	16.20
45349.445	13.67	–	47884.544	13.86	16.20
45410.302	13.98	–	47887.528	13.90	15.84
47484.609	14.08	16.87	47890.469	14.05	–
47614.305	13.89	16.60	47896.347	13.85	15.87
47615.254	13.78	16.43	47916.406	13.65	15.76
47623.304	13.96	–	47918.406	13.68	15.71
47834.536	13.95	16.07	47922.354	14.17	15.60
47836.551	14.06	15.68	47941.337	13.99	15.58
47855.499	14.10	15.95	47943.284	14.05	15.74
47855.522	14.12	15.87	47944.345	14.02	15.68
47869.576	13.89	16.14	47946.287	13.70	16.02:

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ON THE NEW CATACLYSMIC VARIABLE STAR IN CRATER

Recently Maza et al. (1992) announced the spectrophotometric discovery of a new cataclysmic variable J 05.23, which the authors, on the basis of their objective–prism photographic survey, at first considered to be a Seyfert 1 galaxy candidate (position 1950.0: $11^h01^m09^s.4$, $-21°21'36''$).

I inspected the locality of this object on several hundred Sonneberg Sky Patrol plates taken mainly by C. Hoffmeister, P. Ahnert, H. Huth and B. Fuhrmann from 1928 to 1983 and centred near 11^h–20°. 392 exposures reached a threshold of $12^m.5$ or deeper, and half of these showed a limiting magnitude of $13^m.0$ or fainter.

One distinct eruption has been found. It is characterized by the following data, which have been gained by comparison with Harvard Selected Area 127 and corrected to the international system:

1953	March	6.9	UT	invis.	>$13^m.0$ pg
		15.0			12.6
		15.9			12.9:
		17.0			12.6
		18.0			12.4
		18.9			12.6
	Apr.	5.9		invis.	>13.2

On a number of exposures further faint traces of the object at the limit of detectibility could be seen, for instance at 1965 March 29.9 and 31.9 ($12^m.0$). To draw statistical conclusions as regards the mean cycle length of the eruptions is not possible, because it cannot be ruled out that a part or all of these traces are caused by accidental grain accumulations.

However, even if we take into account the bad conditions of the visibility of that sky region in central Europe, we can conclude that bright maxima are intrinsically rare and that this star might be either a long-cycle dwarf nova or of SU UMa type. Amplitude: 5.0 mag pg.

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Maza, J., González, L. E., Wischnjewsky, M., Barrientos, F., 1992, *Publ. Astron. Soc., Pacific*, **104**, 1060

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HD28665: A PROBABLE δ SCUTI STAR

In this note we present the results of 1.9 hours of differential photometry of HD28665. This bright (V=7.7) southern (declination $-29°$) star is classified spectroscopically as F2III by Houk (1982). HD29507 (V=8.2, A2) and HD27905 (V=7.8, G0) were used as comparison stars.

The observations were obtained using the Modular photometer attached to the 0.5 meter telescope of the South African Astronomical Observatory at Sutherland. One cycle of observations consisted of Johnson V and B measurements (two 30 second integrations per filter) of HD29507, HD28665 and HD29507. Sky brightness measurements were obtained on average every 10 minutes. After correction of the count rates for sky background and atmospheric extinction, the two comparison stars showed a common drift of about 0.03 magnitudes in V, which may be ascribed to sky transparency changes. The B-V colour indices did not change by more than 0.005 during the period of observation.

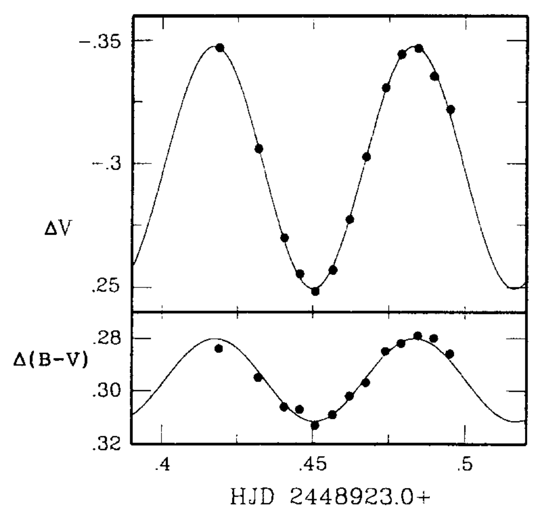

Figure 1

The differential V measurements of HD28665 are shown in the upper panel of the figure. Observations have been corrected for the zero-point drift, and are given with respect to the average of HD29507 and HD27905 brightnesses. The values shown can be related to V(HD27905) by subtracting 0.186, or to V(HD29705) by adding 0.186. It is clear that the plotted sinusoid with a frequency of 15.136 cycles/day (period 1.58 hours) and semi-amplitude of 0.049 magnitudes, fits the data extremely well. The lower panel shows the variation in B-V, for which no differential correction was deemed necessary. The slight phase difference found between the two fitted curves is not significant, being about one standard error of the colour curve phase.

The amplitude and period of the variation, together with the spectral type of the star, are consistent with HD28665 being a δ Scuti pulsator.

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THE RATES OF PERIOD CHANGE IN BS Aqr AND DY Her

The rate of change in the pulsational period is in fact a measurement of stellar evolution rate. So, it is important to record the times of light maximum and to study the rates of period change of pulsating variable stars.

Percy et al. (1980) collected forty−three times of light maximum occurred in the variable BS Aqr from 1935 to 1973 and five times of light maximum of BS Aqr in 1983 was observed by Meylan (1986). We observed the variable too in 1984, and obtained one moment of light maximum. These times, altogether forty−nine, are listed in Table 1.

Mahdy et al. (1980) collected sixty times of light maximum occurred in the variable DY Her from 1938 to 1979, including their own observational results. We obtained three times of light maximum of the variable in 1981. These moments, altogether sixty−three, are listed in Table 2.

We not only collected aforecited observational data, but also redetermined certain times of light maximum of BS Aqr and DY Her using the original data, and drew the O−C diagrams of them (Figures 1 and 2), computed their rates of period change.

If the linear fitting formula of the times of light maximum T_{max} with cycle number E is:

$$T_{max}=T_{01}+P_{01}E,$$

the quadratic fitting formula is:

$$T_{max}=T_{02}+P_{02}E+0.5\beta E^2$$

then $T_{01}, P_{01}, T_{02}, P_{02}$ and β of the variable stars are listed below:

star	T_{01}(HJD)	P_{01}(*days*)	T_{02}(HJD)	P_{02}(*days*)	β(day/cycle)
BS Aqr	2428095.3350	0.197822604	2428095.3303	0.197822854	-5×10^{-12}
	±9	±16	±13	±56	$\pm1\times10^{-12}$
DY Her	2433439.4876	0.148631221	2433439.4868	0.148631303	-2.11×10^{-12}
	±1	±4	±1	±10	$\pm0.25\times10^{-8}$

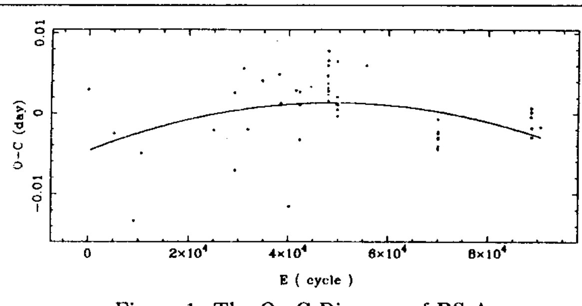

Figure 1. The O−C Diagram of BS Aqr

Table 1
Time of Light Maximum and O−C Residuals
of BS Aqr for Linear and Quadratic Fits

No:	T_{max}	E	$(O-C)_L$	$(O-C)_Q$	W.	Ref.
1	28095.338	0.0	0.0030	0.0077	1.0	An
2	29111.745	5138.0	-0.0025	0.0009	1.0	As
3	29899.266	9119.0	-0.0133	-0.0107	1.0	Sa
4	30187.304	10575.0	-0.0050	-0.0027	1.0	Sa
5	33027.446	24932.0	-0.0021	-0.0022	1.0	Sa
6	33862.460	29153.0	0.0026	0.0022	1.0	Sa
7	33888.365	29284.0	-0.0071	-0.0076	1.0	Sa
8	34211.422	30917.0	0.0056	0.0049	1.0	Sa
9	34400.335	31872.0	-0.0020	-0.0028	1.0	Sa
10	34961.366	34708.0	0.0041	0.0031	1.0	Sa
11	35631.392	38095.0	0.0049	0.0037	1.0	Sa
12	35696.472	38424.0	0.0013	0.0000	1.0	Sa
13	36040.0771	40161.0	-0.0115	-0.0128	0.1	Ki
14	36300.426	41477.0	0.0029	0.0015	1.0	Sa
15	36458.0904	42274.0	0.0027	0.0012	1.0	Sp
16	36460.854	42288.0	-0.0033	-0.0047	0.3	Sp
17	36461.8475	42293.0	0.0011	-0.0003	0.5	Sp
18	36874.112	44377.0	0.0033	0.0018	0.5	Ki
19	37561.3491	47851.0	0.0047	0.0031	0.5	TS
20	37561.5445	47852.0	0.0023	0.0007	0.5	TS
21	37562.5345	47857.0	0.0032	0.0016	0.5	TS
22	37563.5242	47862.0	0.0038	0.0022	0.5	TS
23	37564.5156	47867.0	0.0060	0.0045	0.5	TS
24	37582.5180	47958.0	0.0066	0.0050	0.5	TS
25	37583.3105	47962.0	0.0078	0.0062	0.5	TS
26	37584.2934	47967.0	0.0016	0.0000	0.5	TS
27	37584.4924	47968.0	0.0028	0.0012	0.5	TS
28	37911.4916	49621.0	0.0012	-0.0004	0.5	TS
29	37932.4617	49727.0	0.0021	0.0005	0.5	TS
30	37933.4552	49732.0	0.0065	0.0049	0.5	TS
31	37934.4383	49737.0	0.0005	-0.0011	0.5	TS
32	37946.3083	49797.0	0.0011	-0.0005	0.5	TS
33	37947.2960	49802.0	-0.0003	-0.0019	0.1	TS
34	39087.1561	55564.0	0.0060	0.0044	0.5	HP
35	41946.6714	70019.0	-0.0045	-0.0051	0.6	El
36	41946.8693	70020.0	-0.0044	-0.0050	0.5	El
37	41947.6620	70024.0	-0.0030	-0.0036	1.0	El
38	41947.8603	70025.0	-0.0025	-0.0031	0.5	El
39	41948.6500	70029.0	-0.0041	-0.0047	0.5	El
40	41948.8489	70030.0	-0.0030	-0.0036	0.5	El
41	41949.6400	70034.0	-0.0032	-0.0038	0.5	El
42	41950.6300	70039.0	-0.0023	-0.0029	1.0	El
43	41950.8295	70040.0	-0.0007	-0.0013	0.5	El
44	45612.7240	88551.0	-0.0004	0.0017	1.0	Me
45	45620.6380	88591.0	0.0007	0.0028	1.0	Me
46	45625.5830	88616.0	0.0002	0.0023	1.0	Me
47	45637.6470	88677.0	-0.0030	-0.0009	1.0	Me
48	45644.5720	88712.0	-0.0018	0.0003	1.0	Me
49	45997.0920	90494.0	-0.0017	0.0008	1.0	Pp

An=Andrews (1936)
El=Elst (1976)
Ki=Kinman (1961)
Pp=Present paper
Sp=Spinrad (1959)
As=Ashbrook (1943)
HP=Harding and Penston (1966)
Me=Meylan et al. (1986)
Sa=Satanova (1961)
TS=Tremko and Sajtak (1964)

Table 2
Time of Light Maximum and O−C Residuals
of DY Her for Linear and Quadratic Fits

No:	T_{max}	E	$(O-C)_L$	$(O-C)_Q$	W.	Ref.
1	29068.390	-29409.0	-0.0020	0.0021	0.1	MS
2	33366.807	-489.0	0.0001	0.0009	0.1	As
3	33371.857	-455.0	-0.0034	-0.0026	0.1	As
4	33442.607	21.0	-0.0019	-0.0011	0.1	As
5	33501.614	418.0	-0.0014	-0.0007	0.1	As
6	33506.671	452.0	0.0021	0.0028	0.1	As
7	33507.563	458.0	0.0023	0.0030	0.1	As
8	33509.640	472.0	-0.0015	-0.0008	0.1	As
9	33767.5172	2207.0	0.0005	0.0011	0.5	BM
10	33775.837	2263.0	-0.0031	-0.0025	0.5	Sm
11	33815.5243	2530.0	-0.0003	0.0003	0.5	Sm
12	34068.940	4235.0	-0.0008	-0.0004	0.5	Sm
13	34097.923	4430.0	-0.0009	-0.0005	0.5	Sm
14	34118.881	4571.0	0.0001	0.0005	0.5	Sm
15	34119.771	4577.0	-0.0017	-0.0013	0.5	Sm
16	34123.785	4604.0	-0.0007	-0.0003	0.5	Sm
17	34133.744	4671.0	0.0000	0.0004	0.5	Sm
18	34134.785	4678.0	0.0005	0.0009	0.5	Sm
19	34137.755	4698.0	-0.0021	-0.0017	0.5	Sm
20	34139.689	4711.0	-0.0003	0.0001	0.5	Sm
21	34149.794	4779.0	-0.0022	-0.0018	0.5	Sm
22	34159.4570	4844.0	-0.0002	0.0002	0.5	LD
23	34162.4295	4864.0	-0.0004	0.0000	0.5	LD
24	34178.4818	4972.0	-0.0002	0.0001	0.5	LD
25	34180.4140	4985.0	-0.0002	0.0001	0.5	LD
26	34182.4950	4999.0	-0.0001	0.0003	0.5	LD
27	34184.4277	5012.0	0.0004	0.0008	0.5	LD
28	34188.4390	5039.0	-0.0013	-0.0009	0.5	LD
29	34875.5633	9662.0	0.0008	0.0009	0.5	BM
30	34888.4937	9749.0	0.0003	0.0004	0.5	BM
31	34945.4190	10132.0	-0.0001	-0.0001	0.5	BM
32	34956.4177	10206.0	-0.0001	-0.0001	0.5	BM
33	34960.4316	10233.0	0.0007	0.0007	0.5	BM
34	35241.789	12126.0	-0.0008	-0.0009	0.5	Fi
35	35241.939	12127.0	0.0006	0.0005	0.5	Fi
36	35249.817	12180.0	0.0011	0.0010	0.5	Fi
37	35622.881	14690.0	0.0008	0.0005	0.5	Fi
38	35631.799	14750.0	0.0009	0.0007	0.5	Fi
39	36336.757	19493.0	0.0010	0.0006	0.1	Sp
40	36337.797	19500.0	0.0006	0.0002	0.1	Sp
41	36337.945	19501.0	0.0000	-0.0005	0.1	Sp
42	36338.836	19507.0	-0.0008	-0.0013	0.1	Sp
43	36404.3850	19948.0	0.0018	0.0013	0.5	Br
44	36681.8780	21815.0	0.0003	-0.0002	1.0	HL
45	36694.8097	21902.0	0.0011	0.0006	1.0	HL
46	36695.7010	21908.0	0.0006	0.0001	1.0	HL
47	36696.7410	21915.0	0.0002	-0.0003	1.0	HL
48	36703.7267	21962.0	0.0002	-0.0003	1.0	HL
49	36704.7676	21969.0	0.0007	0.0002	0.5	HL
50	36730.4806	22142.0	0.0005	0.0000	0.5	Br
51	36733.7500	22164.0	0.0000	-0.0005	1.0	HL
52	36747.7226	22258.0	0.0013	0.0007	1.0	HL
53	36782.6496	22493.0	-0.0001	-0.0006	1.0	HL
54	37075.4538	24463.0	0.0006	0.0000	1.0	Br
55	38476.0061	33886.0	0.0009	0.0001	0.5	FA
56	39252.9024	39113.0	0.0018	0.0010	0.5	Ep
57	41508.3797	54288.0	0.0004	-0.0002	1.0	MS

continuation of Table 2

No:	T_{max}	E	$(O-C)_L$	$(O-C)_Q$	W.	Ref.
58	41840.4222	56522.0	0.0007	0.0002	1.0	GH
59	43341.7445	66623.0	-0.0010	-0.0009	1.0	BE
60	44050.4181	71391.0	-0.0010	-0.0007	1.0	MS
61	44755.2290	76133.0	0.0006	0.0013	0.5	Pp
62	45795.3485	83131.0	-0.0012	0.0001	1.0	Pp
63	45796.2407	83137.0	-0.0008	0.0005	0.5	Pp

Al=Alania (1954) As=Ashbrook (1954)
BE=Breger et al. (1978) BM=Broglia and Masani (1955)
Br=Broglia (1961) Ep=Epstein (1969)
FA=Fitch et al. (1966) Fi=Fitch (1957)
GH=Geyer and Hoffmann (1974) HL=Hardie and Lott (1961)
LD=Lenouvel and Daguillon (1954) MS=Mahdy and Szeidl(1980)
Pp=Present paper Sm=Smith(Ashbrook,1954)
Sp=Spinrad (1959)

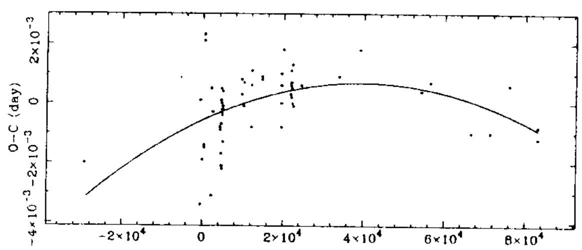

Figure 2. The O−C Diagram of DY Her

For both stars the rate of period change, β, is negative, this means that the periods of light variations are decreasing. They are respectively $-(0.9\pm0.2)\times 10^{-8}$ day/year and $-(0.52\pm0.06)\times10^{-8}$ days/year.

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HR 8851=HD 219586 IS A δ SCUTI STAR

Here we announce that HR 8851 is possibly a δ Scuti star which is newly discovered during the two night observation on December 23 and 25, 1992 at Xinglong Station, Beijing Astronomical Observatory. The observation was performed with the 60cm reflector in V band. HR 8918=HD 220974 and HD 220841 were chosen as the comparison star and check star, respectively. Some information on these three stars resorted from the newest version of the Bright Star Catalogue is given in Table 1. The weather conditions on these two nights were quite good and the observational log is listed in Table 2. The V band data of HR 8851 observed on Dec. 23 and 25 are listed in Table 3 and the lightcurves of HR 8851 with those of HD 220841 are plotted in Fig.1. The lightcurves suggest that the full amplitude of the light variation exceeds 0.05 mag. and the periodicity is complex.

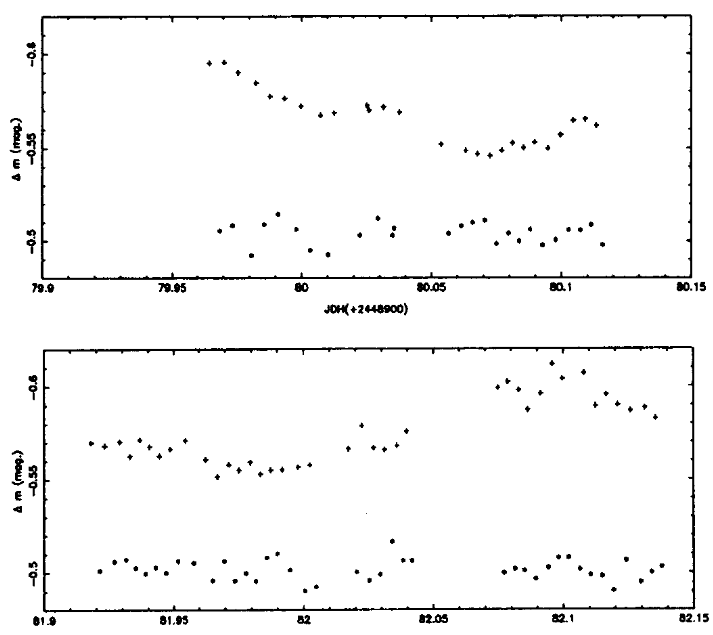

Figure 1. The lightcurves of HR 8851(+) and those of the check star HD 220841 for comparison($\star$)

Table 1. Information from The Bright Star Catalogue

	V	B−V	U−B	spectral type	v*sini* (rotational)	radial velocity
HR 8851	5.56	0.24	0.12	F0IV	140 km/s	+12 km/s
HR 8918	5.6	0.19?		A6IV	115 km/s	−3 km/s
HD 220841	6.7			A2		

Table 2. Observation log

	weather	begin (UT)	end (UT)	time span (hour)	number of obs.	accuracy (mag)
Dec. 23	Excellent	11:05:09	14:44:58	3.66	26	0.0059
Dec. 25	Good	9:58:11	15:16:35	5.31	39	0.0055

Table 3. Observational data of HR 8851

JDH +2448900	V	JDH +2448900	V	JDH +2448900	V	JDH +2448900	V
79.96457	−.595	80.07706	−.549	81.95451	−.571	82.07487	−.599
79.97026	−.596	80.08121	−.553	81.96244	−.561	82.07866	−.602
79.97554	−.590	80.08543	−.550	81.96692	−.552	82.08284	−.598
79.98239	−.585	80.08971	−.553	81.97136	−.558	82.08636	−.587
79.98781	−.578	80.09484	−.550	81.97523	−.555	82.09131	−.596
79.99339	−.576	80.09965	−.557	81.97952	−.559	82.09577	−.612
79.99962	−.572	80.10448	−.565	81.98348	−.553	82.09962	−.604
80.00722	−.567	80.10912	−.565	81.98738	−.555	82.10790	−.607
80.01243	−.569	80.11341	−.562	81.99180	−.555	82.11236	−.589
80.02519	−.573	81.91796	−.570	81.99793	−.557	82.11646	−.595
80.02591	−.570	81.92313	−.568	82.00230	−.558	82.12102	−.590
80.03146	−.572	81.92894	−.571	82.01723	−.567	82.12596	−.587
80.03768	−.569	81.93287	−.563	82.02237	−.579	82.13137	−.588
80.05375	−.552	81.93672	−.572	82.02698	−.567	82.13547	−.583
80.06328	−.549	81.94047	−.568	82.03130	−.566		
80.06763	−.547	81.94428	−.563	82.03595	−.568		
80.07256	−.546	81.94849	−.567	82.03966	−.576		

*Note: The V band values are those of VAR−0.5×(comparison+check)

We used the periodogram method to estimate the variation and get two periods of $P_1=0^{d}.2717\pm0.0007$ and $P_2=0^{d}.0734\pm0.0002$ with amplitudes of $0^{m}.021$ and $0^{m}.006\pm0.001$, respectively. The phase diagram of P_1 is shown in Fig. 2. We can see that the variation trend is fitted well by P_1, but some parts are not good enough because of the existence of P_2. Considering the limit of the data quantity (only two night observation), we cannot confirm the second period P_2 but the first one is undoubted. Further observations are needed to improve the accuracy of the period determination and find the small amplitude periods so that we can identify the pulsation mode of the δ Scuti star HR 8851.

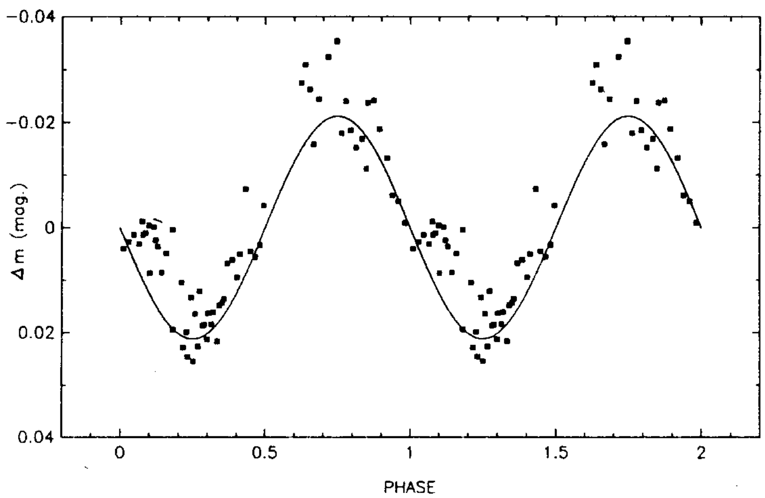

Figure 2. The phase diagram of the variaton in HR 8851 for the period of $0^{d}_{.}2717$

We searched the newest edition of General Catalogue of Variable Stars and the catalogue of δ Scuti stars (Lopez de Coca et al., 1990). We also searched Abstracts of A&A until 1991 and Astronomical Abstracts Database until October, 1992 in Astronomical Data Center of Beijing Astronomical Observatory. No reports about the photometric variation of HR 8851 were found, even a piece of information on this star. So we conclude that this is the first time the pulsation was found in HR 8851.

Finally we note that HR 8851 is announced to be a spectroscopic binary system by the Bright Star Catalogue, but no elements of the orbit are given. So the possibility of the shallow eclipse between the primary star and the secondary star should be taken into account. Anyway, we tend to think that the variation is caused by the pulsation of the star instead of the eclipse because the spectral type, the time scale and the amplitude of the photometric variation for HR 8851 indicate that this star is a δ Scuti star candidate.

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Reference:
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THE VARIABILITY OF BD +40°5040

In the course of photoelectric photometry of comparison stars on the AAVSO chart for TY Andromedae (AAVSO 1942), one of us (B.A.S.) noted that the star marked 9.2 visual magnitude was 0.4 magnitude fainter than indicated, which was about twice the usual error for the other measured stars in this comparison sequence. More significantly, the star was unusually red, +2.12 B-V.

This star is BD +40°5040 = AGK +40°2437, spectral type M8 (AGK3, 1975). Espin (1895) first noted the strongly banded spectrum with a visual spectroscope and included this star in his list as Espin 1051. It has also been catalogued as a double star, ADS 16659.

BD +40°5040 is not included in the General Catalogue of Variable Stars (Kholopov et al. 1985), the subsequent Name Lists of Variable Stars (Kholopov et al. 1985, 1987, 1989; Kazarovets and Samus 1990), or the New Catalogue of Suspected Variable Stars (Kholopov et al. 1982). However, a star of this type is likely to be variable, so D.B.W. estimated its magnitude on 76 Harvard Observatory patrol plates of the Damon blue series spanning the interval 1975 to 1989. Comparison stars with photoelectric B magnitudes were used.

Light variations were found over the range 10.5-11.2 ptg, with observations near maximum or minimum recurring at intervals less than about 100 days. A Discrete Fourier Transform analysis found a weak frequency peak equivalent to the period 72.4 days. We conclude that BD +40°5040 is a semiregular variable with a range of $0^m.7$ ptg and a characteristic cycle length of about 72 days.

Some of the information in this report was obtained from SIMBAD, database of the Strasbourg, France, Astronomical Data Center. D.B.W. wishes to thank Dr. Martha Hazen for the opportunity to use the Harvard plate collection for this and other variable star investigations.

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SPECTROSCOPY OF THE B[e] STAR HD 50138 (MWC 158)

A recent paper by Jaschek et al. (1992) draws attention to recent changes in the spectrum of the B[e] star HD 50138 (MWC 158). In addition to profile and equivalent width variations of the hydrogen lines, HD 50138 also exhibits strong and variable emission in the Ca II infrared triplet, a variable O I 7774 Å absorption/emission feature, and variable N I emission lines near 8700 Å. HD 50138 has been grouped with HD 45677, since both stars show infrared excesses and have similar emission line characteristics. Near the end of 1990 HD 50138 apparently began a new shell phase, when the O I 7774 Å line developed an inverted P Cygni profile, and the V/R ratio for the Paschen lines showed a marked change from what was seen a year before.

HD 50138 has been spectroscopically monitored at Ritter Observatory since 1987. Usually the Hα profile has been observed with our echelle spectrograph and CCD detector, but we have obtained a few observations of the Na I D-line region and the Ca II infrared triplet as well. We can confirm the emission line variability noted by other observers, noting that dramatic profile changes can be seen to occur on timescales as short as one week.

In this note, we wish to draw attention to the spectrum of HD 50138 in the D-line region, which has thus far received little comment in the literature. Figure 1 is a CCD scan of the region of the Na I D-lines and He I 5876 Å obtained on 10 April 1991, a few months after the start of the outburst reported by Andrillat and Houziaux. The He I line at 5876 Å shows an inverse P Cyg profile, similar to what was seen at the O I 7774 Å line in December 1990 (Jaschek et al. 1992). The velocity separation of the emission/absorption components of the He I line is 200 km/s, compared with a value of about 300 km/s for the O I components in December 1990. The D-lines in HD 50138 are remarkable, with two

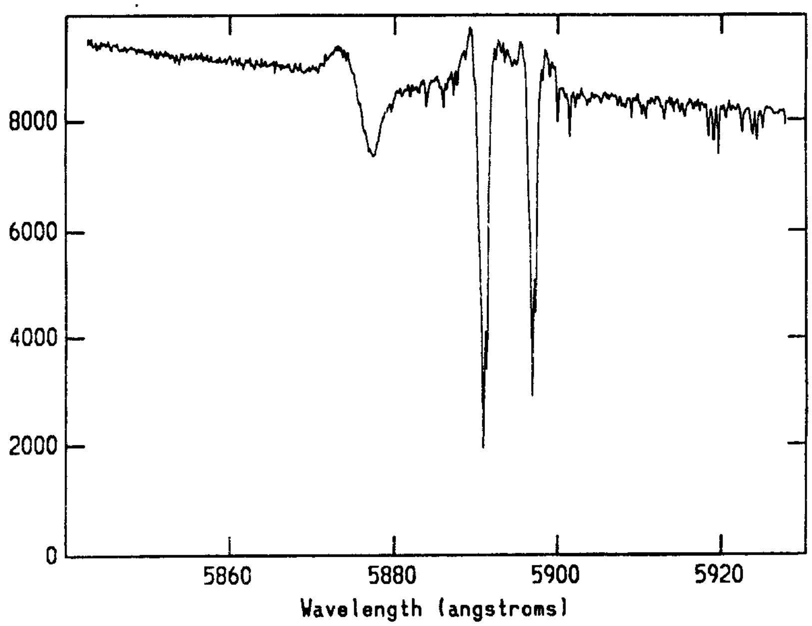

Figure 1: The Na I D-line region of HD 50138 on 10 April 1991 UT.

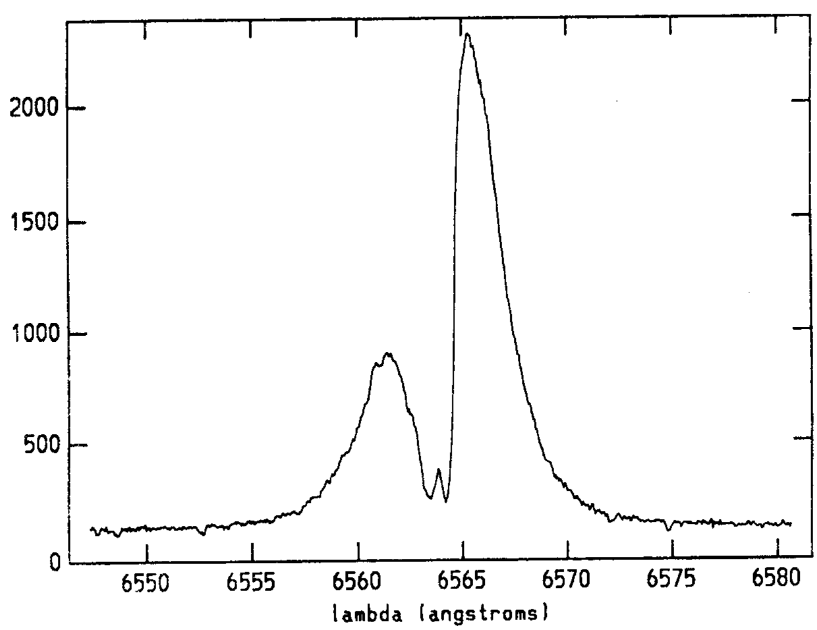

Figure 2: The Hα region of HD 50138 on 22 March 1991 UT.

strong, narrow absorption components superimposed on broad emission. The D-line absorptions are circumstellar, rather than interstellar, since one earlier (1990) echelle scan shows quite different line depths. The two D-line components have velocities of +38 and +18 km/s (this may be compared with the +34 km/s value for the velocity of HD 50138 given by the GCRV). All observations of this region that we obtained in 1992 are of lower (1 Å) resolution, but are adequate to show that the inverse P Cyg emission component of He I has apparently vanished, leaving a strong absorption line.

In contrast, changes in the Hα profile during 1990-92 have been small. Figure 2 is an Hα scan of HD 50138 obtained at Ritter on 22 March 1991, three months after the detection of the shell episode. Comparison of this figure with the profiles illustrated by Halbedel (1991) and Dachs, Hummel, and Hanuschik (1992) obtained in 1987 and 1988, respectively, show only small differences, some of which may be the result of differing spectral resolutions.

More intensive observations of the Hα and D-line regions at high resolution will take place at Ritter Observatory during 1993.

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A PHOTOELECTRIC LIGHT CURVE OF GR CARINAE

The meager history of GR Car is undoubtedly due to its faintness. The discovery by Kruytbosch (1936) and the follow-up by Kruytbosch and Hertzsprung (1936) resulted in an erroneous period and Algol–type designation. With Prager's (1943) corrected period, it is possible to see that the system is likely an unevolved one with a very eccentric orbit.

In 1974 and 1975 E.J.W. observed GR Car as part of her Cerro Tololo program working on eccentric pairs. Both the Lowell 0.6–m and Yale 1.0–m reflectors were used and conventional *UBV* filters were mounted in the photometers. Integration intervals were 30–sec long. Most of Prager's stars and two anonymous ones were checked for suitability as comparison stars. None appeared to be certainly variable but Prager's "a" and "e" and an anonymous one ("x") are recommended for future observing. These are indicated in Fig. 1. Since GR Car is almost circumpolar from CTIO, it can be observed to large hour angles. At full moon, sky background is comparable to Prager's "e" itself through an ultraviolet filter.

On several nights 5 *UBV* standards were observed and these were used to standardize the objects noted in the following table:

STAR	*V*	*B–V*	*U-B*
GR Car at max	+13.63	+0.67	+0.12
Prager's "a"	+13.21	+0.57	−0.02
Anonymous "x"	+13.15	+0.18	+0.13

Errors for the magnitudes are of the order of ±0.05 and for the color indices of the order of ±0.03. The color indices lead to no unique value of reddening. GR Car itself may be inferred to suffer little reddening and to be a mid–F type object or to be reddened by $E(B-V) = 0.80$ and to be a mid–B type star.

During a sequence of personal moves, most of the reduced data were misplaced and cannot be recovered conveniently. The present note concerns only the yellow data which were, in fact, studied from a plot of the measures.

Fig. 1. The neighborhood of GR Car showing the recommended comparison stars, Prager's "a" and "e", and a new one "x". In the figure, north is up and east is to the left. The declination dimension in the figure subtends 7.5′. The chart has been prepared by optically scanning the appropriate field on the J-print of the SRC Schmidt survey atlas.

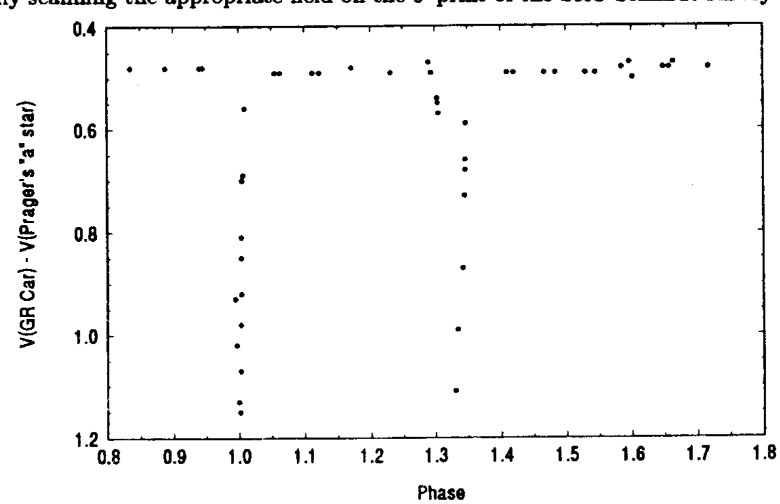

Fig. 2. The differential V light curve for GR Car against star "a" used by R. Prager.

GR Car was at minimum light at HJD 2,442,211.52. Prager's ephemeris shows this to be a primary eclipse with respect to his epoch. There appears to be no need to improve his period of 17.13952 days. The *V* light curve, in the sense of GR Car *minus* Prager's "a" appears in Fig. 2. The spacing between the minima is the same as for the Leiden and Prager's light curves of photographic estimates, indicating no measurable rotation of the apse since 1924. The apsidal period must be very long.

Even though the data are few, it appeared possible to recover some information from the Tololo light curve useful for future observers. Accordingly, it was studied with the *EBOP* code of Popper and Etzel (1981). A certain amount of trial and error, lengthy because of the incomplete coverage of the secondary eclipse shoulder, resulted in values of $e = 0.50$ and $\omega = 119°$. More numerical experiments on the data, iterating back and forth to the eccentricity components, led to the following parameters: $k = 1.00$, $i = 89°$, $J_s = 1.00$, and $r = 0.06$ for $x = 0.7$. The systemic light ratio is 0.51/0.49. These results are obviously not of high weight and parameter precision is about ±2 in each last quoted figure.

Even the small amount of information gleaned from the Tololo light curve has value. The light curve gives every indication of deriving from very young stars which are widely separated. Kepler's Third Law applied to the system appears as:

$$M_1 + M_2 = 454.11a^3$$

(in the conventional units of solar mass, years, and Astronomical Units). It was assumed that the component masses are equal just as appears to be the case for the stellar radii. For successive trial values of mass, values of the semi-major axes and then the stellar radii (from the *EBOP* results) were calculated. This Mass–Radius "relation" for the GR Car stars was then mapped and compared to the empirical one for unevolved stars. The intersection of the loci indicates the components of GR Car to be B1 stars, consistent with the possible reddening of about 0.8 noted above.

Although it will be a very long time before their internal density distributions can be evaluated, more complete photometry and thorough radial velocity study should give precise global parameters for this system. It is certainly to be counted among the presently known young, massive binaries.

E.J.W. takes pleasure in acknowledging financial grant support from NSF (MPS74-01656) and the Society of the Sigma Xi, and the help of the Cerro Tololo staff and observing assistants. Advice on the use of the *EBOP* code by P. B. Etzel is also appreciated.

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A FLARE EVENT ON THE A-TYPE STAR BD+47°819

A flare phenomenon was detected on the 60/90cm Schmidt telescope of Beijing Astronomical Observatory on January 9, 1992. Kodak 103aO plates and UG2 filter were used during the observation. Each plate included 6 exposures of each object. The exposure time for every single point was 10 minutes. By using the CCD plate-measuring instrument, set up in the laboratory of the infrared astronomical group of BAO, I discovered a flare event and identified the star with BD+47°819. It is near the open cluster α Persei. Figure 1 presents the finding chart of the star.

The V magnitude of the star was 9.25, and B−V=0.413 (Prosser, 1992). Its spectral type was A7 in CSI Catalog, and A5 in Fehrenbach's list (1987). The normal U magnitude on the plates was about 10.0 mag., and the flare one was around 8.5 mag. Figure 2 shows the photographic reproduction of the flare event of BD+47°819. The maximum brightness appeared in the interval between $11^h41^m00^s$and $11^h51^m00^s$(U.T.).

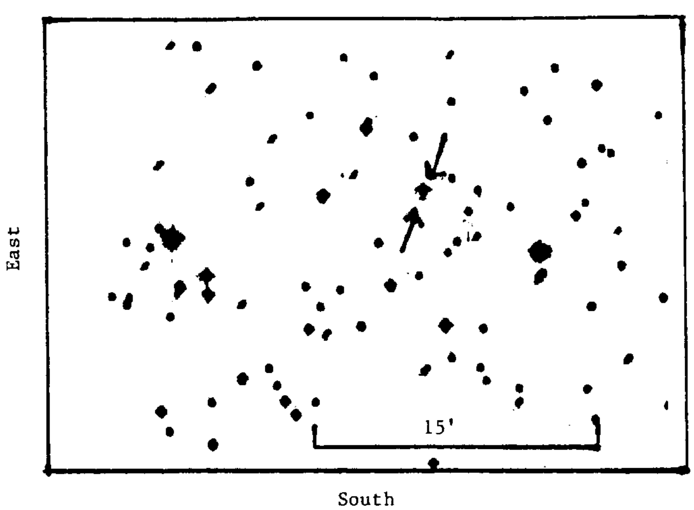

Figure 1. Finding chart of BD+47°819

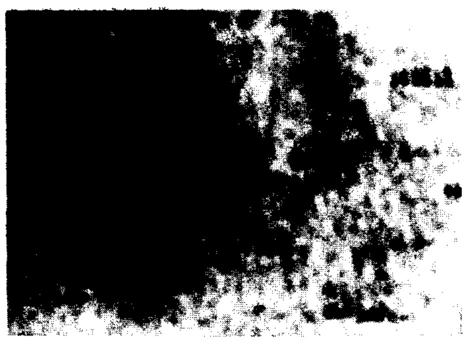

Figure 2. Photographic reproduction of the flare event of BD+47°819

I shall make further observations so as to understand the characteristics of the star better.

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A NEW BRIGHT ECLIPSING VARIABLE IN CEPHEUS

(BAV-Mitteilung Nr.64)

Variations in the light of HD 208106 (BD+61°2209, SAO 019685) were first recorded photoelectrically by Särg and Wramdemark (1970). As NSV 13911 the star was included in the "New Catalogue of Suspected Variable Stars". The type of variability was unknown. Up to now, an investigation of the light variations seems not to have been undertaken.

The star was observed on 11 nights between Nov. 1990 and Aug. 1992 with the 8-inch Newtonian at the author's observing station at Eckental (Germany). The photometer was equipped with a 931A tube and Schott filters BG12 (1mm)+GG13 (2mm) for the B and GG14 (2mm) for the V colour. For a description see Gröbel (1992).

Nearby comparison and check stars (see Figure 1) with closely matching colour indices could be taken from Särg and Wramdemark (1970):

	Star	α(1991)	δ(1991)	mag. V	(B−V)	(U−B)
Var.	HD 208106	$21^h51^m34^s$	61°41′	7.27−7.58	+0.14	−0.54
Comp.	HD 207951	$21^h50^m27^s$	61°45′	8.17	+0.14	−0.54
Check	HD 207308	$21^h45^m29^s$	62°15′	7.49	+0.25	−0.58

Recent observations and measurements on a standard cluster showed that at least for early type stars, the instrumental system matches the Johnson BV system quite well.

Each point of the lightcurve in Figure 2 is the mean of five consecutive measurements. A total of 210 point could be taken in both colours, 85 per cent of which show a standard deviation smaller than $0\overset{m}{.}015$. Throughout the observation period, the magnitude difference check−comp. remained constant.

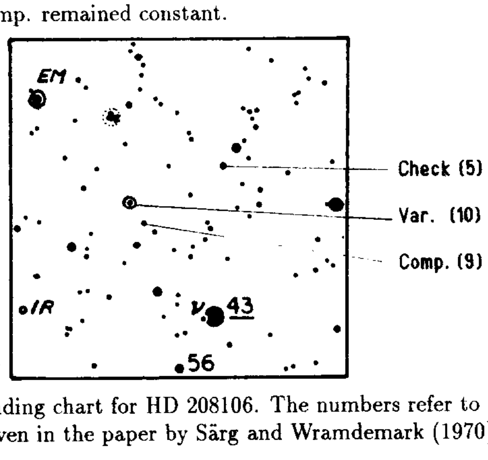

Figure 1. Finding chart for HD 208106. The numbers refer to designations given in the paper by Särg and Wramdemark (1970).

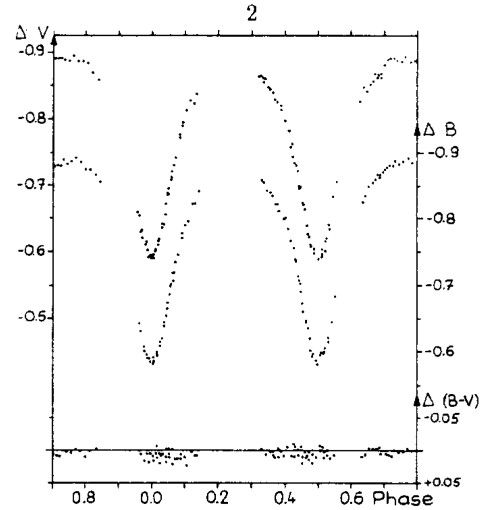

Figure 2. The differential B and V light and B−V colour curves of HD 208106.

Respectively four (1991) and two (1992) minima could be secured. Due to unequal coverage in the branches, they were determined with the tracing-paper method.

Minimum (hel.)	Epoch	
2448484.3938	−4	Min. I
48490.3731	0	Min. I
48498.6004	5.5	Min. II
48501.5903	7.5	Min. II
48843.3679	236	Min. I
48872.5381	255.5	Min. II

These minima are almost identical in depth and duration, so that minimum attribution is arbitrary. The following provisional elements could be calculated with the method of least squares and were used to reduce the lightcurve:

$$\text{Min. I (hel.)} = \text{JD } 2448490.3740 + 1^{\rm d}.49574 \times E$$

Due to the period near $1^{\rm d}.5$, the lightcurve could not be covered at one location. To refine the given elements, the star will be observed further, but observations from other longitudes are highly desirable for verification.

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UBVR LIGHT CURVES OF TY PYXIDIS

The RS CVn binary TY Pyx (No. 67 in the Catalogue of Strassmeier *et al.*, 1988) is considered to consist of two nearly identical, somewhat evolved G5 stars, rotating synchronously in a nearly 3.2 day orbital period. It was the target of an observing campaign involving IUE and ROSAT in November 1990, and was discussed with considerable interest at a recent 'Cool Star Workshop' (Neff, *et al.*, 1991). We were encouraged to follow up with observations in the 1991–92 season by Dr. M. Zeilik of UNM, Albuquerque.

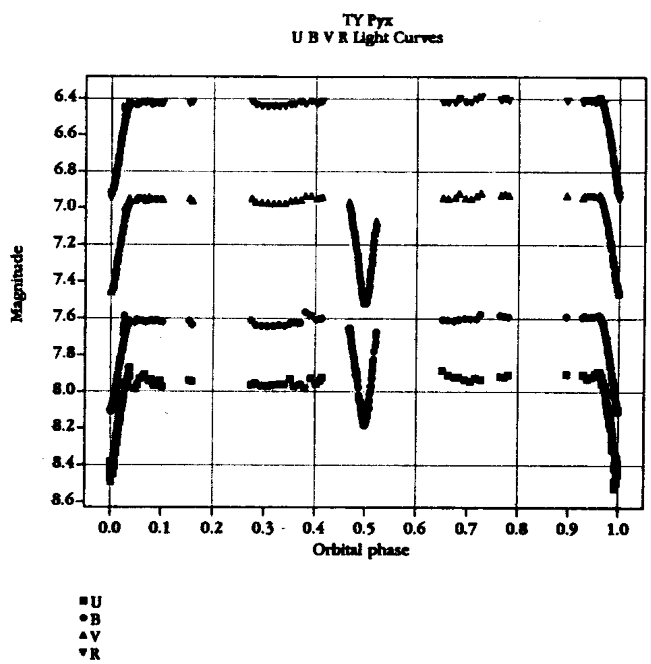

Figure 1

We observed the system on 14 nights at Black Birch Observatory over the period Nov. 1991 – Apr. 1992, and then on one night at the nearby Adams Lane Observatory, Blenheim (NZ). Facilities at these observatories are reported in Budding and McLoughlin (1987) and Allen and Budding (1986). The main comparison star was SAO176851, with SAO176789 and SAO176746 being used as checks. Photometry of nearby δ Pyx has been useful in enabling the differential light curves to be related to standard magnitudes (Figure 1).

In Figure 1 we have binned about 1200 out-of-eclipse data points in each of U, B, V and R into samplings of around 50 points, while the eclipse minima show individual observations. The data were phased according to the ephemeris of Vivekananda Rao and Sarma (1981). We were unsuccessful in monitoring the secondary eclipse at Black Birch in clear weather, however, the minimum was finally observed from Adams Lane on the night of April 19 through B and V filters. Using recent inter-calibration data the separate observation sets have been combined.

In the IUE's FES light curve, which Neff *et al.* (1991) reported, the secondary minimum was observed to be deeper than the primary. This was attributed to the presence of a 'spot' maculation wave, centred at around phase 0.6, and of amplitude about 0.06 mag. We have observed a similar amplitude wave (in B), though it now appears centred around phase 0.3. The amplitude is noticeably smaller in R — the U data, on the other hand, are subject to significantly more observational scatter, and whilst the maculation minimum is still there, it is more 'noisy'. In any case, the decreasing amplitude with increasing wavelength of this wave gives evidence that the effect is associated with large cool regions of surface maculation.

It also appears in our light curves that the secondary minimum is slightly deeper than the primary. In the rather sparser coverage of the minima of Neff *et al.*, (1991) it seems that the difference in depths could be greater than the scale of the maculation effect, though most literature light curves show the few hundredths of a magnitude difference in the depths of minima in the same sense as originally reported by Vivekananda Rao and Sarma (1981). More recent observations than those we have reported here suggest some secular light decline of the secondary minimum region, which might also play a part in accounting for the apparent extra dimming on April 19.

We plan to follow up with further work and analysis in the near future.

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NEW PROBABLE ECLIPSING BINARY GSC 1383_600

On December 28-29, 1992, I observed minor planet (4179) Toutatis. The observations were done with 0.18-m, f/5.6 Maksutov and SBIG ST-6 CCD-camera; eleven R and eight V images were taken, each exposure 2 minutes long. Already during the observations I noticed that one 11-magnitude star in the field of view changed its brightness by about 0.6 mag in the course of observing session. The variable star is GSC 1383_600. Observing conditions on December 28-29 were not fully photometric (cirrus clouds intereference in a part of the night), so two additional (V and R) images were taken on the photometric night of January 2, 1993, to assure absolute photometric calibration of the images. Results of photometric reduction of the images are presented in Table 1 and a sparse composite lightcurve is shown in Figure 1.

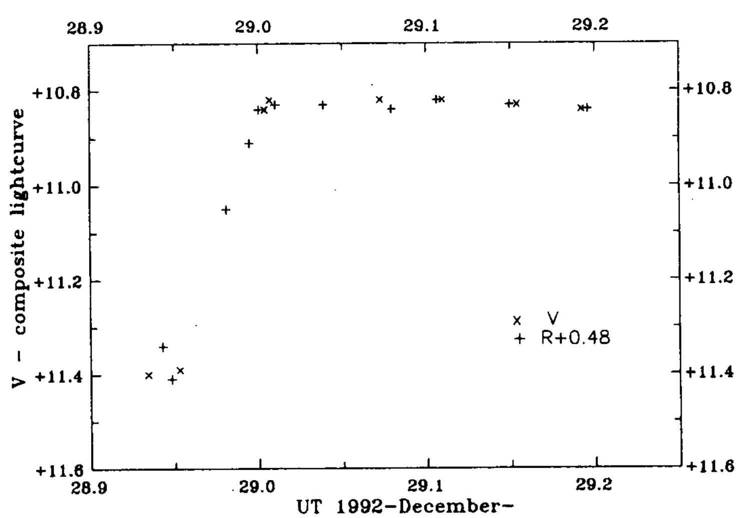

Figure 1: Composite lightcurve of the variable star GSC 1383_600 on December 28-29, 1992. R-points were shifted by +0.48 to meet V-points.

Table 1: V and R magnitudes of the variable star GSC 1383_600.

UT	$JD - 2448000$	V	R
1992 Dec. 28.9343	985.4343	11.40 ± 0.03	–
28.9430	985.4430	–	10.86 ± 0.03
28.9481	985.4481	–	10.93 ± 0.03
28.9530	985.4530	11.39 ± 0.03	–
28.9808	985.4808	–	10.57 ± 0.03
28.9950	985.4950	–	10.43 ± 0.03
29.0006	985.5006	–	10.36 ± 0.02
29.0041	985.5041	10.84 ± 0.03	–
29.0071	985.5071	10.82 ± 0.03	–
29.0105	985.5105	–	10.35 ± 0.02
29.0389	985.5389	–	10.35 ± 0.02
29.0725	985.5725	10.82 ± 0.02	–
29.0794	985.5794	–	10.36 ± 0.02
29.1061	985.6061	–	10.34 ± 0.02
29.1095	985.6095	10.82 ± 0.03	–
29.1494	985.6494	–	10.35 ± 0.02
29.1538	985.6538	10.83 ± 0.02	–
29.1919	985.6919	10.84 ± 0.02	–
29.1957	985.6957	–	10.36 ± 0.02
1993 Jan. 02.0345	989.5345	10.84 ± 0.02	–
02.0369	989.5369	–	10.38 ± 0.02

Mean V-R is 0.48 ± 0.01, no significant color change was detected. There is no variable star at that position listed in the fourth edition of GCVS (Kholopov *et al.*, 1985). The shape of the lightcurve suggests that the variable star is an eclipsing binary. An amplitude of the brightness change is 0.57 mag in V (10.83 – 11.40). The brightness is nearly constant during its minimum for at least 27 minutes, and there is rather steep rising branch with maximal duration of 68 minutes (lower limit of the mean rate is 0.50 mag/hour).

There is a convenient comparison star for photoelectric and other photometry, GSC 1383_1005, which is located at distance of 99 arcsec approximately in SSE direction. Positions (from GSC, 1989) and photometric parameters (measured, errors 0.01-0.02) of both stars are listed in Table 2. One of the R-images (taken on January 2, 1993) is reproduced in Figure 2.

Table 2: The variable star and convenient comparison star.

Star	R.A. (2000)	Decl.(2000)	V	V-R
GSC 1383_600	$08^h29^m39.36^s$	$+17°17'01.8''$	10.83–11.40	0.4
GSC 1383_1005	$08^h29^m43.00^s$	$+17°15'38.1''$	11.34	0.2

I conclude that GSC 1383_600 is probably an eclipsing binary with an amplitude of 0.57 ($\pm$0.02) mag and maximal brightness corresponding to 10.83 ($\pm$0.01) mag in V-band. Further studies could confirm the type of variability suggested, determine a period and find a detailed lightcurve.

The author is grateful to Dalibor Hanžl for his valuable help.

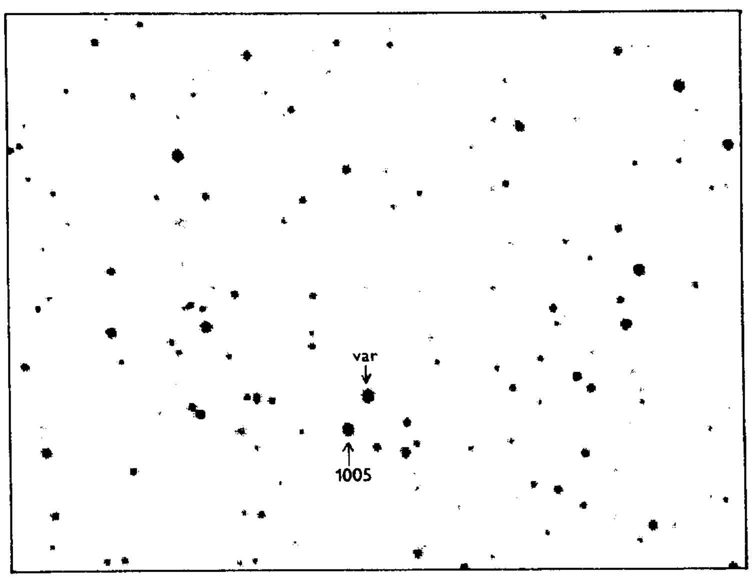

Figure 2: R-image of the field of the variable star GSC 1383_600, taken on January 2, 1993. The size of the area imaged is $31 * 23$ arcmin^2, north is up. The star GSC 1383_1005 is also marked.

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THE 71st NAME-LIST OF VARIABLE STARS

The present 71st Name-List of Variable Stars compiled in the manner first introduced in the 67th Name-List (IBVS No.2681, 1985) contains all data necessary for identification of 438 new variables finally designated in 1992. The total number of designated variable stars has now reached 30702.

The 71st Name-List consists of two Tables. Table 1 contains the list of new variables arranged in the order of their right ascensions. It gives the ordinal number and the designation of each variable; its equatorial co-ordinates for the equinox 1950.0; the range of variability and the system of magnitudes used (sometimes the column "Min" gives in parentheses the amplitude of light variation; the symbol "Ic" means magnitudes in Cousins's I system); the type of variability according to the system of classification described in the forewords to the first three volumes of the 4th GCVS edition (with the additions introduced in the 68th Name-List, IBVS No.3058, 1987, and in the 69th Name-List, IBVS No.3323, 1989); two references to the reference list which follows Table 2 (the first reference indicates the investigation of the star, the second one indicates the paper containing a finding chart or the corresponding Durchmusterung - BD, CoD, or CPD - containing the variable).

Some new variables needed improvement of co-ordinates. If the finding chart is available, such improvement has been undertaken on the basis of measurements made by one of us (V.P.G.).

In a small number of cases the value of the variability amplitude (column "Min", in parentheses) could not be expressed in the same system of magnitudes as the star's brightness; indicating the photometric band for the amplitude separately in such cases, we distinguish the Strömgren bands as "u", "v", etc.

During the preparation of the present Name-List it has become clear that it is necessary to introduce a new variability type for slow pulsating B stars (periods exceeding one day). We shall define this type in more detail in our future publications; here we give for such stars the symbol "*" in the column "Type" with a corresponding remark in Table 2.

Table 2 contains the list of variables arranged in the order of their names inside constellations. After the designation of a variable its ordinal number from Table 1 is given, as well as identifications with several major catalogues and identifications necessary to find this star in the papers with the first (or independent) announcement of the discovery of its variability. References to such papers are given in square brackets after the corresponding identification. The name of the discoverer accompanies the reference only in the case of its being different from the name of the author(s) of the paper referred to. For the stars having NSV catalogue numbers, the references to discovery papers already taken into account in the NSV catalogue are not always given. After the identifications some minimal remarks are given if necessary.

Please take into account the following corrections to the 69th Name-List. The coordinates for No.271=V1406 Aql (p.8) should be $19^h43^m27^s+04°07'.4$. For KP Peg (p.13) the identification should be PG 2303+243, not PG 2203+243. A correction to the 70th Name-List (IBVS No. 3530, 1990) has also been found. Ref. 165 (p.11) should be: *J. E. Winzer*, Dissertation, 1974.

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Table 1

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.
001	PW	And	00 15 44	+30 40.9	8.6	(0.10)	V	RS	001 BD
002	V668	Cas	00 24 47	+69 22.2	1.0	2.8	L	M	002
003	PX	And	00 27 28	+26 00.8	14.95	17.	V	E+UG	003 004
004	PY	And	00 33 41	+26 58.8	6.02	(0.03)	U	ACV	005 BD
005	BE	Psc	01 01 24	+26 19.1	8.8	(0.21)	V	RS	001 BD
006	BF	Psc	01 29 14	+15 47.5	7.81	(0.02)	V	RS	001 BD
007	V669	Cas	01 30 28	+62 11.5	1.57	3.02	L	M:	006
008	BG	Psc	01 34 25	+20 26.8	8.69	(0.06)	V	RS	007 BD
009	XX	Tri	02 00 49	+35 21.1	8.1	8.7	V	RS	008 BD
010	BN	Cet	02 03 55	−19 21.4	9.3	(0.01 B)	V	ACVO	009 BD
011	BO	Cet	02 04 07	−02 18.0				NL	010
012	V502	Per	02 14 14	+56 40.2	9.36	9.56	V	BE	011 012
013	V503	Per	02 17 06	+57 05.0	9.43	9.72	V	BE	011 012
014	V504	Per	02 17 45	+57 04.4	9.77	9.98	V	BE	011 012
015	V505	Per	02 17 46	+54 16.9	6.87	7.46	V	EA/DM	013 BD
016	V506	Per	02 18 11	+56 53.8	9.45	(0.24)	V	BE	011 012
017	V507	Per	02 18 20	+56 56.2	9.77	10.09	V	BE	011 227
018	V670	Cas	02 18 29	+60 57.	14.1	15.2	B	SR:	015
019	V671	Cas	02 19 42	+59 24.	14.1	(16.5	I	SR	015
020	V672	Cas	02 20 50	+59 11.	15.0	17.4	B	SR	015
021	BP	Cet	02 22 11	+08 09.6	14.2	15.1	P	RRAB	016 016
022	V673	Cas	02 22 15	+59 24.	12.8	13.6	I	L	015
023	V674	Cas	02 24 19	+61 56.	18.4	20.0	B	LB	015
024	V675	Cas	02 25 25	+60 17.	11.4	14.5	I	M	015
025	V676	Cas	02 27 11	+62 32.	7.4	10.4	I	M	015
026	V508	Per	02 29 22	+58 12.	16.1	18.0	B	I	015
027	V677	Cas	02 31 27	+62 59.	15.6	16.6	B	I	015
028	V678	Cas	02 31 29	+59 45.	13.2	15.4	I	SR	015
029	BQ	Cet	02 32 35	+02 35.1	13.7	16.4	P	UV	016 016
030	V679	Cas	02 32 42	+59 10.	14.7	16.0	B	E:	015
031	V680	Cas	02 32 46	+63 24.	14.1	16.4	I	I:	015
032	BR	Cet	02 34 18	+06 40.8	14.3	(16.5	P	UV	016 016
033	V681	Cas	02 34 51	+58 37.	16.8	17.7	B	I:	015
034	V682	Cas	02 35 09	+58 50.	16.5	18.0	B	I	015
035	V683	Cas	02 35 17	+59 31.	11.7	12.9	I	I	015
036	V684	Cas	02 35 28	+61 51.	12.8	13.8	I	I	015
037	V685	Cas	02 36 33	+63 14.	12.1	12.9	I	LB	015
038	V686	Cas	02 37 21	+62 22.	17.2	18.4	B	I	015
039	V687	Cas	02 37 24	+62 31.	13.2	16.0	I	SR	015
040	BS	Cet	02 38 04	−14 39.8	6.65	6.73	V	DSCTC	017 BD
041	V688	Cas	02 41 00	+61 52.	17.7	18.8	B	SR	015
042	V689	Cas	02 41 50	+60 26.	16.9	17.7	B	I	015
043	V690	Cas	02 41 51	+62 53.	12.3	15.4	I	M	015
044	V691	Cas	02 42 07	+58 10.	17.6	18.5	B	I	015
045	V692	Cas	02 43 40	+57 56.	12.3	15.9	I	M	015
046	V693	Cas	02 43 51	+62 30.	14.9	16.2	B	E	015
047	V694	Cas	02 46 57	+58 16.	12.9	15.7	I	M	015
048	V695	Cas	02 47 05	+61 27.	17.2	19.1	B	SRA	015
049	V696	Cas	02 47 50	+59 14.	12.2	15.5	I	M	015
050	V697	Cas	02 50 59	+60 16.	14.1	15.1	B	I	015
051	V698	Cas	02 55 16	+61 02.	16.8	18.1	B	I	015
052	V699	Cas	02 56 41	+61 25.	12.2	13.2	I	E:	015
053	V700	Cas	02 56 54	+59 31.	10.8	11.8	I	LB	015
054	V509	Per	03 00 30	+47 39.2	6.47	6.64	V	DSCT	018 BD

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.
055	γ	Per	03 01 10	+53 18.7	3.63	(0.55)	B	EA/GS	019 BD
056	BT	Hyi	03 03 43	-82 05.7	9.1	(0.01 B)	V	ACVO	020 CPD
057	WZ	Ari	03 05 44	+25 24.1	8.4	(0.08)	V	RS	001 BD
058	V510	Per	03 10 30	+43 40.7	7.30	(0.22)	V	RS	228 BD
059	XX	Ari	03 16 56	+18 53.8	7.33	7.42	V	ACV	021 BD
060	V701	Cas	03 18 39	+70 16.5	1.3	3.6	L	M	002
061	V511	Per	03 23 08	+40 17.0	8.1	8.6	V	EA/DM	014 BD
062	V512	Per	03 25 58	+31 05.8	20.22	23.8 :	V	INT	022 022
063	V513	Per	03 29 11	+41 16.4	10.4	13. :	V	M	024 024
064	V1029	Tau	03 36 03	+23 36.4	15.3	17.7	U	UV	026
065	V1030	Tau	03 36 04	+23 21.7	15.6	(18.	U	UV	026
066	V1031	Tau	03 37 28	+23 48.8	16.6	(18.	U	UV	026
067	V1032	Tau	03 37 50	+24 31.2	15.8	17.8	U	UV	026
068	V1033	Tau	03 39 53	+24 32.6	13.0	(18.	U	UV	026
069	V1034	Tau	03 39 57	+25 21.6	14.7	(18.	U	UV	026
070	V1035	Tau	03 40 08	+25 27.7	13.0	16.6	U	UV	026
071	V1036	Tau	03 40 39	+22 58.6	14.7	17.1	U	UV	026
072	V1037	Tau	03 41 13	+23 42.1	16.8	(18.	U	UV	026 027
073	V1038	Tau	03 41 21	+24 38.4	11.26	11.46	U	BY	028 027
074	V1039	Tau	03 41 26	+23 38.2	15.5	17.1	U	UV	026 027
075	V1040	Tau	03 41 51	+24 15.7	14.5	18.	U	UV	026 027
076	V1041	Tau	03 42 41	+23 36.0	12.4	14.1	U	UV:	029 027
077	V1042	Tau	03 43 11	+23 55.2	16.4	(18.	U	UV	026 027
078	V1043	Tau	03 43 12	+25 23.8	15.8	(18.	U	UV	026
079	V1044	Tau	03 43 15	+23 52.1	15.5	18.	U	UV	026 027
080	V1045	Tau	03 43 24	+24 25.0	11.17	11.28	U	BY	028 027
081	V1046	Tau	03 43 55	+24 38.6	11.28	11.37	U	BY:	028 027
082	V1047	Tau	03 44 55	+25 24.8	15.0	17.	U	UV	026
083	V1048	Tau	03 46 38	+23 20.1	12.8	14.5	U	UV	029 027
084	V1049	Tau	03 48 11	+23 48.0	14.6	17.6	U	UV	026 027
085	WX	Hor	03 48 14	-52 13.9	7.14	7.88	V	SRA	030 230
086	V1050	Tau	03 48 16	+22 09.4	15.8	(18.	U	UV	026
087	V1051	Tau	03 48 18	+23 40.7	11.1	14.2	U	UV	029 027
088	V1052	Tau	03 48 32	+24 11.9	14.5	16.5	U	UV	026 027
089	V1053	Tau	03 48 37	+23 19.8	15.1	(18.	U	UV	026
090	V1054	Tau	03 48 40	+24 24.0	12.7	13.8	U	UV	029 027
091	V1055	Tau	03 48 48	+24 07.2	14.6	(18.	U	UV	026
092	V1056	Tau	03 49 58	+22 46.1	16.3	(18.	U	UV	026
093	V1057	Tau	03 50 42	+23 54.2	14.9	17.	U	UV	026
094	V1058	Tau	03 52 08	+22 51.8	12.6	18.	U	UV	026
095	V1059	Tau	04 39 52	+25 11.0	13.2	14.5	P	UVN	031 032
096	EO	Eri	04 43 04	-23 57.0	10.3	18.0	P	M	033 033
097	V1060	Tau	04 47 45	+15 41.9	11.2	12.18	B	LB:	034 BD
098	CC	Cam	04 51 53	+69 22.5	10.7	14.5	V	M	035 024
099	V1202	Ori	04 53 21	+10 01.0	11.88	12.76	V	EA	036 037
100	V1061	Tau	04 55 50	+24 25.2	7.95	8.45:	V	EB/KE	038 BD
101	V1062	Tau	04 59 24	+24 41.1				NL	010
102	V1063	Tau	05 13 22	+26 05.4	17.	(0.2)	V	ZZB	039 040
103	AF	Men	05 14 43	-74 42.6	13.1	(0.8)	Ic	SR	041 041
104	V1203	Ori	05 23 51	-04 36.0	16.2	16.9	P	UVN	043 043
105	V1204	Ori	05 25 54	-05 46.0	14.4	17.2	U	UVN	044 045
106	V1205	Ori	05 28 21	-07 32.7	14.2	(18.9	U	UVN	043 043
107	V1206	Ori	05 28 59	-05 38.8	15.2	17.4	U	UVN	044 045
108	V1207	Ori	05 29 23	-06 02.5	14.2	15.4	U	UVN	043 046
109	V1208	Ori	05 29 26	-07 02.2	14.1	17.7	U	UVN	043 043
110	V1209	Ori	05 30 10	-03 38.4	15.5	16.2	U	UVN	043 043

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.	
111	V1210	Ori	05 30 30	-05 42.4	15.6	18.1	U	UVN	043	046
112	V1211	Ori	05 30 33	-04 10.9	16.4	17.4	U	UVN	043	043
113	V1212	Ori	05 30 37	-05 21.7	15.7	16.8	U	UVN	043	046
114	V1213	Ori	05 31 17	-06 44.2	16.2	17.2	U	UVN	043	043
115	V1214	Ori	05 31 31	-04 45.1	15.6	16.8	P	UVN	047	045
116	V1215	Ori	05 31 37	-05 04.9	17.0	17.6	U	UVN	043	046
117	V1216	Ori	05 31 42	-03 11.4	16.5	17.0	P	UVN	048	045
118	V1217	Ori	05 31 48	-03 35.6	14.8	(18.5	U	UVN	043	043
119	V1218	Ori	05 31 57	-04 24.6	15.5	(18.5	U	UVN	043	043
120	V1219	Ori	05 31 59	-05 03.0	16.1	16.9	P	UVN	047	045
121	V1220	Ori	05 32 00	-04 36.6	14.8	17.6	P	UVN	050	045
122	V1221	Ori	05 32 02	-06 12.4	14.0	14.92	U	UVN	043	046
123	V1222	Ori	05 32 12	-04 23.5	15.4	17.4	U	UVN	043	046
124	V1223	Ori	05 32 17	-04 06.6	14.3	17.5	U	UVN	043	046
125	V1224	Ori	05 32 20	-04 25.1	16.0	18.2	P	UVN	051	045
126	V1225	Ori	05 32 25	-04 23.2	13.9	(18.8	U	UVN	045	045
127	V1226	Ori	05 32 27	-06 50.4	17.0	(18.8	U	UVN	043	043
128	V1227	Ori	05 32 43	-05 23.8	12.74	13.01	Ic	IN:	052	053
129	V1228	Ori	05 32 45	-05 25.7	12.21	12.51	Ic	IN:	052	053
130	V1229	Ori	05 32 51	-05 24.5	11.36	11.64	Ic	IN:	052	053
131	V1230	Ori	05 32 53	-05 23.6	9.12	9.30	Ic	IN:	052	053
132	V1231	Ori	05 32 55	-05 26.1	12.7	14.4	Ic	IN:	052	053
133	V1232	Ori	05 32 59	-05 29.5	11.5	12.9	V	IN	055	046
134	V1233	Ori	05 33 08	-06 16.4	16.5	(18.8	U	UVN	043	043
135	V1234	Ori	05 33 18	-04 28.1	16.1	16.9	P	UVN	051	046
136	V1235	Ori	05 33 20	-06 54.5	15.7	16.7	U	UVN	044	046
137	V1236	Ori	05 33 24	-04 31.9	14.0	15.6	U	UVN	044	046
138	V1237	Ori	05 33 30	-04 31.2	16.3	17.9	P	UVN	057	045
139	V1238	Ori	05 33 38	-04 22.5	15.9	16.8	U	UVN	044	045
140	V1239	Ori	05 33 41	-03 50.7	16.0	18.5	U	UVN	043	043
141	V1240	Ori	05 33 42	-05 52.9	16.3	17.5	P	UVN	045	045
142	V1241	Ori	05 34 00	-05 48.5	15.1	17.6	U	UVN	043	046
143	V1242	Ori	05 34 03	-03 44.8	15.1	17.1	U	UVN	043	043
144	V1243	Ori	05 34 12	-05 14.1	15.5	17.5	U	UVN	043	043
145	V1244	Ori	05 34 33	-04 02.5	16.0	(18.	U	UVN	043	043
146	V1245	Ori	05 34 36	-04 15.6	14.8	17.9	U	UVN	044	045
147	V1246	Ori	05 34 48	-06 21.4	16.5	21.0 :	P	UVN	047	045
148	V1247	Ori	05 35 12	-01 19.3	9.82	9.87	V	DSCTC	017	BD
149	V1248	Ori	05 35 17	-06 42.0	14.8	15.7	U	UVN	044	046
150	V1249	Ori	05 36 06	-06 38.0	15.3	18.5	U	UVN	043	043
151	V1250	Ori	05 36 09	-05 42.5	16.1	17.1	P	UVN	047	045
152	V1251	Ori	05 36 24	-04 04.6	16.7	18.3	P	UVN	043	043
153	V1252	Ori	05 36 31	-04 32.3	16.3	19.0 :	P	UVN	047	045
154	V1253	Ori	05 36 49	-03 56.9	15.2	17.3	U	UVN	231	043
155	V1254	Ori	05 36 54	-06 56.5	12.6	14.7	U	UVN	043	046
156	V1255	Ori	05 37 50	-03 59.7	15.9	16.8	U	UVN	044	045
157	V1256	Ori	05 38 08	-03 58.1	14.5	15.7	U	UVN	044	045
158	V1257	Ori	05 38 59	-06 22.2	15.2	16.0	U	UVN	043	043
159	AG	Men	05 42 02	-73 22.3	9.27	(1.52)	Ic	LB	041	041
160	V1258	Ori	05 42 57	-04 15.6	12.0	12.6	P	SR:	059	059
161	V393	Aur	05 44 03	+43 11.6	1.3	2.3	L	SRA	002	060
162	TY	Col	05 56 09	-38 04.5	9.57	9.64	V	RS	106	
163	V1259	Ori	06 01 17	+07 26.1	6.04	8.27	K	M	061	
164	V394	Aur	06 03 11	+29 31.1	6.01	6.11	V	SRC	062	BD
165	V347	Pup	06 09 16	-48 43.8	13.55	16.75	B	EA/WD+NL	063	063

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.
166	V395	Aur	06 13 12	+28 52.2	7.34	7.43	V	ELL	064 BD
167	V1260	Ori	06 16 39	+13 28.2	7.7	(0.11)	V	RS	001 BD
168	HR	CMa	06 30 26	-11 07.7	6.24	6.32	V	EA/GS	065 BD
169	HS	CMa	06 31 29	-18 05.2	9.8	14.0	V	M	066 066
170	V690	Mon	06 31 58	+10 30.1	16.0	16.6	P	UV	067 068
171	V691	Mon	06 35 37	+10 03.5	15.7	16.7	P	UVN	067 068
172	V692	Mon	06 37 00	+10 25.5	16.2	16.7	P	UVN	067 068
173	V693	Mon	06 41 25	+08 17.1	16.5	17.0	P	UV	067 068
174	V348	Pup	07 10 45	-36 00.5	15.4	17.1	V	EA/WD+NL	069 069
175	V694	Mon	07 23 26	-07 38.1	9.1	10.1	V	*	070 071
176	V349	Pup	07 27 25	-34 04.0	7.49	7.53	B	DSCTC	072 CoD
177	V350	Pup	07 28 42	-33 59.1	7.48	7.52	B	BCEP	073 CoD
178	OZ	Gem	07 30 49	+30 37.1	0.5	1.9	L	M	002
179	V695	Mon	07 58 13	-02 44.6	6.48	6.55	V	BE	074 BD
180	V351	Pup	08 09 44	-34 58.5	6.4	(12.	V	NA	075
181	LS	Vel	08 33 44	-52 53.9	14.5	19.5	B	UV	076 076
182	LT	Vel	08 46 30	-44 41.1	9.95	10.46	V	EB	077 236
183	ES	Cnc	08 48 37	+12 04.7	11.16	11.28	V	EA	078 079
184	ET	Cnc	08 48 43	+12 07.5	15.96	(0.12)	V	EW/KW	080 081
185	EU	Cnc	08 48 43	+11 58.2	20.4	21.0	V	AM:	080 081
186	EV	Cnc	08 48 45	+12 00.8	12.80	(0.10)	V	EW/KW	080 081
187	EW	Cnc	08 48 48	+12 02.0	12.27	(0.02)	V	DSCTC	082 081
188	EX	Cnc	08 48 50	+12 02.5	10.95	(0.05)	V	DSCTC	082 083
189	EY	Cnc	08 48 51	+12 01.8	19.94		V	BY:	080 081
190	EZ	Cnc	08 50 02	+23 59.2	11.78	12.72	V	RRAB	084 084
191	VY	Pyx	08 52 17	-23 19.9	7.65	8.08	B	CWB	086 BD
192	VZ	Pyx	08 57 08	-24 17.2	12.5	16.8	V	UG	087
193	BI	Lyn	09 00 06	+40 02.9	12.93	13.13	B	NL	088 088
194	WW	Pyx	09 02 28	-32 10.6	12.4	13.2	V	E	089 089
195	LX	Hya	09 16 07	-20 09.6	7.79	7.82	V	ACVO	090 BD
196	AI	Ant	09 39 22	-29 08.7	8.6	(0.02 B)	P	ACVO	091 CoD
197	DU	Leo	09 41 19	+25 35.1	8.68	9.43	R	EA/SD	092 BD
198	TT	Sex	09 43 56	-05 48.0	10.4	11.9	P	LB	034 BD
199	DV	Leo	09 51 18	+10 29.7	7.78	8.13	V	SR	094 BD
200	LU	Vel	09 56 34	-46 10.7	11.5	13.76	U	UV	095 CoD
201	LV	Vel	10 03 43	-44 06.9	16.6	(0.1)	V	ZZ	096 097
202	LW	Vel	10 11 27	-50 59.1	5.24	5.29	V	DSCTC	017 CoD
203	DW	Leo	10 23 30	+15 09.3	8.5	(0.08)	V	RS	001 BD
204	LX	Vel	10 28 28	-56 49.2	6.60	6.66	b	EB/GS	074 CPD
205	EO	UMa	10 42 31	+41 34.3	7.07	7.15	V	DSCTC	098 BD
206	EP	UMa	11 06 31	+67 28.9	6.06	(0.01)	V	ACVO	099 BD
207	V432	Car	11 06 34	-60 26.6	11.79	12.43	V	SDOR	100 101
208	GU	Mus	11 24 18	-68 24.0	13.65	20.9	B	XND+ELL	102 104
209	V857	Cen	11 29 24	-40 46.4	13.4	13.98	U	UV	095
210	V858	Cen	11 33 48	-37 45.6	10.58	(0.15)	V	RS	106 CoD
211	V859	Cen	11 43 16	-61 42.8	12.87	13.48	I	L	107
212	V860	Cen	11 43 59	-61 51.2	12.59	13.47	I	L	107
213	V861	Cen	11 50 01	-61 54.0	12.83	13.66	I	L	107
214	V862	Cen	11 53 40	-61 42.7	10.01	10.59	I	L	107
215	CF	Cru	12 02 20	-62 30.9	11.81	12.12	I	LB	107
216	CG	Cru	12 03 17	-62 29.0	12.11	12.36	I	LB	107
217	V863	Cen	12 05 29	-50 23.0	4.38	4.43	b	BE:	074 CoD
218	II	Vir	12 07 53	-07 29.8	6.49	6.55	V	DSCTC:	109 BD
219	IK	Vir	12 11 23	+02 17.2	11.51	11.79	V	EA	110 110
220	TV	Crv	12 17 48	-18 10.4	12.	18.	P	UG	114 114

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.
221	IL	Vir	12 27 08	+08 17.5	19.00	19.42	V	RRAB	115 115
222	CH	Cru	12 39 03	-59 24.7	4.88	5.7	B	GCAS:	105 CPD
223	IM	Vir	12 47 03	-05 48.4	9.74	(0.15)	V	EA/RS:	116 BD
224	V864	Cen	13 14 46	-62 10.3	11.90		V	WR	117 118
225	V865	Cen	13 19 01	-62 51.8	9.30	10.51	I	L	107
226	IN	Vir	13 21 49	-02 03.2	9.24	(0.15)	V	RS	007 BD
227	LY	Hya	13 29 06	-29 25.6	17.41	18.40	V	NL	119 120
228	V866	Cen	13 33 11	-63 04.9	13.18	13.71	I	L	107
229	V867	Cen	13 35 16	-62 49.2	13.14	14.10	I	L	107
230	LZ	Hya	13 38 31	-28 31.9	9.0	(0.01)	B	ACVO	121 CoD
231	V868	Cen	13 46 37	-62 54.0	10.24	(22.5	V	N	122
232	V869	Cen	14 06 17	-51 16.1	5.92	(0.09)	V	*	123 CoD
233	IO	Vir	14 08 40	-07 30.7	4.0	6.0	J	M	002 124
234	CX	Boo	14 22 12	+09 30.9	14.3	(0.1)	V	ZZA	125 126
235	EI	Dra	14 29 26	+60 59.8	8.50	(0.11)	V	DSCT	127 BD
236	IP	Vir	14 37 34	+00 14.6	11.51	11.63	V	DSCT	128 129
237	EK	Dra	14 37 56	+64 30.4	8.15	(0.09)	B	BY	130 BD
238	HU	Lup	15 06 52	-51 49.9	9.07	9.13	V	DSCTC	017 CoD
239	EL	Dra	15 21 08	+61 23.5	15.2	16.0	P	RRAB	131 131
240	HV	Lup	15 24 51	-44 57.7	7.30	8.09	V	BE:	132 CoD
241	NN	Aps	15 26 20	-70 53.5	6.86	6.92	V	ACV	133 CPD
242	HW	Lup	15 42 06	-34 09.1	9.95	10.45	H	INT	134 135
243	V350	Nor	15 58 46	-60 11.9	9.20	9.31	V	*	123 CPD
244	NQ	Ser	16 03 32	+10 49.2	8.3	(0.11)	V	RS	001 BD
245	UW	CrB	16 03 40	+25 59.8	18.87	20.10	R	X+E	136 137
246	UX	CrB	16 14 58	+31 14.3	13.12	13.60	B	EA	138 138
247	γ	Her	16 19 43	+19 16.1	4.02	(0.09)	B	SRD:	140 BD
248	V978	Sco	16 23 07	-38 42.8	16.2	(19.6	B	L:	141 141
249	V979	Sco	16 23 16	-39 05.7	18.4	(19.6	B	L:	141 141
250	V2251	Oph	16 23 48	-23 08.2	13.84	14.24	V	INT	142 143
251	V980	Sco	16 24 39	-39 02.2	17.8	19.4	B	RRAB	141 141
252	V981	Sco	16 24 43	-38 31.2	18.2	18.6	B	E:	141 141
253	V982	Sco	16 24 50	-39 02.3	19.0	19.8 :	B	E:	141 141
254	V983	Sco	16 25 22	-38 57.4	16.5	(19.6	B	L:	141 141
255	V2252	Oph	16 28 04	-23 58.2	13.75	14.50	V	INT	142 143
256	V984	Sco	16 29 49	-36 02.9	7.66	8.74	J	M	144
257	V985	Sco	16 37 27	-35 31.7	8.45	9.67	J	M	144
258	V986	Sco	16 43 56	-33 12.6	10.62	12.46	J	M	144
259	V987	Sco	16 45 34	-32 55.8	9.09	10.44	J	M	144
260	V2253	Oph	16 49 50	-26 40.1	8.1	(0.18)	V	RS	001 CoD
261	V988	Sco	16 50 52	-31 20.9	9.46	13.19	J	M	144
262	V989	Sco	16 53 45	-31 12.0	7.89	9.57	J	M	144
263	V990	Sco	16 55 00	-30 53.8	8.03	9.23	J	M	144
264	V2254	Oph	17 00 36	-29 46.4	8.94	11.15	J	M	144
265	V2255	Oph	17 03 02	-28 01.4	8.23	11.38	K	M	144
266	V991	Sco	17 03 04	-37 45.3	9.67	9.76	V	RS:	007 CoD
267	V992	Sco	17 03 43	-43 11.4	7.26	18. :	V	NA	145 146
268	V2256	Oph	17 04 16	-28 33.9	9.36	12.31	H	M	144
269	V2257	Oph	17 04 38	-27 01.4	8.88	9.86	J	M	144
270	V2258	Oph	17 04 39	-27 58.2	9.35	11.72	J	M	144
271	V2259	Oph	17 04 46	-27 07.5	8.63	10.07	J	M	144
272	EM	Dra	17 05 59	+55 31.4	16.0	16.8	B	RR(B)	147 147
273	V2260	Oph	17 06 16	-27 58.6	7.44	8.78	J	M	144
274	V832	Her	17 11 55	+26 14.2	8.8	(0.04)	V	RS	001 BD
275	V2261	Oph	17 13 25	-25 16.8	7.67	9.07	J	M	144

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.
276	V2262	Oph	17 13 30	-25 51.4	8.50	9.61	J	M	144
277	V2263	Oph	17 15 43	-23 55.8	8.93	10.16	J	M	144
278	V2264	Oph	17 17 14	-26 43.5	9.8	(21. :	V	NA	148 149
279	V2265	Oph	17 17 16	-24 35.7	7.26	8.86	J	M	144
280	V2266	Oph	17 20 12	-22 44.9	6.52	7.88	J	M	144
281	NO	Aps	17 22 04	-80 49.1	5.71	5.95	V	SR	030 CPD
282	V2267	Oph	17 22 59	-20 59.3	9.66	12.39	J	M	144
283	V2268	Oph	17 23 02	-21 35.0	7.94	9.18	J	M	144
284	V2269	Oph	17 23 42	-21 38.6	7.45	8.04	H	M	144
285	V2270	Oph	17 24 08	-22 02.9	9.15	10.62	J	M	144
286	V2271	Oph	17 24 27	-21 31.2	8.24	9.80	J	M	144
287	V2272	Oph	17 24 55	-21 40.2	8.18	10.05	J	M	144
288	V2273	Oph	17 26 04	-21 01.9	8.32	9.73	J	M	144
289	V2274	Oph	17 26 27	-20 37.2	11.74	13.7	J	M	144
290	V2275	Oph	17 26 46	-21 22.8	9.80	12.61	K	M	144
291	V2276	Oph	17 27 36	-19 33.2	9.53	10.99	J	M	144
292	V2277	Oph	17 27 41	-20 29.5	9.77	11.29	J	M	144
293	α	Ara	17 27 58	-49 50.3	2.79	3.13	b	BE	150 CoD
294	V2278	Oph	17 28 43	-19 56.0	8.14	10.16	K	M	144
295	V2279	Oph	17 28 51	-16 55.3	17.32	17.62	B	EA	151 152
296	V2280	Oph	17 29 18	-19 31.0	9.48	11.60	J	M	144
297	V833	Her	17 29 42	+17 47.6	2.6	5.4	K	M	002
298	V2281	Oph	17 30 25	-19 33.8	8.44	10.79	K	M	144
299	V2282	Oph	17 30 26	-19 47.8	10.62	13.10	J	M	144
300	V2283	Oph	17 32 20	-18 33.7	8.09	9.68	J	M	144
301	V993	Sco	17 33 28	-45 19.6	7.94	9.99	J	M	144
302	V2284	Oph	17 35 47	-17 04.6	9.76	11.9	J	M	144
303	V994	Sco	17 36 22	-32 17.6	7.10	7.22	V	BCEP	123 153
304	V833	Ara	17 36 26	-45 37.6	6.69	8.48	J	M	144
305	V2285	Oph	17 36 32	-16 41.0	8.68	10.26	J	M	144
306	V2286	Oph	17 36 44	-16 56.6	8.90	11.03	J	M	144
307	EN	Dra	17 37 36	+55 08.4	14.6	15.3	B	RR(B)	147 147
308	V2287	Oph	17 38 14	-17 04.6	7.76	9.65	J	M	144
309	V2288	Oph	17 39 24	+05 17.7	12.6	13.1	P	EA	154 155
310	V834	Her	17 39 42	+29 37.4	8.0	(0.10)	V	RS	001 BD
311	V2289	Oph	17 40 06	-16 05.6	8.14	9.73	J	M	144
312	V2290	Oph	17 40 07	-20 05.7	9.3	(22.	V	NA	156
313	NR	Ser	17 44 02	-14 04.4	7.57	9.08	J	M	144
314	V834	Ara	17 44 31	-51 54.1	10.32	(0.01 B)	V	ACVO	157 CoD
315	NS	Ser	17 44 38	-14 15.8	7.70	8.71	J	M	144
316	V995	Sco	17 44 54	-42 42.4	6.47	8.62	J	M	144
317	NT	Ser	17 45 44	-13 47.2	7.79	9.33	J	M	144
318	NU	Ser	17 45 46	-13 01.6	7.59	9.00	J	M	144
319	NV	Ser	17 47 54	-12 27.0	7.60	9.38	H	M	144
320	V996	Sco	17 50 46	-40 10.7	9.04	10.31	J	M	144
321	V997	Sco	17 50 54	-39 56.6	7.95	9.33	J	M	144
322	V998	Sco	17 52 27	-40 06.6	8.54	9.89	J	M	144
323	V999	Sco	17 53 23	-39 10.8	8.90	10.64	J	M	144
324	V835	Her	17 53 40	+36 11.7	7.94	8.09	V	RS	001 BD
325	V695	CrA	17 55 36	-38 47.5	9.35	11.59	J	M	144
326	V696	CrA	17 56 39	-38 01.6	10.15	12.57	J	M	144
327	V697	CrA	17 57 01	-37 48.5	7.45	8.89	H	M	144
328	V698	CrA	17 58 59	-38 27.3	8.24	10.37	J	M	144
329	V699	CrA	17 59 32	-37 12.1	7.54	8.68	J	M	144
330	V700	CrA	17 59 59	-37 46.5	8.33	9.98	J	M	144

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.
331	V4154	Sgr	18 01 54	-36 05.4	8.93	11.95	J	M	144
332	V4155	Sgr	18 02 25	-35 43.4	10.87	12.52	J	M	144
333	V4156	Sgr	18 06 02	-34 51.5	6.72	9.11	J	M	144
334	V4157	Sgr	18 06 29	-25 52.6	7.	(21.	V	NA	158 159
335	V4158	Sgr	18 07 52	-35 11.3	7.92	9.01	J	M	144
336	V4159	Sgr	18 08 54	-16 54.4	8.09	8.16	V	BCEP	160 BD
337	V836	Her	18 09 28	+23 54.5	10.7	11.4	V	EA	161 161
338	V4160	Sgr	18 10 58	-32 13.4	7.0	(21.	V	NA	162
339	V4161	Sgr	18 12 55	-33 05.2	11.30	13.93	J	M	144
340	V4162	Sgr	18 13 41	-33 03.7	8.87	11.83	J	M	144
341	V4163	Sgr	18 14 58	-31 41.8	7.68	8.82	J	M	144
342	V4164	Sgr	18 16 22	-31 06.0	7.41	8.66	J	M	144
343	V4165	Sgr	18 16 55	-30 35.1	7.50	8.82	J	M	144
344	V4166	Sgr	18 16 58	-30 06.2	9.16	11.97	J	M	144
345	V4167	Sgr	18 17 19	-31 07.4	8.99	10.60	J	M	144
346	V4168	Sgr	18 18 00	-30 33.4	8.06	9.00	J	M	144
347	EO	Dra	18 19 42	+50 30.2	10.8	13.	P	M:	164 165
348	V4169	Sgr	18 20 17	-28 23.6	7.7	(12.6	V	NA	166 167
349	V4170	Sgr	18 20 24	-30 27.5	8.87	10.00	J	M	144
350	V4171	Sgr	18 20 39	-23 01.1	7.49	20.5 :	V	NA	168 252
351	V4172	Sgr	18 21 46	-29 06.5	8.35	11.03	J	M	144
352	V4173	Sgr	18 22 00	-29 20.5	8.14	9.95	J	M	144
353	V4174	Sgr	18 22 24	-27 56.4	8.03	9.81	J	M	144
354	V4175	Sgr	18 22 34	-28 52.5	9.23	9.81	J	M:	144
355	V2291	Oph	18 23 14	+08 00.1	7.02	(1.1)	U	EA/GS	169 BD
356	V4176	Sgr	18 26 04	-26 19.1	8.17	10.11	H	M	144
357	V4177	Sgr	18 26 28	-27 20.1	10.61	14.6	H	M	144
358	V4178	Sgr	18 26 42	-26 03.2	10.49	12.64	J	M	144
359	V4179	Sgr	18 26 45	-27 15.1	9.40	11.35	J	M	144
360	V4180	Sgr	18 27 21	-26 32.4	6.84	7.89	H	M	144
361	V4181	Sgr	18 27 29	-26 57.4	8.00	10.11	J	M	144
362	V4182	Sgr	18 28 13	-25 36.3	9.50	11.87	J	M	144
363	V4183	Sgr	18 28 43	-26 11.1	9.38	12.53	H	M	144
364	V4184	Sgr	18 29 03	-24 59.6	3.21	4.26	H	M	144
365	V4185	Sgr	18 29 06	-26 42.2	8.68	11.17	J	M	144
366	V4186	Sgr	18 30 33	-24 48.0	8.28	9.71	J	M	144
367	V4187	Sgr	18 30 47	-26 04.4	7.46	9.04	J	M	144
368	V4188	Sgr	18 31 07	-25 46.0	7.81	8.77	J	M	144
369	V4189	Sgr	18 32 00	-24 42.7	8.15	9.33	J	M	144
370	V4190	Sgr	18 32 22	-20 52.9	6.44	6.48	V	DSCTC	017 BD
371	V4191	Sgr	18 34 10	-23 57.9	12.50	15.4	J	M	144
372	V4192	Sgr	18 34 45	-23 51.3	8.41	11.53	J	M	144
373	V4193	Sgr	18 35 11	-23 25.0	8.27	9.56	J	M	144
374	V4194	Sgr	18 35 11	-23 04.1	6.65	8.08	H	M	144
375	V4195	Sgr	18 35 46	-22 08.8	7.96	9.25	J	M	144
376	V837	Her	18 41 19	+13 54.3	0.2	1.3	L	M	002 165
377	V4196	Sgr	18 41 25	-19 59.6	7.88	9.52	J	M	144
378	V838	Her	18 44 12	+12 10.8	5.0	20.	V	NA+EA	172 171
379	V444	Sct	18 44 27	-08 24.2	10.5	(20.	V	NA	174 175
380	V489	Lyr	18 54 43	+28 35.4	13.0	18.3	P	M	176 176
381	V701	CrA	18 59 53	-38 19.6	5.69	5.73	V	DSCTC	017 CoD
382	V1413	Aql	19 01 32	+16 21.8	10.6	15.1	V	ZAND+E	177 178
383	V4197	Sgr	19 03 02	-19 33.5	7.95	8.70	V	EW/KE	179 BD
384	V4198	Sgr	19 04 13	-18 49.0	6.23	6.29	V	*	123 BD
385	EP	Dra	19 07 20	+69 03.8	17.6	(20.5	V	E+XM	180 180

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	Ref.	
386	V344	Pav	19 11 34	-62 41.2	14.5	(20.	P	UG	181	
387	V490	Lyr	19 16 00	+28 37.3	14.2	17.7	P	SRB:	182	182
388	V4199	Sgr	19 18 41	-19 19.8	6.18	6.26	V	*	123	BD
389	V335	Vul	19 21 10	+24 22.4	10.1	12.	P	SR	164	164
390	EQ	Dra	19 24 19	+57 07.8	10.3	11.6	V	SRB	035	183
391	V1964	Cyg	19 28 10	+31 17.9	12.0	12.8	P	SRD:	184	184
392	V1414	Aql	19 31 58	-07 40.9	9.0	14.4	V	M	185	186
393	V1965	Cyg	19 32 09	+27 57.5	3.7	6.0	H	M	002	187
394	V336	Vul	19 32 36	+23 46.7	7.7	9.6	V	SRB:	188	188
395	V1966	Cyg	19 32 48	+30 24.3	9.95	10.04	V	E:/PN	189	BD
396	V1415	Aql	19 41 15	+03 37.3	0.9	1.9	L	M	002	
397	V1967	Cyg	19 43 44	+30 08.1	7.43	7.83	V	SRB	094	BD
398	QZ	Sge	19 50 08	+18 32.5	6.16	6.23	V	E:	190	BD
399	V4200	Sgr	19 51 18	-24 04.0	6.18	(0.07)	V	BY	001	CoD
400	V1968	Cyg	19 59 25	+40 47.2	1.2	3.2	L	M	002	
401	V1416	Aql	20 05 16	+05 54.5	1.1	2.1	L	M	002	
402	CK	Oct	20 06 32	-79 01.6	9.90	(0.01)	V	ACVO	157	CPD
403	V1969	Cyg	20 07 15	+31 16.9	0.7	2.0	L	M	002	
404	V335	Sge	20 12 04	+16 51.7	9.8	11.2	P	SRB	191	248
405	V1970	Cyg	20 14 16	+46 45.2	11.4	12.3	P	SR	191	034
406	V1971	Cyg	20 19 34	+32 09.2	7.9	(0.18)	V	RS	001	BD
407	QR	Tel	20 20 29	-51 53.1	9.19	(0.01 B)	V	ACVO	157	CPD
408	V1972	Cyg	20 21 14	+39 20.1	11.54	12.12	B	IA	193	194
409	V1973	Cyg	20 21 22	+40 40.5	9.67	10.09	V	ISA	195	BD
410	V1974	Cyg	20 29 07	+52 27.7	4.2	17.5 :	V	NA+E:	197	197
411	AW	Cap	20 35 20	-17 40.7	9.72	(0.01 B)	V	ACVO	157	BD
412	HS	Aqr	20 38 20	-00 46.5	9.35	(0.42)	V	EB	200	199
413	V1975	Cyg	20 41 52	+34 17.7	15.4	16.3	B	SR	201	202
414	V1976	Cyg	20 45 42	+34 08.1	16.0	17.5	B	SR	201	202
415	V1977	Cyg	20 45 51	+43 36.3	10.81	11.44	V	INA	204	205
416	V1978	Cyg	20 46 55	+33 11.8	13.2	14.2	B	SR	201	202
417	V1979	Cyg	20 48 50	+33 30.5	15.9	18.0	B	SR	201	202
418	V1980	Cyg	21 00 17	+49 39.7	12.29	12.50	V	INT	207	207
419	V1981	Cyg	21 00 37	+44 35.6	7.5	8.1	B	SRB	209	BD
420	V1982	Cyg	21 02 16	+50 03.2	12.	13.8	B	INT	210	207
421	V1983	Cyg	21 11 15	+39 59.0	12.26	14.48	V	SR:	211	211
422	KV	Peg	21 19 44	+16 55.5	11.73	(0.20)	V	EW/KW	212	212
423	KW	Peg	21 36 56	+26 29.0	12.1	(0.31)	V	EA	213	214
424	HT	Aqr	21 37 45	-02 00.8	9.6	11.0	B	SR	059	BD
425	CF	Gru	21 38 11	-45 18.2	19.9	(0.85)	V	NL	215	216
426	V1984	Cyg	21 42 29	+37 09.1	14.0	(18.4	B	M	217	217
427	V375	Cep	21 43 44	+65 30.1	16.11	16.6	V	EW:	218	219
428	V376	Cep	22 00 13	+82 37.9	7.5	(0.07)	V	RS	001	BD
429	UU	PsA	22 01 46	-27 03.9	5.86	5.91	b	BE	150	CoD
430	KX	Peg	22 20 15	+30 06.3	7.46	7.58	V	RS	220	BD
431	V702	Cas	22 58 28	+54 23.6	14.0	15.0	P	EA/SD	221	203
432	CN	Tuc	23 06 23	-63 55.4	9.35	(0.01 B)	V	ACVO	157	CPD
433	ψ^2	Aqr	23 15 18	-09 27.3	4.30	4.36	b	BE:	150	BD
434	V377	Cep	23 24 27	+86 08.6	6.58	6.64	V	DSCTC	222	BD
435	V378	Cep	23 31 01	+85 54.1	7.09	7.12	V	ELL	222	BD
436	BT	Cet	23 55 21	-13 08.2	15.6	16.2	P	EA	016	016
437	BH	Psc	23 56 57	-03 07.3	7.13	(0.09)	V	DSCTC	223	BD
438	AX	Scl	23 58 53	-30 42.5	15.	17.	B	UV	076	076

Table 2

PW And=001=BD+30°34(8.6)= =HD 1405(G5)[001]= =SAO 053799.

PX And=003=PG 0027+260[224].

PY And=004=BD+26°91(6.5)= =HD 3322(B8)=HR 149= =SAO 074136=NSV 00221.

AI Ant=196=CoD-28°7536(9.0)= =CPD-28°3808(8.6)= =HD 84041(A5)[091]= =SAO 177848.

NN Aps=241=CoD-70°1302(7.0)= =CPD-70°2069(6.9)= =HD 137509(B8)[244]= =SAO 257290.

NO Aps=281=HR 6429=CoD-80°638 (6.4)=CPD-80°828(7.4)= =HD 156513(Mb)[030]= =SAO 258769= =IRAS 17220-8049= =NSV 08609.

HS Aqr=412=BD-1°4025(8.8)= =HD 197010(F8)[199]= =SAO 144692=ADS 14147= =1E 2038.3-0046= =MS 2038.3-0046.

HT Aqr=424=BD-2°5597(9.3)= =SAO 145577(M5)= =IRC 00507= =IRAS 21377-0200= =AFGL 2787=DHK 8[014].

ψ^2 Aqr=433=ψ^2 Aqr[150]= =93 Aqr=HR 8858= =BD-9°6160(5.5)= =HD 219688(B5)= =SAO 146620.

V1413 Aql=382=AS 338[163]= =SS 428=MHα 305-6= =He 3-1737=PK 048+4°1= =K 4-12.

V1414 Aql=392=Wakuda's Variable Star in Aql(1984)[185, *Wakuda*].

V1415 Aql=396=IRC 00450= =AFGL 2440= =IRAS 19412+0337= =NSV 12342.

V1416 Aql=401=IRC+10451= =AFGL 2511[002]= =IRAS 20052+0554= =NSV 12814.

V833 Ara=304=IRAS 17364-4537 [144].

V834 Ara=314=CoD-51°11145(9.9)= =CPD-51°10582(9.4)= =HD 161459(A2)[157]= =SAO 245045.

α Ara=293=α Ara=HR 6510 [150]=CoD-49°11511 (2.9)=CPD-49°10052 (4.3)=HD 158427 (B3p)=SAO 228069= =IRAS 17279-4950= =NSV 08999.

WZ Ari=057=BD+25°497(8.0)= =HD 19485(G5)[001]= =SAO 075751.

XX Ari=059=BD+18°459(7.3)= =HD 20629(A0)[021]= =SAO 093386.

V393 Aur=161=AFGL 815= =IRC+40140[060]= =IRAS 05440+4311= =NSV 02629.

V394 Aur=164=HR 2146[062]= =BD+29°1112(6.0)= =HD 41429(Ma)= =SAO 077958=ADS 4673= =IRC+30137= =IRAS 06031+2931.

V395 Aur=166=BD+28°1062(7.5)= =HD 43246(A2p)[064]= =SAO 078165=AS 122.

CX Boo=234=GD 165[125]= =WD 1422+095=L1124-10= =LTT 14236.

CC Cam=098=TAV 0451+69[024, *Collins*]= =IRAS 04518+6922.

ES Cnc=183=Blue straggler in M 67=Sanders 1082= =Fagerholm 131=vM 160= =RGO 417=NSV 04276.

ET Cnc=184=III-79 (M 67=NGC 2682)[080].

EU Cnc=185=II-222 (M 67=NGC 2682)[080].

EV Cnc=186=III-2 (M 67=NGC 2682)[080]= =Sanders 1036= =Fagerholm 161= =NSV 04277.

EW Cnc=187=III-12 (M 67=NGC 2682)[080]= =Sanders 1280= =Fagerholm 184.

EX Cnc=188=Sanders 1284 (M 67=NGC 2682)[080]= =Fagerholm 190[237].
EY Cnc=189=III-210 (M 67=NGC 2682)[080].
EZ Cnc=190=Wr 102[085]= =CVS 6669=NSV 04285.
HR CMa=168=HR 2392[049]= =BD-11°1520(7.0)= =HD 46407(K0p)[065]= =SAO 151625= =IRAS 06304-1107= =NSV 03024. The indication of variability in [049] is most probably due to a misprint.
HS CMa=169=Wakuda's star[066, *Wakuda*].
AW Cap=411=BD-18°5731(9.4)= =HD 196470(A2)[157].
V432 Car=207=He 3-591=Wray 751= =IRAS 11065-6026[100].
V668 Cas=002=AFGL 67[002]= =IRAS 00247+6922.
V669 Cas=007=AFGL 230[225]= =OH 127.81-0.02= =IRAS 01304+6211.
V670 Cas=018=M 311[015].
V671 Cas=019=M 286[015].
V672 Cas=020=M 299[015].
V673 Cas=022=M 292[015].
V674 Cas=023=M 290[015].
V675 Cas=024=M 283[015].
V676 Cas=025=M 287[015].
V677 Cas=027=M 306[015].
V678 Cas=028=M 280[015].
V679 Cas=030=M 288[015].
V680 Cas=031=M 294[015].
V681 Cas=033=M 312[015].
V682 Cas=034=M 298[015].
V683 Cas=035=M 303[015].
V684 Cas=036=M 297[015].
V685 Cas=037=M 289[015].
V686 Cas=038=M 302[015].
V687 Cas=039=M 279[015].
V688 Cas=041=M 307[015].
V689 Cas=042=M 309[015].
V690 Cas=043=M 278[015].
V691 Cas=044=M 308[015].
V692 Cas=045=M 282[015].
V693 Cas=046=M 304[015].
V694 Cas=047=M 284[015].
V695 Cas=048=M 296[015].
V696 Cas=049=M 281[015].
V697 Cas=050=M 300[015].
V698 Cas=051=M 305[015].
V699 Cas=052=M 291[015].
V700 Cas=053=M 293[015].
V701 Cas=060=AFGL 482[229]= =IRAS 03186+7016.
V702 Cas=431=S 10104[203]= =NSV 14387.
V857 Cen=209=Gliese 431[095]= =LHS 2423=L396-7.
V858 Cen=210=CoD-37°7355(9.6)= =CPD-37°4818(9.7)= =SAO 202618[106]= =EXOSAT 1133-3745.
V859 Cen=211=11432-6142[107].
V860 Cen=212=11439-6151[107].
V861 Cen=213=11500-6153[107]= =IRAS 11500-6153.
V862 Cen=214=11536-6142[107].
V863 Cen=217=HR 4618[103, *Balona, Egan*]= =CoD-49°6813(4.8)= =CPD-49°4867(5.0)= =HD 105382(B5)= =SAO 239687= =IRAS 12054-5022.
V864 Cen=224=WR 50[117]= =LSS 3013=The 17-84.
V865 Cen=225=13190-6251[107]= =IRAS 13190-6251.
V866 Cen=228=13331-6304[107].
V867 Cen=229=13352-6249[107].
V868 Cen=231=Nova Cen 1991 [111].
V869 Cen=232=HR 5296= =CoD-50°8294(6.3)= =CPD-50°6654(9.6)= =HD 123515(B9)= =SAO 241491=NSV 06565. Slowly pulsating B star.
V375 Cep=427=Var(NGC 7142) [219].
V376 Cep=428=BD+82°674(8.0)= =HD 209943(F5)= =SAO 003675= =ADS 15571B[001]= =IRAS 22001+8237.
V377 Cep=434=BD+85°399(7.5)= =HD 221142(F0)[250, 222]=SAO 003904= =Zi 2145=CSV 102262= =NSV 14566.
V378 Cep=435=BD+85°403(7.8)= =HD 221829(A5)[250, 222]=SAO 003926= =SVS 2879.

BN Cet=010=BD-19°384(9.3)=
=HD 12932(A5)[009].
BO Cet=011=H 0204-022[010].
BP Cet=021=SVS 2876[016, *Goranskij*].
BQ Cet=029=SVS 2877[016, *Goranskij*].
BR Cet=032=SVS 2878[016, *Goranskij*].
BS Cet=040=BD-15°473(6.8)=
=HD 16723(A5)[017]=
=SAO 148538.
BT Cet=436=SVS 2874[016, *Goranskij*].
TY Col=162=EXO 05609-3804.5 [106].
V695 CrA=325=IRAS 17555-3847 [144].
V696 CrA=326=IRAS 17566-3801 [144].
V697 CrA=327=IRAS 17570-3748 [144].
V698 CrA=328=IRAS 17589-3827 [144].
V699 CrA=329=IRAS 17595-3712 [144].
V700 CrA=330=IRAS 17599-3746 [144].
V701 CrA=381=HR 7197=
=CoD-38°13300(6.1)=
=CPD-38°7685(6.6)=
=HD 176723(F0)[017]=
=SAO 210859.
UW CrB=245=MS 1603.6+2600 [136].
UX CrB=246=MS 1614.9+3114=
=1E 1615.0+3114[139].
TV Crv=220=Cataclysmic var in Crv[113,*Tombaugh*]=
=Nova? Crv 1931.
CF Cru=215=12023-6230[107]=
=IRAS 12023-6230.
Carbon star Cen 80 [108].
CG Cru=216=12032-6229[107].
Carbon star Cen 86 [108].
CH Cru=222=HR 4823=
=CoD-58°4692(5.0)=
=CPD-59°4393(5.4)=
=HD 110335(B8p)=
=SAO 240161=MWC 223=
=IRAS 12390-5924=
=Zi 958=CSV 1910=
=NSV 05858.
V1964 Cyg=391=SVS 2882[184].
V1965 Cyg=393=IRC+30374=
=AFGL 2417=
=IRAS 19321+2757=
=NSV 12165. Not identical with V1129 Cyg.
V1966 Cyg=395=BD+30°3639(9.3) [189]=HD 184738(Ocp)=
=AFGL 4251=
=IRAS 18327+3024.
V1967 Cyg=397=BD+29°3730(8.3)=
=HD 186860(Ma)=
=SAO 068801=
=IRC+30391=
=RAFGL 5426S=
=IRAS 19437+3008=
=DHK 12[014]=NSV 12387.
V1968 Cyg=400=CRL 2494[232]=
=AFGL 2494[002]=
=IRAS 19594+4047.
V1969 Cyg=403=CRL 2513[232]=
=AFGL 2513[002]=
=IRAS 20072+3116.
V1970 Cyg=405=BD+46°2892(9.5)=
=IRAS 20142+4645=
=DHK 21[034].
V1971 Cyg=406=BD+31°4046(7.9)=
=HD 193891(K0)[001]=
=SAO 069890=
=IRAS 20195+3209.
V1972 Cyg=408=MWC 342[193]=
=LSII+39°41=He 3-1892.
V1973 Cyg=409=BD+40°4145(9.5)=
=HDE 229189(A5)[195]=
=Hoag 5(NGC 6910).
V1974 Cyg=410=Nova Cyg 1992[196, *Collins*].
V1975 Cyg=413=V 11[202]=MS 11=
=S 10059[203]=
=IRAS 20418+3417=
=NSV 13264.
V1976 Cyg=414=V 31[202]=MS 31=
=IRAS 20457+3408.
V1977 Cyg=415=AS 442[206,192]=
=MHα 235-36=SVS 2880=
=NSV 13308.
V1978 Cyg=416=V 45[202]=MS 45=
=IRAS 20469+3312.
V1979 Cyg=417=V 61[202]=MS 61.
V1980 Cyg=418=E 5[207]=LkHα 321=
=HRC/HBC 303=
=IRAS 21002+4939=
=NSV 13477.
V1981 Cyg=419=HR 8062[198]=
=BD+44°3679(6.8)=
=HD 200527(Mb)=
=SAO 050381=IRC+40464=
=AFGL 2689.

V1982 Cyg=420=E 12=LkHα 324 [210]=HRC/HBC 305= =IRAS 21023+5002= =NSV 13505.
V1983 Cyg=421=BC 45[211].
V1984 Cyg=426=SVS 2881[217, *Shugarov*].
EI Dra=235=BD+61°1435(8.1)= =HD 127759(F0)= =SAO 016405[127].
EK Dra=237=BD+64°1017(7.3)= =HD 129333(F8)[130, 242]=SAO 016453= =Gliese 559.1.
EL Dra=239=SVS 2887[131, *Smekhov*].
EM Dra=272=VIII-10 [147, *Wirtanen,Stryker*].
EN Dra=307=VIII-58 [147, *Wirtanen,Stryker*].
EO Dra=347=IRC+50278= =IRAS 18196+5030= =NSV 10701.
EP Dra=385=H 1907+690[180].
EQ Dra=390=TASV 1924+57[035]= =IRAS 19243+5707.
EO Eri=096=IRC-20062[033]= =IRAS 04430-2356= =NSV 01710.
OZ Gem=178=IRC+30187= =AFGL 1141= =IRAS 07308+3037= =NSV 03641.
CF Gru=425=2138-453[215].
V832 Her=274=BD+26°2976(8.6)= =HD 155989(G5)[001]= =SAO 084940.
V833 Her=297=IRC+20326= =AFGL 1977[002]= =IRAS 17297+1747= =NSV 09118.
V834 Her=310=BD+29°3087(8.1)= =HD 160952(K0)[001]= =SAO 085326.
V835 Her=324=BD+36°2975(7.5)= =HD 163621(G5)[001]= =SAO 066472= =IRAS 17536+3611.
V836 Her=337=HDE 341703(K0)= =TASV 1809+23[245].
V837 Her=376=IRC+10374[002]= =AFGL 2241= =IRAS 18413+1354= =NSV 11263.
V838 Her=378=Nova Her 1991[170, *Sugano,Alcock*].
γ Her=247=γ Her=20 Her= =HR 6095=BD+19°3086 (3.0)=HD 147547(F0)= =SAO 102107=ADS 10022= =IRC+20296= =IRAS 16197+1916= =Zi 1237=CSV 101580= =NSV 07667.
WX Hor=085=CoD-52°776(7.1)= =CPD-52°456(8.2)= =HD 24306(Mb)= =SAO 233291=BV 1583 [230]=IRAS 03482-5213= =NSV 01382.
LX Hya=195=BD-19°2674(8.0)= =CPD-19°4064(8.3)= =HD 80316(A3)[239,090]= =SAO 177244.
LY Hya=227=Cataclysmic var 1329-294 in the M 83 (=NGC 5236) region [119,120].
LZ Hya=230=CoD-28°10204(9.3)= =CPD-28°4738(9.0)= =HD 119027(A3)[121].
BT Hyi=056=CoD-82°53(9.1)= =CPD-82°54(8.6)= =HD 19918(A5)[020]= =SAO 258324.
DU Leo=197=BD+26°1996(9.0)= =HD 84207(G0)= =SAO 080992=DHK 16 [093].
DV Leo=199=BD+10°2067(8.0)= =HD 85720(Mb)= =SAO 098835=IRC+10219= =RAFGL 4758S= =IRAS 09513+1029= =DHK 15[093].
DW Leo=203=BD+15°2197(8.5)= =HD 90385(G0)[001]= =SAO 099117.
HU Lup=238=CoD-51°8802(8.5)= =CPD-51°7609(8.0)= =HD 134185(A2)[017]= =SAO 242278.
HV Lup=240=CoD-44°10140(8.0)= =CPD-44°7405(7.9)= =HD 137518(B0)[243]= =SAO 225814=BV 450= =LSS 3359=NSV 07086.
HW Lup=242=Sz 69[134]=

=The 15-2=LHα 450-5=
=He 3-1096=HBC 598.
BI Lyn=193=PG 0900+401[088].
V489 Lyr=380=New longperiodic variable star[176]= =SVS 2873.
V490 Lyr=387=New variable star in Lyra[182]=SVS 2875.
AF Men=103=SHV 0514426-744238 /LMC[041]. LMC non-member [042].
AG Men=159=SHV 0542021-732216 /LMC[041]= =IRAS 05420-7322. Foreground star.
V690 Mon=170=No.2 in the NGC 2264 region[067, 068].
V691 Mon=171=No.16 in the NGC 2264 region[067, 068]. Co-ordinates in [067,068] are wrong.
V692 Mon=172=No.13 in the NGC 2264 region[067, 068].
V693 Mon=173=No.27 in the NGC 2264 region[067, 068].
V694 Mon=175=MWC 560[233]= =LSS 391= =IRAS 07233-0737. A symbiotic-like system with spectral emissions accompanied with broad violet-shifted absorptions; Doppler velocities sometimes reach 6000 km/s. According to [234], total B amplitude in 1928-1990 was about 3 mag.
V695 Mon=179=HR 3135=BD-2°2379 (6.8)=HD 65875(B3p)= =SAO 135368=MWC 190= =NSV 03857.
GU Mus=208=Nova Mus 1991 [102]=GRS 1121-68= =GS 1124-683.
V350 Nor=243=CoD-59°5980(9.3)= =CPD-59°6557(8.8)= =HD 143309(B8)[226]= =SAO 253396=No.12 (NGC 6025). Slowly pulsating B star.
CK Oct=402=CoD-79°800(10.0)= =CPD-79°1062(8.8)= =HD 190290(A0)[157].
V2251 Oph=250=Haro 1-8[142]= =HRC 261=Do-Ar 28= =NSV 07720.
V2252 Oph=255=Haro 1-14[142]= =HRC 267=Do-Ar 42= =NSV 07776.
V2253 Oph=260=CoD-26°11634(8.2)= =CPD-26°5749(8.4)= =HD 152178(K0)[001]= =SAO 184742.
V2254 Oph=264=IRAS 17005-2946 [144].
V2255 Oph=265=IRAS 17030-2801 [144].
V2256 Oph=268=IRAS 17042-2833 [144].
V2257 Oph=269=IRAS 17046-2701 [144].
V2258 Oph=270=IRAS 17046-2758 [144].
V2259 Oph=271=IRAS 17047-2707 [144].
V2260 Oph=273=IRAS 17062-2758 [144].
V2261 Oph=275=IRAS 17134-2516 [144].
V2262 Oph=276=IRAS 17135-2551 [144].
V2263 Oph=277=IRAS 17157-2355 [144].
V2264 Oph=278=Nova Oph 1991[148, *Camilleri*].
V2265 Oph=279=IRAS 17172-2435 [144].
V2266 Oph=280=IRAS 17202-2244 [144].
V2267 Oph=282=IRAS 17229-2059 [144].
V2268 Oph=283=IRAS 17230-2135 [144].
V2269 Oph=284=IRAS 17237-2138 [144].
V2270 Oph=285=IRAS 17241-2202 [144].
V2271 Oph=286=IRAS 17244-2131 [144].
V2272 Oph=287=IRAS 17249-2140 [144].
V2273 Oph=288=IRAS 17260-2101 [144].
V2274 Oph=289=IRAS 17264-2037 [144].
V2275 Oph=290=IRAS 17267-2122 [144].
V2276 Oph=291=IRAS 17275-1933 [144].

V2277 Oph=292=IRAS 17276-2029 [144].
V2278 Oph=294=IRAS 17287-1955 [144].
V2279 Oph=295=Comparison star 1 for GX9+9 (=V2216 Oph)[151].
V2280 Oph=296=IRAS 17292-1931 [144].
V2281 Oph=298=IRAS 17304-1933 [144].
V2282 Oph=299=IRAS 17304-1947 [144].
V2283 Oph=300=IRAS 17323-1833 [144].
V2284 Oph=302=IRAS 17357-1704 [144].
V2285 Oph=305=IRAS 17365-1641 [144].
V2286 Oph=306=IRAS 17367-1656 [144].
V2287 Oph=308=IRAS 17382-1704 [144].
V2288 Oph=309=S 4176=CSV 3382= =NSV 9538.
V2289 Oph=311=IRAS 17401-1605 [144].
V2290 Oph=312=Nova Oph 1991 No.2[156,*Camilleri*].
V2291 Oph=355=HR 6902[169,001]= =BD+ 7°3682(5.8)= =HD 169689(G0)= =SAO 123462= =IRAS 18232+0800.
V1202 Ori=099=HV 10400=CSV 464= =NSV 01776.
V1203 Ori=104=Ton 261[043].
V1204 Ori=105=Ton 257[044, *Haro,Gonzalez*]=No.17.
V1205 Ori=106=Ton 263[043].
V1206 Ori=107=Ton 260[044, *Haro,Gonzalez*]=No.52.
V1207 Ori=108=Ton 264[043]= =П 786.
V1208 Ori=109=Ton 266[043].
V1209 Ori=110=Ton 268[043].
V1210 Ori=111=Ton 269[043]= =П 1057.
V1211 Ori=112=Ton 270[043].
V1212 Ori=113=Ton 271[043]= =П 1084.
V1213 Ori=114=Ton 272[043].
V1214 Ori=115=LS 6[047]=LS 5= =No.145. The La Silla (LS) numbers in the catalog [045] sometimes deviate from those used in [047]. The co-ordinates are given according to [045]; the equinox indicated in [047] is probably wrong.
V1215 Ori=116=Ton 273[043]= =П 1340.
V1216 Ori=117=Ab 29[048]=No.159= =SVS 1880=NSV 02176.
V1217 Ori=118=Ton 274[043].
V1218 Ori=119=Ton 275[043].
V1219 Ori=120=LS 7[047]=П 1458= =TSN 117=No.174= =CSV 100537=NSV 02196. See remark to V1214 Ori.
V1220 Ori=121=No.3[050]=B 29= =No.179.
V1221 Ori=122=Ton 277[043]= =П 1487=HBC 446=P 218= =CSV 100540=NSV 02198.
V1222 Ori=123=Ton 279[043]= =П 1531.
V1223 Ori=124=Ton 280[043]= =П 1566.
V1224 Ori=125=Ab 138[051]= =No.220.
V1225 Ori=126=B 30=No.229[045, *Parsamian*].
V1226 Ori=127=Ton 281[043].
V1227 Ori=128=JW 347[052]= =П 1782.
V1228 Ori=129=JW 378[052]= =П 1808=NSV 02280.
V1229 Ori=130=JW 589[052]= =П 1925.
V1230 Ori=131=BD-5°1318(10)= =JW 660[052]=П 1956= =CSV 100590=NSV 02309.
V1231 Ori=132=JW 710[052]=E 24 [054]=CSV 6268= =NSV 02319.
V1232 Ori=133=No.1[055]= =П 2033.
V1233 Ori=134=Ton 283[043].
V1234 Ori=135=Ab 139[051]= =No.298=П 2191.
V1235 Ori=136=Ton 329[044]= =No.305=П 2239.
V1236 Ori=137=Ton 330[044]= =No.319=П 2240.
V1237 Ori=138=Ton 331[044]= =No.325=TSN 337=Haro 9 [056]=No.222 in Kiso Area A-0976 [chart: 058]=CSV 6304= =NSV 02384.

V1238 Ori=139=Ton 332[044]= =No.336=TSN 352=Haro 4 [056]=No.234 in Kiso Area A-0976[chart: 058]=CSV 6306= =NSV 02400.
V1239 Ori=140=Ton 287[043].
V1240 Ori=141=LS 5[047]=No.344= =TSN 370=Haro 184[056]= =CSV 6315=NSV 02406.
V1241 Ori=142=Ton 288[043]= =П 2390.
V1242 Ori=143=Ton 290[043].
V1243 Ori=144=Ton 291[043].
V1244 Ori=145=Ton 293[043].
V1245 Ori=146=Ton 335[044]= =No.404.
V1246 Ori=147=LS 4[047]=No.416.
V1247 Ori=148=BD-1°983(9.5)= =HD 290764(A5)[017].
V1248 Ori=149=Ton 336[044]= =No.430=П 2593.
V1249 Ori=150=Ton 294[043].
V1250 Ori=151=LS 11[047]= =No.450.
V1251 Ori=152=Ton 295[043].
V1252 Ori=153=LS 12[047]= =No.453.
V1253 Ori=154=Ton 296[043].
V1254 Ori=155=Ton 297[043]= =П 2797.
V1255 Ori=156=Ton 338[044]= =No.468.
V1256 Ori=157=Ton 339[044]= =No.471.
V1257 Ori=158=Ton 298[043].
V1258 Ori=160=DHK 10[014]= =IRC 00085= =IRAS 05429-0415= =NSV 02622.
V1259 Ori=163=AFGL 865=CRL 865 [232]=IRAS 06012+0726.
V1260 Ori=167=BD+13°1200(8.5)= =HD 43930(G5)[001]= =SAO 095536.
V344 Pav=386=Dwarf Nova in Pavo [181,*Wischnjewsky*].
KV Peg=422=1E 2119.7+1.655 [212].
KW Peg=423=New variable in the BX Peg field[213]= =Comparison star w for BX Peg.
KX Peg=430=BD+29°4645(7.5)= =HD 212280[249,220] (G0)=SAO 072275= =ADS 15883A.

V502 Per=012=BD+56°484(9.1)= =SAO 023136=Oo 309 (h,χ Per)[011].
V503 Per=013=BD+56°548(9.2)= =Oo 1702 (h,χ Per) [011].
V504 Per=014=BD+56°559(9.5) [226]=Oo 1926 (h,χ Per).
V505 Per=015=BD+53°507(6.5)= =HD 14384(F5)= =SAO 023229=DHK 11 [014,*Kaiser*].
V506 Per=016=BD+56°563(9.3)= =Oo 2088 (h,χ Per)= =MWC 36=NSV 00794.
V507 Per=017=BD+56°566(9.4)= =Oo 2165 (h,χ Per)= =Ed 329=NSV 00796.
V508 Per=026=M 310[015].
V509 Per=054=BD+47°760(7.0)= =HD 18878(F0)[018, *Kusakin*]=SAO 038543.
V510 Per=058=BD+43°657(7.3)= =HD 19942(G5)[001]= =SAO 038659.
V511 Per=061=BD+39°784(8.2)= =HD 21155(B8)= =SAO 038830=DHK 9[014].
V512 Per=062=SVS 13[022,023] in HH7-11 region= =HBC 346= =IRAS 03259+3105.
V513 Per=063=TAV 0329+41[024, *Collins*]=CCS 149[025]= =IRAS 03291+4116.
γ Per=055=γ Per[019]=23 Per= =HR 915=BD+52°654(3.2)= =HD 18925/6(F5,A3)= =SAO 023789=ADS 2324= =IRC+50084= =IRAS 03011+5318.
BE Psc=005=BD+25°161(8.5)= =HD 6286(G0)[001]= =SAO 074467.
BF Psc=006=BD+15°227(8.0)= =HD 9313(G5)[001]= =SAO 092489.
BG Psc=008=BD+19°269(8.5)= =HD 9902(G5)= =SAO 074827= =EXOSAT 0134+2026[007].

BH Psc=437=BD-3°5741(7.3)= =HD 224639(F0)[251]= =SAO 147015.
UU PsA=429=HR 8408[150]= =CoD-27°15757(6.1)= =CPD-27°7371(6.0)= =HD 209522(B5)= =SAO 190864=NSV 14011.
V347 Pup=165=LB 1800[063]= =4U 0608-49= =XRS 06084-491.
V348 Pup=174=1H 0709-360[069].
V349 Pup=176=CoD-33°3857(7.5)= =CPD-33°1515(7.6)= =HD 59594(A2)[072]= =SAO 198048.
V350 Pup=177=CoD-33°3879(7.5)= =CPD-33°1536(7.6)= =HD 59864(B0)[235]= =SAO 198063.
V351 Pup=180=Nova Pup 1991[075, *Camilleri*].
VY Pyx=191=BD-22°2440(7.2)= =CoD-23°7878(7.5)= =CPD-23°4210(7.6)= =HD 76296(G0)= =SAO 176679=BV 690 [238]=NSV 04298.
VZ Pyx=192=1H 0857-242[087].
WW Pyx=194=Comparison star u=c for T Pyx[089, *Baldwin*].
QZ Sge=398=9 Sge[190]= =HR 7574=BD+18°4276 (6.6)=HD 188001(Oe)= =SAO 105360= =CSV 102965=NSV 12503.
V335 Sge=404=BD+16°4199(9.3)= =HD 192446(Mb)= =IRC+20460= =IRAS 20120+1651= =CSS 639=Wr 41[248]= =DHK 20[034]=CSV 8465= =NSV 12930.
V4154 Sgr=331=IRAS 18018-3605 [144].
V4155 Sgr=332=IRAS 18024-3543 [144].
V4156 Sgr=333=IRAS 18060-3451 [144].
V4157 Sgr=334=Nova Sgr 1992[208, *Liller,Camilleri*] No.1.
V4158 Sgr=335=IRAS 18078-3511 [144].
V4159 Sgr=336=BD-16°4747(8.2)= =HD 166540(B2)[160]= =SAO 161164=LSS 4746.
V4160 Sgr=338=Probable Nova Sgr 1991[162,*Camilleri*].
V4161 Sgr=339=IRAS 18129-3305 [144].
V4162 Sgr=340=IRAS 18136-3303 [144].
V4163 Sgr=341=IRAS 18149-3141 [144].
V4164 Sgr=342=IRAS 18163-3106 [144].
V4165 Sgr=343=IRAS 18169-3035 [144].
V4166 Sgr=344=IRAS 18169-3006 [144].
V4167 Sgr=345=IRAS 18173-3107 [144]. May be identical with Prager 1588= =672.1933=HV 9390= =CSV 4015=NSV 10639.
V4168 Sgr=346=IRAS 18179-3033 [144].
V4169 Sgr=348=Nova Sgr 1992 No.2[166,*Liller*].
V4170 Sgr=349=IRAS 18204-3027 [144].
V4171 Sgr=350=Nova Sgr 1992 No.3 [168,*Camilleri*].
V4172 Sgr=351=IRAS 18217-2906 [144].
V4173 Sgr=352=IRAS 18220-2920 [144].
V4174 Sgr=353=IRAS 18224-2756 [144].
V4175 Sgr=354=IRAS 18225-2852 [144].
V4176 Sgr=356=IRAS 18260-2619 [144].
V4177 Sgr=357=IRAS 18264-2720 [144].
V4178 Sgr=358=IRAS 18267-2603 [144].
V4179 Sgr=359=IRAS 18267-2715 [144].
V4180 Sgr=360=IRAS 18273-2632 [144].
V4181 Sgr=361=IRAS 18274-2657 [144].
V4182 Sgr=362=IRAS 18282-2536 [144].
V4183 Sgr=363=IRAS 18287-2611 [144].
V4184 Sgr=364=IRC-20491= =IRAS 18290-2459[144]= =NSV 10970.
V4185 Sgr=365=IRAS 18290-2642 [144].

V4186 Sgr=366=IRAS 18305-2447 [144].
V4187 Sgr=367=IRAS 18307-2604 [144].
V4188 Sgr=368=IRAS 18311-2546 [144].
V4189 Sgr=369=IRAS 18319-2442 [144].
V4190 Sgr=370=HR 6969= =BD-20°5189(6.5)= =CPD-20°7069(7.4)= =HD 171369(A5)= =SAO 187012.
V4191 Sgr=371=IRAS 18341-2357 [144].
V4192 Sgr=372=IRAS 18347-2351 [144].
V4193 Sgr=373=IRAS 18351-2325 [144]. Close to V4021 Sgr.
V4194 Sgr=374=IRAS 18351-2304 [144].
V4195 Sgr=375=IRAS 18357-2208 [144].
V4196 Sgr=377=IRAS 18414-1959 [144].
V4197 Sgr=383=BD-19°5292(8.0)= =CPD-19°7289(8.0)= =HD 177559(B5)= =SAO 162180=BV 888 [173]=NSV 11722.
V4198 Sgr=384=HR 7241[123]= =BD-18°5206(6.5)= =HD 177863(B8)= =SAO 162204=Zi 1599= =CSV 101800=NSV 11743. Slowly pulsating B star.
V4199 Sgr=388=HR 7339[123]= =BD-19°5412(6.5)= =CPD-19°7420(6.8)= =HD 181558(B8)[246]= =SAO 162511.
V4200 Sgr=399=HR 7578[001]= =CoD-24°15668(6.4)= =CPD-24°6848(7.4)= =HD 188088(K0)= =SAO 188692=ADS 13072A= =IRAS 19512-2404.
V978 Sco=248=F2 in the NGC 6139 region[141].
V979 Sco=249=F1 in the NGC 6139 region[141].
V980 Sco=251=F4 in the NGC 6139 region[141].
V981 Sco=252=F6 in the NGC 6139 region[141].
V982 Sco=253=F3 in the NGC 6139 region[141].
V983 Sco=254=F5 in the NGC 6139 region[141].
V984 Sco=256=IRAS 16298-3602 [144].
V985 Sco=257=IRAS 16374-3531 [144].
V986 Sco=258=IRAS 16439-3312 [144].
V987 Sco=259=IRAS 16455-3255 [144].
V988 Sco=261=IRAS 16508-3120 [144].
V989 Sco=262=IRAS 16537-3112 [144].
V990 Sco=263=IRAS 16549-3053 [144].
V991 Sco=266=CoD-37°11275(9.4)= =CPD-37°6939(9.2)= =HD 154338(G5)[106].
V992 Sco=267=Nova Sco 1992[145, *Camilleri*].
V993 Sco=301=IRAS 17334-4519 [144].
V994 Sco=303=CoD-32°13072(7.3)= =CPD-32°4686(7.5)= =HD 160124(B5)= =SAO 209092=No.100 (NGC 6405)=NSV 09397. Slowly pulsating B star.
V995 Sco=316=IRAS 17449-4242 [144].
V996 Sco=320=IRAS 17507-4010 [144].
V997 Sco=321=IRAS 17509-3956 [144].
V998 Sco=322=IRAS 17524-4006 [144].
V999 Sco=323=IRAS 17533-3910 [144].
AX Scl=438=Flare star in the Blanco 1 region[076].
V444 Sct=379=Possible Nova Sct [174]=Nova Sct 1991.
NQ Ser=244=BD+11°2910(8.5)= =HD 144515a(G5)[001]= =SAO 101919.
NR Ser=313=IRAS 17440-1404 [144].
NS Ser=315=IRAS 17446-1415 [144].
NT Ser=317=IRAS 17457-1347 [144].
NU Ser=318=IRAS 17457-1301 [144].

NV Ser=319=IRAS 17478-1227 [144].
TT Sex=198=BD-5°2898(9.2)= =HD 84617(Ma)= =IRC-10224= =RAFGL 4754S= =IRAS 09439-0547= =DHK 18[034]=NSV 04621.
V1029 Tau=064=No.47[026]. Co-ordinates in [026] are wrong.
V1030 Tau=065=Nos.19,20[026]. Co-ordinates in [026] are wrong.
V1031 Tau=066=No.57[026]. Co-ordinates in [026] are wrong.
V1032 Tau=067=No.55[026]. Co-ordinates in [026] are wrong.
V1033 Tau=068=No.28[026]. Co-ordinates in [026] are not accurate.
V1034 Tau=069=Nos.100,101[026]. Co-ordinates in [026] are wrong.
V1035 Tau=070=No.79[026]. Co-ordinates in [026] are wrong.
V1036 Tau=071=Nos.75,76[026].
V1037 Tau=072=No.18[026]= =HII 290. Co-ordinates in [026] are wrong.
V1038 Tau=073=HII 314[028].
V1039 Tau=074=No.54[026]= =HII 342. Co-ordinates in [026] are wrong.
V1040 Tau=075=No.97[026]= =HII 456. Co-ordinates in [026] are wrong.
V1041 Tau=076=HII 738[025,029].
V1042 Tau=077=No.21[026]= =HII 911. Co-ordinates in [026] are wrong.
V1043 Tau=078=No.33[026]. Co-ordinates in [026] are wrong.
V1044 Tau=079=No.59[026]= =HII 943. Co-ordinates in [026] are wrong.
V1045 Tau=080=HII 996[028].
V1046 Tau=081=HII 1207[028].
V1047 Tau=082=No.45[026]. Co-ordinates in [026] are wrong.
V1048 Tau=083=HII 2381[029].
V1049 Tau=084=Nos.38,85,89,96 [026]=HII 2959. Co-ordinates in [026] are wrong.
V1050 Tau=086=No.24[026]. Co-ordinates in [026] are wrong.
V1051 Tau=087=HII 2984[029].
V1052 Tau=088=No.6[026]= =HII 3064. Co-ordinates in [026] are wrong.
V1053 Tau=089=No.87[026]. Co-ordinates in [026] are wrong.
V1054 Tau=090=HII 3096[029].
V1055 Tau=091=No.88[026]. Co-ordinates in [026] are wrong.
V1056 Tau=092=Nos.42,43[026]. Co-ordinates in [026] are wrong.
V1057 Tau=093=No.16[026]. Co-ordinates in [026] are wrong.
V1058 Tau=094=Nos.73,74[026]. Co-ordinates in [026] are wrong.
V1059 Tau=095=w on the chart for MHα 259-19[032, *Kurochkin*]=SVS 1099= =B 88[031]=CSV 6126= =NSV 01699.
V1060 Tau=097=BD+15°691(9.4)= =HD 30710(Na)=DHK 24 [034]=IRC+20094= =IRAS 04477+1542= =Zi 312=CSV 100413= =NSV 01737.
V1061 Tau=100=BD+24°719(8.0)= =HD 31679(B5)= =SAO 076868=DHK 14[093, *Kaiser*].
V1062 Tau=101=H 0459+246[010].
V1063 Tau=102=KUV 05134+2605 [039].
QR Tel=407=CoD-52°9483(8.7)= =CPD-52°11681(8.4)= =HD 193756(F0)[157]= =SAO 246562.
XX Tri=009=BD+34°363(7.8)= =HD 12545(G5)[001]= =SAO 055233= =IRAS 02007+3520.
CN Tuc=432=CoD-64°1415(9.0)= =CPD-64°4322(8.6)= =HD 218495(A2)[157]= =SAO 255415.

EO UMa=205=BD+42°2145(7.2)=
=HD 93044(F0)[098,240]=
=SAO 043461.

EP UMa=206=HR 4330[241]=
=BD+68°632(6.5)=
=HD 96707(A5)=
=SAO 015414.

LS Vel=181=Flare star in the
IC 2391 region[076].

LT Vel=182=CoD-44°4834(10)=
=CPD-44°3096(9.8)=
=LSS 1160=BV 1200[236]=
=NSV 04260.

LU Vel=200=CoD-45°5627(10)=
=Gliese 375[095]=
=LTT 3661=LHS 2213=
=NSV 04689.

LV Vel=201=PNN Longmore 4
[096]=IRAS 10037-4406.

LW Vel=202=HR 4017=
=CoD-50°4924(5.8)=
=CPD-50°3186(6.5)=
=HD 88824(A5)[017]=
=SAO 237804=
=IRAS 10114-5059.

LX Vel=204=CoD-56°3398(6.5)=
=CPD-56°3448(7.4)=
=HD 91188(B8)[074]=
=SAO 238130=Zi 827=
=CSV 101133=NSV 04879.

II Vir=218=BD-6°3518(6.4)=
=HD 105759(A0)[109]=
=SAO 138625.

IK Vir=219=Star b[110]=
=Feige 58.

IL Vir=221=RR Lyr star[115].

IM Vir=223=BD-5°3578(9.0)=
=HD 111487(G5)[116]=
=SAO 138983=
=1E 1247.0-0548.

IN Vir=226=BD-1°2816(8.8)=
=HD 116544(K5)[007]=
=SAO 139320=
=EXOSAT 1321-0203.

IO Vir=233=AFGL 1686=CRL 1686
[232,112]=
=AFGL No.712-1551=
=OH 334.7+50.0=
=IRAS 14086-0730.

IP Vir=236=SA106/1024[128].

V335 Vul=389=AS 356=CCS 2728=
=IRAS 19211+2421=
=TAV 1921+24[164].
Identification with
BD+24°3730
(=HDE 338337,Sp A1)
suggested in [164] is
wrong.

V336 Vul=394=BD+23°3694(8.4)=
=HDE 344531(M0)=
=IRC+20415=RAFGL 5398S=
=IRAS 19325+2346=BV 142
[247]=DHK 6[014]=
=CSV 8209=NSV 12178.

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SIMULTANEOUS PHOTOMETRY AND RADIAL VELOCITIES OF DELTA SCUTI

It is well known that for some types of pulsating variable stars the application of the Baade-Wesselink method is connected with serious difficulties. Nevertheless, when applicable, this method is a good source of luminosities, radii, etc. for pulsating variables.

If we want to try to apply the Baade-Wesselink method to stars varying their light curves from one cycle to another and having not quite stable periods (like δ Scuti stars), we need to obtain photometric data and radial velocities practically simultaneously. In the literature such material is sparse.

During the recent years we are measuring radial velocities of pulsating variables using the CORAVEL-type spectrophotometer ILS designed by Tokovinin (1987). δ Scuti stars are on the boundary of the possibilities of this device: for main sequence stars we can measure velocities in the spectral type range F5-M5, it being possible to measure somewhat earlier type giants. On July 26/27, 1992 we tried to measure the radial velocity of the prototype star, δ Sct, at the 1-m reflector of the Simeiz International Observatory

Table 1
Radial velocities of Delta Scuti

JD hel 2448...	$V_{r\odot}$	σ	JD hel 2448...	$V_{r\odot}$	σ
830.289	-37.8	0.4	835.282	-40.9	0.4
830.293	-31.9:	0.5	835.284	-39.0	0.4
830.296	-37.8	0.4	835.286	-39.2	0.4
830.301	-37.7	0.2	835.308	-39.2	0.4
830.304	-38.2	0.4	835.311	-38.3	0.4
830.307	-38.9	0.3	835.325	-38.4	0.3
830.332	-43.0	0.9	835.328	-38.3	0.5
830.335	-44.2	0.7	835.345	-39.8	0.7
830.339	-44.4	0.9	835.348	-39.7	0.7
830.354	-57.1:	2.0	835.361	-46.6	0.8
830.354	-52.2:	2.3	835.364	-43.5	0.5
830.357	-52.2:	2.2	835.368	-48.6	0.5
830.357	-57.1:	2.0	835.384	-45.7	1.0
830.375	-47.6:	0.9	835.386	-48.1	0.7
830.378	-51.3:	1.0	835.388	-50.5	0.8
830.380	-48.4:	1.1	835.407	-43.0	0.7
830.398	-44.6	0.7	835.409	-47.2	0.8
830.401	-47.0	0.5	835.411	-46.3	0.7
830.404	-47.2	0.5	835.432	-43.9	0.9
			835.434	-43.1	0.8
			835.448	-42.1	1.3
			835.450	-42.3	0.9

Table 2
Photometry of Delta Scuti

JD hel 2448...	V	$B-V$	$V-R$
835.2941	4.75	0.39	0.32
835.3028	4.77	0.39	0.35
835.3104	4.77	0.40	0.32
835.3173	4.79	0.40	0.35
835.3269	4.79	0.39	0.34
835.3348	4.79	0.39	0.34
835.3381	4.79	0.38	0.34
835.3429	4.74	0.37	0.31
835.3516	4.76	0.35	0.35
835.3582	4.69	0.37	0.33
835.3635	4.66	0.37	0.30
835.3690	4.65	0.36	0.30
835.3772	4.62	0.32	0.29
835.3854	4.62	0.34	0.30
835.3907	4.60	0.33	0.28
835.3960	4.62	0.33	0.30
835.4043	4.59	0.35	0.29
835.4105	4.56	0.32	0.28
835.4167	4.62	0.36	0.29
835.4244	4.64	0.37	0.31
835.4322	4.62	0.35	0.31
835.4377	4.70	0.34	0.35

(Crimea, the Ukraine). The attempt was quite successful, so on July 31/August 1 we organized simultaneous photometric and spectroscopic observations at two telescopes of the Simeiz Observatory. The same 1-m reflector was used for radial velocities, and the photometric obsevations were done at the 60-cm reflector. The photometric conditions, rather typical for Simeiz, were far from being excellent, and we estimate the real accuracy of our results as $\pm 0\overset{m}{.}02 - 0\overset{m}{.}03$ in all filters.

Table 1 contains the radial velocities measured during the two nights, Table 2 the results of photometry during the second night.

We have covered with simultaneous photometric and spectroscopic observations practically a complete cycle of δ Sct ($P=0\overset{d}{.}194$). Then we have undertaken an attempt to use the Baade-Wesselink method (in its "maximum likelihood" version suggested by Balona, 1977, with subsequent iterations described by Coulson et al., 1986). In minor variance with the traditional approach, we approximated with trigonometric polynomials only the radial velocity curve, and then computed the radial velocity integral for the moments when the photometry had been acquired. It seems to us that this modification allows us to reduce the number of avoidable approximations, this being of particular importance for not strictly periodic variables. The unknown ($5 \log e/R_{\circ}$) in Balona's method (before iterations) for our observations is determined with rather poor accuracy (40 to 59 per cent for different combinations of magnitudes and colours), but the final results are in good agreement, their average being $<R>=1.9\pm0.1\ R_{\odot}$. Though a somewhat larger radius would seem preferable, this value does not disagree too much with expectations for an F3III star. Frolov (1970) derived for δ Sct $<R>=2.9\ R_{\odot}$ from its atmospheric parameters and quoted the value $3.7\ R_{\odot}$ from Bessell (1967). Estimates based on the star's luminosity ($M_V \sim +1.5$) and effective temperature lead to radius values about $3\ R_{\odot}$. On the contrary, the value 8.4 $R_\odot$ from Rachkovskaya (1986), based on model atmospheres, is unexpectedly large.

It seems to us that, provided one obtains more accurate photometry, it is possible to use ILS radial velocities with simultaneous photometry for Baade-Wesselink determinations of radii for the large amplitude subgroup of δ Scuti variables.

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NSV10848: A PROBLEMATIC STAR

Estimating the magnitudes of the variable stars in the field of M16-M17 listed in Maffei (1975), we found that the variable M150 (NSV10848) is almost always invisible. More precisely the star is visible only on two infrared plates as shown below.

Date	J.D.	m_I	m_B
1967.09.05	2439739.3384	<16.0	
1967.09.25	759.2798	14.5	
1967.10.03	767.2790	14.4	<17.4
1968.07.04	40042.4876	<15.5	

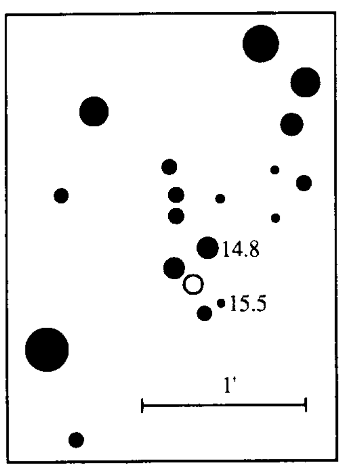

Figure 1. Finding chart

We examined 65 infrared plates (I-N hypers.+RG5) taken with the 65/90 cm Schmidt telescope at Asiago Astrophysical Observatory in the years: 1962, 1967, 1968, 1969, 1970, 1971, 1975 and 1990. The star is invisible also on an infrared UKSTU plate (IV-N+RG715) taken at the date 1984.06.03. The infrared limit magnitude of this plate is 18.0.

We enclose the finding chart, till now not published. North is at the top. The infrared magnitudes of two comparison stars are indicated.

The star might be a nova. In this case it would be very important to search for it on plates obtained near the epoch in which the star was visible during our observations. On the other side this object may be a cataclysmic star. If so, we believe that its true nature could be shown only by a deep monitoring.

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Reference:
Maffei, P., 1975, *IBVS*, No. 985

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HU ISSN 0324 - 0676

A NEW VARIABLE IN SAGITTARIUS

Estimating the photographic infrared magnitude (m_I) of the long period variable V3935 Sgr, a new variable star was discovered. The provisional name of the variable is M313, following the progressive numerations adopted by Maffei (1975). The position is: $\alpha(1950.0)=18^h21^m26^s$; $\delta(1950)=-17°4'25''$. Figure 1 shows the infrared finding chart and the comparison stars.

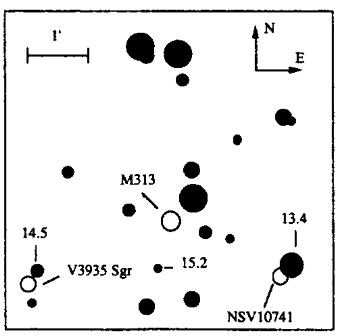

Figure 1. Finding chart

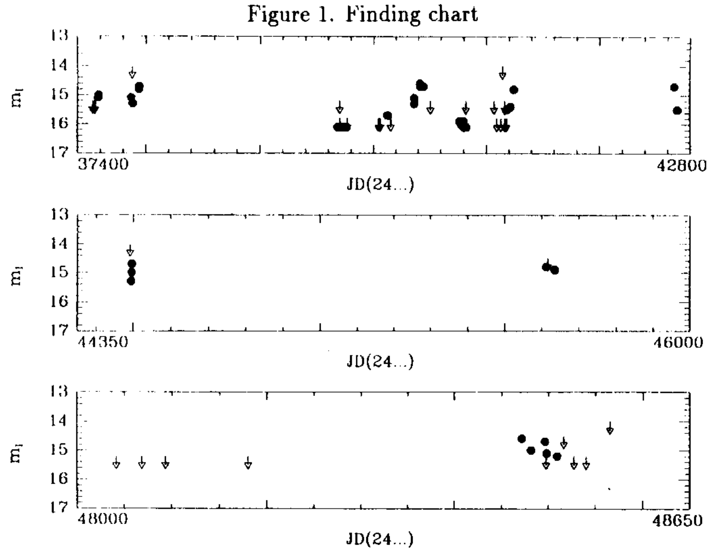

Figure 2. The light curve of the new variable

Table I

JD (24.....)	m_I	JD (24.....)	m_I	JD (24.....)	m_I
37529.40610	<15.2	37544.32360	<15.2	37549.34880	<15.2
37552.33540	<15.2	37578.30590	15.1	37583.30260	15.0
37870.40210	15.1	37880.43510	<14.0	37883.41170	15.3
37940.27980	14.8	37942.27820	14.7	39681.44020	16.1
39699.39910	<15.2	39701.39690	<15.8	39703.36910	16.1
39739.33840	16.1	39759.27980	16.1	39767.27900	<15.8
40042.48760	<15.8	40043.36550	<15.8	40053.36270	<15.8
40057.38290	<15.8	40058.42530	<15.8	40060.49180	<15.8
40124.31040	15.7	40153.24120	<15.8	40362.60070	15.1
40364.57780	15.3	40415.49570	14.6	40417.48050	14.7
40448.50000	14.7	40508.25170	<15.2	40765.46610	15.9
40778.39790	16.0	40780.44500	15.9	40799.34980	15.9
40801.34480	<15.8	40803.33560	<15.8	40805.39580	16.1
40809.35940	<15.8	40821.40790	<15.2	40824.32120	16.1
41068.62440	<15.2	41093.54590	<15.8	41129.49250	<15.8
41143.37700	<14.0	41160.34630	<15.2	41162.37620	<15.8
41163.35470	<15.8	41177.32590	<15.8	41181.37130	15.5
41213.30760	15.4	41215.29690	15.4	41244.25820	14.8
42663.40020	14.7	42688.25690	15.5	42691.24750	15.5
44491.34640	<14.0	44494.36070	15.3	44495.38980	15.0
44496.33970	14.7	45612.25750	14.8	45612.31660	14.8
45616.31230	<14.5	45635.22870	14.9	48041.53150	<15.2
48068.53230	<15.2	48093.41680	<15.2	48180.29570	<15.2
48471.34470	14.6	48481.42310	15.0	48496.34630	14.7
48497.40030	<15.2	48498.33770	15.1	48509.39300	15.2
48516.31310	<14.5	48527.33850	<15.2	48540.25690	<15.2
48565.22270	<14.0				

The photographic infrared plates (I−N(hypers.)+RG5) were taken with the:

−40/50 cm Schmidt telescope at the Asiago Observatory (12 plates the in years 1961, 1962, plus one in 1969);

−65/90 cm Schmidt telescope at the Asiago Observatory (58 plates in the years 1967÷1971, 1975, 1990);

−40/60 cm Schmidt telescope at the Catania Astrophysical Observatory (78 plates in the years 1980, 1983, 1991).

The star M313 is in the field only 79 of all the plates obtained. The estimated m_I shows that the star varies over the observed range of 1.5 magnitudes. The m_I light curve is drawn in Figure 2 (the down arrows indicate when the magnitude of the star is below the limit of the plate). Table I details the values. Search for periodicity was performed with Deeming's method (1975) but no period is supported by a phase diagram. Therefore, at present, the variability type of M313 remains unknown.

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Maffei, P., 1975, *IBVS*, No. 985

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DISCOVERY OF RAPID OSCILLATIONS IN THE Ap STAR HD 42659

In May of 1990 we began the *Cape Rapidly Oscillating Ap (roAp) Star Survey* (Martinez *et al.* 1991), a systematic search for new roAp stars in the Southern sky. In this paper we report the tenth new roAp star to emerge from the Cape Survey. The cool Ap SrCrEu star HD 42659 was monitored photometrically for 5.15 hr on the night 22/23 November 1992 (JD 2448949). The data were acquired using the University of Cape Town Photometer attached to the 0.75-m telescope of the South African Astronomical Observatory (SAAO) at Sutherland. The data comprised continuous 10-s integrations through a Johnson B filter with occasional interruptions for sky background measurements. Inspection of the real-time data display at the telescope indicated the presence of rapid oscillations with a 10-minute period and a Johnson B amplitude of 0.5 mmag. The data were corrected for coincidence-counting losses, sky background and extinction. The resulting instrumental magnitudes were not placed on the standard system. A Fourier transform of the light curve shows a peak at ν = 1.7 mHz corresponding to the signal tentatively identified at the telescope.

HD 42659 has V = 6.768 so the dominant source of noise in these observations is scintillation rather than photon statistics. Because of the extremely low amplitude of these oscillations, we elected to confirm their reality on the larger SAAO 1.0-m telescope using the same photometer as was used in the discovery observations. This is an example of a case where a larger telescope was used not to increase the number of photons counted, but instead to *decrease* the scintillation noise. HD 42659 was observed again on nights JD2448965, 8966, 8967, 8968 and 8969. The 10-min oscillation was evident in the Fourier transform only on the first two nights. On nights 8967 - 8969 there were indications of the 10-min oscillations in the less noisy portions of the light curves, but there were no unambiguous peaks at ν = 1.7 mHz in the Fourier transforms of these light curves.

To obtain further confirming observations at lower noise we switched to using the St Andrews Photometer, which has an autoguider, on the SAAO 1.0-m telescope. The continuous pointing corrections performed by the autoguider minimize the effect of light variations caused by tracking errors in the telescope. This allows us to use smaller apertures when conditions permit and produces more precise photometry than manual guiding. Observations of HD 42659 using this instrumental configuration were acquired on nights JD2449000-9002, 9004 and 9005. The 1.7 mHz signal appears on all these nights.

In Figure 1 we show the amplitude spectra acquired on three good nights. The peak of interest here is the arrowed peak at ν = 1.72 mHz. The other peaks at low frequency are produced by sky transparency variations. Normally we remove such sky transparency variations so that the variance of the data is dominated by the stellar signal standing out against a background of white noise. Here we intentionally include all the low frequency noise to show that we have a convincing detection even in the presence of sky transparency variations.

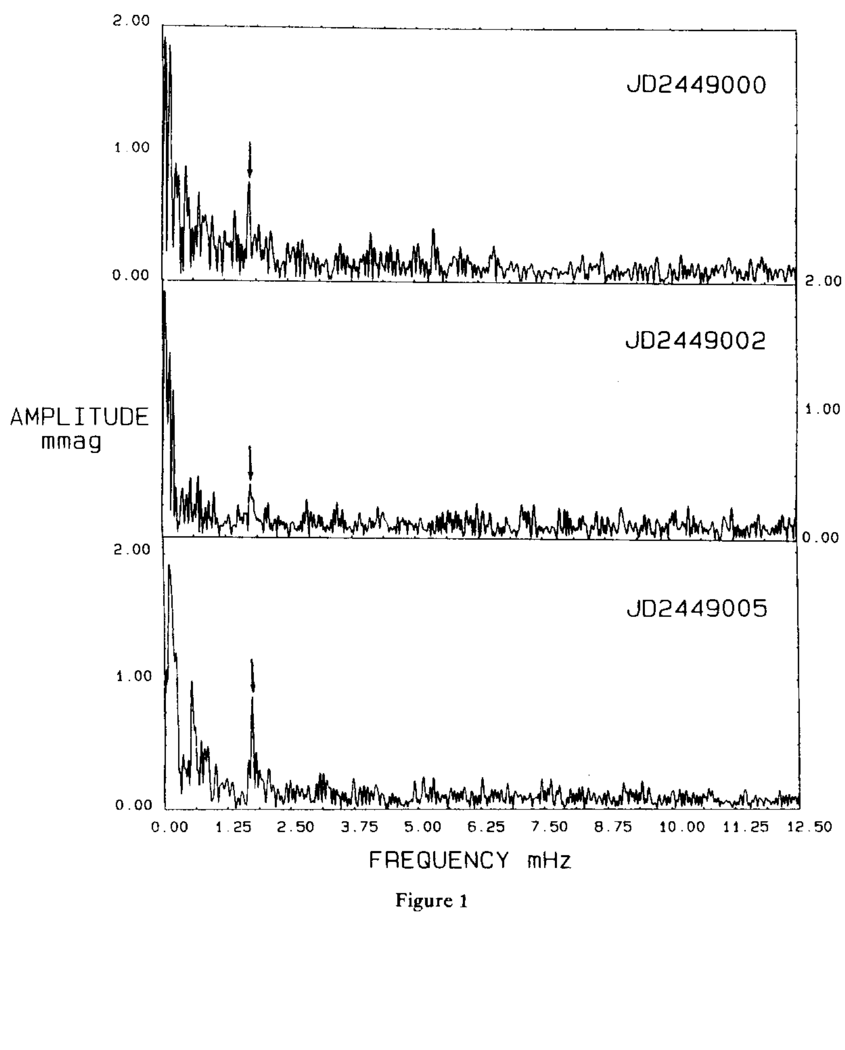

Figure 1

Figure 2 shows the *B* light curve acquired on night JD2449005.

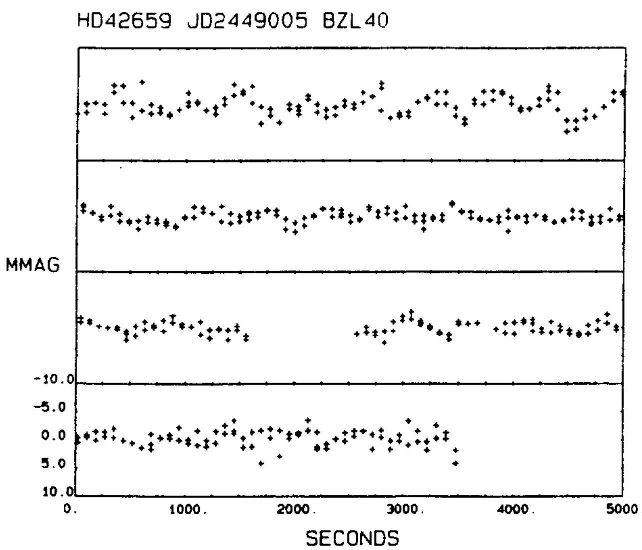

Figure 2

The reality of rapid oscillations in HD 42659 is well established. There is evidence for amplitude modulation of the oscillations since on some nights no signal is seen. However, because the oscillations are at the limit of detectability of the equipment, this star will be very difficult to work on

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22 February 1993
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No long-term variability of PG 0900 + 401

The Palomar Green (Green, Schmidt & Liebert, 1986, hereafter PG) survey object PG0900+401 (sometimes referred to as PG0900+400) has so far received little attention in the literature.

Ferguson, Green & Liebert (1984) obtained the following photoelectric photometry for the star: V=12.^{m}87, B-V=+0.^{m}23, U-B=-0.^{m}96, V-I=+0.^{m}58. They also noticed broad hydrogen absorption lines in the spectrum of the star. No strong emission lines have been detected. Assuming that the object is a binary with a composite spectrum, consisting of a hot subdwarf primary and a cool main-sequence secondary star, they used the flux-ratio diagram method to deconvolve the spectrum. They obtained the result that the secondary component has spectral type K3, and that the primary star's temperature is 31000K.

Lipunova & Shugarov (1990, 1991) carried out photometry of this object and investigated old photographic plates. Neither photographic nor photoelectric data revealed any long term or burst-like variability. Their photoelectric photometry for the star was as follows: V=12.^{m}85, B-V=+0.^{m}2, U-B=-0.^{m}08, V-R=+0.^{m}3. However, comparing their Fig.2a with Fig.2b it seems that the value of the U-B color was misprinted, which must be the reason for the large deviation from the U-B value obtained by Ferguson, Green & Liebert (1984). Lipunova & Shugarov (1991) performed a power spectrum analysis and found two alternative orbital periods: P_1=0.33818d and P_2=0.514d. They also reported the presence of rapid variability with a period of 280 seconds.

We investigated plate number 139 obtained on March 16/17 1963 in the framework of The Torun Spectral Sky Survey (Papaj, 1989). This plate was obtained using objective prism BK7, with a dispersion of 520Å/mm at H gamma; the type of emulsion used was IIa-F. The middle of the 60min exposure time was on JD2438105.405. To obtain the intensity scale of the photographic plate we used the spectra of surrounding stars, together with their photometry given by Lipunova and Shugarov (1991). After a transformation leading to linear dispersion, we used the spectra of the surrounding stars together with their spectral energy distributions (we assumed stars c, d, e, f, k, m to be unreddened dwarfs of types G2, G5, G0, G8, K2 and G5, respectively) from the catalogue of Sviderskiene (1988), and obtained an absolute flux scale by using the flux calibration of UBV photometry given by Straizys (1977). The absolute flux distribution of PG 0900 + 401 we obtained is shown in Fig.1. Table 1 shows fluxes calculated as means of 100Å intervals and their errors are below 10%.

Table 1.
Wavelengths expressed in Å and corresponding absolute fluxes in 10^{-14} ergs s^{-1} cm^{-2} $Å^{-1}$

3400	13.5	4000	4.16	4600	3.35	5200	2.69	5800	2.30	6400	2.18
3500	10.9	4100	3.97	4700	3.21	5300	2.80	5900	2.14	6500	1.95
3600	5.89	4200	3.87	4800	3.05	5400	2.53	6000	2.13	6600	1.70
3700	5.13	4300	3.60	4900	2.63	5500	2.49	6100	2.14	6700	1.87
3800	4.28	4400	3.43	5000	2.40	5600	2.16	6200	2.09	6800	1.86
3900	4.44	4500	3.50	5100	2.54	5700	2.29	6300	2.03		

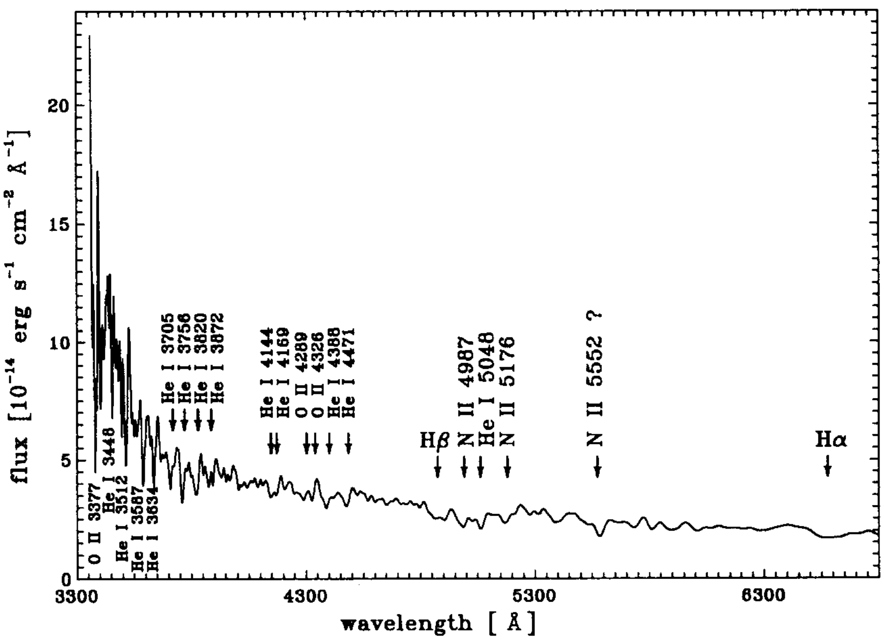

Fig.1. Absolutely calibrated spectrum of PG0900+401 obtained in 1963.

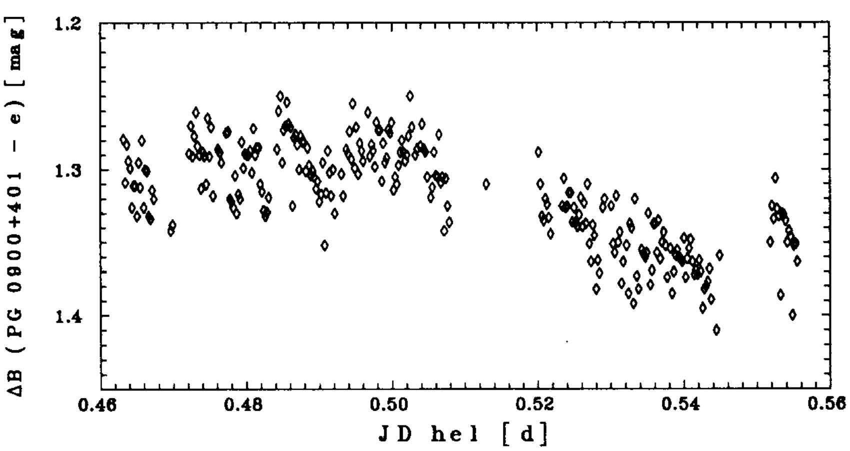

Fig.2. The differential B magnitude of PG0900+401 on Dec.16/17 '92

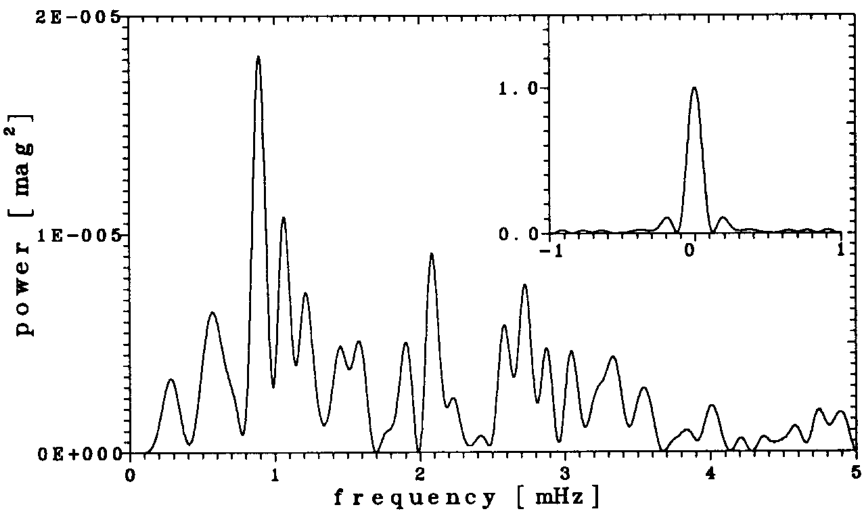

Fig. 3. The power spectrum (main panel) and the spectral window (top right panel) for observations carried out on Dec. 16/17 1992.

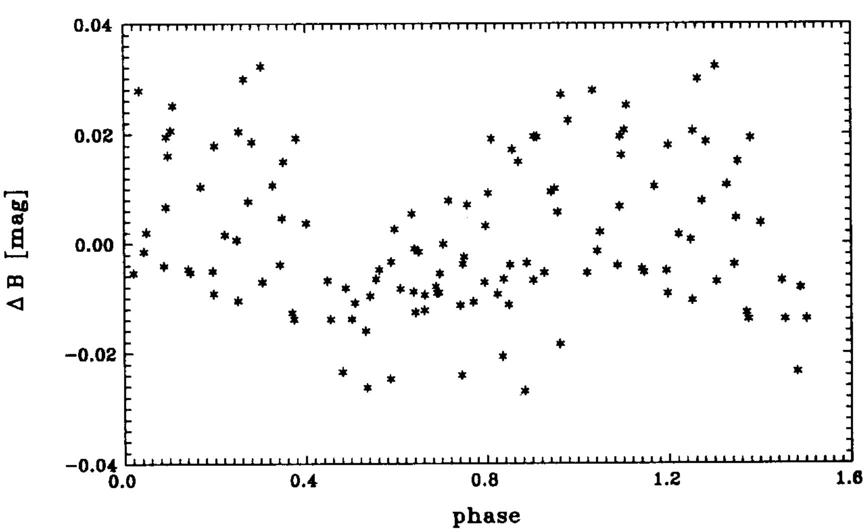

Fig. 4. Residuals of the December 16/17 data folded with period 1117.3s and binned (each bin consists of 3 observational points). Phase was chosen arbitrarily.

The spectrum is dominated by the DB white dwarf of temperature 20 000 - 30 000 K. A possible faint main-sequence companion star of type K may slightly contaminate the spectrum. Absorption lines of He I are the most prominent in the spectrum of PG 0900+401 (especially He I 3756Å, He I 3820Å, He I 4388Å, He I 4471Å). The presence of N II, O II and C II absorptions is also possible (N II 4987Å, N II 5176Å and others). The hydrogen lines are extremely weak and disappear with H gamma.

We observed PG0900+401 photometrically during two nights on December 16/17 1992 and January 12/13 1993. The observations were carried out at Mt.Suhora Observatory of Cracow Pedagogical University, using the 60-cm Cassegrain telescope with a double-beam photometer. The star "e" from the finding chart published by Lipunova & Shugarov (1991) has been used as the comparison star. According to Lipunova & Sugarov (1991) the photometry of the comparison star is as follows: V=10.^{m}84, B=11.^{m}39, U=11.^{m}33. Fig.2. presents differential B photometry of PG 0900+401 on December 16/17 1992. The integration time was equal to 20s. The variability in the B filter during these observations was less than 0.^{m}16. The time covered by our monitoring was about 0.^{d}1.

We have analyzed our observations using a power spectrum method (Deeming, 1975), searching for any periodicities on time scales of minutes. To eliminate low frequency modulations on a time scale of hours, we subtracted the general trends present in our observations using first or second degree polynomials. The spectral window and power spectrum obtained from our first set of data is shown in Fig.3. There is one dominant spike present at the frequency 0.895 mHz, which would imply a period of 1117.3 seconds. There is no significant feature at the frequency 0.357mHz, corresponding to the 280s period reported by Lipunova & Shugarov (1991). In Fig.4. we present the residual B light curve binned and folded with a period of 1117.3s. The amplitude of this variation is about 0.^{m}03. In our opinion these oscillations should be attributed to the white dwarf rather than to a hypothetical accretion disc around it, as was suggested by Lipunova & Shugarov (1991). The same method applied to our second set of observations yields a power spectrum corresponding to a broad distribution of power over a large range of frequency probably just reflecting the much worse quality of this set of data.

We also estimated photometry of PG 0900+401 for 16/17 March 1963 using the spectrum shown in Fig.1 and UBV filters' profiles given by Straizys (1977): V=12.^{m}97, B-V=0.^{m}17, U-B=-0.^{m}97. Such values mean that the object does not manifest any prominent secular changes. Further observations are needed both to find the orbital period and to ascertain whether the 1100s modulation detected by us is real.

Acknowledgements. We would like to thank W. Lewandowski and M. Staniewski for their assistance in carrying out observations. This work was sponsored by Research Grant KBN-2/1182/91/01 and BS 33/92 grant from the Pedagogical University in Cracow. Our spectroscopic data have been processed using the ReWiA software (Borkowski, 1993).

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G172 – THE FOURTH HORIZONTAL BRANCH VARIABLE STAR BLUEWARD OF THE RR LYRAE GAP IN M4

G172 (Greenstein 1939)=A522 (Alcaino 1975)=L1717 (Lee 1977) is a horizontal branch star blueward of the RR Lyrae instability strip in the globular cluster M4 (see Figure 1). The proper motion study (Cudworth 1990) shows G172 is a cluster member (Pc=0.99). The magnitudes and colors given by different authors are:

V=	13.17	B−V=	0.35	(Alcaino 1975)
	13.14		0.56	(Lee 1977)
	13.29		0.52	(Cudworth 1990)

The projection distance of the star from the center of the cluster is 38″. In Table 3 of his paper, Lee (1977) gave the note "V" for L1717 and pointed out that it is a new RR Lyrae variable star not listed in Sawyer-Hogg's catalogue. Lee did not determine the period of the star.

We found the variablility of G172 independently in 1976. We thought that it was an RRc variable star at first. After measuring several hundreds of photographic plates, we realized that it is not an RRc star because the amplitude of the star never exceeds 0.1 mag. in B and the period is shorter than 0.3 day if exists. Due to the low accuracy of photographic photometry we could not determine the period of the star.

Thanks to the use of the CCD camera, preliminary periods have now been obtained. The observations were made with the RCA CCD #1 attached to the Cassegrain focus of the 1-m Zeiss reflector at the Yunnan Observatory on 1992 May 6. The detector contains 320×512 pixels (pixel size 30×30μm) at a scale of about 0.″47/pixel, thus covering a ∼2.′5×4′ field. A series of 270 second exposures taken in rapid succession over a time interval of about $5^h_.7$ were obtained (59 yellow, 2 blue). The seeing was between 2.″0 and 3.″3 (FWHM). The data were reduced at the Zo-Se section of the United Laboratory for Optical Astronomy with the Sun 4/65 workstation. The DAOPHOT (Stetson 1987) in IRAF was used to reduce the data. The red star G248 (V=12.18, B−V=1.38) was used as the comparison star. Comparing with the other stars in the frame, it is shown that the constancy of G248 is better than ±0.006 mag. The differential extinction between G248 and G172 has been corrected approximately. Breger's (1991) program PERIOD was used to determine the periods. The results so obtained are:

$$m(t) = m_0 + \sum_{i=1}^{2} a_i sin(2\pi t/P_i + 2\pi\varphi_i)$$

Here $P_1 = 0^d_.0753$, $a_1 = 0.00894$, $\varphi_1 = 0.7720$,
$P_2 = 0.2117$, $a_2 = 0.00844$, $\varphi_2 = 0.2059$,
$m_0 = 1.142$

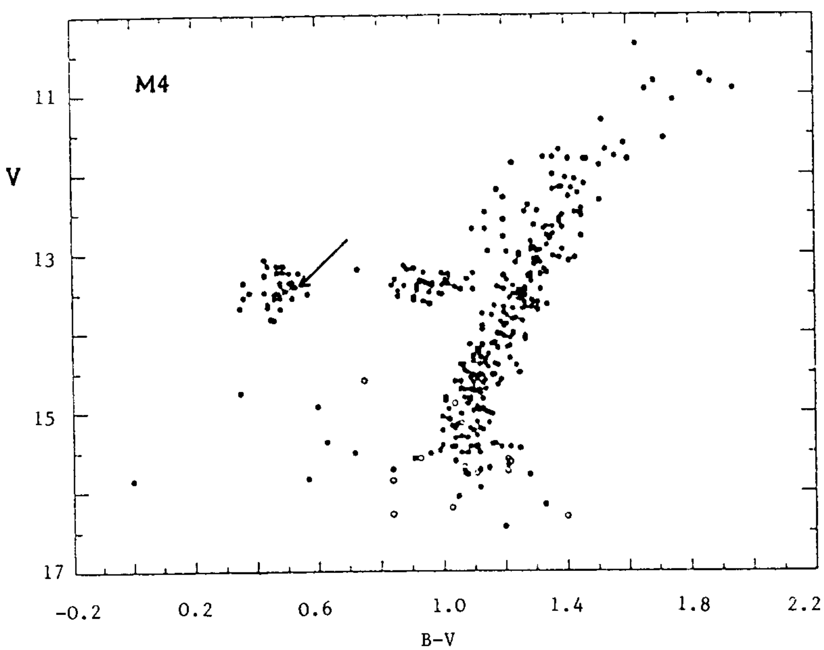

Figure 1

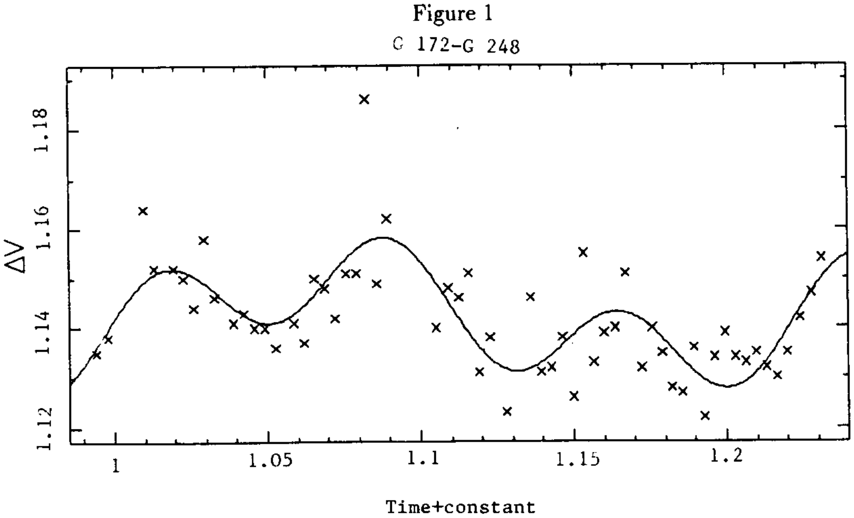

Figure 2

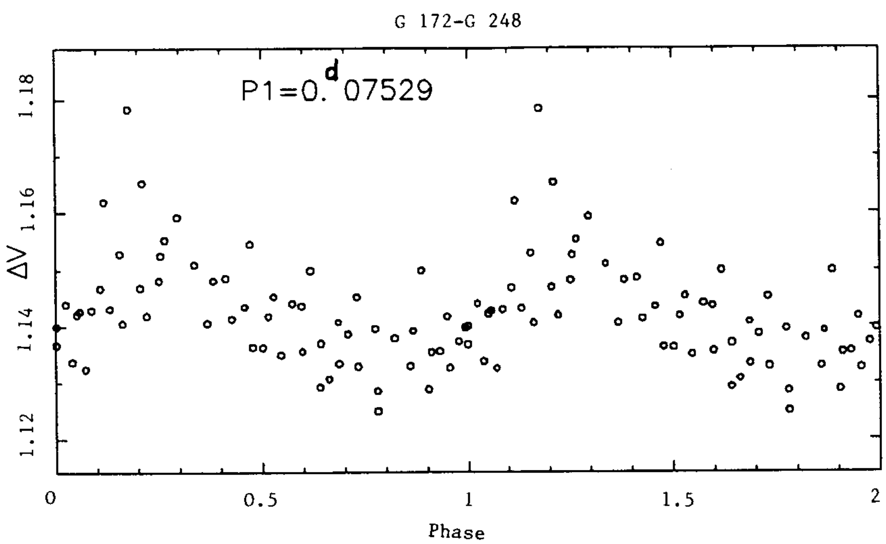

Figure 3

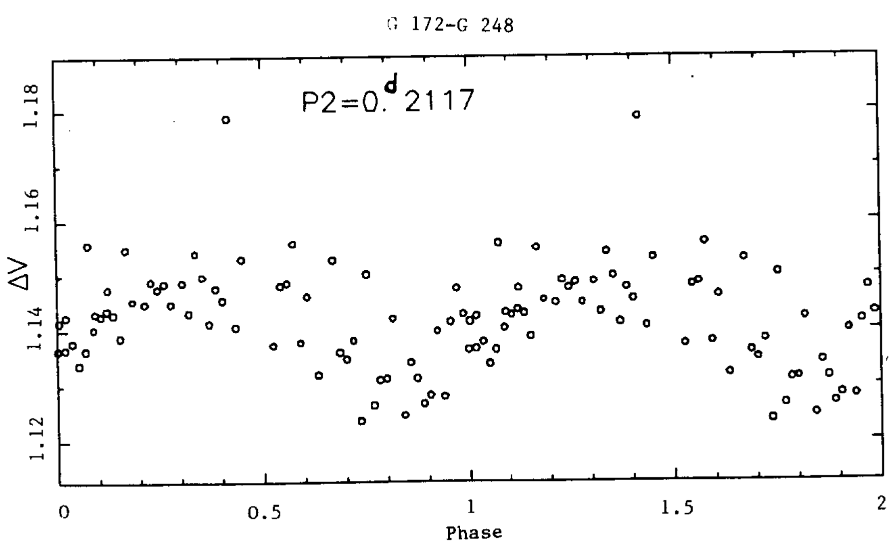

Figure 4

The "real time" light curve is shown in Figure 2 where the curve is calculated with the formula above. The folded light curves are given in Figures 3 and 4. Each light curve is plotted with the data prewhitened with the other frequency.

G172 is the fourth horizontal branch variable star in M4 which is located blueward of the RR Lyrae gap and checked with the CCD photometry by us.

Obviously, the periods given here are only preliminary, further observations are needed to determine the periods accurately.

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W Cru – A PHASE DIAGRAM

Phase diagram for W Cru based on observations obtained from 1985 to 1987 at the Nigel Observatory, was published by Pazzi (1989). What is presented here is an update which includes all observations of this peculiar eclipsing binary from 1985 to 1991 (JD 2446168 to JD 2448466).

The series of photoelectric observations were started following a request for observation by Plavec (1984). Particular attention was paid to the secondary minimum. the reason for this being that a certain amount of data for the primary minimum has already been published by various investigators:
Knipe (1972), Marino et al. (1984), Menzies and Spencer Jones (1984), Marino et al. (1988), Kviz and Rufener (1988) and Kohoutek (1988).

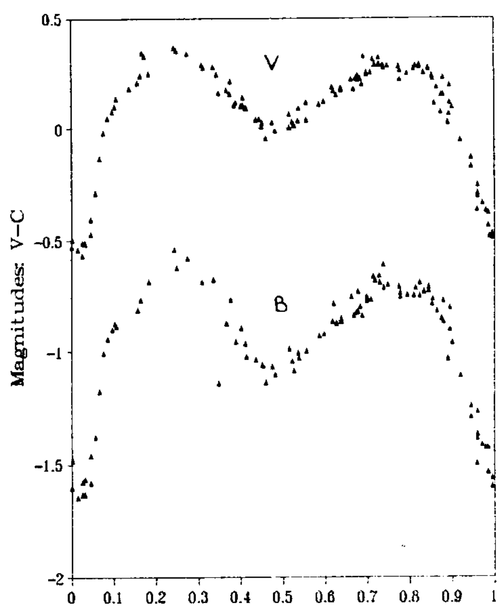

Figure 1. V−C magnitudes in B and V filters against phase for W Cru. Phase is computed from E=2440731.6, P=198.53

Table I

Variable-Comparison "V" magnitude reduced to the UBV system, used to plot Figure 1.

JD	HEL.CORR.	F	V-C
2446168.3081	0.0021	V	-0.1030
2446172.3009	0.0019	V	-0.1036
2446180.3256	0.0015	V	-0.0369
2446194.2813	0.0007	V	-0.0009
2446202.2384	0.0002	V	-0.1137
2446229.2850	-0.0013	V	-0.3246
2446236.3207	-0.0017	V	-0.3222
2446262.2706	-0.0029	V	-0.1114
2446265.2325	-0.0030	V	-0.0702
2446269.2259	-0.0031	V	-0.0596
2446288.2315	0.0035	V	0.4894
2446522.2932	0.0026	V	-0.3408
2446523.2868	0.0025	V	-0.3235
2446551.3290	0.0012	V	-0.2686
2446557.3090	0.0008	V	-0.2398
2446563.2875	0.0005	V	-0.1518
2446569.3337	0.0001	V	-0.1365
2446578.2861	-0.0004	V	-0.0045
2446580.2872	-0.0005	V	0.0495
2446583.2931	-0.0007	V	-0.0215
2446591.2928	-0.0012	V	-0.0579
2446595.3355	-0.0014	V	-0.0306
2446599.2920	-0.0016	V	-0.0342
2446612.2750	-0.0023	V	-0.1665
2446620.2910	-0.0026	V	-0.2214
2446623.2348	-0.0027	V	-0.2376
2446635.2300	-0.0031	V	-0.2891
2446862.3545	0.0033	V	-0.1475
2446864.3336	0.0033	V	-0.0207
2446883.3450	0.0028	V	0.3840
2446886.3151	0.0026	V	0.5006
2446891.3323	0.0024	V	0.5147
2446905.2895	0.0018	V	-0.0778
2446907.2751	0.0017	V	-0.1305
2446913.3226	0.0013	V	-0.1832
2446934.3267	0.0001	V	-0.3638
2446940.3341	-0.0002	V	-0.3367
2446947.3245	-0.0006	V	-0.2874
2446955.3133	-0.0011	V	-0.1583
2446963.2991	-0.0015	V	-0.1127
2446968.2893	-0.0018	V	-0.0889
2447263.3145	0.0021	V	-0.0934
2447275.2997	0.0015	V	0.2621
2447277.2881	0.0014	V	0.3374
2447279.2887	0.0013	V	0.3761
2447282.2823	0.0011	V	0.4770
2447283.2750	0.0011	V	0.5288
2447288.2641	0.0008	V	0.5713
2447289.2753	0.0007	V	0.5172
2447292.3084	0.0006	V	0.4092
2447294.3425	0.0004	V	0.2912
2447296.3294	0.0003	V	0.1340
2447298.3270	0.0002	V	0.0224
2447300.3403	0.0001	V	-0.0423
2447303.3600	-0.0001	V	-0.0979
2447314.3039	-0.0007	V	-0.2065
2447588.3575	0.0034	V	-0.0888
2447623.3079	0.0024	V	-0.3107
2447626.3191	0.0022	V	-0.2861
2447630.3074	0.0020	V	-0.2839

JD	HEL.CORR.	F	V-C
2447635.3181	0.0018	V	-0.2748
2447649.2891	0.0010	V	-0.2661
2447656.2741	0.0006	V	-0.2274
2447659.2902	0.0005	V	-0.1949
2447669.3152	-0.0001	V	0.1329
2447672.3077	-0.0003	V	0.3054
2447677.3180	-0.0006	V	0.4372
2447679.3052	-0.0007	V	0.4933
2447683.2837	-0.0010	V	0.5453
2447686.2868	-0.0011	V	0.5150
2447689.2834	-0.0013	V	0.4769
2447945.3699	0.0035	V	-0.2728
2447951.3619	0.0035	V	-0.1686
2447974.3920	0.0029	V	0.0125
2447982.3456	0.0026	V	-0.0260
2447997.3175	0.0020	V	-0.1164
2448001.3090	0.0018	V	-0.1847
2448003.2996	0.0017	V	-0.1492
2448005.3185	0.0015	V	-0.1704
2448011.2853	0.0012	V	-0.1733
2448013.3108	0.0011	V	-0.2176
2448015.2662	0.0010	V	-0.1987
2448017.2634	0.0009	V	-0.2415
2448019.2681	0.0008	V	-0.2485
2448025.2676	0.0004	V	-0.2684
2448033.3398	-0.0001	V	-0.2182
2448036.3500	-0.0002	V	-0.2462
2448040.3290	-0.0005	V	-0.2771
2448042.3142	-0.0060	V	-0.2863
2448046.3241	-0.0008	V	-0.2690
2448048.3010	-0.0009	V	-0.2224
2448050.3160	-0.0011	V	-0.1862
2448052.3173	-0.0012	V	-0.1488
2448056.3124	-0.0014	V	-0.1123
2448061.3273	-0.0017	V	0.0589
2448066.2761	-0.0019	V	0.1782
2448069.2701	-0.0020	V	0.2937
2448308.3797	0.0035	V	-0.2385
2448312.3712	0.0035	V	-0.2463
2448325.3889	0.0033	V	-0.3516
2448350.3475	0.0025	V	-0.2129
2448355.3299	0.0023	V	-0.0968
2448357.3350	0.0022	V	-0.0901
2448362.3301	0.0020	V	-0.0360
2448365.3320	0.0018	V	-0.0197
2448380.2673	0.0010	V	-0.0132
2448392.3308	0.0003	V	-0.1053
2448402.3348	-0.0003	V	-0.1812
2448409.3311	-0.0007	V	-0.2243
2448411.3270	-0.0008	V	-0.2247
2448414.3187	-0.0010	V	-0.2500
2448418.3297	-0.0012	V	-0.2886
2448420.2885	-0.0013	V	-0.2917
2448430.2579	-0.0018	V	-0.2578
2448436.2873	-0.0021	V	-0.2645
2448439.2666	-0.0023	V	-0.2726
2448441.2651	-0.0024	V	-0.2511
2448445.2837	-0.0025	V	-0.2384
2448466.2246	-0.0032	V	0.3715

Table II

Variable-Comparison "B" magnitudes reduced to the UBV system, used to plot in Figure 1.

JD	HEL.CORR.	F	V-C	JD	HEL.CORR.	F	V-C
2446580.2876	-0.0005	B	1.1366	2447686.2874	-0.0011	B	1.6378
2446583.2935	-0.0007	B	1.0663	2447689.2844	-0.0013	B	1.5855
2446591.2931	-0.0012	B	0.9907	2447945.3699	0.0035	B	0.6832
2446595.3358	-0.0014	B	1.0086	2447951.3619	0.0035	B	0.8762
2446599.2925	-0.0016	B	1.0002	2447974.3920	0.0029	B	1.1047
2446612.2753	-0.0023	B	0.7877	2447982.3456	0.0026	B	1.0399
2446620.2914	-0.0026	B	0.7554	2447997.3175	0.0020	B	0.9231
2446623.2352	-0.0027	B	0.7333	2448001.3090	0.0018	B	0.8635
2446635.2305	-0.0031	B	0.6161	2448003.2996	0.0017	B	0.8768
2446862.3554	0.0033	B	0.8640	2448005.3185	0.0015	B	0.8494
2446864.3346	0.0033	B	1.0311	2448011.2853	0.0012	B	0.8389
2446883.3455	0.0028	B	1.4291	2448013.3108	0.0011	B	0.8222
2446886.3154	0.0026	B	1.4840	2448015.2662	0.0010	B	0.8383
2446891.3328	0.0024	B	1.5786	2448017.2634	0.0009	B	0.7701
2446905.2900	0.0018	B	0.9007	2448019.2681	0.0008	B	0.7674
2446907.2764	0.0017	B	0.8884	2448025.2676	0.0004	B	0.7147
2446934.3274	0.0001	B	0.5431	2448033.3398	-0.0001	B	0.7379
2446940.3347	-0.0002	B	0.5850	2448036.3500	-0.0002	B	0.7475
2446947.3258	-0.0006	B	0.6912	2448040.3290	-0.0005	B	0.7162
2446955.3138	-0.0011	B	1.1411	2448042.3142	-0.0060	B	0.6957
2446963.2997	-0.0015	B	0.9572	2448046.3241	-0.0008	B	0.7284
2446968.2899	-0.0018	B	1.0232	2448048.3010	-0.0009	B	0.7626
2447263.3149	0.0021	B	0.9607	2448050.3160	-0.0011	B	0.8185
2447275.3000	0.0015	B	1.2683	2448052.3173	-0.0012	B	0.8530
2447277.2885	0.0014	B	1.4147	2448056.3124	-0.0014	B	0.9037
2447279.2891	0.0013	B	1.4298	2448061.3273	-0.0017	B	1.1078
2447282.2828	0.0011	B	1.6031	2448066.2761	-0.0019	B	1.2419
2447283.2755	0.0011	B	1.6072	2448069.2701	-0.0020	B	1.3657
2447288.2644	0.0008	B	1.6399	2448308.3797	0.0035	B	0.7689
2447289.2758	0.0007	B	1.5687	2448312.3712	0.0035	B	0.6917
2447292.3094	0.0006	B	1.4615	2448325.3889	0.0033	B	0.6263
2447294.3428	0.0004	B	1.3776	2448350.3475	0.0025	B	0.7671
2447296.3298	0.0003	B	1.1748	2448355.3299	0.0023	B	0.8996
2447298.3276	0.0002	B	1.0062	2448357.3350	0.0022	B	0.9632
2447300.3415	0.0001	B	0.9431	2448362.3301	0.0020	B	1.0382
2447303.3705	-0.0001	B	0.8751	2448365.3320	0.0018	B	1.0576
2447314.3045	-0.0007	B	0.8149	2448380.2673	0.0010	B	1.0844
2447588.3587	0.0034	B	1.0276	2448392.3308	0.0003	B	0.9324
2447623.3082	0.0024	B	0.6656	2448402.3348	-0.0003	B	0.8638
2447626.3195	0.0022	B	0.6943	2448409.3311	-0.0007	B	0.8254
2447630.3079	0.0020	B	0.7050	2448411.3270	-0.0008	B	0.8005
2447635.3185	0.0018	B	0.7138	2448414.3187	-0.0010	B	0.7522
2447649.2897	0.0010	B	0.7122	2448418.3297	-0.0012	B	0.6854
2447656.2745	0.0006	B	0.7696	2448420.2885	-0.0013	B	0.6602
2447659.2912	0.0005	B	0.8051	2448430.2579	-0.0018	B	0.7524
2447669.3158	-0.0001	B	1.2903	2448436.2873	-0.0021	B	0.7481
2447672.3084	-0.0003	B	1.3812	2448439.2666	-0.0023	B	0.7518
2447677.3184	-0.0006	B	1.5378	2448441.2651	-0.0024	B	0.7334
2447679.3072	-0.0007	B	1.5653	2448445.2837	-0.0025	B	0.7878
2447683.2841	-0.0010	B	1.6533	2448466.2246	-0.0032	B	1.4953

Very little, however, is available concerning the secondary minimum. The phase diagram in Figure 1 is presented here in the form of V−C which is felt may be of more use than the original form of relative magnitude. The magnitude differences in V and B colours are listed in Tables I and II respectively.

For detail of equipment, observation and reduction techniques the reader should refer to the original paper.

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RECENT UBVR MAGNITUDES FOR RHO Cas

Rho Cas is a yellow hypergiant that undergoes both pulsation and mass-loss episodes accompanied by complex spectrum and photometric changes. Zsoldos & Percy (1991) have found an underlying significant period of 298.5 days which has remained constant for nearly three decades.

Photometrically, Rho Cas has been well observed. Its light variations are semi-regular in nature with occasional deep minima which are likely associated with the mass-loss events. This paper continues a series of observations of this star. All data were obtained utilizing the 0.6-m telescope of the Corralitos Observatory and two photometric systems, one based on an EMI 9924A tube and the other on an R4457, both ambient temperature. Considerable care was taken in insuring that sufficient standard stars were observed so as to maintain consistency in magnitude and colors between the two systems. In previous papers (Halbedel, 1988, 1991), two comparison stars were utilized: Tau Cas and HR 9010. However, in the last two observing seasons, Tau Cas has been found to be brighter than normal (Halbedel, to be published). Therefore, it has been dropped as a comparison star for the Rho Cas magnitudes of the last two observing seasons. However, Tau Cas has remained stable enough over the previous years of observing to allow the previously cited Rho Cas magnitudes to continue to be valid. For the most recent magnitudes of Rho Cas (which appear in Table 1), only HR 9010 (V=5.510; B−V=+1.650; U−B= +1.810; V−R= +1.290) is used as a comparison. In the future, another comparison star will be added in order to unambiguously insure that HR 9010 is nonvariable.

Figure 1 shows a composite light curve for Rho Cas. It incorporates data from all recent sources: Halbedel (1988, 1991, and this paper), Leiker & Hoff (1987, 1990), Leiker, Hoff, Nesbella et al. (1988), Leiker, Hoff, & Milton (1989), Leiker, Hoff, & Caruso (1991), and Zsoldos & Percy (1991). There is surprisingly little scatter when one considers the multiplicity of sources used. The behavior of the star is essentially unchanged: it still undergoes semiregular variations, though the most recent increase in mean magnitude has ceased and the star is reddening again. At present, there are too few U−B and V−R magnitudes to delineate a trend in those colors.

Rho Cas will continue to be observed indefinitely at the Corralitos Observatory.

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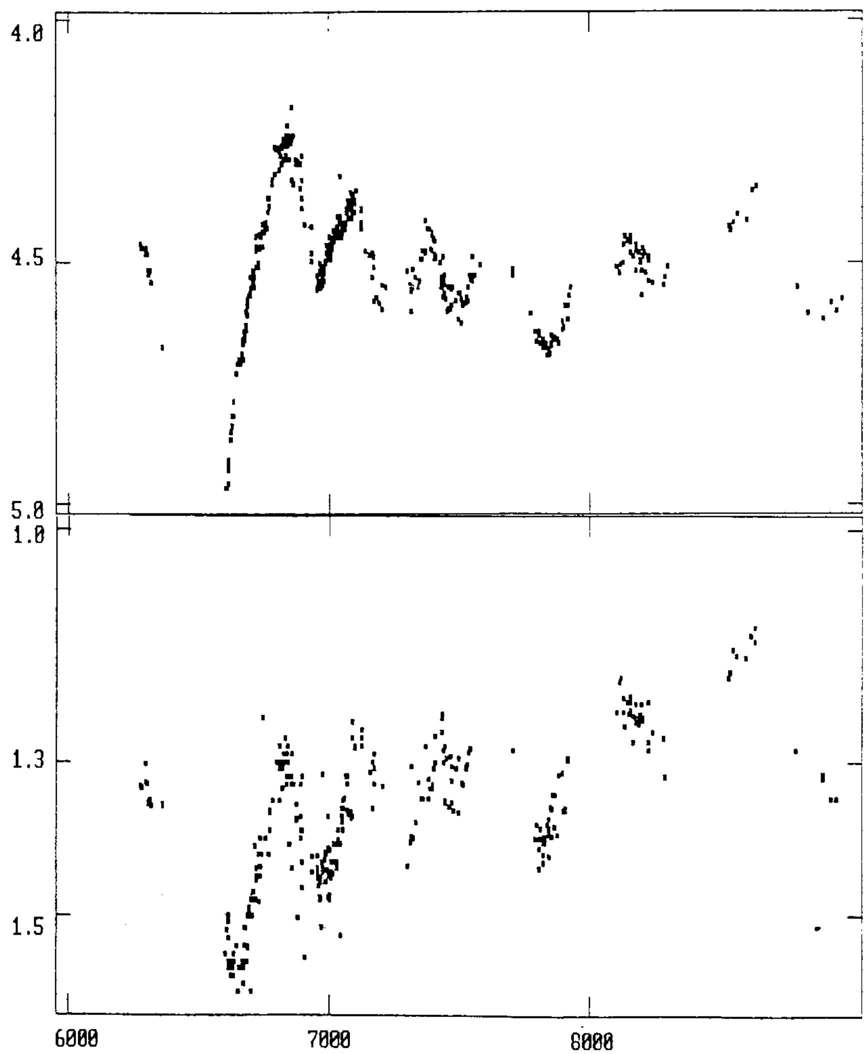

Figure 1. Magnitudes and colors for Rho Cas. The top diagram shows V, the bottom B−V. Julian Date is JD − 2440000.

Table I

UBVR magnitudes for Rho Cas

Since only one star was used for comparison purposes, there are no standard errors

JULIAN DATE (2440000+)	V	B−V	U−B	V−R
8532.78611	4.429	+1.192		
8535.74861	4.434	1.184		
8546.70833	4.417	1.155		
8562.69444	4.404	1.164		
8597.67292	4.413	1.166		
8620.59583	4.353	1.138		
8636.59028	4.342	1.126		
8637.59236	4.343	1.144		
8800.93056	4.550	1.286		
8842.89306	4.606			
8898.78958	4.620	1.318	+1.190	+1.176
8901.75347	4.618	1.322	1.211	1.167
8932.77292	4.586	1.349	1.268	1.161
8951.70903	4.600	1.347	1.259	1.196
8973.65694	4.579			

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RECENT UBVR MAGNITUDES FOR HR 8752=V509 Cas

The hypergiant HR 8752 has been observed over the past nine observing seasons at the Corralitos Observatory. Most of this data has been previously published (Halbedel, 1985, 1986, 1988, 1991). This paper reports on the most recent UBVR data which has been acquired.

A well-known spectrum and photometric variable, HR 8752 has a long publication history whose most recent entry is by Sheffer & Lambert (1992) who have found interesting correlations between [N II] strength and continuum intensity, showing possible cyclical behavior for the continuum with a $\geq$30 year period. On a shorter time-scale, the star varies semi-regularly with periods around 400 days (Arellano Ferro, 1985; Sheffer & Lambert, 1987). Its most recent photometric behavior has been characterized by a trend of fading and bluing with more rapid changes superimposed.

HR 8752 has been observed photometrically with the 0.6-m. telescope of the Corralitos Observatory. Two photometric systems were utilized, the first based on an EMI 9924A tube and the second on an R4457. All U and R magnitudes were obtained with the second system. Two comparison stars were utilized: HR 8761 (V=6.200; B−V= +1.500; U−B= +1.530; V−R= +1.088) and HR 8778 (V=6.430; B−V= +.900; U−B= +.538; V−R= +.767). Over the time period of observation, these two stars were stable to within 0.015, 0.014, 0.015 and 0.017 in V, B−V, U−B and V−R respectively.

The most recent UBVR magnitudes obtained for HR 8752 are shown in Figure 1 and appear in Table 1. It may be seen that the trend towards fading and bluing is still continuing. There are too few U−B and V−R magnitudes to ascribe a trend as of yet.

HR 8752 will continue to be observed at the Corralitos Observatory indefinitely into the future.

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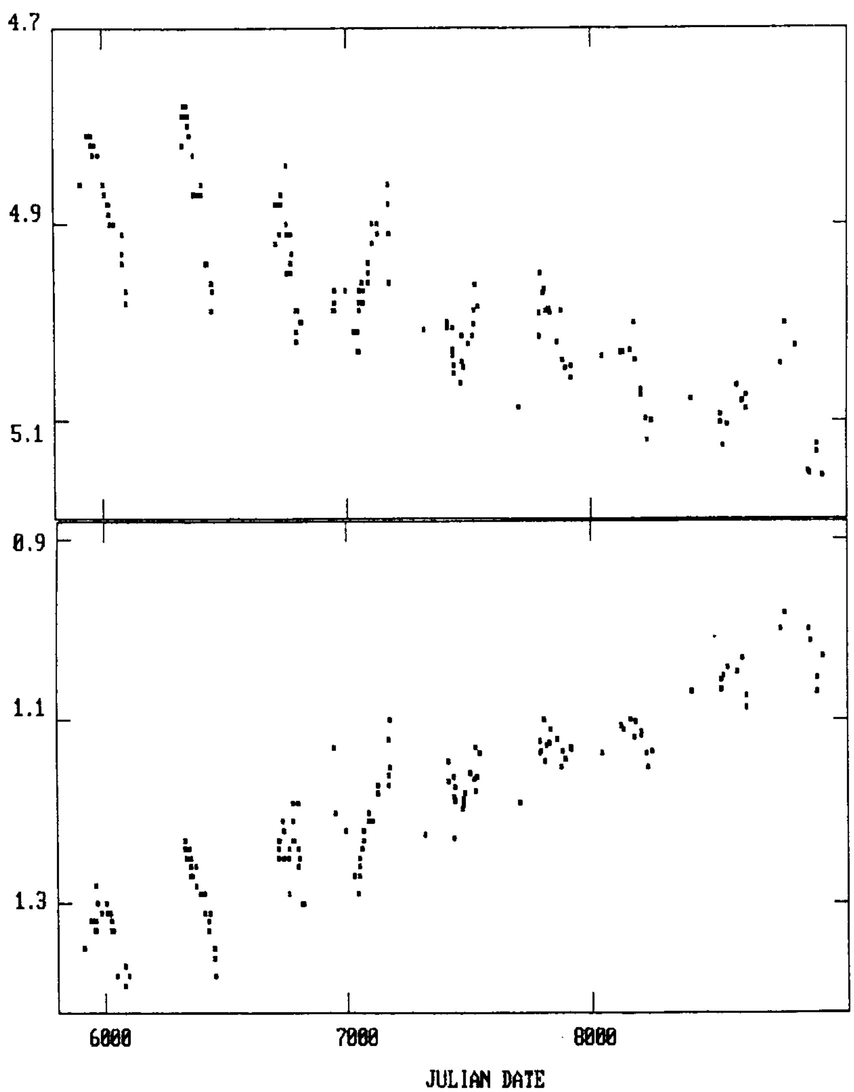

Figure 1. Magnitudes and colors for HR 8752. The top diagram shows V, the bottom B–V. Julian Date is JD–2440000.

Table 1
UBVR magnitudes for HR 8752

Numbers following magnitudes in parentheses are standard errors in millimags.

Julian Date (2440000+)	V(SE)	B−V(SE)	U−B(SE)	V−R(SE)
8414.93125	5.078(21)	+1.070(4)		
8532.77083	5.095(−)	1.066(5)		
8535.73750	5.103(−)	1.057(7)		
8546.69514	5.128(15)	1.051(6)		
8562.68194	5.104(12)	1.044(1)		
8597.66040	5.064(−	1.047(8)		
8620.58264	5.080(−)	1.033(17)		
8636.58681	5.089(−)	1.073(13)		
8637.58958	5.075−)	1.086(15)		
8732.94583	5.042(18)	1.000(3)		
8800.92778	5.001(24)	0.983(4)	+.682(10)	+.887(3)
8842.87431	5.024(−)			
8898.74931	5.152(23)	0.999(2)	.744(11)	.905(8)
8901.72639	5.155(18)	1.012(1)	.719(16)	.925(4)
8932.74028	5.124(32)	1.068(26)	.718(6)	.878(19)
8933.70000	5.133(22)	1.053(1)	.736(2)	.871(13)
8951.68958	5.156(−)	1.030(12)	.745(4)	.883(8)

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OPTICAL VARIABILITY AND H-ALPHA EMISSION FOR THE BRIGHT O STAR HR 2806

HR 2806 (HD 57682) has been classified as a sharp-lined O9V star (Slettebak, 1956). Its $v\sin i$ is truly small: values from 17 (Conti et al., 1977) to 40 km/sec (Buscombe, 1970) have been quoted. There has been some past speculation that it has possessed emission lines at some epochs. Peterson & Scholz (1971) observed possible emission at Hα and Hβ. Conti (1974) found emission shortward of Hα, and elsewhere. However, Jaschek et al. (1964) and Zinn (1970) found no emission at Hα. The star is the exciting object for the IC 2177 nebulosity and a member of the CMa OB1 association.

The author obtained a spectrum centered at Hα with the Kitt Peak coudé feed telescope and RCA2 CCD on JD2446878.73. It was immediately apparent that there was a noticeable single emission component at Hα. Later, two other spectra in the same region were also acquired on JD 2448644.90 and 8645.80 with the same telescope, but this time with the T1KA CCD. They were virtually identical in appearance, with both showing a single emission component at Hα and a strong, uncontaminated λ6678 He I. The spectra from JD 6878 and 8645 are shown in Figure 1. The intensity of Hα emission seems to have increased slightly. The velocity of the Hα emission peak has not changed much (−5.6, −11.4, and −12.0 km/sec for 3 spectra), nor has that of He I λ6678 (+17.9, +19.3, +21.0 km/sec). These last are in good agreement with the published radial velocities of +22.6, +21.9, and +23.9 (Abt & Biggs, 1972). In view of its possible variability, the star was added to the BV photometric monitoring program of the Corralitos Observatory. Along with its 0.6-m. telescope, two different photometers were used, the first being an ambient temperature EMI 9924A tube-based system, and the second based on an R4457 tube. Care was devoted to the observation of standard stars so that there were no measurable transformation errors between the two systems. Two comparison stars were utilized: HR 2798 (V=6.549; B−V= +.513) and HR 2739 (V=6.001; B−V = −.135). The average standard errors for the two comparison stars were .018 magnitudes in V and B−V.

51 observations over the time period JD 2446754−8724 were obtained. They appear in Table 1 and graphically in Figure 2. Clearly, HR 2806 is minorly variable, showing a range of 0.111 in V and .100 in B−V. A plot of V vs. B−V shows no correlation. It would also seem that the range of variability in V magnitude changes: seasons 3 and 4 show larger dispersion than 1, 2, and 5. The cause of variability of this star cannot be ascertained from the data taken. It may proceed from changing conditions in the circumstellar material or HR 2806 may be a rapid variable akin to Zeta Ophiuchi, an O9.5Ve star which shows light variations with periods of 0.193 and 1.075 days (Percy, 1987).

The author wishes to most gratefully acknowledge a Theodore Dunham, Jr. Grant of the Fund for Astrophysical Research for purchase of photometric equipment.

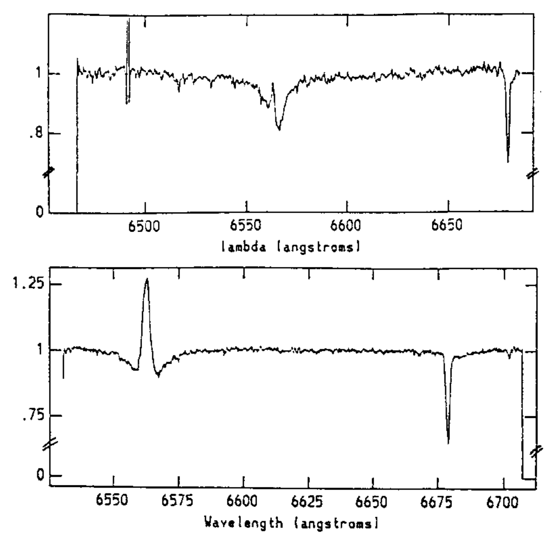

Figure 1. Coudé spectra in the region of Hα for HR 2806. The ordinate is in units of continuum intensity. Dates of spectra are in the text.

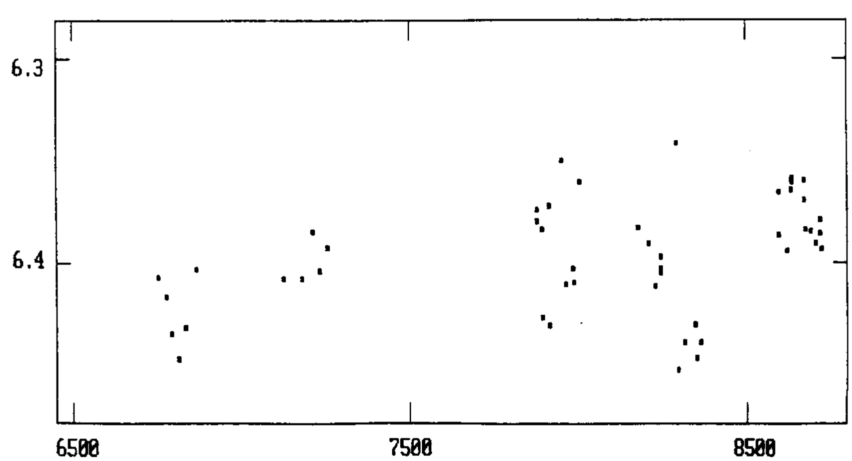

Figure 2. V magnitudes for HR 2806. Julian Date is JD – 2440000.

Table 1

BV magnitudes for HR 2806

Numbers following magnitudes in parentheses are standard errors in millimags.

Julian Date (2440000+)	V(SE)	B−V(SE)	Julian Date (2440000+)	V(SE)	B−V(SE)
6754.9471	6.406(−)	−.162(−)	8243.8361	6.404(1)	−.119(19)
6777.8721	6.416(−)	−.158(−)	8243.8377	6.402(−)	−.171(−)
6795.8928	6.434(−)	−.187(−)	8244.8375	6.397(13)	−.147(13)
6816.8416	6.447(−)	−.141(−)	8292.8410	6.341(−)	−.152(−)
6833.7912	6.431(−)	−.197(−)	8293.7806	6.452(11)	−.173(16)
6867.7748	6.402(−)	−.133(−)	8313.7616	6.439(−)	−.181(21)
7124.9447	6.407(−)	−.186(−)	8328.7042	–	−.189(−)
7183.8243	6.407(−)	−.174(−)	8348.6847	6.430(−)	−.185(−)
7212.7448	6.384(−)	−.147(−)	8350.6694	6.447(10)	−.105(23)
7232.7124	6.403(−)	−.146(−)	8364.6573	6.439(−)	−.154(−)
7259.6546	6.392(−)	−.118(−)	8597.9493	6.365(17)	−.124(6)
7878.9333	6.379(4)	−.140(20)	8598.9188	6.386(15)	−.145(−)
7881.8076	6.374(1)	−.132(4)	8621.8215	6.394(−)	−.191(20)
7896.8132	6.383(18)	−.109(9)	8635.8917	6.359(16)	−.147(4)
7897.8014	6.426(6)	−.154(13)	8635.8931	6.364(−)	−.179(−)
7915.7646	–	−.123(−)	8636.8153	6.358(13)	−.164(−)
7916.8319	6.372(−)	−.119(−)	8637.8028	6.360(−)	−.162(19)
7917.7764	6.430(−)	−.160(4)	8674.8090	6.369(21)	−.158(1)
7952.6750	6.350(−)	−.097(10)	8679.8101	6.359(−)	−.196(−)
7965.7139	6.410(19)	−.125(−)	8677.7667	6.383(4)	−.149(1)
7985.6403	6.402(16)	−.142(−)	8695.6993	6.384(2)	−.160(19)
7986.6694	6.409(14)	−.150(−)	8711.6576	6.390(−)	−.140(4)
8002.6313	6.360(−)	−.190(−)	8722.6410	6.378(1)	−.160(1)
8176.9660	6.382(9)	−.123(29)	8723.6368	6.385(2)	−.144(14)
8205.8896	6.390(5)	−.131(24)	8724.6417	6.393(1)	−.166(4)
8225.8979	6.411(11)	−.123(2)			

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TAU Cas: A VARIABLE STAR AFTER ALL?

The bright star Tau Cas (HR 9008=HD 223165; K1 IIIa) has been commonly used as a comparison star for the variable supergiant Rho Cas. It is a controversial choice: the New Catalogue of Suspected Variable Stars lists it as variable with a possible amplitude of 0.3 magnitudes. Some observers (e.g., Leiker & Hoff, 1988) have claimed recent variability, while others (Percy, 1985; Halbedel, 1989) have seen none.

Consequently, this author has continued to use Tau Cas as a comparison star for observations of Rho Cas. However, when the past two observing seasons' BV data has been examined, it became clear that there had been a slight change in its behavior. All observations were obtained with the 0.6-m. telescope of the Corralitos Observatory and two photometric systems, one based on an EMI 9924A tube and the other on an R4457. As comparison star, HR 9010 (K3 IIb; V=5.510; B−V= +1.650; U−B= +1.810; V−R= +1.290) was used.

Table 1 lists the magnitudes which have been obtained since Halbedel (1989); Figure 1 shows them graphically. It is clear that there has been a slight brightening in the last two observing seasons, as well as a gradual reddening. The extent of brightening at present is estimated to be 0.05 V magnitudes, which is in agreement with Percy's (1985) contention that if the star varies, it is only by no more than several hundredths of a magnitude.

Is this a real brightening? The astute reader will have noted that two different photometers were used to obtain the data. However, extreme care was taken with the observations of standard stars to insure that the transformations between the two systems were such that consistency of magnitude and color was maintained. Also, despite a large observing program of other stars (both early and late in spectral type), this effect was noted in no other case. Nor is it likely to be a transient atmospheric effect(e.g., Mt. Pinatubo) since it was not found in other data.

One final caution is necessary: the observations of Tau Cas have been made with respect to only one comparison star. It is possible that HR 9010 is the variable. However, that star has no history of variability or suspicions thereof. Therefore, at this point, the variability of Tau Cas must be considered as suggestive until proven by observations made with two comparison stars. At the very least, this observer will in future replace Tau Cas as one of the comparisons for Rho Cas and will observe it as a potential variable in is own right until this question is settled. However, because of the relative stability of Tau Cas in the past, all previously published magnitudes for Rho Cas by this author still stand.

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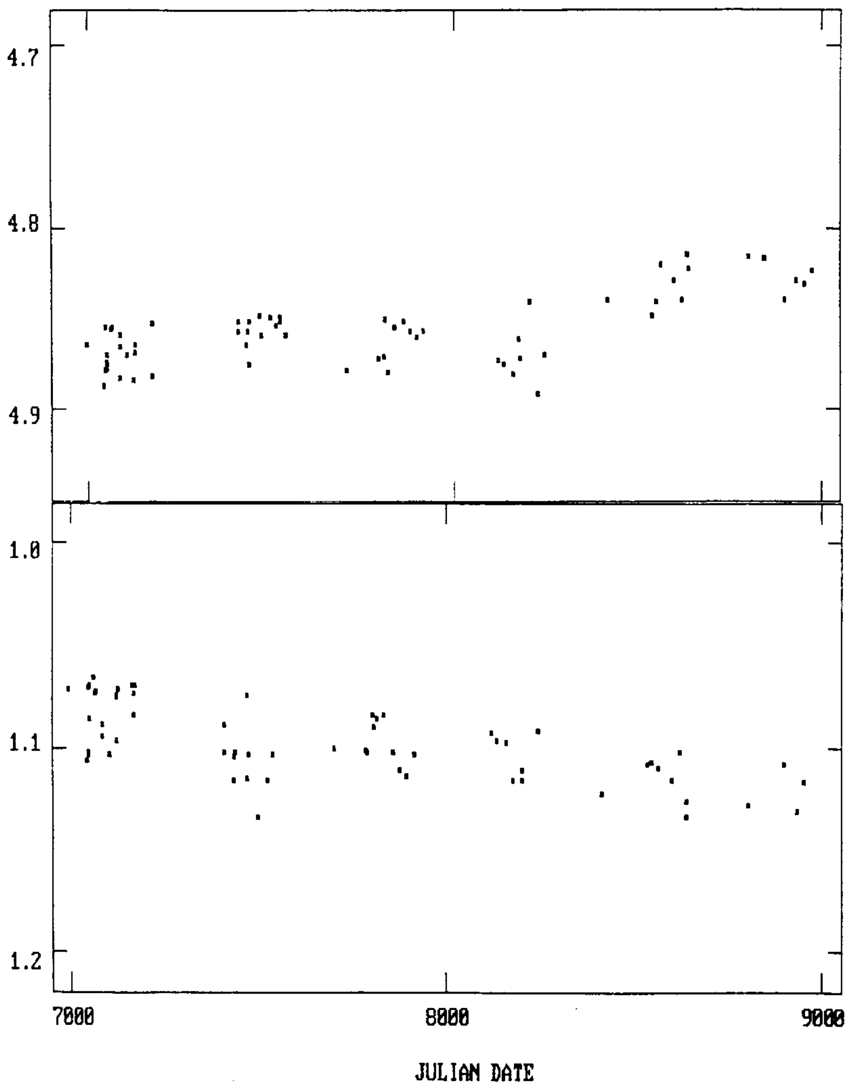

Figure 1. Magnitudes and colors for Tau Cas. The top diagram shows V, the bottom B−V. Julian Date is JD - 2440000.

Table 1
UBVR magnitudes for Tau Cas
Since only one star was used for comparison purposes,
there are no standard errors

Julian Date (2440000+)	V	B−V	U−B	V−R
7835.70139	4.854	+1.084		
7861.60486	4.851	1.102		
7878.64374	4.857	1.111		
7896.61250	4.860	1.114		
7917.59236	4.857	1.103		
8122.81875	4.873	1.093		
8133.83541	4.875	1.097		
8159.78611	4.880	1.098		
8176.69028	4.861	1.116		
8178.72639	4.872	1.116		
8201.68263		1.111		
8204.61111	4.840	1.116		
8228.62917	4.891			
8244.63819	4.870	1.092		
8535.74861	4.848	1.108		
8546.70833	4.840	1.107		
8562.69444	4.820	1.110		
8597.67292	4.829	1.116		
8620.59583	4.839	1.102		
8636.59028	4.814	1.126		
8637.59236	4.822	1.134		
8800.93056	4.816	1.128		
8842.89306	4.817			
8898.78958	4.839	1.108	+1.001	+0.995
8932.77292	4.828	1.131	1.049	0.965
8951.70903	4.831	1.117	1.029	0.999
8973.65694	4.823			

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LIGHTCURVE AND PERIOD OF THE SYSTEM V450 HERCULIS

Discovered in 1955 by Geyer (1955, 1963) on Bamberg plates, the star BD+34°2831 has been given the provisional designation BV 104. The system was classified as EA type star with a period of $0^d\!.912718$ and light variations ranging from $10^m\!.1$ to $10^m\!.65$ (pg.). No secondary minimum could be detected and the eclipse duration was given $2^h\!.6$. In 1968 the list of pg. minima was extended by H. Bauernfeind (Geyer, 1968). A period lengthening of $0^s\!.15$ after JD 2425000 was assumed. This leads to the elements

$$\text{Min.}=\text{JD } 2425687.585+0^d\!.912729\times\text{E} \qquad \text{(I)}$$

In the years 1984-85 and 1988-90 the star was observed photoelectrically with a DC photometer attached to the 34cm Cassegrain at the Nürnberg Observatory. The measurements were made through the V filter and are given in the instrumental system. BD +34°2829 was taken as the comparison star. This choice could not be recommended because of the large B−V index as compared with the variable, whose spectral type was determined as A0 by Götz and Wenzel (1962). BD +34°2832 was chosen as the check star. Throughout the observation period, the magnitude difference check – comparison remained constant. Each point in the lightcurve (Figure 1) is the mean of five consecutive measurements. The standard deviation of 91% from a total of 132 points fell down to a limit of $\pm0^m\!.020$ with a neat maximum of the error distribution in the $0^m\!.010$ to $0^m\!.015$ range.

The 1984-85 observations confirmed roughly the Bamberg period, but the long eclipse duration ($D=0^P\!.38$) led us to the conclusion that the period must be doubled. The lightcurve (Figure 1) shows two nearly equal partial eclipses with an amplitude of $0^m\!.31$, so that the minima attribution in Table 1 is arbitrary. The EA-type classification could be confirmed. The system shows a marked reflection effect with an additional brightening amounting up to $0^m\!.050$ at maximum phases. Both short and long time-scale variations in the reflection phase may be present if the 1985 and 1988-90 lightcurves are compared (Gröbel and Lichtschlag, 1991). The V magnitude of the nearby star BD +34°2830 is $5^m\!.99$ (Papousek, 1988). The magnitude of the comparison could be determined as $9^m\!.73\pm0^m\!.007$. Therefore V450 Her varies within the limits $10^m\!.26$ to $10^m\!.64$ (V).

In the O−C diagram (Figure 2) three observation periods could be discerned:

1. From JD 15000 to 34000: A total of 11 normal minima, each consisting of 9 to 10 observations, could be calculated. The period lengthening around JD 25000 could not be confirmed. The period of $0^d\!.9127221$ derived from that data failed to reproduce later observations.

2. From JD 38000 to 44000: These minima were found by Berthold (1982) on Hartha survey plates. Two normal minima from 6, resp. 5 observations could be calculated. The period of the elements

$$\text{Min.}=2444635.591+0^d\!.9127152\times\text{E} \qquad \text{(II)}$$

is a little bit too short to represent all available minima.

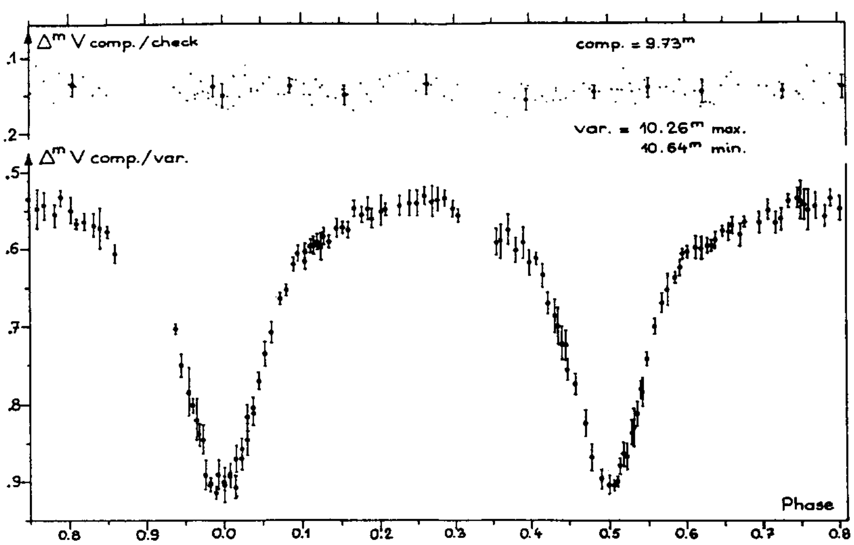

Figure 1. The differential V lightcurve of V450 Her.

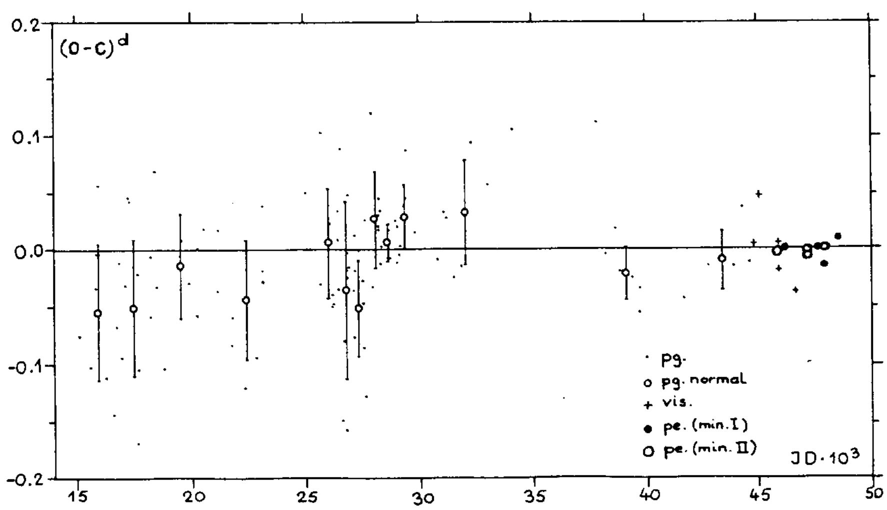

Figure 2. The O–C diagram from the year 1902 to 1992.

Table 1

The residuals of the pg. normal minima and pe. minima in the column $O-C_{III}$ were calculated with half the period given in elements (III).

	Minimum	(O-C) I	(O-C) II	Ep. III	(O-C) III	Min.	Reference
1	15959.791	0.092	-0.114	-33150	-0.055		(5,6,7)
2	17497.727	0.079	-0.103	-31465	-0.049		" "
3	19518.518	0.088	-0.063	-29251	-0.015		" "
4	22419.105	0.023	-0.085	-26073	-0.044		" "
5	26033.518	0.029	-0.025	-22113	0.007		" "
6	26780.079	-0.023	-0.065	-21295	-0.036		" "
7	27361.464	-0.046	-0.079	-20658	-0.052		" "
8	28112.708	0.022	0.000	-19835	0.026		" "
9	28657.581	-0.004	-0.018	-19238	0.006		" "
10	29388.690	0.009	0.006	-18437	0.028		" "
11	32040.139	-0.020	0.018	-15532	-0.032		" "
12	39083.527	-0.162	-0.017	-7815	-0.022		(3)
13	43486.488	-0.205	0.005	-2991	-0.011		" "
14	45903.3733	-0.226	0.021	-343	-0.0025	Min.II	pres. paper
15	46216.4380	-0.228	0.024	0	0.0000	Min.I	pres.paper
16	47239.5904	-0.244	0.023	1121	-0.0041	Min.II	" "
17	47239.5904	-0.243	0.024	1121	-0.0031	Min.II	(1)
18	47616.5465	-0.245	0.028	1534	-0.0004	Min.I	(10)
19	47669.467:	-0.263	0.011	1592	-0.017:	Min.I	pres. paper
20	47670.3977	-0.245	0.029	1593	0.0004	Min.II	pres. paper
21	48496.414:	-0.269	0.038	2498	0.0072	Min.I	(2)

3. After JD 45000: In addition to the pe. observations, some visual minima are plotted in the O−C diagram (Brelstaff, 1985, Kucera, 1986).

The two last observation periods are shifted against the first one, but it is rather improbable that a period change occurred in the remaining observational gap. A search for additional pg. minima will be useful to verify this assumption. For the present, it could be assumed that no significant period change has occurred since the beginning of the observations, contradicting the conclusions of Srivastava (1991).

A mean period derived from Table 1 and the proposed doubling of the period leads to the elements

$$\text{Min. I. (hel.)=JD } 2446216.4380+1^{\mathrm{d}}.8254354\times E \qquad \text{(III)}$$

We would like to thank some members of the Nürnberg astronomical working group (NAA) for assistance during the measurements.

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TIME OF LIGHT MINIMUM OF BW VULPECULAE[1]

BW Vul (HD 199140 = HR 8007, B2III, V = 6.55) has the largest known amplitude of light variation and radial velocity variation among the β Cephei stars. The period of the variation is approximately 5^h, and is now increasing at a rate of about 2 seconds/century.

We report photometric observations obtained on September 26, 1992 at Jungfraujoch Observatory with a 76-cm reflector telescope and the Geneva P1 photoelectric photometer. A Lallemand S-11 photomultiplier, refrigerated at about -23°C, was used as detector. The system was equipped with a DC amplifier and a strip-chart recorder. All measurements were taken through the V_1 filter of the Geneva system.

Comparison stars were the same as C_1 and C_2 used by Sterken et al. (1986), viz. HD 198820 = HR 7996 (B3III, V = 6.44) and HD 198527 = SAO 089185 (B9.5V, V = 7.0).

The observations were carried out according to the scheme $C_1, BW\,Vul, C_1, BW\,Vul, C_1$, $BW\,Vul$, ... and, in addition, a measurement of C_2 was taken at the beginning and at the end of the complete observing sequence. Each datapoint consisted of a measurement of about 1 minute duration. Sky background was measured about once every two cycles.

The data were corrected for sky background contribution, and for the effect of atmospheric extinction; the extinction coefficient $k_{V_1} = 0.569$ was derived by application of the classical Bouguer method on the measurements of C_1. The mean magnitude difference between C_1 and C_2 (in the sense C_1 *minus* C_2) was $-0\overset{m}{.}754 \pm 0\overset{m}{.}003$. Considering the rather large value for the extinction coefficient, and also the fact that the measurements had to be stopped for cirrus clouds, we assess the quality of our data as of weight 2–3 on the scale given by Sterken et al. (1993). Table 1 gives the differential V_1 magnitudes BW Vul *minus* C_1.

The time of minimum light $T_{min} = HJD2448892.3949$ was derived using the method outlined by Sterken et al. (1987). The residual to the linear ephemeris given by Sterken et al. (1993) equals $-0\overset{d}{.}0038$. Figure 1 shows all T_{min} values obtained since June 15, 1988 (that is, our new T_{min} and also those taken from Table 1 of Sterken 1993).

Our result indicates that probably no abrupt change in the period of BW Vul has occurred in the last year. However, more photometric data are needed to elucidate how much of the forthcoming changes of the period of BW Vul can be ascribed to the light-time effect in a binary system. For a detailed discussion on the interpretation of the period changes in BW Vul, we refer to Sterken (1993).

[1] BASED ON OBSERVATIONS COLLECTED AT THE HOCHALPINE FORSCHUNGSSTATION JUNGFRAUJOCH (SWITZERLAND)

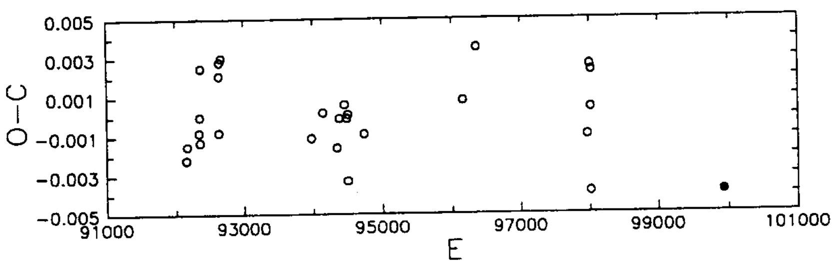

Figure 1: $O-C$ diagram for all available times of minimum since June 15, 1988 (the solid circle represents the new time of minimum reported in this paper) according to the cycle-count scheme given by Sterken(1993) and with $P = 0^d.2010443$ and $T_0 = 2447328^d.4751$.

Table 1. Differential V_1 magnitudes of BW Vul *minus* HD 198820. *HJD* is heliocentric julian date *minus* 2,440,000.

HJD	ΔV_1	*HJD*	ΔV_1
8892.3482	0.130	8892.3602	0.169
8892.3644	0.201	8892.3686	0.209
8892.3779	0.228	8892.3818	0.221
8892.3866	0.233	8892.3906	0.229
8892.3946	0.234	8892.3984	0.232
8892.4028	0.225	8892.4087	0.222
8892.4130	0.218	8892.4182	0.216
8892.4224	0.198	8892.4262	0.192
8892.4302	0.189	8892.4339	0.160
8892.4375	0.153	8892.4412	0.133

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THE PERIOD CHANGE OF RT Aur: AN UPDATE

RT Aur (HR 2332) is a $3^{d}.73$ classical Cepheid which is of some interest because it occupies a point in the Cepheid instability strip on the HR diagram that is very nearly the same as that occupied by Polaris. The two stars are both naked-eye objects of very low reddening, have the same value of $<B-V>_0$ (Fernie 1990) and nearly the same period ($3^{d}.97$ for Polaris.) A remarkable difference between them, however, is that RT Aur has a V-mag amplitude of 0.8 mag, while Polaris now has an amplitude ≤ 0.01 mag (Fernie, Kamper, and Seager, in press.) As detailed in Fernie et al, they are not at the edge of the instability strip.

In pursuit of other similarities or dissimilarities between the stars, I took note of Polaris having a well-documented rate of period increase (Arrelano Ferro 1983) and decided to examine the period change, if any, of RT Aur. This had already been done by Szabados (1977), who compiled O-C data going back to 1897 which suggested the star had shown a small period jump around JD 2430000, but that otherwise the period(s) had been constant. Szabados' own data, however, are now 20 years old, and since then new photoelectric data or sources not then available to Szabados have been obtained. I detail these below and combine them with the earlier data to update our knowledge of RT Aur's period change.

The additional data I have used are those of Kelsall (1971), Feltz and McNamara (1980), Evans (1976), Moffett and Barnes (1985), and Eggen (1985). I used the well-defined lightcurve of Moffett and Barnes as a template to fit to the other data sets where these were less complete. The observed times of maximum V light so obtained were:

Kelsall:	2438692.624 ± 0.041	E = -813
Feltz & McNamara:	2440131.746 ± 0.048	-427
Evans:	2440970.569 ± 0.041	-202
Moffett & Barnes:	2444079.920 ± 0.015	+632
Eggen:	2444523.920 ± 0.015	+751

The cycle count, E, is on Szabados' system.

Combining these results with the other 66 in Szabados' Table 23, and assigning a weight of 3 to photoelectric determinations and 1 to visual determinations, the best fitting linear ephemeris was $JD_{max} = 2441723.726 + 3.7282205\,E$. The O-C residuals from this fit, although small and with considerable scatter, show a trend suggestive of a higher-order term being present. I have formed normal points in bins of 2000 cycles, and these are shown in Figure 1 with a second-order polynomial fitted by least-squares. This leads to an ephemeris for the time of maximum V light that is

$$JD = \underset{\pm 19}{2441723.663} + \underset{12}{3.728166}\,E - \underset{1.8}{8.3\cdot 10^{-9}}\,E^2$$

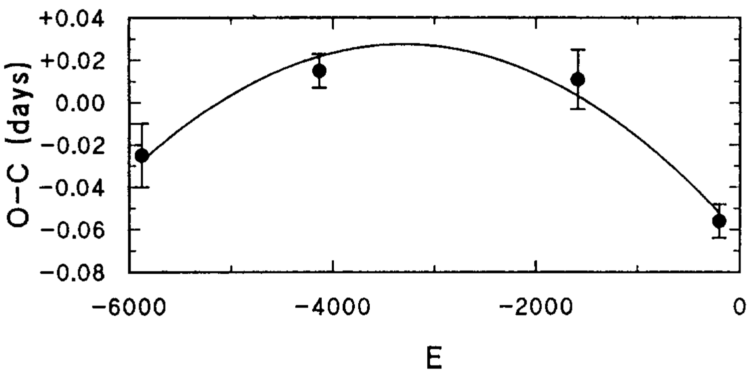

Figure 1

RT Aur thus has a rate of period change, dP/P = $-4.6 \cdot 10^{-9}$ or -0.14 sec/yr. This is among the smaller values known, although not as small as the value of -0.089 sec/yr known for δ Cep. By contrast Polaris shows a value of +3.3 sec/yr. The two stars do, therefore, differ significantly in their rate of period change. As discussed in Fernie et al, however, this is unlikely to be related to their relative amplitudes.

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NEW VARIABLE STARS IN CYGNUS, LYRA AND VULPECULA

The following work is an evaluation of an area of 20°×15°centred at 19^h46^m+30° in my series of 32 fields in the Milky Way. Two fields are previously described in IBVS (Dahlmark, 1982, 1986).

Twenty-one plate pairs (103aD +GG 11 and 103aO) exposed between 1967 and 1982 were collected and treated in the same way as described previously (Dahlmark, 1982).

In addition, 86 exposures of the field were made on Technical Pan film 4415+Schott 495 (1mm) during the period 1985-1992. Two 4"×5" images of one hour exposure were taken immediately after each other with the Perkin-Elmer lens 65/305 mm. During 1990, 4 exposures were made on IIIaJ plates without filter and simultaneously with TP film. TP films and IIIaJ plates were always hypersensitized.

During 1987 and 1990 the area was exposed with a 200/210/300 mm Schmidt camera and a casette with 10° field (TP film+Wr 9 filter).

16 stars were photographed twice with my Newtonian reflector (210/1660 mm) and an image intensifier camera of the micro channel type. Filter combination was Schott BG 12 (2 mm)+BG 28 (1 mm) for B magnitudes and Schott GG 495 (1 mm)+BG 38 (2 mm) for V magnitudes (T Max 400 film was used).

All magnitude estimations were made with a step scale under the films in a stereomicroscope. The scale is calibrated with the magnitudes obtained from NGC 6823, 6834, 6871 and 6882/5 in the publication of Hoag et al. (1961). Around each new variable the magnitudes of about 10 comparison stars were estimated mainly from the 103aD plates and the Schmidt exposures.

Six Schmidt negatives covering the area were enlarged (with negative images) to the scale 1°=60 mm. A grid of epoch 1950 was drawn from the positions from SAO catalog. The coordinates of the new variables were determined from this grid. For 60 stars my coordinates were compared with those from IRAS. The average deviation in both R.A. and decl. is ±13".

In this survey 80 stars are published. 73 of them are quite new variables. The results are based on more than 8700 magnitude estimations.

Rough B−V color estimations could be made for 44 stars. 24 stars have only a lower limit for B−V. 12 stars are without B−V estimations. The average uncertainty is estimated to be ±0.2. It depends mainly on the fact that the B magnitudes are very close to the plate limit.

Three different methods are used for the B−V estimations.

1. 34 stars from 103aO and 103aG +GG 11 plates
2. 21 stars from IIIaJ and TP+S 495 plates and films
3. 16 stars on T Max 400 film from the image intensifier camera

Table 1. New variables in Cyg, Lyr and Vul. Plate centre 19^h46^m $+30°$.

No	R.A. /1950/	Decl. /1950/	m_V max	m_V min	B-V	Type	Epoch 24400 00 +	P /d/	Notes
LD 106	$19^h01^m22^s$	$+33°53'.5$	11.2	< 15.0	1.7	M	7560	459 c	
LD 107	19 04 15	+25 30.0	12.5	< 16.0	0.5	M?	6910	338 c	
LD 108	19 05 23	+31 38.0	12.6	14.4	2.0	SR	6085	308 ?	
LD 109	19 05 38	+35 41.7	12.0	13.0	1.2	IB	-	-	
LD 110	19 06 02	+36 18.3	11.9	13.5	1.6	IB	-	-	1
LD 111	19 07 10	+32 48.3	11.3	12.3	1.5	SR	6990	457	
LD 112	19 08 06	+23 15.9	13.2	< 15	0 ?		7315	234 c	1
LD 113	19 09 08	+24 39.4	12.7	16.0	1.2	M	6620	302 c	
LD 114	19 10 35	+23 06.5	11.8	≤ 15	-	M	6620	335 c	1
LD 115	19 11 17	+26 53.6	13.8	< 15.3	-	M	7060	282 c	1
LD 116	19 12 51	+36 55.8	11.5	14.8	1.5	M	6650	290	1
LD 117	19 19 54	+23 00.8	12.2	15.2	2.3	M	6945	180 c	
LD 118	19 19 59	+26 16.7	13.4	< 16.2	-	SR	6740	395	
LD 119	19 20 37	+25 52.8	12.5	< 15.2	>0.5	M	7085	292 c	
LD 120	19 21 09	+24 21.7	10.5	13.2	3.3	M	6740	342 c	2
LD 121	19 21 46	+26 21.3	13.3	14.7	0.8	IB	-	-	1
LD 122	19 22 28	+32 13.3	11.7	< 15.2	2	SR	6620	531	3,1
LD 123	19 23 52	+26 32.3	13.2	≤ 15.2	1	SR	6930	407	1
LD 124	19 24 12	+34 56.9	11.6	≤ 15.2	1.7	M	7280	405	
LD 125	19 25 18	+35 17.3	11.6	< 15.2	1.6	M	7015	247	4
LD 126	19 25 41	+24 36.4	11.9	15.2	1.7	M	6945	132 c	1
LD 127	19 28 13	+28 03.2	12.4	< 15.2	>2	M	6950	370	2,1
LD 128	19 29 03	+23 24.0	11.4	15.2	2.4	M	6920	363	
LD 129	19 29 42	+28 44.0	12.7	14.5	1.3	SR	-	-	
LD 130	19 33 59	+34 09.2	12.3	15.2	>2	M	6700	358	1
LD 131	19 37 13	+23 37.5	11.7	< 15.0	>1.3	M	7300	292 c	1
LD 132	19 38 13	+23 26.0	14.0	15.0	-	I	-	-	
LD 133	19 38 58	+24 45.6	12.1	≤ 15.2	2.1	M	7300	260	
LD 134	19 40 09	+30 06.6	12.0	< 15.2	2.0	M	6700	362	11
LD 135	19 41 41	+34 21.9	10.4	13.0	3.0	SR	6730	560	5,2
LD 136	19 41 55	+32 22.2	10.2	14.7	4.0	M	6090	562 c	1,2
LD 137	19 44 27	+31 32.8	11.9	15.0	2.3	M	6700	371 c	
LD 138	19 44 46	+28 01.1	12.1	< 15.2	>1.8	M	6890	227	1,6
LD 139	19 45 27	+35 38.4	12.7	14.6	0.8	SRA?	6680	304 c	1
LD 140	19 47 12	+22 30.2	13.0	< 15.5	1.3	M	7000	470 c	1
LD 141	19 47 13	+29 24.0	10.0	12.6	2.7	M	7380	523	2
LD 142	19 47 57	+35 41.3	11.4	< 15.2	1	M?	6640	452	1
LD 143	19 47 58	+22 25.0	13.2	< 15.2	>0.7	M	7280	400	
LD 144	19 48 08	+26 18.8	13.0	15.0	>1.5		-	-	1,7
LD 145	19 49 10	+26 02.9	12.7	< 15.2	-	M?	7130	444	11
LD 146	19 49 33	+32 40.0	13.0	< 15.1	>0.9	M	6650	394 c	
LD 147	19 49 58	+27 01.5	12.0	15.0	1.6	SR	6650	480	8
LD 148	19 51 49	+23 00.7	13.0	15.0	1.3		6950	200	9
LD 149	19 53 03	+22 23.3	12.1	< 15.0	>1.3	M	6945	294	10,11
LD 150	19 53 47	+22 13.1	11.3	14.5	0.7	SRD?	6885	478 c	1
LD 151	19 54 19	+23 08.4	12.4	14.2	1.4	SRB	7350	404	
LD 152	19 56 07	+31 46.7	14.1	≤ 15.2	>0.6	M	7400	600	
LD 153	19 56 13	+29 33.1	12.6	< 15.2	1.5	M	6670	386	1
LD 154	19 57 10	+31 05.1	11.9	15.1	>2.8	M	7040	288 c	1
LD 155	20 00 29	+29 43.3	11.8	15.1	>2	M	7086	585 c	
LD 156	20 01 13	+31 15.6	12.8	13.7	1.2	I	-	-	
LD 157	20 01 23	+29 46.3	11.8	13.6	2.0	SR	-	-	
LD 158	20 04 14	+25 18.9	12.5	< 15.2	1.8	M	7005	204 c	
LD 159	20 04 20	+35 09.0	12.6	15.1	>1.8	M	7310	460	11,2

No	R.A. /1950/	Decl. /1950/	m_V max	m_V min	B-V	Type	Epoch 2440000 +	P /d/	Notes
LD 160	$20^h04^m43^s$	$+33^\circ49'.4$	12.5	15.1	>1.4	M	6920	355	12
LD 161	20 06 21	+25 27.3	13.8	<15.2	-	I	-	-	11
LD 162	20 07 44	+31 49.9	13.0	<15.2	>1	M	6925	437 c	1
LD 163	20 07 56	+25 29.2	11.8	15.1	1.6	M	6720	214 c	1
LD 164	20 08 51	+22 43.0	12.8	15.0	1.5	M	7355	284	1,13
LD 165	20 10 30	+24 27.8	12.4	<15.2	1.8	M	7050	263 c	
LD 166	20 13 34	+25 17.7	10.3	<15.2	2.8	M	6660	262 c	1,2
LD 167	20 13 57	+24 04.4	11.6	<15.2	>1.8	M	6720	452	
LD 168	20 19 30	+3o 15.1	13.0	<15.2	>0.5	SR	6645	403	1
LD 169	20 19 31	+29 05.1	12.4	15.0	-	SR	6620	420?	
LD 170	20 19 57	+22 13.8	13.0	14.9	0.7	SRD	6640	148	1
LD 171	20 24 03	+27 59.7	12.8	<15.0	-		6945	430?	14
LD 172	20 25 18	+24 07.5	12.0	<16.0	1.8	M	6760	440	15
LD 173	19 15 55	+34 20.4	12.0	14.8	1.9	M	7375	269 c	
LD 174	19 19 40	+24 37.4	12.9	<15.8	-	SR	7730	323	1
LD 175	19 28 09	+24 04.0	14.2	<16.0	-	M	6980	250	
LD 176	19 46 35	+31 58.6	13.0	15.1	-	M	6650	275	
LD 177	19 48 44	+29 21.3	12.8	15.2	>1	M	6930	317 c	1
LD 178	19 50 23	+30 42.4	12.5	14.2	>1.7	M	7050	250	16
LD 179	19 52 29	+33 56.7	12.5	<15.2	1.4	M	7056	230 c	1
LD 180	19 54 17	+35 22.2	13.1	<15.0	>0.8	M	6980	382	17
LD 181	19 55 31	+30 35.0	13.9	<15.2	-	SR	6690	375	1
LD 182	19 55 53	+22 41.3	13.0	14.7	>1	I	-	-	1
LD 183	19 56 24	+35 35.1	12.3	14.8	>2	SRB	6619	103	18
LD 184	20 16 16	+26 29.8	11.8	<15.2	>1.6	M	6715	345 c	
LD 185	20 16 33	+28 25.7	13.5	15.0	>0.7	M	7715	298 c	

Notes

1. Close faint star (5" -30") may influence the magnitude estimations at minimum.
2. Possibly carbon star.
3. Small light variations in 1967-82.
4. P changes ± 5 days.
5. P changes between 450 and 560 d.
6. P changes between 215-240 d, average 227 d. LD 138=AI Vul.
7. Light variations only in 1967-70, max 2440030.
8. Long intervals constant 15.0 at min.
9. P between 195-205 d. Fast variations of 0.3 magn in one hour.
10. P increases from 288 to 300 d between 1986 and 1992.
11. Not found on 103aD plates in 1967-82.
12. P changes from 362 to 355 days between 1970 and 1990.
13. 0.5 magn variations in one hour.
14. Nova-like? Only one sharp max 2446945. Nothing in 1967-82.
15. P change ±30 d.
16. P change (between 240-290 days).
17. LD 180=V1460 Cyg. P increases from 367 days (1968) to 382 days (1990).
18. LD 183=V1464 Cyg. V1460 and V1464 are given with wrong coordinates in GCVS (3′ and 5′).

c means that the period P is constant between 1967 and 1992.

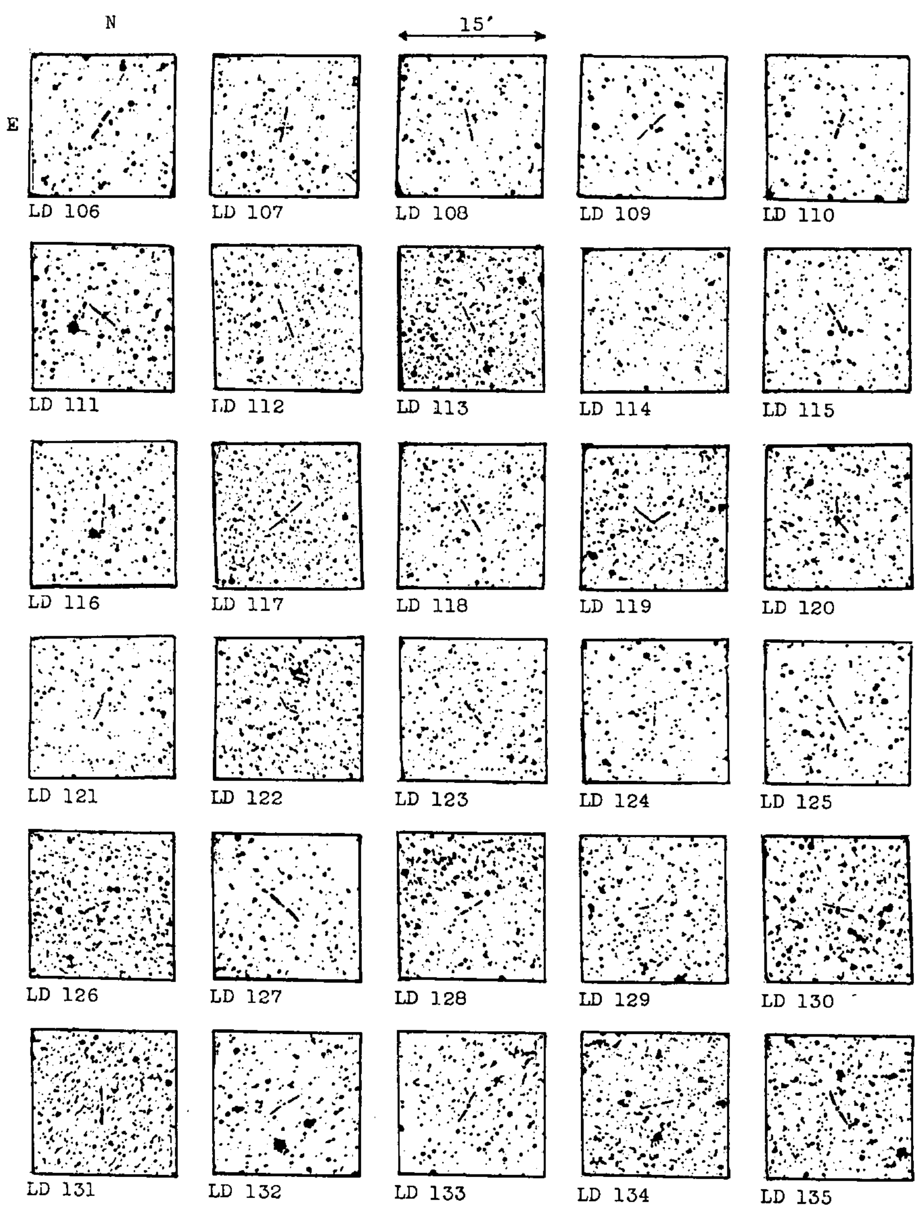
<15.2 means that the star is fainter than $15^m.2$.

LD 120=TAV 1921+24=CCS 2728. The Astronomer, Vol. 28, No. 332, 182, 1991.

LD 135=TAV 1941+34. The Astronomer, Vol. 26, No. 311, 237, 1990.

LD 142=V1000 Cyg.

LD 164=HX Vul. In GCVS given with 10′ wrong coordinates.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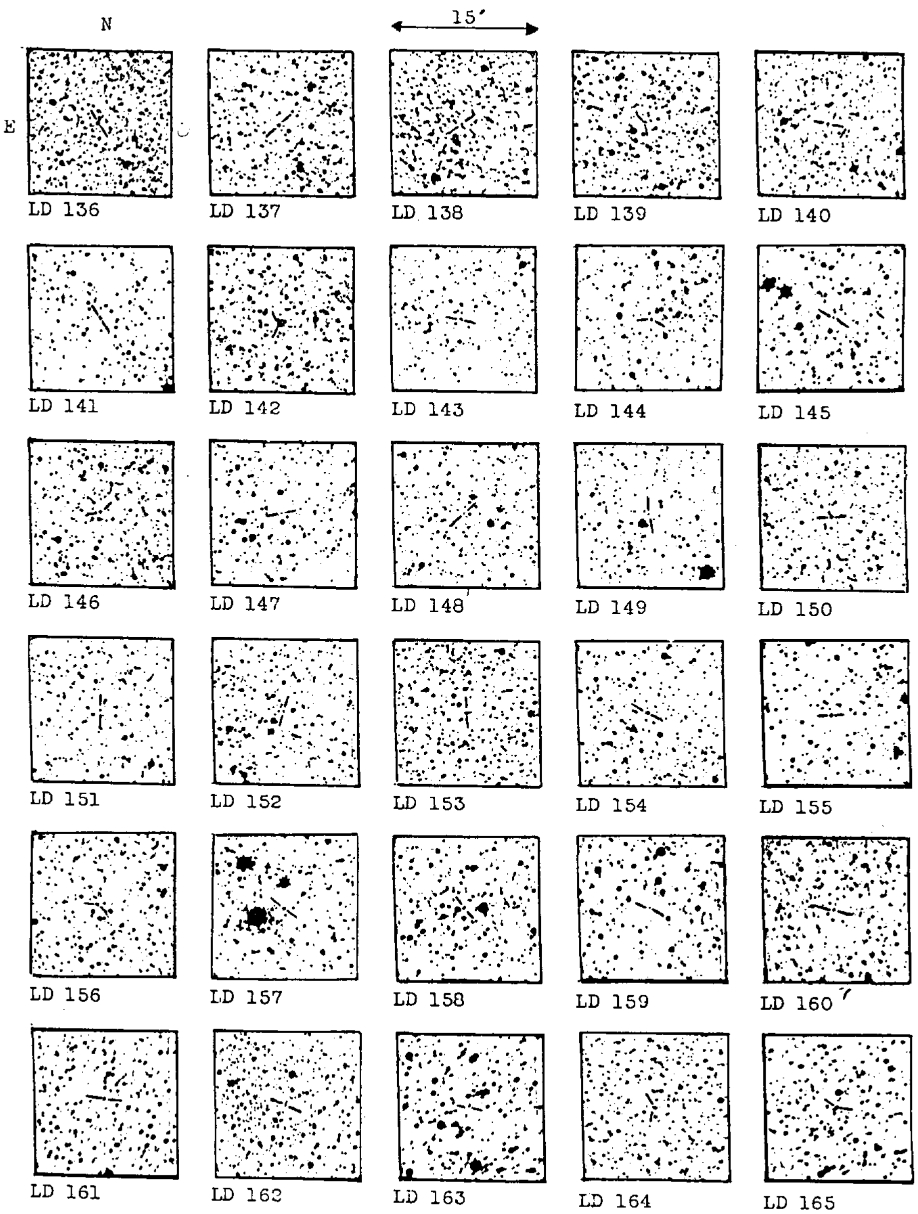
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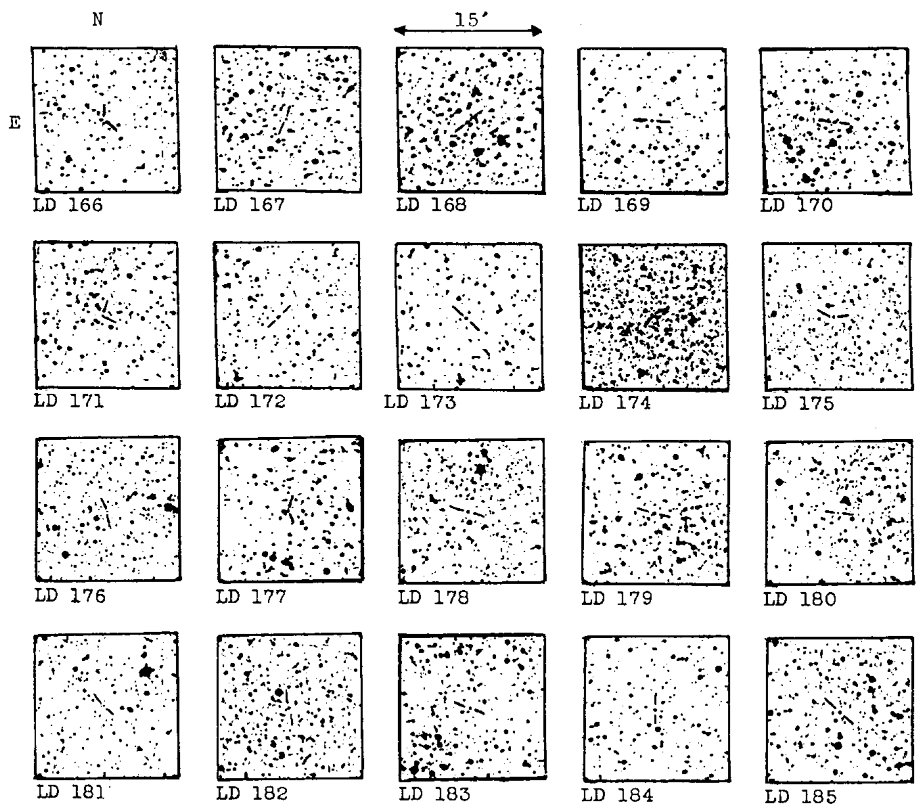

and Newtonian telescope. I cannot find significant differences between the three methods. It is curious that IIIaJ and TP gives almost the same values as 103aO and 103aD. Perhaps the reason is that both IIIaJ and TP have their sensibility shifted about 500$\AA$ to the red compared with 103aO and 103aD.

From 6720 magnitude estimations on TP film (1985-1992) the light curves of 80 variable stars have been drawn. From these curves the types, epoch and period (P) are estimated. The shape of these curves is correct, but the Technical Pan "V" magnitudes could be too bright, especially for red stars.

To find out the correction to be made I exposed a TP 2415 Hy film +Wr 9 with the Newtonian telescope on NGC 6866. This cluster has about 22 stars close to magn 13.5 with B−V from 0.15 to 1.85 (Hoag et al., 1961). I found a roughly linear connection between V and B−V for TP film and yellow filter

$$\text{corr.} = 0.4\ (B-V).$$

This means that the carbon stars with B−V=3 or 4 could be 1 to 1.5 magn. too bright in the Table. For instance V=10.2−14.7 and B−V=4 is given for the star LD 136. Perhaps it is more correct with V=11.8−16.3. But no corrections have been made in the table nor in the graphs, while B−V are rough and only known for 44 stars. The finding charts were obtained with the Schmidt camera in September 1987.

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NGC 2169-12, a photometric and spectroscopic Silicon variable *

In the course of a *Durchmusterung* of open clusters for the presence of chemically peculiar ('CP') stars of the upper main sequence using Δa photometry, the object No. 12 (numbering according to Hoag et al., 1961) in the young open cluster NGC 2169 has been identified as peculiar (Maitzen, 1993). Moreover, its Δa-index turned out to have a large scatter.

Table 1 gives the log of 7 observations obtained at ESO-La Silla both at the 1m-ESO and the 61cm-Bochum telescopes (description of the equipment: Maitzen, 1993). Since such a low number prevents us from applying the usual period search codes we have relied on visual inspection of phase diagrams in order to single out possible periods.

An important starting point for period search is the *uvby*-photometry of Delgado et al. (1992) who discovered photometric variability of NGC 2169-12 through two extended night series (duration: about 7 hours each) separated by 3 days. Since they observed in both nights a decline in brightness in all colours (with decreasing range from blue to red) at roughly the same level, they conclude that the period should be larger than two times the duration of the observing run, hence about 14 hours. Delgado et al., however, retreated to the suggestion of Perry et al. (1978) who concluded from their 2 spectrograms (taken with a 0.9m telescope) that the star is a spectroscopic binary and ascribed the light variation to a binary system with components of rather different type. Had they taken into account that Young and Martin (1973) already classified it as Silicon star both the possible period length and the amplitude increase from y to u would have appeared to them as typical features of a hot CP2 star.

Fig. 1 shows the variation of the Δa-index with phase for $P = 1.56$ days yielding the smoothest picture. While $P = 0.77$ has still to be retained as possible period, our photometry renders a period near 3 days improbable although it has shown up prima facie from the *uvby*-photometry of Delgado et al.

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* based on observations collected at the *European Southern Observatory (ESO)* on La Silla, Chile, and at the *Leopold-Figl-Observatorium für Astrophysik* on Mount Schöpfl, Austria. This research has made use of the SIMBAD database, operated at *CDS*, Strasbourg, France.

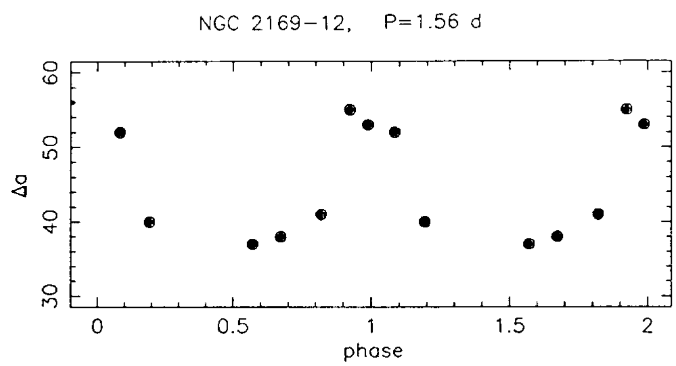

Fig. 1: Δa in mmags versus phase (elements of the variation: Tab. 1)

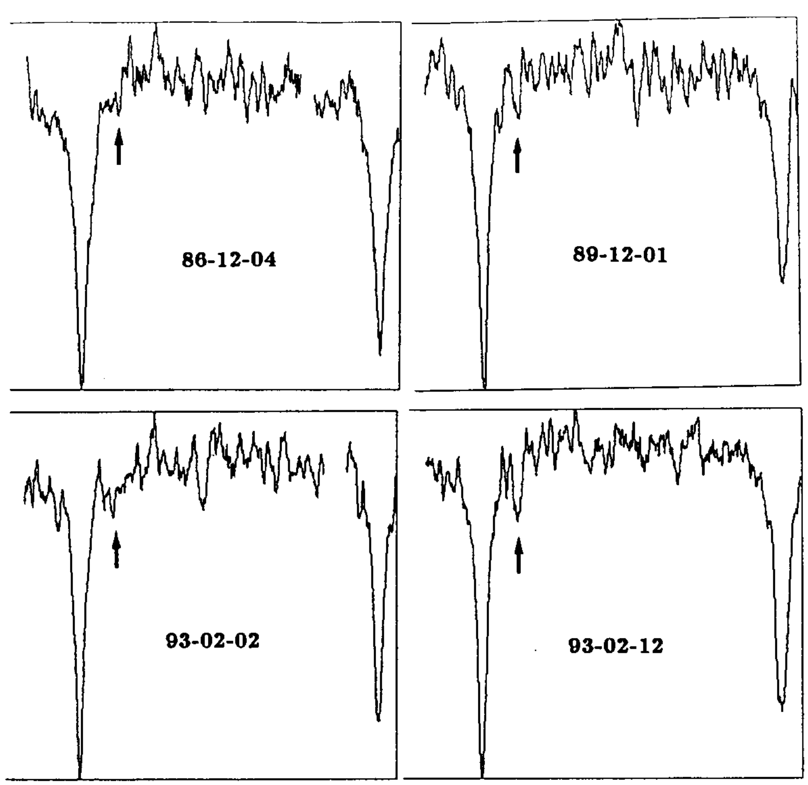

Fig. 2: Density tracings of NGC2169-12 spectrograms between $H\delta$ (left) and $H\gamma$ (right) obtained at the observing nights indicated. The location of the Si II doublet 4128-31 is marked by an arrow. Gaps in the tracings are due to emulsion defects.

TABLE 1. Δa-photometry of NGC 2169-12

HJD	ϕ	Δa	n	m.e.	telesc.
2447524.70	0.08	52	4	2.7	1m ESO
25.62	0.67	38	9	1.6	1m ESO
27.67	0.99	53	4	3.2	1m ESO
30.69	0.92	55	7	5.0	Bochum
31.70	0.57	37	16	2.8	Bochum
32.67	0.19	40	5	3.9	Bochum
33.65	0.82	41	5	1.3	Bochum

Notes: the phases ϕ were calculated with $\Delta a(max) = 2447524.57 + 1.56E$. The photometric quantities are expressed in mmags.

TABLE 2. Spectroscopic observations at Mt.Schöpfl

Plate No.	HJD	night	exposure
S811-3	2446769.51	86-12-04	81 min.
S878-3	2447862.47	89-12-01	60 min.
S974-3	2449021.35	93-02-02	184 min.
S978-1	2449031.38	93-02-12	175 min.

Although there is triple evidence (one spectroscopic identification, our Δa-values and *uvby*-variability) for the CP2-nature of NGC 2169-12, we were worrying about the fact that 3 other spectroscopic classifications indicated normal main sequence types:
Hoag and Applequist (1965): A0V,
van Rensbergen et al. (1978) and Perry et al. (1978): B9V.

Maitzen (1993) pointed out that one reason for missing peculiarity could have been the insufficient spectrum widening forced by the fact that for the telescopes and photographic technique used the star is practically at the magnitude limit.

Since the star is at $\delta = 13°$, hence observable also from the northern hemisphere we decided to resort to our home observatory, the *Leopold-Figl-Observatorium für Astrophysik* on Mt. Schöpfl and to obtain spectra with its Boller&Chivens Spectrograph at dispersion 125 A/mm on IIaO emulsion. The widening of the spectrograms on the plate was 500 microns. Table 2 contains the log of the spectrographic observations and Fig. 2 the density tracings obtained at the PDS 1000 microdensitometer of the Vienna Institute for Astronomy (step size: 2 microns, slit width: 4 microns).

From the behaviour of the Si II 4128-31 doublet it is clear that NGC 2169-12 is a spectrum variable. Our spectrograms S811-3 and S974-3 do not show any prominence of the Si feature and we would have classified the star as normal like the other sources except Young and Martin. On the other hand, S978-1 and to a lesser extent also S878-3 exhibit the Silicon doublet as outstanding. Hence, the problem of controversial classifications is resolved by the existence of intrinsic changes of peculiar spectral features.

We conclude therefore that all existing observational evidence consistently identifies No. 12 as CP2-Silicon star with strong variability in Silicon line strength, Δa and *uvby*, and rather fast rotation.

A final note is due to the appearance of an object 'No. 12' with Geneva photometry (reported e.g. in the SIMBAD database): This number refers to the designation of Cuffey and McCuskey (1956) and represents Hoag No. 15 (North, 1993).

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uvbyβ PHOTOMETRY OF THE NEWLY DISCOVERED PULSATING STAR HR 8851

After HR 8851 was found to be a pulsating star, possibly a δ Scuti star (Hao and Huang, 1993), we made observation in Strömgren uvbyβ system with the 60 cm reflector located at Xinglong Station, Beijing Astronomical Observatory on January 21, 1993. The aim of the observation is to get more information about the physical character of this star.

The observation was performed on a very good photometric night. We chose HD 221421 (COM1) and HD 221167 (COM2) as the comparison stars whose standard uvbyβ values are listed in Table 1.

We use the relations by Crawford (1975)

$$E(c_1)=0.20E(b-y)$$
$$E(m_1)=-0.32E(b-y)$$
$$E(b-y)=0.74E(B-V)$$

to correct for the interstellar extinction. We know that HR 8851 is listed as an F0IV type star with B−V=0.24 in Preliminary Version of the Bright Star Catalogue, 5th Revised Edition (Hoffleit and Warren, 1991), but for an F0IV type star, $(B-V)_o=0.29$ (Straizys, 1977), then $E(B-V)=-0.05<0$. So we think that the MK classification for HR 8851 adopted by BSC is uncertain. Here we use A7V type (see RGOB, 1968, **135**, 385, as searched from Simbad) for HR 8851 to estimate $E(B-V)=B-V-(B-V)_o=0.24-0.20=0.04$. After making the correction, we can get the results listed in the last row of Table 2.

In order to determine the absolute magnitude, we use the empirical relation (Breger, 1990)

$$M_v=-9(c_1)_o+15\beta-32.22$$

Table 1. Standard values for the two comparison stars (Olsen, 1983)

	SAO number	Sp	V	b−y	m_1	c_1	β
HD 221421	10770	F8	8.215	0.349	0.158	0.403	2.628
HD 221167	10752	G0	7.737	0.332	0.125	0.364	2.615

Table 2. uvbyβ results observed for HR 8851

	u	v	b	y	b−y	m_1	c_1	β
with COM1	7.366	6.058	5.723	5.557	0.166	0.169	0.973	2.727
with COM2	7.353	6.067	5.731	5.555	0.176	0.160	0.950	2.740
average					0.171	0.165	0.962	2.734
					$(b-y)_o$	$(m_1)_o$	$(c_1)_o$	
					0.141	0.175	0.956	

which results in M_v=0.19±0.3. We also use another relation (Breger, 1979)

$$M_v = -3.052 log P + 8.456(b-y)_o - 3.121,$$

where P=0.272 days is the period of light variation (see Hao and Huang, 1993), to get M_v=−0.20±0.3. These two independent determinations of M_v agree very well with each other within the uncertainty. So we can take the mean M_v=0.0 as our estimate for the absolute magnitude. This value is too bright to fit either F0IV or A7V type star and is due to the extremly large $(c_1)_o$ which is an indicator of the luminosity. We examined our observation carefully, but no problems were found.

According to the uvbyβ indices calibration made by Philip and Relya (1979), we obtain T_{eff}=(7700±200)K, and $log g$=3.65±0.1.

For A7 to F2 type stars, BC=0.0, $M_{bol}=M_v$. So, we use the radiation law

$$log(R/R_{\odot}) = -0.2M_{bol} - 2 log T_{eff} + 8.472$$

to derive R=(5.0±1.0)$R_{\odot}$. Then from

$$log g = log g_{\odot} + log(M/M_{\odot}) - 2 log(R/R_{\odot}),$$

we have M=(4.0±1.7)$M_{\odot}$.

From the uvbyβ photometry and the physical parameter determinations we can find that

(a) UBV measurement and MK classification taken by BSC do not agree well with each other, and

(b) HR 8851 has an extremely large c_1 in comparison with those stars which have the same other indices as HR 8851. This leads to a too bright absolute magnitude to fit any of the calibrations for the models of A−F stars.

Further observations on this star are necessary. High resolution spectroscopy covering a wide range of wavelength is especially desirable for clarifying the possible effects of the binarity which may be the cause for the problems mentioned above.

Acknowledgement. We are grateful to Prof. Jingyao Hu for his help in providing us with some useful references for this work.

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SUSPECTED VARIABLE STAR NEAR V654 Her

BD+35°2891=SAO 65670 was used as a check star of V654 Her in the beginning of 1991. On 8 May, 1991 the star was found to flare. A group of 3 fast flares was detected, using a single channel photon-counting photoelectric photometer, attached to the 60 cm telescope at the Belogradchik Observatory (Antov and Konstantinova-Antova, 1992). The flares were observed in the U-band of the UBV system with integration time of 1 sec. Data for the flares are given in Table 1 in the following form:

- date;
- serial number of the flare;
- U.T. of the beginning;
- U.T. of the maximum;
- the duration of the flare;
- the amplitude of the flare $\Delta m(U)$, where m(U) is the magnitude in U-band of the UBV system. $\Delta m(U)$ was calculated regarding the quiet state phase of the star;
- the standard deviation of random noise fluctuation $\sigma(mag)=2.5 \log (I_0+\sigma)/I_0$, where I_0 is intensity in impulses of the quiet star, lessened with the sky backround and σ is the standard deviation of random noise fluctuation in impulses.

Table 1

Date	Flare No.	U.T. beginning	U.T. max	Duration (sec)	$\Delta m(U)$	$\sigma(mag)$
8 May 1991	1	$23^h07^m07^s$	$23^h07^m17^s$	34	0.17	0.03
Belogradchik	2	23 13 13	23 13 31	47	0.16	0.03
	3	23 14 11	23 14 30	36	0.13	0.03

The data processing has been made by Kirov, Antov and Genkov's program package (Kirov et al., 1991).

The light curves of the detected flares are shown in Figures 1a and 1b. The identification chart is given in Figure 2.

The authors carried out an intensive monitoring of the suspected variable star, using the two identical single channel photon-counting photometers, attached to the 60 cm Cassegrain telescopes at the Belogradchik Observatory and at the National Astronomical Observatory Rozhen. No more flares were detected during 24 hours 23 min 08 sec total monitoring time in 1991 and 8 hours 57 min 21 sec total monitoring time in 1992.

Estimates of the colors of the star in the UBV system were obtained at Belogradchik Observatory in 1992. HD 153472 was used as a comparison star for all the estimates. They are given in Table 2.

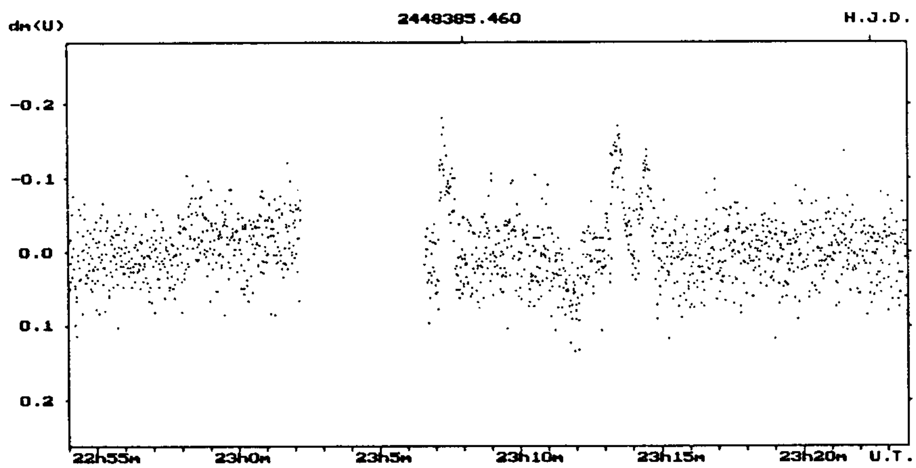

Figure 1a

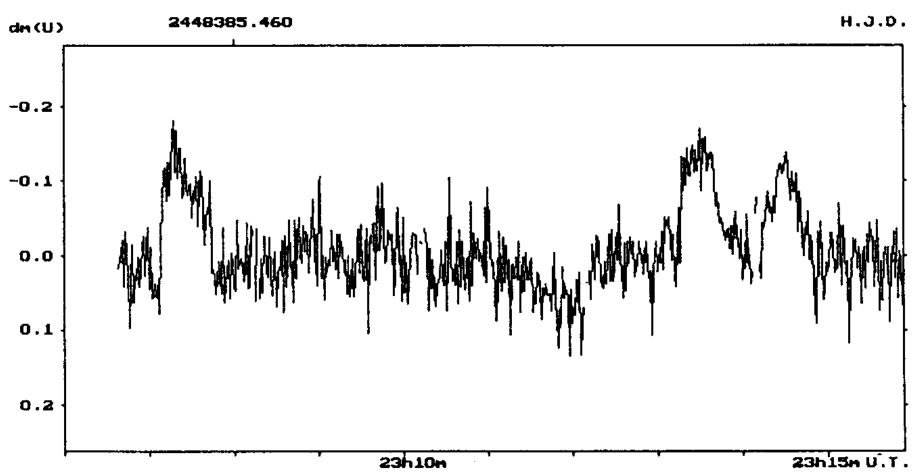

Figure 1b

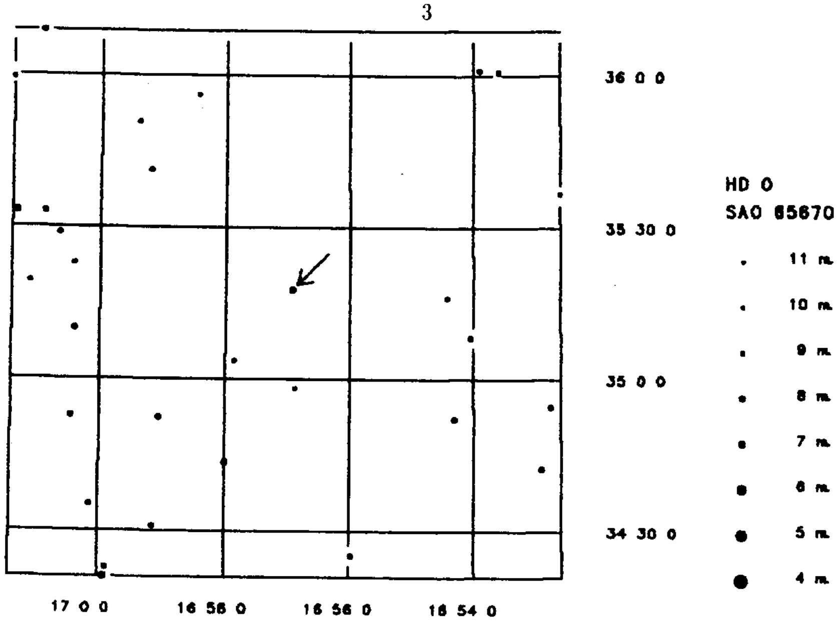

Figure 2. The identification chart is drawn using Valchev's SAO plot program package (Valchev, 1992). Center of the field: ($16^h56^m55^s$, 35°17' 47" (1993.0)). The suspected variable is indicated by an arrow.

Table 2

Date	U.T.	V	B−V	U−B	Notes
25/26 Apr 92	2^h04^m	7.87	1.51	1.80	mean of 3 estimates
02/03 May 92	1 08	7.92	1.50	1.78	mean of 3 estimates
04/05 May 92	1 20	7.93	1.50	1.79	a single estimate
07/08 May 92	1 29	7.95	1.50	1.80	mean of 3 estimates

Mean values:
V=7.92±0.03; B−V=1.50±0.01; U−B=1.79±0.01

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A NEW ECLIPSING BINARY (Fr3 Cnc)*

On photographic observation of asteroid 4179 Toutatis on December 28/29, 1992 (with a Lichtenknecker Highspeed-Flatfield-Camera f=576/2.0) I found eclipsing light variation (about 11.0-11.5 mag.) on one of three comparison stars.

In the following two months I could observe a further primary minimum and two secondary minima. Moreover I could fill the gaps over the total phase, so that first rough elements could be derived:

$$\text{Min.}=\text{JD } 2449030.430+1^{d}.323147\times \text{E}$$

The duration of the primary minimum is short (about half an hour—Figure 1) is contrast to the relatively long "d" of the secondary minimum (about 0.25 mag.) of nearly one hour (Figure 2). In view of these facts photoelectric observations are highly recommended.

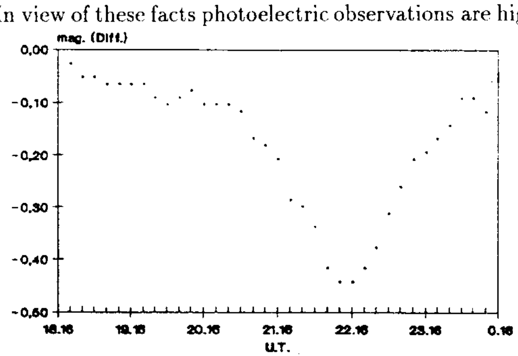

Figure 1

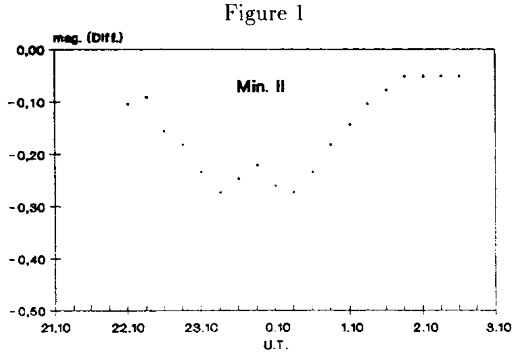

Figure 2

*This is an independent discovery of light variation of GSC 1383_600 announced in the No. 3839 issue of the IBVS. (The Editors)

Coordinates for Epoch 2000.0: RA=$08^h29^m39^s$ D=+17°17' 01".

The finder chart (Figure 3a) shows a field of 3°×3° of the SAO-Atlas, and a 1°×1° field of the TMA-Atlas (Figure 3b).

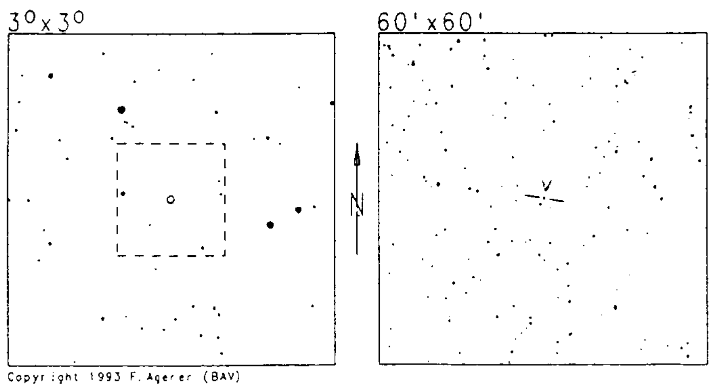

Figure 3a and 3b

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THE DIFFERENTIAL EXTINCTION TOWARD NOVA CYGNI 1992

I. Introduction

The intrinsic luminosity of an astronomical object is one of its most important physical characteristics. Without the intrinsic luminosity, our understanding of it would not be complete. These statements may be taken one step further for novae: Not only is the intrinsic luminosity important for nova astrophysics, but it is also important for cosmological astrophysics because novae are used as distance indicators.

Unfortunately, the intrinsic luminosity estimates of objects are hindered by varying amounts of extinction due to dust grains along the line of sight. There are several methods for determining the extinction. Some of them require an *a priori* knowledge of the object's properties. Others do not require this knowledge, e.g., measuring the strength of the 0.22 μm feature (Bless and Savage 1972), but they are not always reliable.

A lower limit to the differential extinction may be obtained from linear polarization observations of stars within a few degrees of the desired object (*cf.* Section II). With this lower limit, an improved upper limit to the object's distance (and luminosity) may be obtained (as compared to upper limits derived assuming no extinction).

II. The Technique

In a global sense, the average differential extinction ($\langle dA_V/dr \rangle$; in mag kpc^{-1}) is approximately the same along most lines of sight within the local spiral arm because the distribution of interstellar dust grains is nearly uniform. The average differential interstellar linear polarization ($\langle dp/dr \rangle$; in % kpc^{-1}), however, depends on the angle between the line of sight and the Galactic magnetic field which aligns the dust grains. At the present time, there is no satisfactory one-to-one relationship between $\langle dA_V/dr \rangle$ and $\langle dp/dr \rangle$, but a useful inequality can be derived.

For stars near the Galactic plane, the interstellar linear polarization and the color excess are related by a simple inequality (Serkowski, Mathewson, and Ford 1975; hereafter SMF), namely

$$p \lesssim 9E(B-V), \tag{1}$$

where p is the interstellar linear polarization (%) and $E(B-V)$ is the color excess (mag). Note that the upper limit corresponds to lines of sight which are perpendicular to the spiral arm. The interstellar reddening can be expressed in two ways,

$$R \triangleq \frac{A_V}{E(B-V)} = \frac{\lambda_{max}}{0.18\,\mu m}, \tag{2}$$

where R is the reddening, A_V is the extinction (mag), and λ_{max} is the wavelength of the interstellar linear polarization peak (μm). Note that the first equality is the definition of reddening and the second is an empirical formula (SMF). Along most lines of sight, $R \approx 3$ (Johnson 1965).

If we assume that both A_V and p are linear functions of distance with zero intercepts, i.e.,

$$A_V = \left\langle \frac{dA_V}{dr} \right\rangle r \qquad (3a)$$

and

$$p = \left\langle \frac{dp}{dr} \right\rangle r \, , \qquad (3b)$$

we obtain a lower limit for $\langle dA_V / dr \rangle$ when all the above equations are combined,

$$\left\langle \frac{dA_V}{dr} \right\rangle \gtrsim \frac{\lambda_{max}}{1.6} \left\langle \frac{dp}{dr} \right\rangle . \qquad (4)$$

Note that λ_{max} does not change by more than a few percent across the entire sky, so the error introduced by this factor is relatively small compared to the total uncertainty of the inequality.

In order to estimate $\langle dp / dr \rangle$, we must search the literature for stars, within a few degrees of the desired line of sight, that have been observed polarimetrically *and* have reliable distances. With these data in hand, a least-squares fit to Equation 3b may be performed to get $\langle dp / dr \rangle$. There are, however, a few pitfalls which must be avoided. Firstly, all stars that are known to be polarization variables must be excluded from the analysis, because they are intrinsically polarized and will skew the results. Secondly, there are many regions of the sky which have relatively few stars with linear polarization observations and reliable distances. Thirdly, the interstellar medium in some parts of the sky is more "clumpy" than the average. Lastly, the magnetic field in some parts of the Galaxy may be tangled and non-uniform. Any one of these problems may make this technique difficult to use.

III. Nova Cygni 1992

For Nova Cygni 1992, we are indeed fortunate. Not only have a lot of good quality linear polarization measures and distances been obtained in a single survey (Appenzeller 1966), but the dust grains and magnetic field in this part of the galaxy appear to be reasonably well behaved as well.

According to SMF, $\lambda_{max} \approx 0.52$ μm (determined empirically from their own linear polarization measures) in this part of the sky, which means that $\lambda_{max} / 1.6 \approx 0.3$. The size of the field had to be a bit larger than desired, $\approx \pm 10°$ (typically it is $\approx \pm 5°$) in order to obtain enough stars for the least-squares fit. A list of the field stars may be found in Table 1, and a plot of the linear polarizations versus distance may be found in Figure 1.

There appears to be a linear trend in the polarization, but unfortunately there are not many points at distances comparable to that of the nova, between

2 and 3 kpc (Quirrenbach *et al.* 1993; Starrfield 1993; Wagner 1993). We assume because of the Galactic geometry that $\langle dp/dr \rangle$ is constant to 3 kpc. The fit gave $\langle dp/dr \rangle \approx 0.6\%$ kpc^{-1}. This value is close to what is expected for a line of sight at an $\approx 45°$ angle to the spiral arm (the value is $\approx 1.2\%$ kpc^{-1} for lines of sight perpendicular to the spiral arm; Elias 1990). Therefore, $\langle dA_V/dr \rangle \gtrsim 0.2$ mag kpc^{-1}.

Table 1

The Linear Polarization of the Nova Cygni 1992 Field Stars

Star (HD/BD)	$V/B-V/U-B$	Stellar Class	$d/l^{II}/b^{II}$ (kpc)/(°)/(°)	$\bar{p}_L$ [a]/$\bar{\theta}$ [a] (%)/(°)
195068	5.59/+0.30/+0.04	dF0	0.036/86.14/+6.40	0.02(0.03)/62(26)
195338	7.48/+1.17/+0.96	G7 II	0.540/84.85/+5.14	0.70(0.06)/17(3)
196090	7.79/+1.43/+1.56	K3 III	0.220/84.94/+4.26	0.47(0.06)/18(4)
+46°3014	8.43/+0.52/+0.02	F7p V	0.073/85.87/+3.06	0.23(0.11)/151(13)
198345	5.55/+1.47/+1.78	K5 III	0.130/86.97/+2.72	0.13(0.03)/75(7)
199612	5.86/+1.05/+0.93	G8 II-III	0.140/88.93/+2.49	0.12(0.03)/78(8)
190149	6.97/+1.64/+2.02	M0 II-III	0.380/79.32/+7.15	0.12(0.06)/100(12)
191854	7.46/+0.69/+0.22	G5 V	0.028/79.98/+5.77	0.09(0.05)/173(15)
192514	4.81/+0.09/+0.11	A3 III	0.056/82.71/+6.87	0.10(0.02)/60(5)
192535	6.16/+1.52/+1.83	K4 III	0.130/79.85/+4.93	0.26(0.03)/91(3)
192867	7.24/+1.61/+1.94	M1 III	0.310/80.66/+5.08	0.27(0.06)/99(6)
192869	7.85/+0.55/+0.08	F6 IV	0.105/79.19/+4.08	0.17(0.06)/76(10)
193090	7.10/+1.50/+1.82	K5 III	0.260/81.87/+5.58	0.09(0.04)/85(11)
193217	6.31/+1.63/+1.91	K4 II	0.370/79.69/+3.99	0.35(0.05)/112(4)
193536	6.44/-0.13/-0.69	B2 V	0.520/82.82/+5.80	0.20(0.06)/68(7)
193701	6.67/+0.45/+0.41	F5 IV	0.066/82.12/+5.12	0.12(0.07)/126(15)
194152	5.57/+1.07/+1.01	K0 III	0.068/82.70/+5.04	0.11(0.03)/79(9)
194220	6.22/+0.95/+0.76	K0 III	0.096/80.46/+3.32	0.09(0.03)/92(9)
194479	7.46/+1.08/+1.01	K1 III-IV	0.140/82.00/+4.12	0.10(0.07)/79(19)
194708	6.91/+0.44/+0.11	F6 III	0.240/80.42/+2.72	0.24(0.06)/82(7)
195100	7.59/+0.85/+0.49	G5 III	0.200/81.02/+2.66	0.19(0.10)/96(14)
195405	7.99/+0.64/+0.27	G2 IV	0.100/80.62/+1.95	0.26(0.05)/81(5)
195506	6.44/+1.14/+1.09	K2 III	0.135/83.60/+3.99	0.03(0.04)/170(27)
195985	7.69/-0.12/-0.54	B5	0.740/83.12/+3.03	0.40(0.09)/33(6)
198151	6.24/+0.06/+0.02	A3	0.078/85.83/+2.06	0.09(0.03)/93(9)
+44°3582	8.51/+0.36/+0.06	F0n III	0.225/84.58/+0.79	0.09(0.13)/116(29)
199081	4.72/-0.14/-0.58	B5 V	0.135/84.90/-0.19	0.17(0.02)/88(4)
199098	5.44/+1.11/+0.95	G8 III	0.058/85.82/+0.31	0.15(0.07)/66(13)
199395	6.71/+1.44/+1.75	K4 III	0.190/84.38/-1.15	0.29(0.05)/83(5)
199580	7.21/+0.97/+0.74	K0 III-IV	0.100/84.17/-1.65	0.24(0.07)/109(9)
199761	7.97/+0.46/+0.13	F4 III	0.160/87.51/+1.05	0.06(0.07)/142(26)
199870	5.55/+0.97/+0.84	G9 III-IV	0.041/85.55/-0.83	0.07(0.02)/119(9)
200102	6.63/+1.05/+0.72	G1 Ib	1.150/86.13/-0.69	0.38(0.04)/32(3)
200527	6.24/+1.68/+1.84	M3 Ib-II	0.940/86.27/-1.17	0.12(0.02)/69(5)
200560	7.68/+0.97/+0.78	K2.5 V	0.017/87.12/-0.47	0.05(0.06)/6(27)
200805	8.28/+0.81/+0.66	F5 Ib	1.950/86.75/-1.16	1.88(0.07)/47(1)
201065	7.55/+1.76/+1.89	K5 Ib	2.000/88.26/-0.13	0.89(0.07)/43(2)
201456	7.81/+0.53/+0.08	F8 V	0.052/86.20/-2.65	0.37(0.10)/82(7)
201924	7.83/+0.78/+0.42	G9 V	0.028/87.81/-1.86	0.14(0.06)/76(12)
202312	7.33/+0.87/+0.50	G5 II-III	0.360/87.89/-2.37	0.23(0.06)/85(7)

[a]Parenthesized quantities are 1σ errors.
All of this data was obtained from Appenzeller (1966).

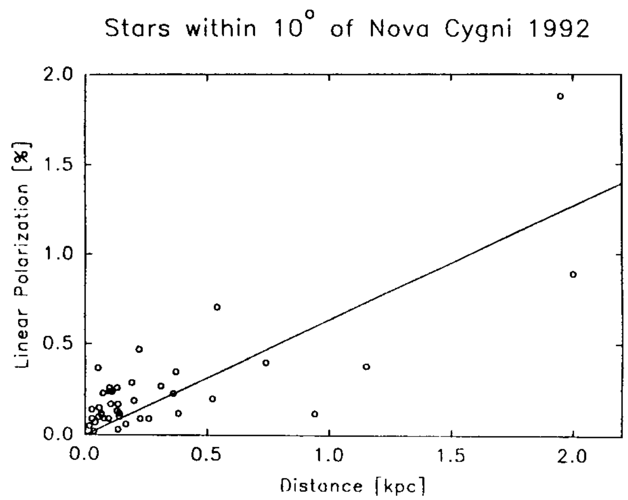

Figure 1.

IV. Conclusion

Wagner (1993) has determined from ultraviolet spectroscopy that $A_V \approx 0.6$ mag. If we assume that the distance to the nova is ≈ 2.5 kpc (Quirrenbach *et al.* 1993), then $A_V \gtrsim 0.5$ mag, consistent with the Wagner result.

Although this technique is usable only in a few instances at the present time, it is still another weapon in the arsenal for determining the extinction. With the advent of more extensive linear polarization surveys in the near future, this method should find a wider applicability.

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NEW PHOTOELECTRIC MINIMA TIMES OF V566 OPHIUCHI AND ITS PERIOD STUDY

The binary system V566 Oph (HD163611, BD+5°3547, Sp:F2/4Vn) is a short period eclipsing variable of W UMa-type. It is one of the best observed W UMa-type systems with many light curve analyses and minima times.

V566 Oph has been observed photoelectrically with a two-beam, multi-mode, nebular-stellar photometer attached to the 48-inch Cassegrain reflector at the Kryonerion Astronomical Station, Greece.

The stars BD+4°3553 and BD+4°3556 were used for comparison and checking, respectively. Reduction of the observations has been made as usual (Hardie, 1962) and the passbands of the B and V filters used are in close accordance with the standard ones. From our observations of V566 Oph four new minima times were derived using Kwee and Van Woerden's (1956) method and these are the mean values of B and V. They are given in Table 1, the successive columns of which present: Hel. JD, $(O-C)_I$, E_I and $(O-C)_{II}$, E_{II}.

In the residuals $(O-C)_I$ and $(O-C)_{II}$ the C's have been calculated using the following ephemeris formulae, respectively.

$$\text{(I): MinI} = 2435245.5440 + 0^{d}.40964101 \times E \qquad (1)$$
(due to Binnendijk, 1959)

$$\text{(II): MinI} = 2440047.3478 + 0^{d}.40964600 \times E \qquad (2)$$
(due to Seeds & Dawson, 1985)

Table 1
New Photoelectric Minima Times of V566 Ophiuchi

Hel. JD.	$(O-C)_I$	E_I	$(O-C)_{II}$	E_{II}
2440000+				
7298.4876	0.0762	29423	−0.0040	17701
7299.5138	0.0783	29425.5	−0.0019	17703.5
7300.5383	0.0787	29428	−0.0015	17706
7301.5607	0.0770	29430.5	−0.0032	17708.5

From all minima times of V566 Oph found in the literature and our new ones given in Table 1 and for linear least squares fitting, formulae (1) and (2) become, respectively:

$$\text{MinI} = 2435245.2258 + 0^{d}.40964923 \times E \qquad (3)$$
$$\pm 0.0028 \pm 0.00000004$$

and

$$\text{MinI} = 2440047.5348 + 0^{d}.40964183 \times E \qquad (4)$$
$$\pm 0.0025 \pm 0.00000003$$

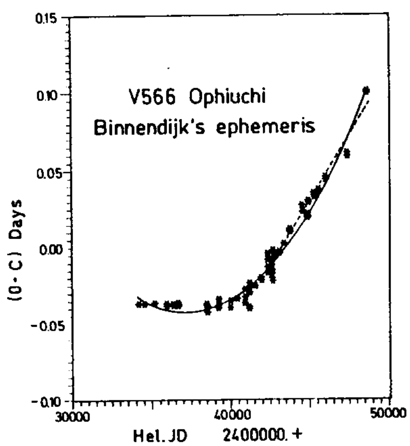

Figure 1. The O−C diagram of V566 Oph according to Binnendijk's (1959) ephemeris. Quadratic fitting has been applied to all minima times and linear (- - -) after Hel. JD 2442000.

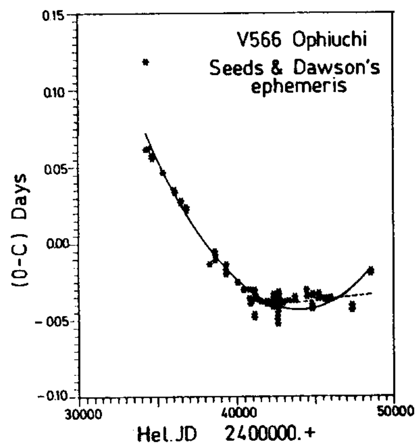

Figure 2. Same as a Fig. 1, but according to Seeds & Dawson's (1985) ephemeris formula.

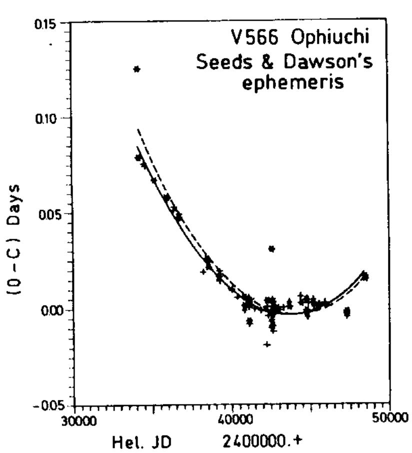

Figure 3. The O−C diagram of V566 Oph according to Seeds & Dawson's ephemeris. Quadratic fitting has been separately applied to primary (+) and secondary ($\star$) photoelectric minima times only.

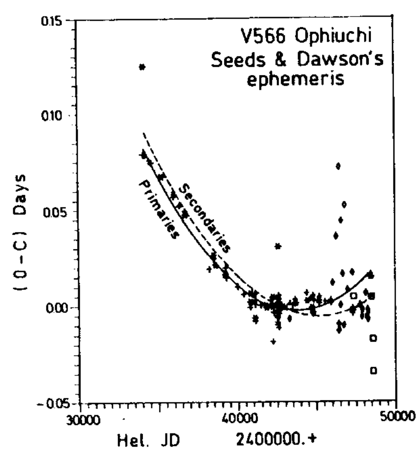

Figure 4. Same as Fig.3, but the visual minima are also included. Visual primaries are denoted by $\diamond$, while secondaries by $\square$.

while for quadratic least squares fitting we get:

$$\mathrm{MinI}=2435246.6389+0^{\mathrm{d}}.40958120\times E+8.13\times 10^{-10}\times E^2 \quad (5)$$

and

$$\mathrm{MinI}=2440049.0395+0^{\mathrm{d}}.40956939\times E+8.65\times 10^{-10}\times E^2 \quad (6)$$

respectively.

Moreover, if the visual minima times are not taken into account, formulae (1) and (2) for linear least squares fitting become, respectively:

$$\mathrm{MinI}=\underset{\pm 0.0017}{2435245.2881}+\underset{\pm 0.00000004}{0^{\mathrm{d}}.40964769}\times E \quad (7)$$

and

$$\mathrm{MinI}=\underset{\pm 0.0013}{2440047.5986}+\underset{\pm 0.00000003}{0^{\mathrm{d}}.40964025}\times E \quad (8)$$

while for quadratic one we get:

$$\mathrm{MinI}=2435245.7911+0^{\mathrm{d}}.40957370\times E+9.05\times 10^{-10}\times E^2 \quad (9)$$

and

$$\mathrm{MinI}=2440049.2109+0^{\mathrm{d}}.40956089\times E+9.70\times 10^{-10}\times E^2 \quad (10)$$

From the foregoing linear ephemeris formulae (3), (7) the period of V566 Oph given by Binnendijk ($P=0^{\mathrm{d}}.40964101$) seems to have increased with a rate which is greater if all minima times are considered. While formulae (4) and (8) indicate that the period given by Seeds and Dawson ($P=0^{\mathrm{d}}.40964600$) has decreased with a rate which is greater if the visual minima are not taken into account. Of course, neither the linear fitting, nor the quadratic one is suitable for all minima times of V566 Oph. (For a new method see Kalimeris et al., 1993).

In Figures 1 and 2 quadratic fitting has been applied to photoelectric minima times only using Binnendijk's (1959) and Seeds & Dawson's (1985) ephemeris formulae, respectively. From these, one can notice that after Hel. JD 2442000 the O−C values could be approached by a linear fitting. Doing so, formulae (1) and (2) are improved to:

$$\mathrm{MinI}=\underset{\pm 0.0015}{2435244.9972}+\underset{\pm 0.00000004}{0^{\mathrm{d}}.40965433}\times E \quad (11)$$

and

$$\mathrm{MinI}=\underset{\pm 0.0010}{2440047.2991}+\underset{\pm 0.00000003}{0^{\mathrm{d}}.40964711}\times E \quad (12)$$

respectively, which show that the period of V566 Oph continues increasing; but more data are needed to examine its future behaviour.

Moreover, since the number of both primary and secondary minima times was large enough, a separate O−C diagram has been drawn for each one of them. The results are presented in Figures 3 and 4, which are based on Seeds & Dawson's (1985) ephemeris.

The consistency of the two curves, corresponding to primary (+) and secondary minima ($\star$) respectively, is much better in Figure 3 than in Figure 4, where the visual minima ($\diamond$ for primaries and $\square$ for secondaries) are also included.

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PHOTOGRAPHIC OBSERVATIONS OF NSV 1671

Bradley et al. (1992) detected "a considerable and unexpected fade of brightness of the star HR 1469=49 Eri", which is also designated as NSV 1671 (Kukarkin et al., 1982). Cousins (1963) reported on possible variability of $0^m_.08$ in V near a mean value $V=5^m_.31$. However, a fading to $V=6^m_.9$ (Bradley et al., 1992) was never observed before.

To search for such significant variations in the past, we studied the object on 125 photovisual (JD 2437583-2447917) and 40 photographic (JD 2437560-2439122) plates obtained with Odessa seven-camera astrograph. We used comparison stars from the Catalogue of Blanco et al. (1968). All observations were made in instrumental *pg* and *pv* systems because not all observations were obtained simultaneously in both photometric systems, and because photographic accuracy does not allow to make a good reduction to the standard system. Finding chart is shown in Figure 1.

For the photovisual system, we used instrumental magnitudes m_{pv}=V−0.15(B−V), for the photographic system m_{pg}=V+0.55(B−V). The last expression was obtained by minimizing the relative error of the slope of the mean characteristic curve for 8 standard stars (listed at the beginning of Table 1). One may note significant difference in the mean *pg* magnitudes of other "standard" stars HD 26462, HD 30211, HD 28978, HD 29634 from that obtained by the color equation mentioned above. However, their brightness lie outside an interval covered by our comparison stars, and we did not test them for possible variability.

For *pv* observations, we used a sequence of comparison stars *q, b, h, k* in a closest neighbourhood of the variable.

Only one possible fading down to $m_{pv}\approx5^m_.80$ was detected on JD 2437672.335, whereas brightness estimates of NSV 1671 at other 124 plates varied between $5^m_.23$ and $5^m_.55$ with a mean $<m_{pv}>=5^m_.39$ and a r.m.s. deviation $\sigma_{pv}=0^m_.065$. The range for photographic system is $5^m_.17-5^m_.42$, mean $<m_{pg}>=5^m_.33$ and $\sigma_{pg}=0^m_.056$. An estimate at the date mentioned above is m_{pg}=5.36, without any evidence for fade within the observational error. Thus it is surprising that the fade at the *pv* plate does not resemble a plate defect. Amplitudes and color index obtained for other plates are consistent with those of Cousins (1963).

Absence of major variations is in excellent agreement with Wenzel's (1992) result based on the more numerous Sonneberg plate collection.

Examination of the object at the other plate collections and new observations are needed to clarify nature of its fade(s).

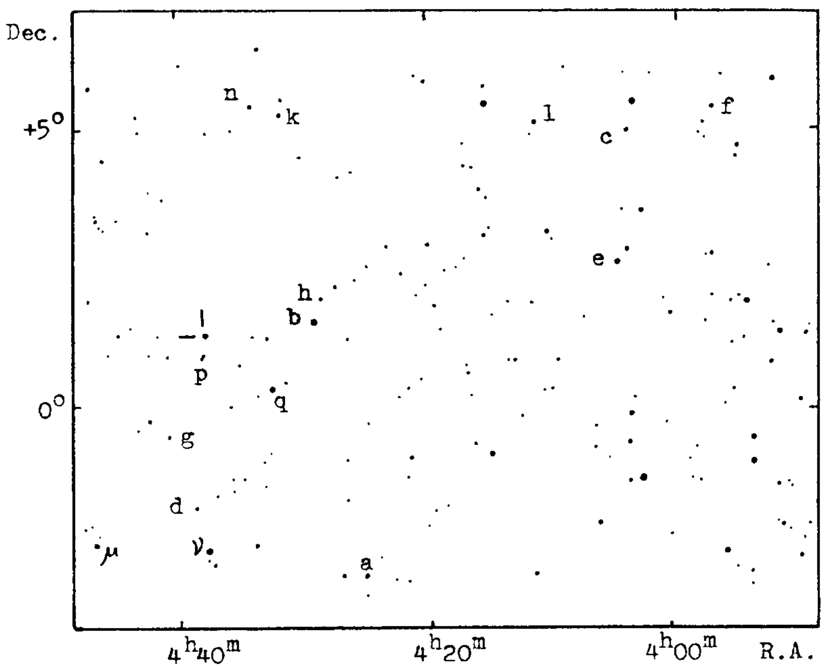

Figure 1. Finding chart for NSV 1671

Table 1. Brightness of the comparison stars for NSV 1671 in standard and instrumental photometric systems.

	Star No.						
⋆	Blanco	HD	V	B−V	m_{pg}		m_{pv}
a	4254	27861	5.17	0.08	5.00	±0.09	
b	4312	28375	5.54	−0.10	5.17	0.08	5.56
c	3977	25558	5.32	−0.08	5.32	0.07	
d	4463	29391	5.20	0.29	5.48	0.06	5.16
e	3985	25621	5.35	0.50	5.79	0.05	
f	3854	24817	6.08	0.06	6.12	0.05	
g	4489	29610	6.10	0.94	6.57	0.07	5.96
h	4307	28322	6.14	1.02	6.58	0.07	5.99
k	4359	28736	6.38	0.42	6.64	0.07	6.32
l	4077	26462	5.73	0.35	7.32	0.12	
μ	4561	30211	4.02	−0.15	5.75	0.05	
n	4395	28978	5.68	0.05	6.33	0.06	5.67
p	4494	29634	8.57	0.08	6.71	0.08	
ν			≈3.93		4.25	0.14	
q	4360	28749	4.91	1.32			4.71

Authors are thankful to S. Yu. Shugarov and I. Platais for pointing their attention to this interesting object.

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PHOTOELECTRIC BVR OBSERVATIONS OF RR LYRAE STAR V381 Cyg

V381 Cyg is an RRab star with elements (Kholopov et al., 1985):

$$\mathrm{Max{=}JD\ hel\ 2439005.667{+}0\overset{d}{.}6100146{\times}E} \qquad (1)$$

This star has not been observed photoelectrically before. We have observed V381 Cyg with the 60-cm reflector of the Mt. Maidanak Observatory of the Tashkent Astronomical Institute, 19 BVR measurements were carried out in September 1991.

The observations are presented in Table 1 and plotted in Figure 1. The estimated error of the individual data is about ±0.15 mag. Light curves in Figure 1 show that the elements (1) do not need improvement.

It is a pleasure to thank Dr. V. S. Shevchenko for the observing time necessary to carry out the present observations.

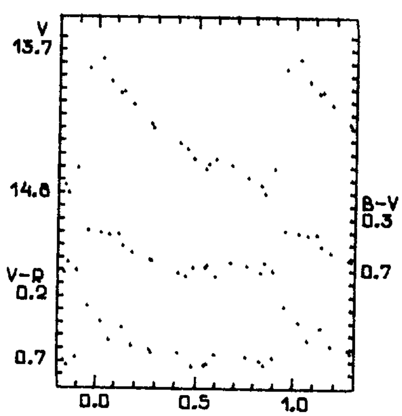

Figure 1

Table 1

JD Hel 2400000+	Phase	V	B−V	V−R
48503.3167	0.545	14.621	0.675	0.731
48504.2474	0.071	13.943	0.425	0.541
48505.2786	0.761	14.685	0.664	0.666
48506.2855	0.412	14.422	0.722	0.633
48507.2694	0.025	13.767	0.409	0.395
48508.2284	0.597	14.537	0.749	0.644
48509.2552	0.280	14.303	0.625	0.636
48510.2426	0.899	14.609	0.704	0.667
48511.2522	0.554	14.573	0.655	0.715
48512.2458	0.182	14.126	0.562	0.582
48513.2533	0.834	14.740	0.716	0.696
48514.2595	0.483	14.544	0.673	0.742
48515.2678	0.136	14.021	0.512	0.430
48516.3151	0.853	14.808	0.634	0.731
48517.2884	0.449	14.469	0.744	–
48518.3069	0.118	14.035	0.418	–
48519.2581	0.678	14.590	0.632	–
48520.2304	0.272	14.273	0.621	0.612
48521.2561	0.953	13.845	0.384	0.271

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Reference:

Kholopov, P. N. et al., 1985, General Catalogue of Variable Stars, Vol. II., Moscow, "Nauka"

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BVR OBSERVATIONS AND NEW ELEMENTS FOR THE CEPHEID FT Mon

Photoelectric observations of the Cepheid FT Mon were carried out in autumn 1987 and 1992. The 60-cm reflector of Mt. Maidanak Observatory of the Tashkent Astronomical Institute was used and 34 BVR measurements were obtained.

The observations are listed in Table 1. The estimated error of the individual data is about ±.015 mag. These observations together with other published ones (Berdnikov, 1992; Eggen, 1969) allow to improve the period: $3^{d}.421740 \pm 0^{d}.000011$. The new elements

$$\mathrm{Max} = \mathrm{JD\ hel}\ 2448516.5 + 3.421740 \times E$$

have been used for phase calculation in Table 1 and for plotting the light and colour curves in Figure 1, where open circles indicate Eggen's observations.

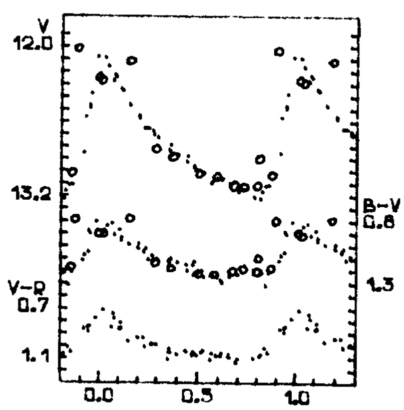

Figure 1

Table 1

JD Hel 2400000+	Phase	V	B−V	V−R
47082.5190	0.920	12.559	1.069	0.860
47083.4796	0.201	12.576	0.981	0.934
47084.4127	0.473	12.966	1.153	1.075
47085.4589	0.779	13.210	1.197	1.100
47087.4479	0.360	12.783	1.106	1.022
47088.4431	0.651	13.101	1.196	1.096
48858.4689	0.940	12.467	1.045	0.848
48860.4806	0.527	13.016	1.252	1.033
48862.4716	0.109	12.346	0.961	0.813
48870.4487	0.441	12.930	1.154	1.039
48872.4356	0.021	12.090	0.889	0.711
48872.4911	0.038	12.162	0.837	–
48874.4509	0.610	13.068	1.278	1.083
48874.4674	0.615	13.057	1.298	1.053
48875.4792	0.911	12.850	1.116	–
48876.4710	0.201	12.555	1.023	0.935
48877.4340	0.482	12.995	1.123	1.054
48877.4770	0.495	12.995	1.217	1.078
48879.4518	0.072	12.226	–	0.739
48879.4723	0.078	12.242	0.915	0.779
48880.4358	0.359	12.849	1.137	1.044
48880.4577	0.366	12.869	1.101	1.053
48881.4456	0.654	13.125	1.223	1.096
48882.4492	0.948	12.376	0.901	0.841
48883.4439	0.238	12.653	1.018	1.013
48883.4874	0.251	12.658	1.110	–
48885.4358	0.821	13.161	1.216	1.066
48885.4936	0.838	13.115	1.322	1.013
48886.4314	0.112	12.354	0.931	0.861
48888.4341	0.697	13.167	1.226	1.103
48890.4272	0.279	12.707	1.102	0.984
48890.4921	0.298	12.731	1.103	0.988
48891.4237	0.571	13.077	1.235	1.057
48891.4956	0.592	13.059	1.253	1.082

It is a pleasure to thank Dr. V. S. Shevchenko for the observing time necessary to carry out the present observations.

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PHOTOELECTRIC BVR OBSERVATIONS OF THE ECLIPSING VARIABLE HY Tau

On the identification chart of the Cepheid EF Tau (Zessevich, Kazanasmas, 1971) the suspected variable star CSV 669 is also indicated. We have observed it together with the Cepheid photoelectrically in the BVR system. The 60-cm reflector of the Mt. Maidanak Observatory of the Tashkent Astronomical Institute was used and 45 observations (Table 1) were obtained. The estimated error of the individual data is about ±.015 mag. It turned out later, that CSV 669 is identical with the eclipsing variable HY Tau (Kholopov et al., 1987) the elements of which are as follows:

$$\mathrm{Min=JD\ hel}\ 2431530.306+3\overset{d}{.}01682\times E \qquad (1)$$

HY Tau has not been observed photoelectrically before. The elements (1) were used in phase calculations for Table 1 and Figure 1. Light curves in Figure 1 show that the elements need improvement.

Table 1

JD Hel 2400000+	Phase	V	B−V	V−R
47083.4386	0.473	11.728	0.780	0.581
47084.3846	0.786	11.717	0.807	0.570
47085.4285	0.132	12.038	1.081	0.686
47087.4265	0.795	11.656	0.815	0.583
47088.4205	0.124	12.026	1.059	0.676
47409.4876	0.550	11.744	0.848	0.863
47410.4848	0.880	11.771	0.812	0.875
47411.4915	0.214	11.768	0.815	0.918
47413.4857	0.875	11.800	0.778	0.935
47415.4942	0.541	11.735	0.827	–
47416.4916	0.872	11.739	0.820	0.873
47417.4841	0.201	11.796	0.845	0.885
47418.4866	0.533	11.699	0.854	0.861
47419.4894	0.865	11.658	0.866	0.836
47420.4896	0.197	11.796	0.876	0.889
47421.4913	0.529	11.707	0.859	0.871
47422.4902	0.860	11.719	0.790	0.873
47424.4841	0.521	11.683	0.815	0.870
47425.4817	0.852	11.685	0.861	0.836
47427.4865	0.516	11.684	0.892	0.859
47428.4766	0.844	11.787	0.827	0.956
47430.4882	0.511	11.697	0.838	0.863
47431.4903	0.843	11.724	0.842	0.827
47432.4864	0.173	11.886	0.973	0.927
47433.4651	0.498	11.696	0.888	0.869
47760.4865	0.897	11.730	0.846	–
47768.4820	0.548	11.688	0.874	–
47770.4633	0.204	11.741	0.860	0.965

Table 1 (cont.)

JD Hel 2400000+	Phase	V	B−V	V−R
47771.4696	0.538	11.690	0.871	0.882
47772.4744	0.871	11.715	0.840	0.898
47773.4686	0.200	11.778	0.854	0.904
47774.4837	0.537	11.698	0.867	–
47775.4762	0.866	11.678	0.847	0.929
47776.4659	0.194	11.823	0.885	0.912
48505.4249	0.826	11.740	0.850	0.895
48509.4427	0.157	12.086	1.066	1.033
48510.4332	0.486	11.744	0.851	0.868
48511.4073	0.809	11.743	0.840	0.871
48513.4148	0.474	11.725	0.845	0.870
48516.4181	0.470	11.736	0.859	0.889
48517.4151	0.800	11.708	0.864	0.876
48518.4142	0.131	11.995	1.068	0.961
48520.4193	0.796	11.753	0.856	0.871
48521.4301	0.131	12.007	1.067	0.974
48523.4081	0.787	11.748	0.862	0.877

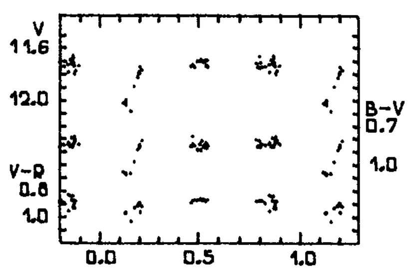

Figure 1

It is pleasure to thank Dr. V. S. Shevchenko for the observing time necessary to carry out the present observations.

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WW VULPECULAE - LIGHT VARIATIONS FOR 1929 TO 1992

Recently, Friedemann et al. (1993) studied the light variations of the evolutionarily young Isa variable WW Vul. Conspicuous features in the lightcurve are the irregularly occurring Algol-like minima being up to 1.5 mag deep. For a number of them UBV and $UBVR$ observations are available (for references see Friedemann et al., 1993). A thorough investigation of these data resulted in the conclusion that the Algol-like minima are caused by circumstellar dust clouds occulting the star incidentally. For the first time this hypothesis was put forward by Wenzel (1969) as an interpretation of the light variations of the related variable SV Cephei. In the case of WW Vul our discussion of the $UBVR$ data led to the conclusion that the extinction properties of the dust grains confined to the individual clouds differ both from each other and the interstellar mean. The dust cloud hypothesis is strongly supported by the finding that WW Vul coincides with the infrared point source IRAS 19238+2106. The infrared fluxes measured by IRAS as well as available NIR data (see Gezari et al., 1987) can be interpreted as thermalized stellar radiation from circumstellar dust. Using the radiative transfer code by Chini et al. (1986), we found that thermal emission from a spherically symmetric circumstellar dust shell matches the observed IR spectrum surprisingly well. The amounts of circumstellar extinction inferred from the optical and infrared data agree satisfactorily (for further details see Friedemann et al., 1993).

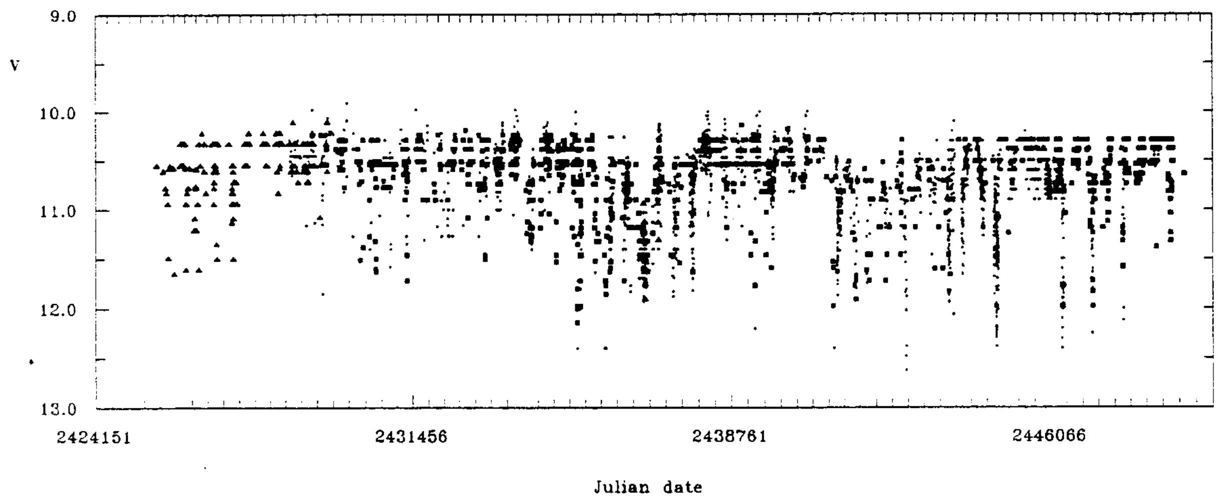

Figure 1: Long-term behaviour of the lightcurve of WW Vul. The different symbols have the following meaning: triangles–Bamberg plate archive; squares–Sonneberg plate archive; dots–data from different authors.

Besides an analysis of individual photoelectrically observed Algol-like minima we tried to collect as many photometric data as possible in order to investigate the long-time behaviour of WW Vul. References to the data used can be found by Friedemann et al. (1993). In addition to these data sets we made use of the plate collections at Bamberg and Sonneberg observatories. Brightness estimates (by C. F. and H.-G. R. at Bamberg and J. H. at Sonneberg), mainly on sky patrol plates, enlarged the data base for the last 60 years considerably. For our brightness estimations the sequence of comparison stars published by Rössiger and Wenzel (1972) has been used. In order to combine the different data sets into a common lightcurve we calculated linear brightness transformations for each of them. The individual data are available upon request from the authors.

The lightcurve of WW Vul in Figure 1 combines our estimates with those of Tsesevich and Dragomiretskaya (1973) and photoelectric measurements of Zaytseva (1983) and Kardopolov and Filip'ev (1985). The V magnitudes have been computed by first transforming the original photographic magnitudes $m_{\rm pg}$ to B magnitudes using equation (8) in the paper by Ažusienis (1965) and then into V magnitudes according to the colour index $E(B-V)$ of the star. The light variations seem to consist of at least two different components: (i) longer lasting wavelike variations with a small amplitude and (ii) aperiodically occurring short-lived Algol-like minima with amplitudes up to 1.5 mag. This rough characterization agrees with an earlier description of the lightcurve given by Rössiger and Wenzel (1972).

The long-time variations of WW Vul outside the Algol-like minima seem to follow a wavelike pattern. It can be approximated formally by a sinusoidal term, i.e.

$$m(JD) = m(JD_0) - \Delta m_A sin 2\pi((JD - JD_0)/P). \qquad (1)$$

A discrete Fourier analysis of the whole data set shown in Fig. 1 revealed no clear periodicities. The highest peak in the Fourier spectrum corresponds to a period of $P \approx 5200$ d. With this period a visual fit gave for the values of the other constants $m(JD_0) = 10^{\rm m}\!.6$, $\Delta m_A \approx 0.15$ mag, and $JD_0 = 2440500$. A quasi-periodicity with $P = 404$ d for the Algol-like minima as reported by Zaytseva (1983) is not confirmed by the analysis of our considerably increased data base. As an explanation of the Algol-like minima, obscurations by orbiting circumstellar dust clouds seem to be evident (Friedemann et al., 1993). Contrary to this, the origin of the slight wavelike changes in maximum light is yet unknown. Both the small amplitude and the lack of accurate *UBVR* data over a sufficiently long time interval make an interpretation difficult. At present a stellar (due to a variation of the effective temperature) or circumstellar (varying extinction by dust) origin seems to be conceivable (For further details see Friedemann et al., 1993).

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BF Draconis

The star BD+69°1006 = BV379 = BF Dra was reported as an eclipsing variable by Strohmeier, Knigge and Ott (1962). Döppner (1962) established the elements of variation from photographic photometry and gave a finder chart. These elements were further refined by Strohmeier, Knigge and Ott (1963), yielding

$$JD_{hel,\,min} = 2436317.579 + 5.60545 \cdot E. \qquad (1)$$

With these data, BF Dra was included in the GCVS (Kholopov et al., 1985).

As far as we know, no complete photoelectric light curve of this rather bright variable has been published. The only three photoelectric measurements known to us were obtained by Lacy (1992) in order to establish the mean brightness at maximum light and the mean colours of BF Dra (V=9.823±0.005, B-V = 0.489±0.005, U-B = -0.022 ±0.003).

Between 1988 and 1993, we have secured a set of photoelectric observations covering the whole light curve of BF Dra in blue light, as well as complete photoelectric coverage of the primary minimum in the visual part of the spectrum from three different observatory sites. RD and MW used the 35cm Schmidt-Cassegrain telescope of R. Scafraniec Observatory in Metzerlen, Switzerland in connection with a commercial, uncooled, photon-counting photometer of the „Starlight-1" type. This photometer is equipped with an EMI 9924A photomultiplier tube and a filter set very close to the standard Johnson UBV system. FA observed with his private, automated telescope at Zweikirchen, Germany, also a 35cm Schmidt-Cassegrain system outfitted with an uncooled photometer tube (EMI 9781A) and a set of filters matching the standard BV closely. Finally, MW collected more data at the Skalnate Pleso Observatory(1780m above sea level), Slovak Republik, employing a 60 cm reflecting telescope with a single-channel pulse-counting photoelectric photometer.

We have deposited the whole list of observations (262 in B, 127 in V) in the IAU Commission 27 Archives of Unpublished Photoelectric Photometry (Breger, 1988). All the data are in the instrumental system, with no correction for differential extinction applied. Since the comparison star is located close to the variable, this simplification is well founded. The general good agreement of the three different and independent sets of observations to within ±0.02 mag in both colours supports this conclusion. In Figure 1 we show the whole set of blue observations, using the elements determined from the photoelectrically observed minima

$$JD_{hel,\,Min} = 2447276.3948 + 11.211079 \cdot E. \qquad (2)$$

For reasons that will be discussed below, the period given by Strohmeier et al. (1963) had to be approximately doubled.

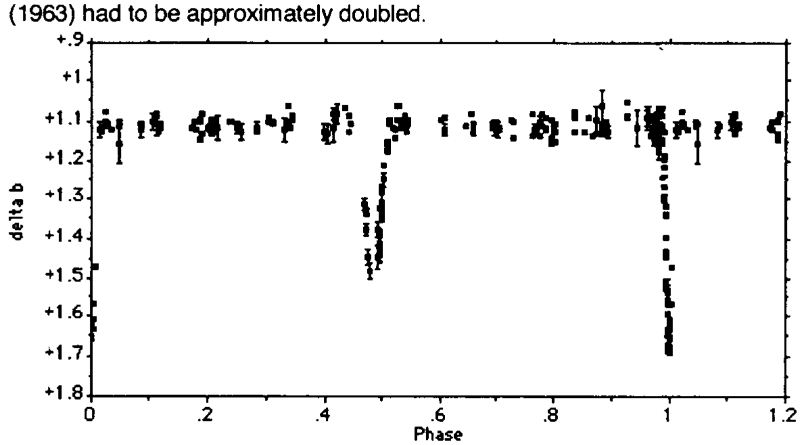

Figure 1: Photoelectric blue light curve of BF Draconis in the instrumental system. Differential magnitudes in the sense variable minus comparison star (HD176086 = SAO009270 = BD+70°1034) are shown.

BF Dra exhibits the typical light curve of a well detached binary system. The two minima are narrow and, because a difference in minimum brightness of 0.12 ± 0.02 mag is clearly discernible, well established. The BV photometry of FA during primary minimum shows, that the value of B-V changes only by 0.02 mag. Therefore, we can infer, that the two components in the system have about the same spectral type. The mean colours given by Lacy (1992) are indicative of a pair of unreddened stars of spectral type F7V, while the GCVS classifies BF Dra as an F8 star.

In Figure 2, we give the primary minimum, both in B and V, while Figure 3 shows the secondary minimum in blue light. It is immediately evident, that the two minima are of unequal duration, and that the secondary is displaced from phase 0.5 by a small amount. Although the secondary minimum is not sufficiently covered by observation, we find the following parameters describing the two minima of BF Dra:

$$\Phi_{Min\,II} = 0.484 \pm 0.002; \; A_{B,Min\,I} = 0.57 \pm 0.01 \; ; \; A_{B,Min\,II} = 0.45 \pm 0.02$$

$$D_{I} = 0.028\ p \pm 0.001 = 0.314\ d \pm 0.011$$
$$D_{II} = 0.056\ p \pm 0.005 = 0.63\ d \pm 0.06$$

These results indicate a slight ellipticity of the orbit of BF Dra. From the data given above, we have tried to derive the parameters of this orbit by applying the arguments of Martynov (1973):

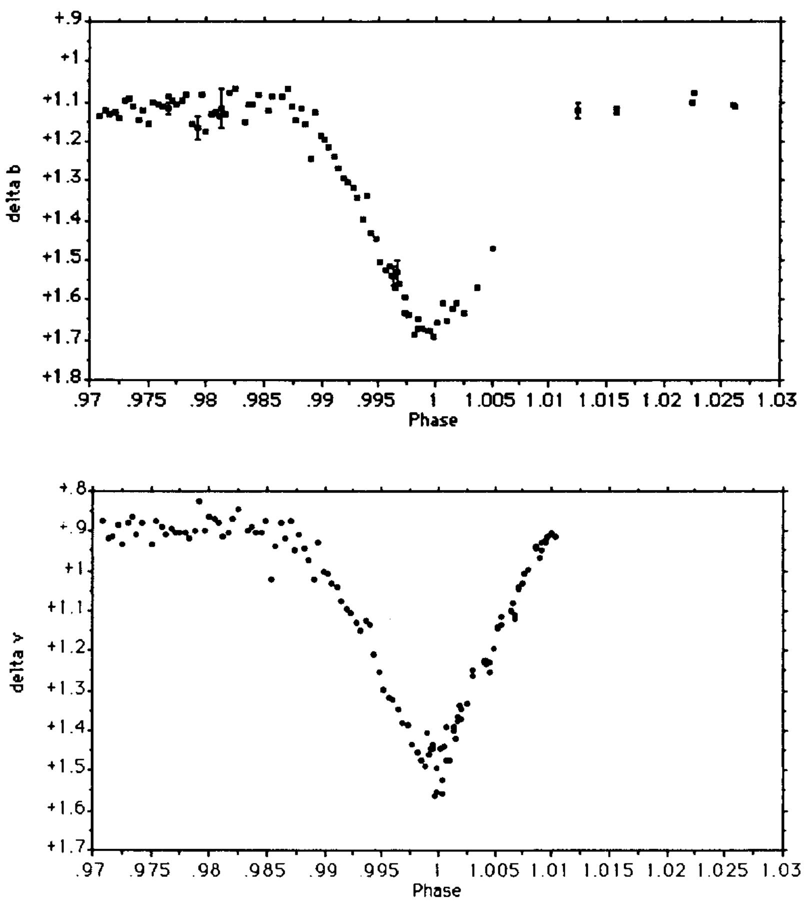

Figure 2: Primary minimum of BF Draconis in blue (above) and in visual light.

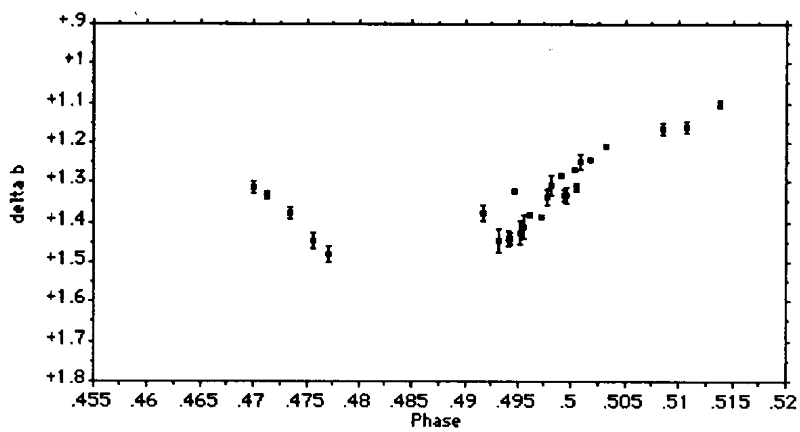

Figure 3: Secondary minimum of BF Draconis in blue light

Considering the spectral type (F7V), the length of the period, the narrow eclipses and the nearly equal depth of both minima, we can assume the orbital inclination i to be very close to 90°. From the phase of secondary minimum and the ratio $D_{II} : D_{I}$, we derive the values for the excentricity e = 0.33 and for the current longitude of the periastron ω = 94°. Further observations are needed to clarify the exact physical nature of this interesting star.

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PERIOD OF SV CENTAURI CONTINUES DECREASING [1]

The eclipsing binary SV Centauri is an early-type (B2 V) contact system, which is known for its rapid period decrease - the fastest one among all binaries in terms of $\dot{P}/P$, averaging $-1.52 \cdot 10^{-5}$ yr^{-1} during the last 100 years. The period has shortened from about $1.^d6606$ in 1894 to $1.^d6581$ in 1993. It has been shown that the rate of period decrease is not strictly constant and can exhibit fast changes, but has a long-term mean value of about 2.2 seconds per year. The period decrease and its irregularities can be ascribed to the mass exchange and mass loss of this rapidly evolving interacting system (Herczeg and Drechsel, 1985; hereafter HD).

New photoelectric UBV observations were carried out in January and February 1993 with the ESO 50cm telescope equipped with its standard single channel photometer. HD 102503 served as comparison star. Two primary minima could be covered in UBV colors. The following minimum times given as heliocentric Julian dates were derived by applying the Kwee-van Woerden (1956) and various other methods:

Prim. min. I:	hel. J.D. $2449017.^d7636$ ($\pm 0.^d0007$) and
Prim. min. II:	hel. J.D. $2449022.^d7389$ ($\pm 0.^d0005$).

As an example, Fig. 1 shows the data for primary minimum II in B color.

The two new minima were used for an O-C analysis to improve the previous ephemeris as given by HD, who had investigated all available photographic and photoelectric minimum timings of SV Cen between J.D. 2412608 and 2445669 (1894 to 1983). Due to the short-term variations of the rate of period decrease,

[1] Based on observations collected at the European Southern Observatory, La Silla, Chile

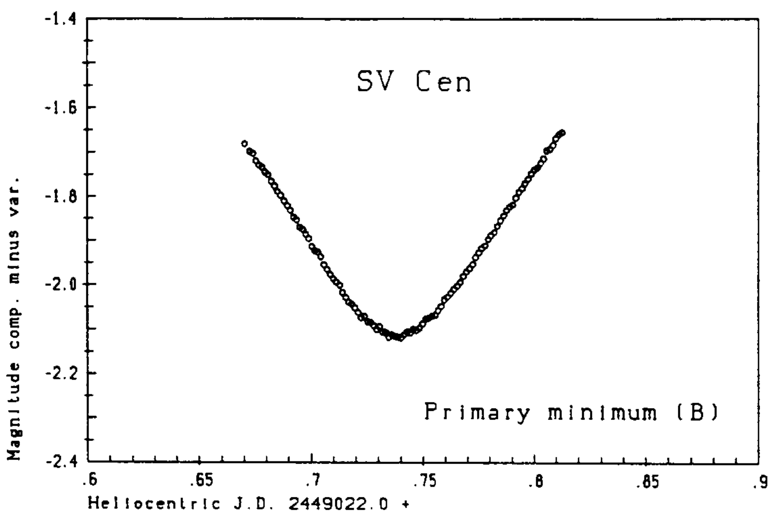

Fig. 1: SV Cen primary minimum of hel. JD 2449022.7389 in B. Integration time was 1 second; points shown are 30 second means.

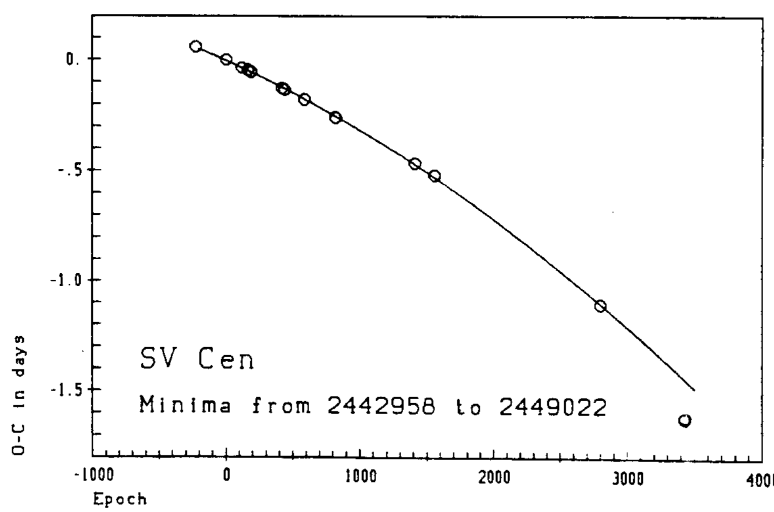

Fig. 2: O-C fit of minima between JD 2442958 (epoch -225.5) and 2447973 (epoch +2798); the new minima at epochs 3428 and 3431 are clearly inconsistent with the previous rate of period decrease.

it is impossible to represent the data from such a broad time interval by a single parabolic O-C curve. Instead, the minimum times were grouped into different data sets, for which piecewise constant period decrease rates were evident, and satisfactory representations could be achieved by quadratic O-C fits.

The two new minima were added to the last group F of photoelectric data, which now extends from J.D. 2442958 to 2449022 (1976 to 1993). Also, a recently published primary minimum by Rucinski et al. (1992) as well as two primary minima by Pfleiderer (1984), which had been omitted in the analysis of HD due to a somewhat lower timing accuracy, were now added to the data sample. Assuming the primary minimum of hel. J.D. 2443332.9780 (Kvíz, 1979) as epoch zero, and an initial period of $1.^{d}6588106$, the O-C values with respect to this linear ephemeris have been fitted to yield the new quadratic ephemeris formula:

$$\begin{array}{lllll} \text{hel. J.D. (prim.)} = & 2443332.^{d}9634 & + 1.^{d}6585895 \cdot E & - 7.0 \cdot 10^{-8} \cdot E^2 \\ & \pm .0149 & \pm 294 & \pm 0.8 \cdot 10^{-8} \end{array}$$

The parabolic fitting of the whole sample of minima is, however, relatively poor, since another fast shortening of the period seems to have happened during the last few years. Fig. 2 shows the parabolic fitting of the photoelectric minima of group F of HD, supplemented by the primary minima of Pfleiderer (1984) and Rucinski et al. (1992). The O-C values refer to a linear ephemeris J.D. $2443332.^{d}9780 + 1.^{d}6588106$. Secondary minima and the two primary minima by Pfleiderer have been weighted half as much as the other primaries due to their lower accuracy. It is apparent that the latest minima are no longer in accord with a constant period decrease rate over the time interval covered.The new primary minima at epochs 3428 and 3431 are clearly inconsistent with the previous decrease rate. If included in the fit, the standard deviation increases to a much larger value of $0.^{d}0229$, compared with $0.^{d}0043$ for the fit shown in Fig. 2 (epochs -225.5 to 2798.0). This value is still higher than expected for photoelectric timings. If the time interval is further restricted to the epoch range from -225.5 to 1409.0, the standard deviation, however, decreases to $0.^{d}0019$. Hence it can be anticipated that the period has shortened with time in a non-linear way after epoch 1409 (1983).

Between JD 2442958 (epoch -225.5) and JD 2447973 (epoch 2798), the mean value of $\dot{P}$ was $-5.22 \cdot 10^{-8}$ corresponding to $\dot{P}/P \approx -1.15 \cdot 10^{-5}$ yr^{-1}. Including the new minima, the average value of $\dot{P}$ between JD 2442958 and 2449022 (epoch 3431) would amount to $-8.42 \cdot 10^{-8}$ or $\dot{P}/P \approx -1.85 \cdot 10^{-5}$ yr^{-1}, a value well above the long-term decrease rate of $-1.52 \cdot 10^{-5}$ yr^{-1}, indicating that another fast shortening of the period comparable to that of 1975 (see HD) has happened within the last 3 years. The actual period in February 1993 (epoch 3431) was $1.^{d}658109$ ($\pm 0.^{d}000030$), in accordance with a continued long-term decrease as extrapolated from Fig. 4 of HD.

The above new ephemeris will be applicable only for a relatively short time, since a major acceleration of the decrease rate had happened at the end of the time interval covered by the O-C fit. The further development of the period decrease has to be monitored carefully.

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IS V731 Sco AN RCB STAR?

There are 37 stars classified as RCB in the fourth edition of the General Catalogue of Variable Stars (GCVS) (Kholopov, 1987), the membership of 11 of them in this group is doubtful. In recent years V854 Cen (Kholopov, 1989) and LV TrA (Kholopov, 1990) were assigned to the group, though the membership of the last is doubtful. UX Ant, listed in the GCVS as doubtful, could be nowadays considered as a new "certain" member of the group after the great crisis it suffered in 1990 (Minniti, 1990; Milone et al., 1990), the first reported after its discovery in 1940 (Erro, 1940). On the contrary, and in agreement with spectroscopic studies, V504 Cen, AE Cir and V618 Sgr (Kilkenny & Lloyd Evans, 1989; Kilkenny 1989a, 1989b) must be definitely excluded from the RCB group in spite of the fact that they were listed as "certain" RCB type in the GCVS.

Spectroscopically, the RCB stars class are typified by extreme hydrogen-deficiency and by being somewhat cool and carbon-rich stars, excepting the hot objects such as MV Sgr, DY Cen and V348 Sgr which are extreme helium stars, whose spectra are B-peculiar type (Drilling, 1986). Kilkenny & Whittet (1984) have suggested that although these hot stars had been included in the GCVS as RCB stars their RCB-behavior may be only a circumstantial evidence.

V731 Sco is one of the stars whose membership to the RCB group is considered doubtful, it was discovered in 1958 (Plaut, 1958) and has been listed in the 3rd (Kukarkin et al., 1969) and 4th editions of the GCVS. It was poorly cited in the literature from then on, Feast (1975) suggested it would not be RCB-type from its spectrum.

We obtained an astrographic plate of the zone of V731 Sco with the aim of having a good identification of the star. The plate was taken with the 33 cm Astrographic Telescope, "Carte du Ciel" (plate scale 1mm=1') of the Córdoba Observatory. It was measured with a Repsold machine. The coordinates of the star were found by the least squares method, taking 7 stars of the SAO catalog as reference stars. The measured coordinates (Equinox 1950.0, Epoch 1991.3) were:

R.A. $17^h30^m04\overset{s}{.}60\pm0\overset{s}{.}05$
Dec. $-32°32'24\overset{''}{.}00\pm1\overset{''}{.}5$

These coordinates have a difference of approximately 16" from that of the GCVS. Such a difference is not a surprise according to López (1990), who reported noticeable differences in several positions of stars with negative declination in that catalog. Figure 1 shows the new identification of V731 Sco.

Spectrograms at 58 Å/mm of the star identified as V731 Sco and, for comparison, of the well established RCB stars RZ and RT Nor (Feast, 1975; Drilling, 1986; Kholopov, 1987) were obtained with the Reticon photon counting system (Z-Machine) (Latham, 1982; da Costa, 1984) on the 2.15 m telescope of the Complejo Astronomico El Leoncito (San Juan,

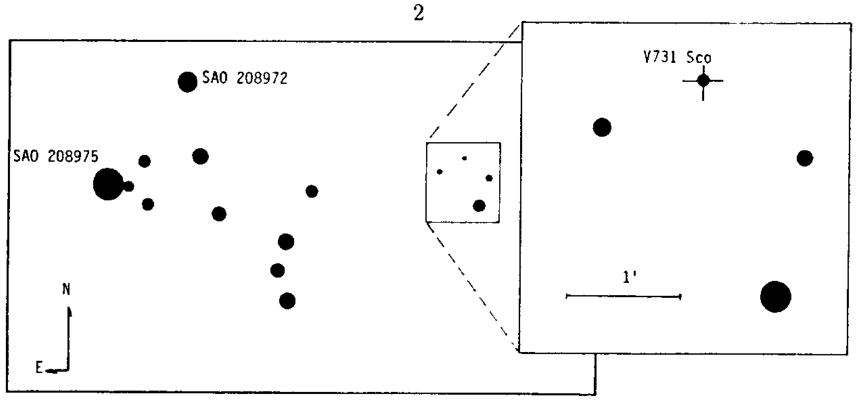

Figure 1
New identification chart of V731 Sco.

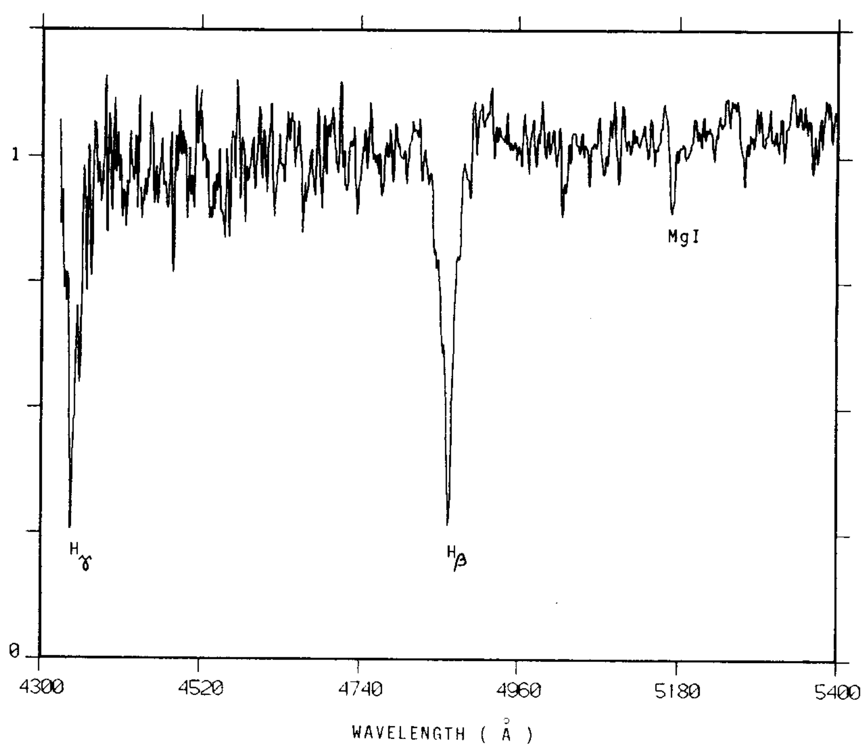

Figure 2
Normalized by its continuum (not flux calibrated) spectrogram of V731 Sco, note the strong H_β and H_γ lines.

Argentina) on 1991 May 20 and 23. The spectra cover the range 4400 to 5700 Å and were reduced in a standard way.

The sky-subtracted and the normalized (not flux calibrated) spectrograms of the star identified as V731 Sco (Figure 2) show the strong features of the Balmer series and not the characteristic absorption bands observed in the spectra of the well established RCB stars RZ and RT Nor.

In conclusion, we think V731 Sco is not an RCB star, confirming the unpublished result of M. W. Feast. It would be necessary to reassign it to the correct variable group according to its photometric behavior.

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NEW VARIABLE STAR IN CEPHEUS

The Hα-emission survey in the emission nebula NGC 7129 of Semkov and Tsvetkov (1986) has revealed an interesting irregular variable star. On objective prism plates the star has very strong Hα-emission and was included on the list of such stars with the number 7. The coordinates of the star are:

$$\alpha = 21^h39^m.3, \ \delta = 66°22', \quad (1950.0)$$

The identification chart of the new variable star is shown in Fig.1.

The UBV photographic observations were made with the 50/70/172 cm Schmidt telescope of the Rozhen Astronomical Observatory of the Bulgarian Academy of Sciences during the period September 1984 - August 1992 (Table 1). At our disposal there are also three plates taken on J.D. 2444493.4, 2444495.4 and 2444497.4 which were obtained with the 100/130/210 cm Schmidt telescope of the Byurakan Astrophysical Observatory of the Armenian Academy of Sciences by M. Tsvetkov. The photometric standards in the open cluster NGC 7142 (Hoag et al. 1961) were used.

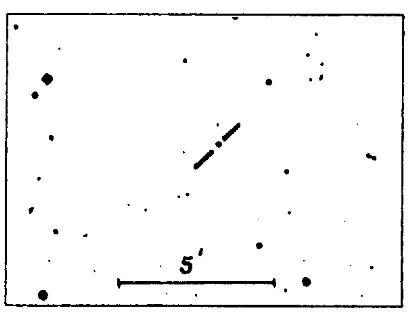

Figure 1. Identification chart of the new variable star as a reproduction from the 60 minute exposure photographic plate in R-light. North is on the top, East - on the left.

Table 1. Photometric behaviour of the new variable star in the period 1980-1992

J.D. 244...	U mag	B mag	V mag	J.D. 244...	U mag	B mag	V mag
4493.4	–	15.7	–	8207.3	–	15.9	–
4495.4	–	–	14.1	8290.2	–	15.4	–
4497.4	15.3	–	–	8291.2	–	16.4	–
5960.3	15.6	–	–	8328.7	–	15.4	–
5961.3	–	15.6	–	8329.6	–	–	14.4
6564.5	–	15.5	14.2	8330.5	–	16.4	14.0
6712.4	–	–	14.5	8363.4	14.6	15.6	14.2
7000.4	–	–	14.0	8364.5	–	15.6	14.2
7001.4	–	15.3	–	8366.5	–	15.6	–
7002.4	–	–	14.3	8367.5	–	15.6	14.1
7065.3	–	15.8	–	8378.4	–	16.0:	–
7065.4	15.6	15.9	14.2	8379.5	15.6	16.3	–
7123.4	–	15.7	–	8380.5	–	15.8	–
7208.2	–	15.8	–	8382.5	–	15.7	–
7209.2	–	15.8	–	8385.4	15.0	15.5	–
7305.5	–	15.6	–	8408.5	15.4	–	14.1
7334.5	–	15.4	–	8409.5	14.3:	15.7	14.4
7362.4	–	15.7	–	8411.5	–	–	14.5
7384.4	15.5	16.2	13.7	8430.5	16.5	16.0	–
7385.4	15.0	16.6	14.2	8431.5	15.6	16.4	–
7386.4	–	15.9	–	8462.4	–	–	14.9
7388.5	–	15.9	–	8464.4	–	–	14.7
7443.3	15.2	15.3	–	8468.5	15.3	16.1	–
7448.4	–	16.6	–	8469.3	16.2	15.6	14.3
7474.3	–	15.5	14.4	8478.4	15.1	16.0	14.3
7475.2	–	15.4	–	8511.4	15.5	15.8	14.3
7627.5	–	15.4	–	8513.3	14.9	16.0	–
7644.4	–	15.0	–	8515.4	–	15.8	–
7707.4	–	15.9	–	8547.4	15.2	16.3	14.2
7707.5	–	17.0:	–	8563.3	15.2	15.8	14.9
7733.3	–	15.7	–	8629.2	–	15.5	14.5
7774.3	15.0	15.6	14.3	8663.6	14.2	15.3	13.8
7777.4	–	15.9	–	8687.6	14.8	15.3	14.4
7829.3	15.9	15.8	–	8694.5	–	15.3	13.9
7830.3	15.6	16.5	–	8719.5	–	15.5	–
7831.3	–	15.7	14.3	8720.5	–	–	13.6
7924.3	15.8	–	–	8734.4	–	–	13.8
7926.6	–	15.5	14.3	8735.4	–	15.2	13.9
7947.6	–	15.3	–	8753.5	–	15.4	14.2
7948.6	14.8	15.0	–	8825.4	–	–	14.2
7956.6	–	15.6	–	8828.4	–	16.2	–
7979.5	–	15.4	–	8855.4	–	15.7	14.0
8071.4	–	15.6	–	8857.4	–	15.5	14.1
8071.5	–	16.1	–	8860.4	15.5	15.6	–
8072.4	–	15.9	14.1	8861.3	–	15.4	14.1
8129.4	–	16.2	–	8862.4	–	15.6	–

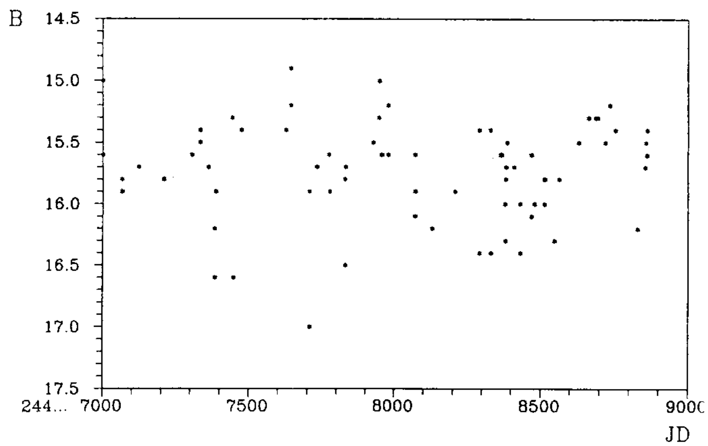

Figure 2. Light curve of the new variable star during the period July 1987 - August 1992 in B-light.

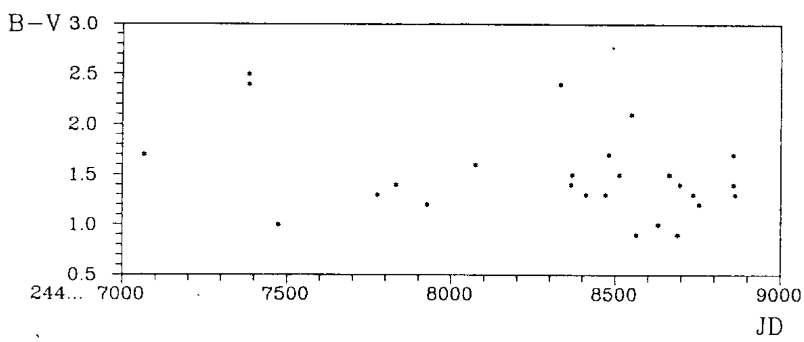

Figure 3. The B–V colour index of the new variable star during the period July 1987 - August 1992.

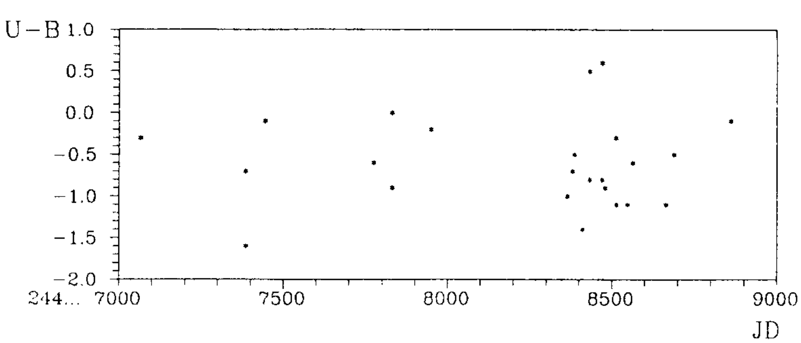

Figure 4. The U–B colour index of the new variable star during the period July 1987 - August 1992.

The observing data suggests that the star brightness ranges from $14^{m}.9$ to $17^{m}.0$ in B– light (Fig. 2). The variations in U– and V– light are similar ones. The colour index B–V varies about the value $1^{m}.5$ (Fig. 3), and the colour index U–B about $-0^{m}.6$ (Fig. 4). Having in mind the presence of the strong Hα-emission and the comparatively quick irregular variations it is possible to suspect the T Tauri type of variability. We plan to do CCD spectral observations in order to clarify the nature of the star.

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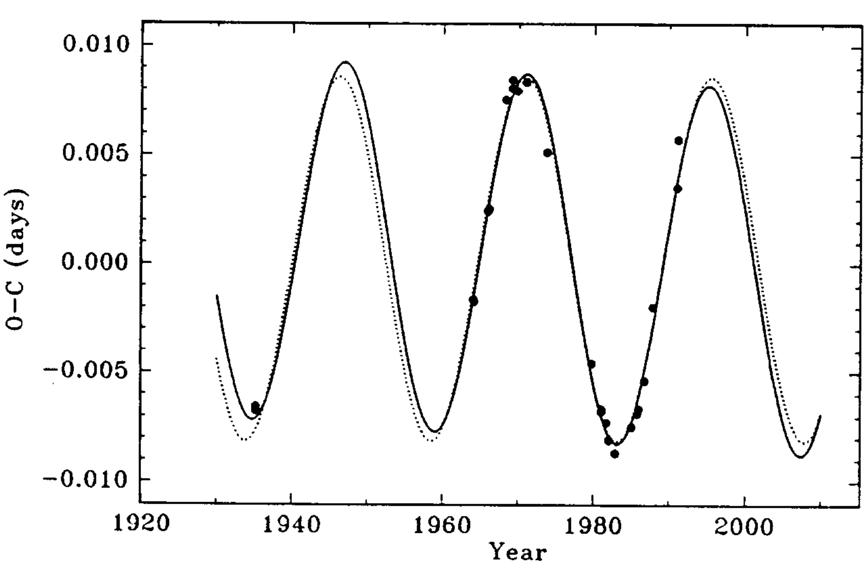
TIMES OF MINIMUM NEEDED FOR AR AURIGAE!

The well-known bright ($6^m_.15$-$6^m_.82$) eclipsing binary AR Aurigae (HD 34364, HR 1728, B9 Vp + B9.5 V, $P = 4^d_.13$) is one of the very few early-type stars with a radius small enough that it must be essentially unevolved. In fact, a recent analysis (Johansen & Nordström 1993) shows that the secondary may still be contracting towards the ZAMS. At the same time, at least one of the components is a Bp star of the Hg-Mn variety. Thus, determining the masses, radii, and other physical properties of the components of AR Aur to the highest modern standards becomes a matter of priority in order to optimise the value of this system as a test object for evolution models of young stars around $2M_\odot$. (cf. Andersen 1991)

Among its several unusual features, AR Aur is also a triple system with a near-circular orbit of period $\sim$24 yr as revealed by the light time effect on the observed times of minimum (Chochol et al. 1988). The light-time orbit has also been studied in our reanalysis of the system, taking into account the recent photoelectric minima observed by Busch (1989, 1991).

Fig. 1 shows the *O-C* diagram corresponding to the Chochol et al. ephemeris:

$$\text{MinI} = \text{HJD } 2\,438\,402.1847 + 4^d_.1346662 \cdot E$$



The two curves show two light-time orbit fits to the data, assuming either the Chochol et al. orbital period of the eclipsing system, or the slightly longer value of $4\overset{d}{.}13466645$.

It is clear that, with the present distribution of the observations, the fit is poorly constrained, and the two orbital motions cannot be separated with certainty. In order to remove this ambiguity, it is important to cover the impending maximum of the *O-C* curve with several well-observed (i.e. photoelectric) times of minimum over the period 1993-1998. As AR Aur is bright and of conveniently short period, this is a task which can be accomplished by amateurs and professionals alike with modest-size telescopes.

In previous photometry of AR Aur, it has been a problem that several promising comparison stars have later proved to be variable (Johansen & Nordström 1993). We therefore propose to use (always) two of the following:

HR 1734 ($6\overset{m}{.}49$, A7V), HR 1738 ($5\overset{m}{.}52$, A3V), or HR 1749 ($5\overset{m}{.}23$, B3V)

HR 1734 has a faint ($11\overset{m}{.}8$) companion at a distance of 3".8 which always should be included.

It is the purpose of this note to call the attention of interested observers to this favourable opportunity to contribute significantly to our knowledge of this important binary system.

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SAO 189111 IN SAGITTARIUS IS AN ECLIPSING BINARY

The variability of SAO 189111 = DM -28°16553 = HD 192825 was noticed when it was used as a check star in a programme of asteroid photometry. We have been unable to find any reference to the variability of this star in either the GCVS (Kholopov 1987), NSV (Kholopov 1982) or in the SIMBAD database, and presume it has not previously been reported. The star appears to be an eclipsing binary.

The initial observations were made with the 0.61-m f/16 reflector of the Mt John University Observatory using a cooled EMI 9558 photomultiplier tube and Johnson-Cousins UBVRI filters. Follow-up observations were obtained at Mt John and at the Black Birch Observatory, near Blenheim, New Zealand, the latter using a 0.41-m f/13.5 reflector and cooled EMI 9558B tube. Comparison and check star details are in Table 1. The journal of observations is given in Table 2. A finder chart appears in Figure 1.

TABLE 1: Catalogue Data

	R.A. (1950)	DEC.	Observed Magnitude	Spec.	
SAO 189111	$20^h 14^m 55^s.3$	-28° 17' 21"	8.9 - 9.2	G?	Variable
SAO 189070	$20^h 12^m 20^s.5$	-29° 21' 29"	10.2	G5	Comparison
SAO 189004	$20^h 08^m 50^s.8$	-29° 04' 43"	9.5	G5	Check

TABLE 2: Journal of Observations

U.T. Date	HJD 2448800+	Number of Measures	Filters	Observers	Place
July 24	28.0412 - 28.2970	14	BV	B,K	MJUO
July 30	33.9118 - 34.1731	16	BV	B	MJUO
July 31	34.9870 - 35.1067	9	BV	B	MJUO
August 5	39.9574 - 40.2280	14	BVRI	G	MJUO
August 17	51.8872 - 52.0826	8	UBVR	G	MJUO
August 19	54.1616 - 54.2104	4	UBV	G	MJUO
August 21	56.0057 - 56.1282	14	UBVR	B	BBO
August 22	56.8383 - 57.2058	39	UBVR	B	BBO
August 23	57.8149 - 58.2061	41	UBVR	B	BBO
September 17	82.9079 - 83.1283	10	UBVR	G	MJUO

Notes: Observers : B = Blow, G = Gilmore, K = Kissling.
Place : BBO = Black Birch Observatory, 0.41 m f/13.5 reflector.
MJUO = Mt John University Observatory, 0.6 m f/16 & f/13 reflectors.

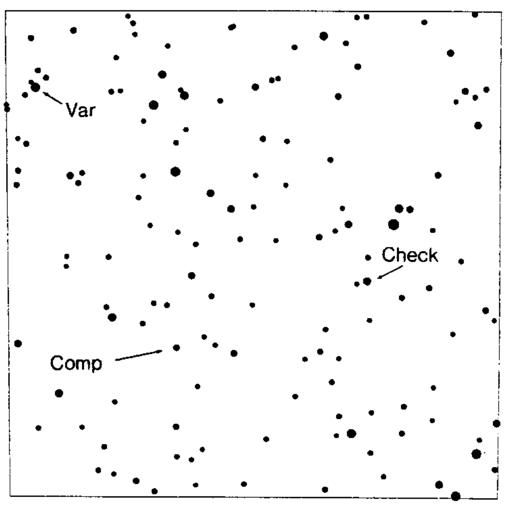

FIGURE 1: Field of SAO 189111

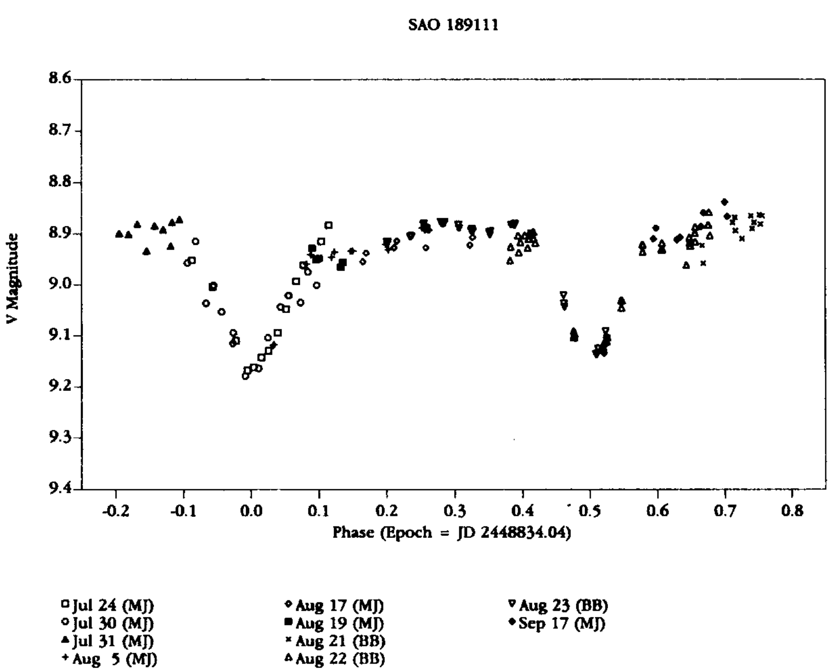

FIGURE 2: Plot of V Magnitude versus Phase

From measures of A.W.J. Cousins's E region standards (Menzies et al, 1980) the comparison star was found to have V = 10.17, U-B = +0.06, B-V = +0.56, V-R = + 0.35, V-I = +0.68. These values were added to the standard differential magnitudes of the variable.

On nights where variability was noted, both the V and B light curves followed portions of a smooth decline and rebrightening covering about 0.3 magnitudes over a period of approximately six hours. Definite minima occurred on July 24 and 30, and on August 22 and 23. Although all the minima are very similar in shape, those observed in July are slightly wider and deeper than those observed in August.

The observed minima in the lightcurve are best matched with a period of 1.177 days. Since minima were observed on the nights of both August 22 and 23, periods longer than 1.177 days are not possible. Times of primary minimum are given by:

$$\text{HJD (Primary Min.)} = \underset{\pm 0.01}{2448834.04} + \underset{0.001}{1.177}\,E$$

A plot of the V data based on a period of 1.177 days appears in Figure 2. The combined colour data was noisy, probably due to frequently poor skies. No convincing evidence for variation in colour from a mean B-V = 0.65 was seen.

The shape of the lightcurve and the period suggest a close eclipsing binary system. We note that the Michigan Spectral Catalogue (Houk 1982) describes SAO 189111 as being of composite spectral types "G5/8 + A/F", consistent with this deduction. The possible plateau feature following primary eclipse may suggest the presence of a chromospherically active star.

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Identification of NSV Stars in the Hubble Space Telescope Guide Star Catalogue

The Hubble Space Telescope Guide Star Catalogue (GSC) is a collection of approximately 20 million objects in the magnitude range 9 to 16 (see Lasker *et al.* 1990). Among other data, accurate coordinates (equinox J2000) are quoted for each star (see Taff *et al.* 1990 for a discussion on the positional errors of the GSC).

This extensive database when combined with the excellent Pickles software package (McCarney, McArthur, and Jefferys 1989) is a powerful source for the identification and improvement of positions for different types of objects such as variable and suspected variable stars. In fact, the GSC has already been used in variable stars research by Gil Hutton (1992) and Morel (1992a,b) among others.

In this note we report cross-identifications of southern suspected variable stars with GSC objects, as part of a program conducted to improve the positions of southern variable and suspected variable stars (see Lopez and Girard 1990, 1991).

The suspected variable stars discussed here were extracted from the NSV catalogue provided in CD-ROM by the Astronomical Data Center and the National Space Science Center/World Data Center A for Rockets and Satellites (ADC/NSSDC). Stars which have both, the declination given to the nearest minute of arc and a literature reference to a finding chart, were isolated.

The objects on one square degree around each of the NSV stars were plotted on the computer screen using Pickles (version 3.058). The suspected variables were then identified using the chart recommended in the NSV catalogue. Due to the fact that most of the coordinates quoted in the NSV are only approximate, this approach seems to be the most convenient for a correct identification of the star. No attempt has been made to do an automatic (computer) identification like the one being done by Egret *et al.* (1992) for the cross-identification of INCA with GSC objects.

Table I lists the identifications which have been found. The first column gives the NSV number, the second one provides the GSC number with the

TABLE I

Identification of NSV with GSC Stars

NSV	GSC	RA (1950.0) h m s	Dec ° ' "
03037	5948.00574	6 33 2.31	-15 20 21.0
03042	5373.01957	6 33 28.41	-13 2 29.8
03046	5952.01758	6 34 25.85	-16 56 59.9
03100	5953.02223	6 38 4.81	-17 47 24.5
03169	5957.00499	6 38 58.48	-20 6 9.8
03182	5953.01422	6 40 44.97	-17 17 15.9
03184	5949.01722	6 40 59.16	-15 53 9.2
03209	5957.01622	6 44 22.18	-19 16 0.2
03251	5391.01022	6 49 47.59	-13 26 15.5
03256	5958.01164	6 50 20.85	-19 3 31.0
03267	5958.02547	6 51 54.04	-19 26 4.8
03327	5963.00870	6 57 40.48	-15 51 33.4
03329	5967.00642	6 58 6.57	-18 32 36.3
03336	5971.00472	6 58 52.26	-18 47 16.6
03348	5963.01809	7 0 14.05	-15 34 55.1
03354	5963.01286	7 1 14.62	-15 28 6.9
03362	5967.00817	7 1 42.06	-17 48 17.4
03366	5972.02429	7 2 21.44	-19 33 11.8
03430	5964.03133	7 7 7.48	-16 15 37.5
03451	5964.03236	7 9 27.46	-16 7 24.9
03465	5406.02125	7 10 54.72	-13 13 23.5
03475	5973.00742	7 12 9.17	-19 35 7.7
03483	5969.01438	7 12 31.97	-17 24 34.8
03488	5406.01967	7 13 8.74	-14 21 37.3
03489	5965.02026	7 13 2.96	-16 10 54.1

TABLE I (cont.)

NSV	GSC	RA (1950.0) h m s	Dec ° ' "
03501	5965.00438	7 14 18.12	-15 36 49.2
03531	5969.00224	7 17 1.11	-17 52 52.8
03621	5983.00400	7 28 36.30	-16 54 25.3
03630	5983.01877	7 29 49.46	-18 16 27.6
03651	5979.02750	7 32 49.81	-15 1 24.7
03657	5987.00120	7 33 43.85	-18 38 20.4
03707	5418.02306	7 41 24.57	-11 47 6.1
03750	5985.00005	7 46 58.41	-17 35 46.6
03751	5423.00809	7 47 2.61	-13 39 38.5
03860	6562.02125	7 58 34.95	-26 48 27.9
03882	6558.02114	8 1 11.82	-25 21 35.6
03908	6007.01592	8 5 14.46	-21 41 2.3
03929	6004.01148	8 7 54.02	-20 9 34.2
03978	6009.00204	8 14 11.94	-21 9 56.4
03995	6560.02934	8 15 42.61	-25 51 25.2
04048	6009.03815	8 21 2.25	-20 49 3.8
04067	6573.04986	8 23 16.33	-25 55 13.7
05749	6109.00856	12 32 39.98	-20 17 13.5
08546	5657.00321	17 18 21.61	-13 27 10.8
12065	6306.02487	19 26 25.02	-19 22 2.4
12620	6313.01630	19 55 37.51	-15 14 28.0
12827	6319.01822	20 5 56.40	-18 24 44.5
12940	6315.00854	20 12 25.53	-15 45 38.7
14091	5806.00066	22 14 34.55	-11 44 41.7

format *rrrrr.nnnnn* where *r* refers to a region number and *n* to the order number on that region (see Lasker *et al.* 1990). The last two columns give RA and Dec (B1950.0). We have preferred to express the positions extracted from the GSC in the 1950 equinox -instead of the J2000 of the GSC- since it is the standard one for both the NSV and GCVS IV. No average between GSC positions of the same star in different regions has been made.

I would like to thank the ADC/NSSDC for providing a CD-ROM with the NSV and GCVS IV among other very useful catalogues.

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NOTE ON THE INTERMEDIATE POLAR RE 0751+14

The intermediate polar RE 0751+14 was first found as an extreme-ultraviolet source in the ROSAT UK Wide Field Camera all-sky survey (Mason et al., 1992). Andronov (1993) studied 24 Sternberg/Crimean archival plates and detected a brightness variation between $13^{m}_{.}65$ and $14^{m}_{.}17$ pg.

Several types of large scale photometric behaviour are present among the one dozen known intermediate polars and DQ Herculis stars, where the magnetic white dwarf primaries are spinning faster than the orbital period of the pair. I therefore checked the location of the object on several hundred Sonneberg sky patrol plates taken between 1956 and 1992 mainly by H. Huth and B. Fuhrmann. None of the 493 exposures of a threshold of $12^{m}_{.}5$ pg and deeper showed any eruption of the kind of EX Hya. Moreover, on those numerous patrol plates which reach $14^{m}_{.}5$ the image of the star is always visible and is varying between $13^{m}_{.}8$ and $14^{m}_{.}2$. The same is true for 41 exposures with a limiting magnitude of $15^{m}_{.}0$ or better, taken with a 14 cm astrograph between 1929 and 1931 and scatteredly during the sixties. This confirms, on a much larger basis, the findings of Andronov (1993), whose comparison stars were used in the present investigation. The result is in agreement with those authors who separate EX Hya from the bulk of intermediate polars (e.g. Vogt, 1992).

It cannot be completely excluded, however, that (contrary to outbursts) depressions of the brightness (short ones, or longer lasting low states) might have happened undetected within the time interval spanned by our material.

I thank Dr. Andronov for directing my attention to this object, and the German Bundesministerium für Forschung und Technologie for funds under contract no. 05-5S0414.

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UBVR PHOTOMETRY OF THE ECLIPSING BINARY DK PERSEI

The eclipsing binary DK Per (=28.1940; m=12.3–13.3 pg) was discovered to be a variable by Ahnert et al. (1947). The spectrum of the components was uncertain. In Zakirov's (1990) paper the system was considered to be in the foreground of the open cluster h and χ Per.

DK Per was observed with the 60 cm telescope during 1988 on Mt. Maidanak in South Uzbekistan. As a comparison star, BD+57°555(=HD 14660; V=$9^m_.805$; U−B=$0^m_.155$; B−V=$0^m_.554$; V−R=$0^m_.167$) was chosen, 67 measurements in U, 80 in B, 83 in each V and R were carried out. According to our estimation the probable error of a single observation of DK Per is $0^m_.008$ in V, for U−B=$0^m_.012$, for B−V=$0^m_.010$. The light elements of the system (as given in the GCVS) are as follows:

$$\text{Min I} = \text{JDH}2442492.374 + 0^d_.898876 \times E$$

Our corrected period is P=$0^d_.8988796$ for the system. The results of our observations are presented in Figure 1 as light and color curves.

The photometric characteristics are given in Table 1.

Table 1

	V	U−B	B−V	V−R
Max	11.332	0.265	0.565	0.505
Min I	12.645	0.388	0.788	0.699
Min II	11.489	0.213	0.529	0.477

All light curves of binary were solved by Lavrov's direct method. The results are listed in Table 2.

Table 2

	U	B	V	R
k	0.760±.018	0.848±.010	0.820±.006	0.794±.010
r_1	0.331±.020	0.370±.011	0.352±.007	0.357±.010
i	$86^\circ_.9$	$88^\circ_.8$	$87^\circ_.3$	$86^\circ_.0$
L_1	0.858±.037	0.861±.017	0.884±.011	0.852±.014

Table 3

HJD	V	U-B	B-V	V-R
2447000+				
375.4737	11.429	0.260	0.559	0.500
378.4362	11.308	0.266	0.563	0.481
379.3772	11.311	0.232	0.567	0.495
379.3855	11.327	0.290	0.543	0.495
379.3904	11.329	0.249	0.562	0.503
380.3973	11.401	0.290	0.564	0.464
381.4424	11.575	0.327		0.493
381.4695	11.375	0.281	0.580	0.485
381.4737	11.375	0.252	0.553	0.489
382.4279	11.357	0.236	0.552	0.526
382.4355	11.327	0.283	0.546	0.516
382.4688	11.342	0.242	0.601	0.519
383.3439	11.336	0.263	0.562	0.490
383.3515	11.334	0.233	0.564	0.491
383.4640	11.315	0.264	0.595	0.513
383.4716	11.301	0.249	0.571	0.518
384.4792	11.430	0.284	0.573	0.482
385.4272	11.489	0.213	0.529	0.477
385.4876	11.403	0.236	0.589	0.494
389.3917	11.467	0.269	0.577	0.489
389.4015	11.515	0.230	0.549	0.505
390.3209	11.780	0.261	0.613	0.537
390.3272	11.873	0.292	0.620	0.537
390.3334	11.981	0.248	0.621	0.566
390.3410	12.170	0.255	0.661	0.596
390.3487	12.353	0.363	0.699	0.643
390.3570	12.540	0.354	0.731	0.587
390.3619	12.620	0.307	0.770	0.654
390.3702	12.640	0.387	0.808	0.702
390.3772	12.552	0.370	0.792	0.706
390.3841	12.377	0.383	0.722	0.678
390.3897	12.199	0.333	0.693	0.599
390.3959	12.102	0.342	0.664	0.615
390.4008	11.998	0.240	0.637	0.585
390.4063	11.904	0.314	0.617	0.566
390.4105	11.821	0.274	0.604	0.534
390.4126	11.734	0.254	0.607	0.525
390.4202	11.714	0.240	0.573	0.527
390.4285	11.563	0.246	0.602	0.511
390.4341	11.546	0.246	0.560	0.492
390.4383	11.486	0.274	0.575	0.503
390.4438	11.456	0.272	0.566	0.493

Table 3 (cont.)

HJD	V	U-B	B-V	V-R
2447000+				
390.4480	11.428	0.238	0.577	0.500
390.4522	11.396	0.261	0.565	0.522
390.4577	11.401	0.266	0.541	0.481
390.4619	11.380	0.220	0.560	0.520
390.4674	11.367	0.268	0.566	0.482
390.4716	11.377	0.265	0.543	0.467
390.4758	11.372	0.270	0.547	0.524
390.4799	11.370	0.249	0.560	0.512
390.4862	11.365	0.215	0.532	0.519
390.4897	11.375	0.200	0.560	0.497
391.4160	11.319	0.259	0.572	0.484
391.4223	11.324	0.222	0.568	0.468
395.3924	11.366	0.222	0.571	0.501
395.4000	11.351	0.215	0.579	0.516
396.3994	11.346	0.287	0.561	0.510
396.4063	11.341	0.273	0.552	0.514
442.3646	11.350	0.237	0.566	0.505
442.3702	11.343	0.229	0.564	0.458
444.1771	11.353		0.557	0.518
444.1847	11.381		0.554	0.512
444.1917	11.359		0.563	0.508
444.1979	11.388		0.552	0.518
444.2021	11.373		0.563	0.506
444.2049	11.389		0.556	0.508
444.2084	11.392		0.550	0.495
444.2119	11.401		0.562	0.501
445.2688	11.481		0.558	0.507
445.2716	11.452			0.506
447.2042	11.337		0.549	0.528
447.2688	11.325		0.551	0.503
447.4264	11.526			0.548
452.4827	11.340	0.237	0.559	0.459
454.3097	11.356	0.269	0.567	0.483
454.3139	11.331	0.263	0.570	0.493
454.3799	11.325	0.284	0.569	0.502
454.5084	11.336	0.228	0.564	0.510
454.5132	11.341	0.211	0.580	0.518
459.3820	11.319	0.293	0.566	0.481
460.2625	11.336		0.541	0.488
460.3389	11.361		0.536	0.487
460.3438	11.364		0.547	0.499

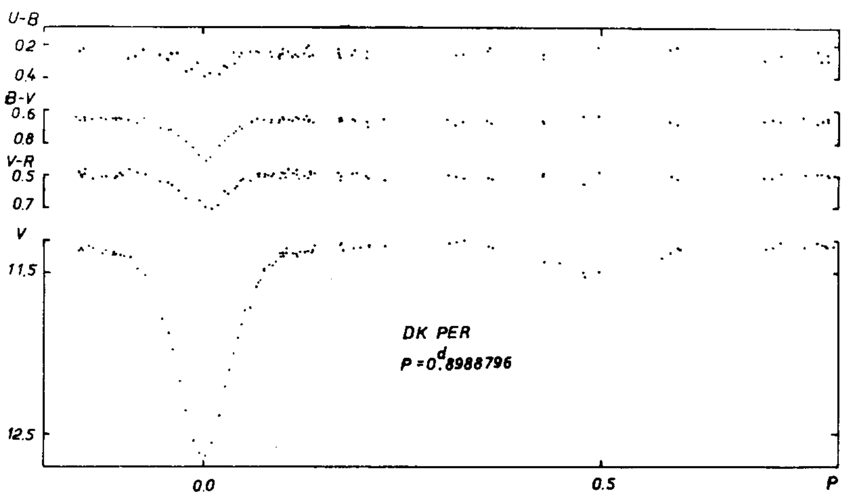

Figure 1. Light and color curves of DK Per

The mass ratio q=0.68 was obtained from formulae by Kopal (1959). The best combination of M_v, R and $\mathcal{M}$ corresponds to B9V+A8IV. Sizes of the Roche lobe for components r_{1crit}=0.389 and r_{2crit}=0.324 were obtained from the mass ratio q. These sizes exceed the relative polar radii of the components.

Accordingly, DK Per is classified as a detached system, containing a subgiant.

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THE DISCOVERY OF APSIDAL MOTION IN THE BINARY SYSTEM α CrB

The first photoelectric light curve of the eclipsing binary α CrB (P=$14^{d}.36$, e=0.37, A0+G6) was obtained by Stebbins (1928). It showed a shallow ($\simeq 0^{m}.1$) primary minimum. The secondary minimum was detected by Kron and Gordon (1953; hereafter referred to as KG) in the near infrared band λ_{eff} = 7230 Å. The depth of this minimum is only $0^{m}.02$. Koch (1973) has shown that the star must have appreciable apsidal motion, mostly relativistic. Ebbighausen (1976) tried to detect this effect, but his attempt failed due to insufficient accuracy of the spectrographic determination of ω. We have estimated the theoretical value of the periastron advance using equations from Sterne (1939) and Rudkjobing (1959) and the parameters of the system from Tomkin and Popper (1986). The relativistic part of the periastron advance is $\dot{\omega}_{rel}$= $0^{\circ}.0046$/year and the part due to the tidal and rotational distortion of the stars supposing synchronous rotation of the components is $\dot{\omega}_{clas}$ = $0^{\circ}.0014$/year. The sum of these values corresponds to a time shift of the secondary minimum by nearly 17 minutes in 40 years that elapsed from the epoch of KG observations in 1946-1948. This value seems quite measurable and does not differ from Koch's result. But taking into consideration the high rotational velocity of the primary component $v\sin i$=110 km/sec (Slettebak et al., 1975) and supposing i=90°one can obtain $\dot{\omega}_{class}$ + $\dot{\omega}_{rel}$ $\simeq 0^{\circ}.0206$/year – even three times greater than Koch's value.

Our observations were carried out with the pulse counting photometer equipped with an EMI 9863 (S-20 cathode) and 48 cm reflector in the mountain station of Moscow University near Alma-Ata (altitude 3000 m). To reduce the flux from this bright star (V=$2^{m}.23$) and to make the atmospheric correction easier, we used two narrow interference filters centered on $\lambda_{1,2}$ = 4600, 7500 Å (compare with Stebbins λ_{eff} = 4600 Å and KG). Most of the observations were made in the 7500 Å filter. We have used HD 135 502="C" as prime standard and HD 143 761 as the check star. These stars proved to be constant within the probable error of an observation $\sigma = \pm 0^{m}.005$ during all the years 1986-1992. But α CrB itself has shown variability between minima. Some nights it had δ Sct-like oscillations with a quasi period of 40 minutes and an amplitude near $0^{m}.01$. To reduce the influence of this variability, we have calculated the corrections for every observational night. Folding the observations of appropriate phases in computer memory we have obtained the individual times of mean primary and mean secondary minima for all observational sets including KG and Stebbins data, see Table 1. To obtain the precise periods for both minima we processed all observations with the Jurkevich algorithm. The resulting formula for primary minima is:

$$JD_{hel} = 2\,447\,346.1168 + 17^{d}.359\,900\,16 \times E$$
$$\pm 13$$

(Our observations in 7500 Å folded with this period are shown in Figure 1.)

for secondary minima:

$$JD_{hel}=2\,447\,010.3923+17^{d}\!.359\,920\,3\times E$$
$$\pm 3\,0$$

The difference between these periods proves the existence of an apsidal motion with the period U=46000±8000 years or $\dot{\omega}_{obs}$ = 0°.0078±0°.0012/year. One can see that the observed value is 2.6 times smaller than the theoretical one. We cannot explain such discrepancy now and more observations in infrared, especially after the year 2000 are badly needed.

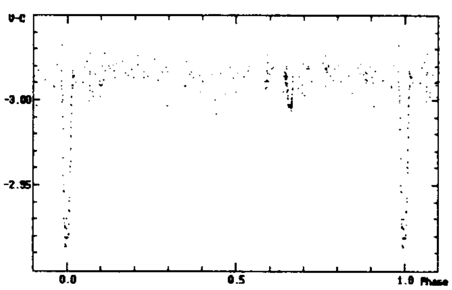

Figure 1. Light curve of Alpha CrB

Table 1

Min I JD$_{hel}$2 400 000+	O−C	Min II JD$_{hel}$2 400 000+	O−C	Author
23 163.7754 ±10	+0.0015	–	–	Stebbins
32 329.8019 ±6	0.0000	32 410.6976 ±30	−0.0017	Kron, Gordon
47 346.1168 ±6	0.0000	47 010.3923 ±25	0.0000	Volkov

I would like to thank Dr. Khaliullin for directing my attention to the problem and for fruitful discussions.

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CCD TIMES OF MINIMA OF FAINT ECLIPSING BINARIES

The list of times of minima of 24 eclipsing binaries is presented. The minima have been obtained with the SBIG ST-6 CCD camera and a 18-cm f/5.6 Maksutov reflector at the Ondřejov Observatory in January and February 1993. Although the camera is mainly used for solar system studies, a part of observational time was devoted to eclipsing binaries too.

The aim of the present observations was to derive the times of minima of relatively faint stars (11.5–13.5 mag in maximum) with the precision of about 5 minutes. As stars with large amplitudes (0.8 mag or more) and relatively rapid light changes were chosen, nearly 10 measurements during the eclipse were sufficient to reach the desired precision. This enabled to observe more (up to four) stars simultaneously.

The camera was used without any filter and only magnitudes in the instrumental, red sensitive (close to the R band) system could be obtained. The exposure times were 60–120 s. The relative precision of a single measurement was 0.03 mag for stars brighter

Table 1: Times of minima of eclipsing binaries.

star	minimum HJD– 2 400 000	error	n	O–C (GCVS)	O–C (2)	Ref.	*d* [h]
CI Aur*	49 028.400	0.003	13	+0.082	−0.013	[1]	0
EQ Aur	49 004.438	0.003	14	−0.362			3.0
LV Aur	49 018.502	0.008	13		−0.189	[2]	
MO Aur*	49 004.449	0.002	10				0
QT Aur	49 018.379	0.004	11		+0.020	[2]	0
TY Cnc	49 006.507	0.002	8	−0.163			
AE Cnc	49 006.495	0.004	8	−0.007			
RY CMi	49 031.385	0.002	9	−0.822			0.3:
AE Cas	49 031.556	0.001	8	+0.068			0
AV Cep	49 031.420	0.002	12	+1.087	+0.018	[3]	0
AN Gem*	49 018.468	0.002	11	−1.613			1.7
CX Gem	49 002.520	0.001	12	−0.007			0
EG Gem	49 006.511	0.001	8	+0.205	−0.011	[1]	
HI Gem*	49 004.397	0.005	12		+0.014	[4]	5.5
AG Lac	49 018.261	0.002	8	−0.310			0:
RY Lyn	49 020.558	0.002	11	−0.024			0
VX Mon	49 029.364	0.003	8	−0.601			
BZ Mon	49 005.384	0.003	10	−0.117	−0.019	[1]	1:
NN Mon*	49 002.541	0.002	13	+0.468			0
V456 Mon	49 005.434	0.002	7	−0.051			
QT Ori	49 002.336	0.003	10	−0.497			0.7
FQ Per	49 005.479	0.003	13	+0.556			3.0
LS Per	49 005.338	0.002	12	−0.306	+0.013	[1]	0
TW UMa	49 020.554	0.002	12	−0.075			1.1

References: [1] Borovička (1993a); [2] Splittgerber (1985), [3] Mánek (1992); [4] Borovička (1993b) than 14th mag and typically 0.09 mag for stars between 14–15th mag.

The results are given the Table 1. All minima are primary. The following data are given: The star name, the heliocentric time of minimum, the error of minimum, the number of images used, the O−C value relative to the linear light elements from the 4th edition of the General Catalogue of Variable Stars (GCVS), the O−C relative to more recent light elements (if any), the reference to the recent elements. In one case (MO Aur) only the present observation enabled the first determination of the period. Besides the time of minimum, also the duration of the constant phase in minimum could be determined for several stars. As these values are poorly known for the stars in question, they are given in the last column (in hours). An asterisk after the star name refers to the remarks.

The importance of the observations is demonstrated by the fact that only two stars (AE Cnc and CX Gem) met their GCVS elements satisfactorily. Often the O−C reaches a substantial part of period. A number of stars from the table was occasionally observed visually in the recent years, mainly by the amateur groups B.B.S.A.G. and B.R.N.O. Further minima are, of course, desirable for period improvements.

Remarks: *CI Aur.* Period changes are frequent in this interacting binary. See Borovička (1993a) for the O–C diagram. The parabolic elements are, however, excluded by the present minimum.

MO Aur. The period unknown. Using also of Geßner's (1973) and Borovička's (1993b) minima, a of period 5.266723 days was derived. An additional image taken at 49 020.258 showed the star near minimum and confirmed the period. The duration of the eclipse is 12 hours. The amplitude in the instrumental system was 12.4–13.4 mag.

AN Gem. The formal value of O−C is +0.419 (the period being $P = 2.032$), but in 1989 the O−C was +0.53 (see Contrib. Brno 30) and is therefore decreasing. It seems probable that O−C in fact exceeds P/2.

HI Gem. The normal minimum derived from the observations in 49 004 and 49 018 is given in Table 1. The elements 47 967.537 + 4.691610 E (Borovička 1993b) were used for reduction.

NN Mon. The formal value of O−C is −0.444 (the period being $P = 0.912$), but in 1990 the O−C was +0.44 (see Contrib. Brno 31) and it is therefore clear that O−C just exceeded P/2.

Acknowledgments. I am indebted to Mr. P. Pravec for his introducing to CCD photometry.

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A STUDY OF FOUR RED STARS

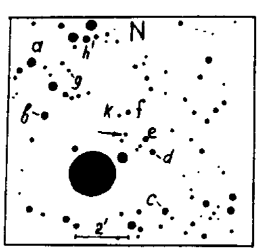
We have studied four variable stars on photographs taken with the 40 cm astrograph of the Sternberg Institute Crimean Laboratory. The discoverer of each star, the number of estimated plates and the time interval covered are indicated in Table I.

Table I

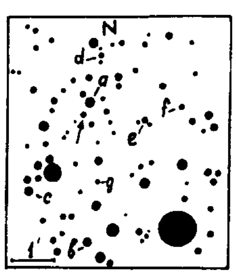
Name	Reference	Type GCVS	Observational interval J.D.2400000+	Number of plates
AM Lac	Hoffmeister (1928)	M	45642–47826	109
BX Lac	Hoffmeister (1929)	M	45642–47851	102
KW Lac	Miller and Wachmann (1971)	SRb:	45642–48532	98
NSV 14200	Morgenroth (1934)	–	45642–48532	121

The finding charts are shown in Figure 1. The magnitudes of comparison stars for KW Lac were taken from Miller and Wachmann (1971), and for the rest of the stars we have measured them with the iris photometer of the Variable Star Department, Sternberg Institute (see Table III).

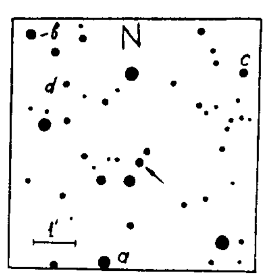
We have reduced the observations on a PC. The main results are given in Table II.



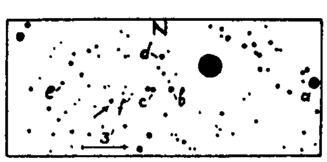
BX Lac



KW Lac



NSV1 4200



AM Lac

Figure 1. The finding charts of the programme stars.

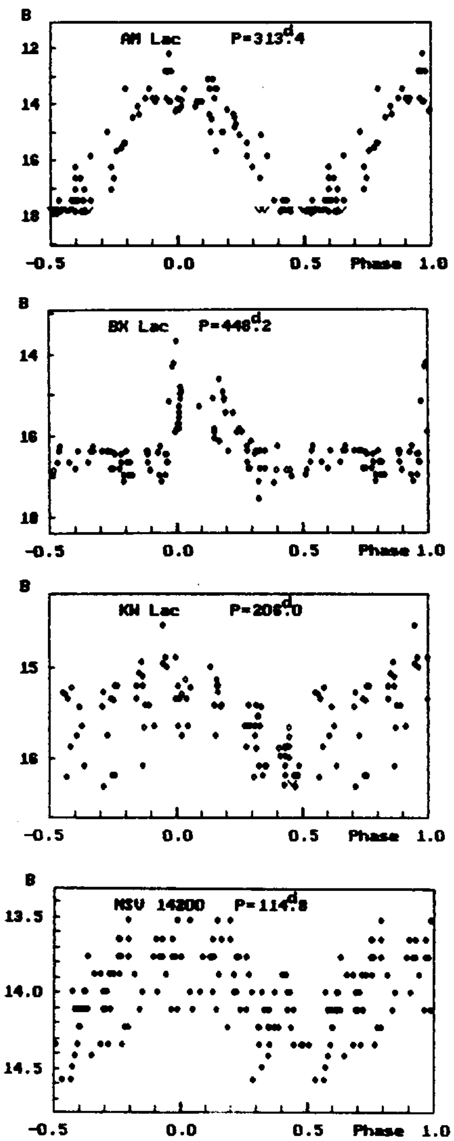


Figure 2. The mean light curve of the stars studied. Uncertain observations are shown as open circles.

Table II

Name	Type	Max	Min	J.D. max	Period	Sp
AM Lac	M	$12^{m}.2$	(18^{m}	46722	$313^{d}.4$	M5
BX Lac	M	13.7	17.6	46413	448.2	M10
KW Lac	SRa	14.6	16.3	45675	206.0	?
NSV 14200	SRb	13.5	14.6	45649	114.8	M6

Remark: The spectral types are given from the literature.

Table III

Name	AM Lac	BX Lac	KW Lac	NSV14200
a	$12^{m}.20$	$12^{m}.83$	$14^{m}.56$	$13^{m}.18$
b	13.80	13.90	14.84	13.77
c	14.51	14.45	15.07	14.34
d	15.11	14.95	15.15	14.72
e	15.86	15.18	15.43	–
f	17.9	15.85	15.87	–
g	–	15.96	16.28	–
h	–	16.48	–	–
k	–	17.14	–	–

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A NEW VARIABLE STAR GSC 4383.0384

Observing supernova 1993J in the evening April 16, 1993 at 19:15 UT, Kamil Hornoch and Jan Kyselý (at 19:12 UT) independently noticed a brightness change of a star plotted in a special AAVSO chart for SN 1993J at NGC 3031 (M81). The star is some 9'.7 north and 4'.7 west with respect to the center of M81 galaxy.

The star's number in the Guide Star Catalog [1] is 4383.0384, $\alpha = 9^h54^m28^s.9$, $\delta = +69°13' 22"$ (equinox 2000.0) its brightness is given there as 10.80 mag. The star is not included in the General Catalogue of Variable Stars [2] nor in the New Catalogue of Suspected Variable Stars [3].

Visual observation by K. Hornoch, J. Kyselý and other visual observers will be published in [4].

K. Hornoch's message arrived immediately at the N. Copernicus Observatory and Planetarium in Brno, where the star was measured the same night by the photometer (uncooled EMI 6256 photomultiplier) of our 0.4 m telescope and variability of this star was definitely confirmed. In the course of photoelectric measurements HD 86677 (V=7.876 mag, B−V=+0.510, Hipparcos Input Catalogue [5]), was used as the comparison star, check stars were HD 85458, HD 85743 and GSC 4383.0565. Their V and B−V data indicate that the comparison star is constant, whereas the GSC 4383.0384 exhibited apparent light variations, when we measured it. Up to now we measured six nights and we caught two maxima and two minima. The V amplitude the star can be estimated at 0.3 mag and period about dozen hours. More detailed information on the photoelectric measurements of the new variable will be published later.

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UBVR OBSERVATIONS OF THE DOUBLE-MODE CEPHEID AS Cas

Recently we (Berdnikov, 1992) have decomposited available UBVRI observations of all double-mode Cepheis into two oscillations. It was also pointed out that the number of existing observations is not sufficient for certain investigation of light curve variations for the majority of these stars. Therefore we continue to carry out the observations of all accessible double-mode Cepheids.

In Table 1 we present photoelectric BVR observations of AS Cas. All measurements were obtained in 1992 August-September at the Mt. Maidanak Observatory of the Tashkent Astronomical Institute. The 60-cm reflector was used and 184 observations were carried out; the accuracy of the individual data is near $0\overset{m}{.}015$ in all filters.

Table 1

JD hel 2440000+	V	B−V	V−R	JD hel 2440000+	V	B−V	V−R
8852.4116	12.255	1.355	1.243	8874.3349	12.354	1.558	1.198
8854.3561	12.430	1.359	1.289	8874.4113	12.442	1.451	1.278
8854.4076	12.426	1.446	1.278	8874.4638	12.432	1.472	1.280
8854.4504	12.463	1.276	1.288	8875.3076	12.377	1.495	1.293
8856.3932	12.466	1.497	1.322	8875.3482	12.343	1.405	1.240
8856.4611	12.440	1.531	1.285	8875.3950	12.346	1.417	1.241
8858.3016	12.057	1.349	1.161	8876.2090	12.194	1.344	1.221
8858.3517	12.132	1.336	1.220	8876.2741	12.119	1.383	1.161
8858.3768	12.126	1.347	1.221	8876.3135	12.139	1.301	1.189
8858.4564	12.158	1.413	1.202	8876.3426	12.115	1.304	1.171
8860.2206	12.349	1.413	1.273	8876.4080	12.101	1.332	1.219
8860.2853	12.328	1.386	1.236	8876.5103	12.047	1.269	1.174
8860.3529	12.329	1.370	1.258	8877.1839	12.175	1.328	1.189
8860.4672	12.279	1.416	1.204	8877.2550	12.188	1.350	1.212
8862.3297	12.267	1.406	1.299	8877.2919	12.219	1.331	1.238
8862.3668	12.267	1.396	1.237	8877.3455	12.217	1.399	1.225
8862.4340	12.312	1.418	1.246	8877.4109	12.242	1.412	1.201
8870.2625	11.779	1.203	1.034	8877.5104	12.285	1.424	-
8870.3093	11.766	1.217	1.050	8878.1958	12.484	1.504	1.238
8870.3319	11.802	1.178	1.091	8878.2894	12.531	1.498	1.294
8870.3842	11.832	1.208	1.104	8878.3283	12.550	1.564	1.325
8870.4045	11.846	1.226	1.110	8878.3634	12.577	1.400	1.334
8870.4135	11.858	1.208	1.096	8879.2920	11.807	1.184	1.087
8870.4628	11.880	1.225	1.091	8879.3421	11.855	1.238	1.116
8870.5070	11.886	1.209	1.110	8879.3628	11.862	1.237	1.101
8872.1721	12.528	1.580	1.261	8879.3967	11.906	1.233	1.143
8872.3000	12.587	1.485	1.325	8879.4409	11.926	1.252	1.125
8872.3218	12.596	1.477	1.318	8879.5115	11.988	1.258	1.169
8872.3602	12.568	1.470	1.315	8880.1848	12.371	1.476	1.287
8872.3865	12.564	1.446	1.316	8880.2404	12.402	1.396	1.302
8872.4301	12.506	1.448	1.253	8880.2712	12.400	1.352	1.271
8874.1783	12.402	1.454	1.292	8880.3080	12.434	1.516	1.277
8874.2557	12.396	1.494	1.260	8880.3522	12.433	1.497	1.292
8874.3052	12.420	1.463	1.276	8880.3872	12.369	1.595	1.192

Table 1 (continued)

JD hel 2440000+	V	B−V	V−R	JD hel 2440000+	V	B−V	V−R
8880.4232	12.441	1.495	1.265	8888.3321	12.020	1.246	1.171
8880.4535	12.495	1.442	–	8888.3055	11.988	1.284	1.175
8880.5061	12.507	1.491	1.339	8888.3815	12.034	1.281	1.164
8881.1794	12.507	1.481	1.286	8888.4144	12.044	1.296	1.186
8881.2330	12.559	1.541	1.405	8888.5163	12.097	1.347	–
8881.2611	12.399	1.538	1.304	8889.2020	12.389	1.437	1.269
8881.3360	12.451	1.438	1.280	8889.2381	12.413	1.450	1.302
8881.3893	12.382	1.470	1.260	8889.2647	12.426	1.466	1.309
8881.4110	12.398	1.385	1.261	8889.2996	12.382	1.468	1.290
8881.5140	12.310	1.392	1.201	8889.3388	12.406	1.467	1.289
8882.1873	12.143	1.310	1.219	8890.1817	12.409	1.423	1.288
8882.2355	12.128	1.346	1.203	8890.2163	12.395	1.413	1.281
8882.2716	12.153	1.314	1.215	8890.2449	12.373	1.424	1.247
8882.3060	12.148	1.356	1.187	8890.2673	12.364	1.452	1.252
8882.3585	12.164	1.339	1.188	8890.3049	12.376	1.425	1.236
8882.4022	12.209	1.300	1.252	8890.3081	12.374	1.411	1.263
8882.4309	12.207	1.325	1.217	8890.3443	12.363	1.434	1.255
8883.2227	12.270	1.384	1.217	8890.3611	12.385	1.395	1.284
8883.2650	12.295	1.383	1.258	8890.3907	12.357	1.422	1.252
8883.3000	12.288	1.391	1.249	8890.4061	12.372	1.393	1.259
8883.3543	12.286	1.355	1.247	8890.5153	12.343	1.415	–
8883.3883	12.296	1.364	1.252	8891.1776	12.258	1.383	1.238
8883.4336	12.307	1.412	1.265	8891.2157	12.252	1.377	1.229
8883.5091	12.291	1.413	1.236	8891.2411	12.233	1.360	1.207
8884.1990	12.402	1.426	1.286	8891.2779	12.232	1.324	1.210
8884.2402	12.437	1.426	1.222	8891.3089	12.217	1.331	1.217
8885.1933	11.977	1.222	1.134	8891.3201	12.205	1.319	1.216
8885.2342	11.923	1.233	1.107	8891.3576	12.182	1.339	1.174
8885.2650	11.895	1.222	1.106	8891.3735	12.166	1.341	1.201
8885.3365	11.818	1.184	1.099	8891.4132	12.136	1.330	1.190
8885.3960	11.826	1.153	1.133	8891.1930	12.130	1.347	1.192
8885.4280	11.805	1.162	1.104	8892.1930	12.130	1.347	1.192
8885.5147	11.837	1.149	–	8892.2327	12.151	1.337	1.206
8886.1957	12.240	1.332	1.265	8892.2579	12.179	1.354	1.233
8886.2460	12.260	1.394	1.267	8892.2942	12.217	1.391	1.238
8886.2984	12.281	1.417	1.245	8892.3274	12.261	1.410	1.247
8886.3220	12.286	1.456	1.264	8893.1830	12.487	1.498	1.301
8886.3424	12.307	1.460	1.263	8893.2233	12.507	1.480	1.323
8886.3850	12.346	1.412	–	8893.2408	12.505	1.463	1.304
8886.4252	12.361	1.422	1.275	8893.2540	12.508	1.497	1.336
8886.5107	12.407	1.464	–	8893.2707	12.507	1.462	1.312
8887.2297	12.580	1.567	1.306	8893.2823	12.517	1.488	1.304
8887.2747	12.609	1.477	1.352	8893.3104	12.513	1.485	1.296
8887.3129	12.593	1.494	1.315	8893.3356	12.538	1.457	1.319
8888.1923	11.931	1.214	–	8893.3558	12.530	1.494	1.326
8888.2318	11.951	1.234	1.132	8893.3748	12.548	1.500	1.321
8888.2495	11.951	1.237	1.11[illegible]	8893.4181	12.521	1.509	1.289
8888.2623	11.952	1.275	1.114	8894.1754	11.730	1.175	1.068
8888.2874	11.997	1.252	1.161	8894.1789	11.729	1.143	1.050
8888.3055	11.988	1.284	1.175	8894.2021	11.710	1.138	1.069

Table 1 (continued)

JD hel 2440000+	V	B−V	V−R	JD hel 2440000+	V	B−V	V−R
8894.2090	11.712	1.162	1.073	8894.2729	11.719	1.151	1.071
8894.2189	11.700	1.174	1.044	8894.2808	11.711	1.132	1.046
8894.2228	11.690	1.152	1.041	8894.2849	11.718	1.160	1.043
8894.2424	11.703	1.149	1.055	8894.2926	11.723	1.160	1.067
8894.2472	11.704	1.141	1.056	8894.3023	11.735	1.170	1.059
8894.2576	11.705	1.154	1.062	8894.3183	11.779	1.167	1.067
8894.2643	11.692	1.160	1.052	8894.3333	11.803	1.155	1.087
8894.2698	11.720	1.153	1.062	8894.3441	11.807	1.152	1.076

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A NEW SEMIREGULAR VARIABLE STAR IN LYRA

A new variable star ($\alpha = 19^h10^m52^s.2$, $\delta = +30°14'30"$, equinox 1950.0, epoch 1973.4) was discovered by one of us (A.P.K.). Figure 1 presents the finding chart. The comparison stars have the following B magnitudes: a - 16.18, b - 16.35, c - 16.69, d - 17.10; these values were found photographically, using the photoelectric and photographic sequences in the globular cluster M 56 (Barbon, 1965). The variable was subsequently studied on 252 plates of Moscow collection, taken at JD 2433034–2448459 with the 40 cm astrograph of the Sternberg Institute Crimean Laboratory; the eye estimates were performed by A. Katsyka.

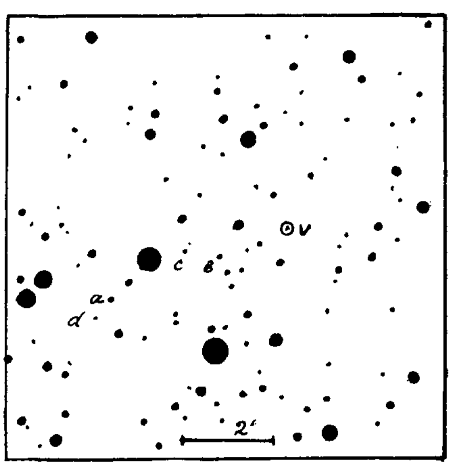

Figure 1. The finding chart for the new variable.

The new variable turns out to be a semiregular star, its cycle length being about 60 to 70 days. The following cycle length values were found for different time intervals: JD 2437118–2439406, ~ 70 days; JD 2440764–2442684, $64^d.1$; JD 2445847–2446732, $74^d.3$. The observations cannot be represented with a single set of linear light elements. The limits of brightness variation are from $16^m.4$ to $17^m.1$ B, the amplitude is about $0^m.7$.

The star does not seem obviously red on Palomar Sky Survey prints, so the variable most probably belongs to the SRD type. Its galactic latitude is $b = +9^\circ\!.1$, and the star might be rather far from the galactic plane. The cycle length values given above contain a hint to alternating periods. Taking all this into account, the new variable could be a candidate to the UU Her class of semiregulars (Sasselov *et al.*, 1987).

The new variable deserves more detailed investigation to reveal its properties and improve classification.

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20 May 1993
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UNSUCCESSFUL SEARCH FOR AN OPTICAL COUNTERPART OF GRS 1915+105

The detection of a new X-ray "transient" in Aquila (first observation 1992 Aug. 15) by the Granat WATCH experiment was announced by Castro-Tirado et al. (1992). Shortly afterwards GRS 1915+105 was confirmed by the BATSE/Compton Observatory team (Harmon et al. 1992) in the energy band 20-230 keV, also of dates before the original discovery. The source had remained at about 300mCrab between 1992 mid-August and the end of September.

On 11 plates taken by E. Splittgerber at the Sonneberg astrographs 400/1600 mm and 1070 Sonneberg Sky Patrol exposures (limiting magnitude 12^{m} to 15^{m} pg) gained from 1928 to 1992 mainly by P. Ahnert, H. Huth, and B. Fuhrmann we searched for an optical counterpart at the ROSAT position (Greiner 1993).

No optical transient, or enhancement of the image of an object, could be detected within a circle of about $1'$ radius. The threshold of the checked astrograph plates are between $16\overset{m}{.}2$ and $17\overset{m}{.}5$pg, the deepest plate being of 1992 Aug. 24.9. By the way, these plates fill the gap in the material of Castro-Tirado et al. (1993).

The work of W. Wenzel has been supported by funds of the German Bundesministerium für Forschung und Technologie under contract no. 05-5S0414.

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A NEW CATACLYSMIC VARIABLE S 10930 IN LYRA

When blinking a pair of Sonneberg 400/1600 mm astrograph plates in the course of the search for an optical counterpart of the BATSE gamma-ray burst source 920804 (19^h53^mUT) (Greiner, 1993) I detected a new U Geminorum type variable at the following position (1950.0):

$$\alpha = 18^h59^m58^s, \qquad \delta = +42^\circ 50'.4.$$

On 597 exposures taken with the astrographs 40/1600 mm, 400/1900 mm, and 170/1200 mm in the years 1963 to 1992 mainly by R. Brandt, L. Meinunger and G. A. Richter, I found 10 eruptions. The star was brighter than $15^m.3$pg on altogether 26 plates and in most cases invisible, much fainter than the quoted value, on the remainder.

Observed maximum brightness: $13^m.2$pg, brightness estimated on the POSS I prints: $18^m.0$ (not conspicuously coloured). List of observed eruptions:

Date of highest brightness UT	Observed maximum pg	Lower limit of duration	Number of eruption plates
1970 June 2	$15^m.4$		2
1973 Sep. 1	13.3		1
1983 June 10	14.7	5^d	6
1985 July 4	13.2	13	7
1986 Sep. 11	13.9		1
1987 Oct. 1	13.5		1
1988 Apr. 19(1)	15.2		1
1988 July 10(1)	14.7	12	1(2)
1989 Oct. 4	13.4		2
1992 Sep. 17	14.0	5	4

Remarks: (1) fainter than $17^m.2$ between the two 1988 dates
(2) one additional plate yields $15^m.5$ at July 22

The pg magnitude system (see Figure 1) has been linked to the Mt. Wilson Selected Area 38.

The methods described by Wenzel and Richter (1986) or Richter (1986) for statistically evaluating the mean cycle length concurrently yield 300±50 days. This value does not severely disagree with modern Kukarkin-Paregano relationships, although it must be borne in mind that these statistical considerations do not include possibly existing undetected short eruptions of lower maximum brightness.

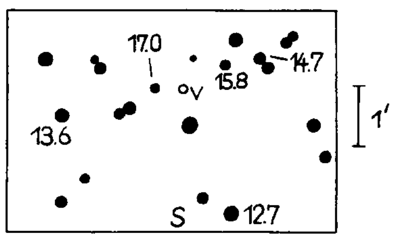

Figure 1

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COMPLETE BVRI LIGHT CURVES OF THE VERY SHORT PERIOD W UMa VARIABLE YZ PHOENICIS

YZ Phoenicis (S7172) was discovered by Hoffmeister (1963). His paper includes a finding chart. Gessner & Meinunger (1975) determined seven timings of minimum light, and calculated a period of $0^{d}.3052$. Jones (1989) presented UBVRI photoelectric observations covering the primary eclipse and determined standard magnitudes at two orbital phases. Kilkenny & Marang (1990) published a complete V photoelectric light curve and determined nine epochs of minimum light. They found Gessner & Meinunger's period to be in error, and recalculated it to be $0^{d}.234727$, making YZ Phe one of the shortest period nondegenerate binaries known.

The present observations of YZ Phe were made on 1989, November 2-8, inclusive, at Cerro Tololo InterAmerican Observatory, Chile. The 1.0-m Yale Reflector was used in conjunction with the ASCAP photometer housing a dry-ice cooled Hamamatsu R943-02 GaAs PMT with standard Johnson-Cousins BVR_cI_c filters.

The coordinates of the check, comparison, and the variable stars are given in Table I. From 450 to 500 observations were taken in each pass band.

Table I

Star	R.A. (2000)	Dec. (2000)
YZ Phe	$01^h42^m22^s.6$	$-45°56'56''$
Comparison	$01^h42^m28^s.8$	$-45°52'35''$
Check	$01^h42^m21^s.4$	$-45°53'54''$

Four precise epochs of minimum light were calculated from observations made during three secondary and one primary eclipses. The bisection-of-chords method was used. Our epochs of minimum light are shown in Table II along with the one by Jones (1989).

Table II

JD Hel. (2440000+)	Min.	Cycles	$(O-C)_1$	$(O-C)_2$	Source
5621.3968	I	0.0	−0.0008	0.0001	Jones
7832.6428(7)	II	9420.5	0.0001	0.0003	Pres. Obs.
7833.8166(4)	II	9425.5	0.0003	0.0002	Pres. Obs.
7834.7557(13)	II	9429.5	0.0005	0.0005	Pres. Obs.
7836.7515(5)	I	9438.0	0.0011	0.0011	Pres. Obs.

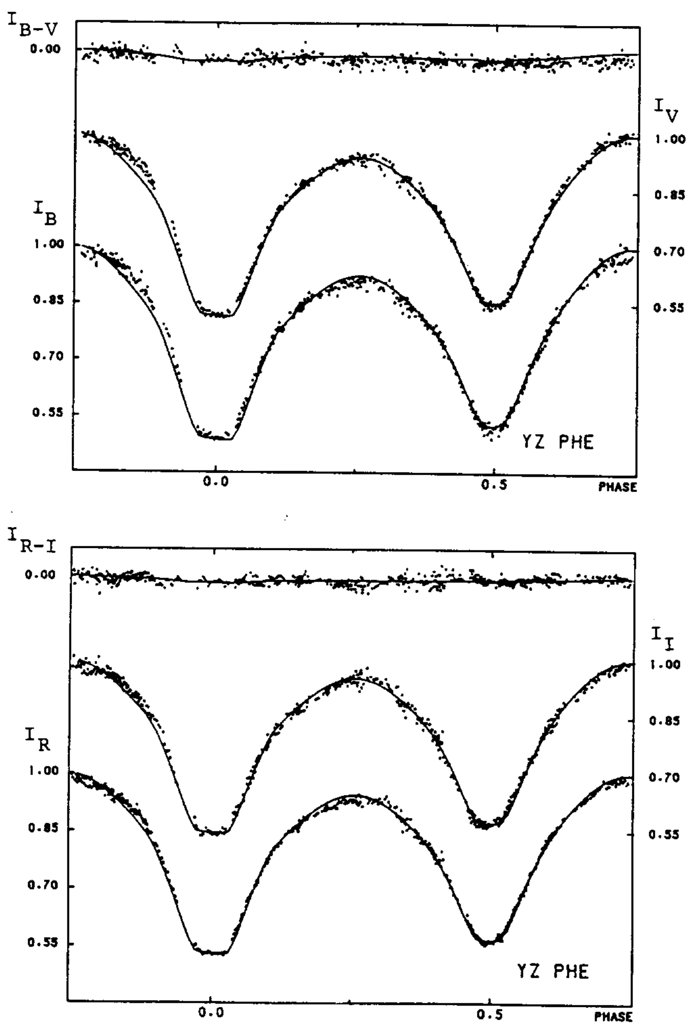

Figure 1. Intensity light curves of YZ Phe as defined by the individual observations and a preliminary light curve solution (solid line).

All available timings of minimum light were introduced into a least squares solution to obtain the linear ephemeris:

$$\text{JD Hel. Min.} = 2445621.3976 \underset{\pm 9}{} + 0^{d}.23472963 \underset{\pm 8}{} \times E \qquad (1)$$

A second ephemeris determined from photoelectric epochs only:

$$\text{JD Hel. Min.} = 2445621.3968 \underset{\pm 5}{} + 0^{d}.23472703 \underset{\pm 5}{} \times E \qquad (2)$$

The period of the system has remained fairly constant over the thirty years it has been observed. Ephemeris (1) was used to calculate $(O-C)_1$ residuals in Table II, and ephemeris (2) was used to phase our observations and its residuals appear as $(O-C)_2$ in the table.

The complete light curves of YZ Phe defined by the individual observations are shown in Figure 1 as intensity versus phase, overlaid with a preliminary light curve solution (solid line). An early analysis by DT indicates that YZ Phe is a W-type W UMa system with a mass ratio of 0.41, a fill-out of 16% and a component difference, $\Delta T \sim 380$ K. A large 46° radius single "dark spot" was simultaneously modeled on the cooler component with a temperature factor of only 0.96. The preliminary reductions and analyses were done by MBA for his undergraduate research project at Butler University.

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NEW ELEMENTS OF THE SMALL AMPLITUDE CEPHEID V1726 Cyg

Variability of V1726 Cyg was discovered by Platais (1979), who determined the elements:

$$\text{Max JD hel}=2442884.996+4^{\text{d}}.2388\times\text{E} \qquad (1)$$

Platais and Shugarov (1981) observed this star photoelectrically and improved the elements:

$$\text{Max JD hel}=2444105.39+4^{\text{d}}.2359\times\text{E} \qquad (2)$$

Szabados (1991), having Berdnikov's (1986) photoelectric observations, derived new elements:

$$\text{Max JD hel}=2444105.697+4^{\text{d}}.236978\times\text{E} \qquad (3)$$

Recently we have obtained new observations (Berdnikov, 1992a) of V1726 Cyg, and now the time-base of the available photometric observations is sufficient for improvement of the elements (3). With this aim all above-mentioned photoelectric observations have been analysed with Hertzsprung's method; Berdnikov's (1992a) light curve served as the standard curve, and computer version of this method (Berdnikov, 1992b) was used. Moments of normal maxima in filter V together with their errors are presented in Table 1; N is the number of utilised observations. On the base of this data, the following elements have been derived (using the least squares method with weights being inversely proportional to error squares):

$$\text{Max JD hel}=2444105.214+4^{\text{d}}.2370487\times\text{E} \qquad (4)$$
$$\pm 0.001 \pm 0.0000006$$

Table 1

Max JD hel	Error	N	E	O−C	Reference
2444105.214	0.019	33	0	0.000	Platais and Shugarov (1981)
2444622.075	0.039	22	358	−0.002	Berdnikov (1986)
2448511.744	0.018	21	1040	0.000	Berdnikov (1992a)

The corresponding epochs E and O−C residuals in Table 1 are calculated with elements (4).

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ON THE PERIOD OF THE CEPHEID CI Per

Variability of CI Per was discovered by Hoffmeister (1944), who later published (Hoffmeister, 1947) the elements:

$$\text{Max JD hel}=2429230.5+3^{d}.3779\times E$$

Schmidt (1991) pointed out that the period $3^{d}.3779$ is wrong, and derived a new one as $3^{d}.767$. However, Berdnikov (1992a) found that the current period was $3^{d}.2963$.

For investigation of the period of CI Per we have analysed all published observations, which are photoelectric ones only, with Hertzsprung's method. The computer version of this method (Berdnikov, 1992b) was used, as Berdnikov's (1992a) light curve served as the standard one. Normal maxima in filter V together with their errors and numbers (N) of observations utilized are listed in Table 1. These data were analysed with the least squares method (with weight being inversely proportional to error squares) and the following new ephemeris used for computing the O−C residuals listed in Table 1 was obtained:

$$\begin{array}{l}\text{Max JD hel}=2446298.815+3^{d}.297224\times E\\ \qquad\qquad\qquad\qquad\pm 0.045\pm 0.000068\end{array}$$

The plot of the residuals in Figure 1, however, shows that the period may undergo periodic and/or sudden changes. In the latter case the following values of the pulsation period can be derived from the existing data:

before JD 2447800	$P=3^{d}.297525\pm 0^{d}.000061$;
after JD 2447800	$P=3^{d}.297074\pm 0^{d}.000099$.

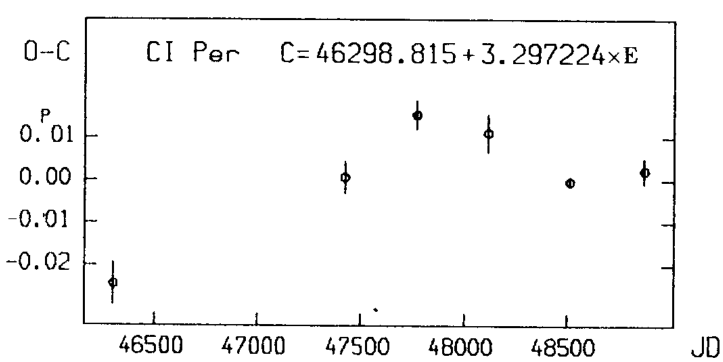

Figure 1

Table 1

Max JD hel	Error	N	E	O−C		Reference
2446298.734	±0.016	15	0	$-0\overset{d}{.}081$	$-0\overset{P}{.}024$	Berdnikov, 1987
2447419.873	0.012	27	340	0.003	0.001	Berdnikov, 1992c
2447769.428	0.011	19	446	0.051	0.015	Berdnikov, 1992d
2448115.622	0.015	20	551	0.037	0.011	Berdnikov, 1992e
2448514.548	0.004	75	672	−0.001	0.000	Berdnikov, 1992a
2448877.252	0.010	26	782	0.008	0.002	Berdnikov, 1993

Obviously, more observations are needed to verify or to reject these results.

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Which is the star V380 Per ?

In the *Hipparcos Input Catalogue* (Turon *et al.* 1992) the variable-star name V380 Per is assigned to HD 25411. But this appears to be wrong, since in volume III of the *General Catalogue of Variable Stars* (Kholopov 1987) the data (coordinates, period, spectral type, ...) of V380 Per are those of HD 25354, and in volume IV of the GCVS (Samus 1990) the name V380 Per is explicitly given for HD 25354 (while HD 25411 B is NSV 1442). The error is probably not far-reaching for Hipparcos data reduction because the variation range is small. However since the *Hipparcos Input Catalogue* has largely been carried out by using informatic processes, it is to be presumed that the error also appears in other star lists, and the HIC itself may be used for other purposes. Thus it is worth while to call users' attention to the error.

HD 25354 is a spectrum-variable star. Its Ap nature was already noted in the HD catalogue (Cannon & Pickering 1918) and described in more detail by Babcock (1958). Rakos (1962) made UBV photometric measures and found the 3.90 d period. This value was confirmed by van Genderen (1970) and refined by Burke *et al.* (1970) and by Panov (see Schöneich *et al.* 1975). These last authors used HD 25411 as comparison star, as Rakos also did, so that one may be wondering which star is the variable one, since they did not use any second comparison star. Fortunately enough, other ones were chosen by van Genderen (HD 25307) and by Burke *et al.* (HD 25643), so that it may be concluded that the star varying with the 3.9 d period is really HD 25354.

The variable-star name V380 Per has been assigned by the Variable Star Commission in the 57th name-list of variable stars (Kukarkin *et al.* 1970) on the basis of the results obtained by Rakos (1962). Besides the reference to Rakos' paper, the identifications are given: BD, HD and GC numbers. Just after this, the authors wrote a note saying that the data given for the star in a paper by Abt and Golson (1962) are in reality for HD 25411. In that paper, the authors gave the mean values of V, $B-V$ and $U-B$, with the dispersion values, for most of the Ap stars in Babcock's catalogue (1958) of magnetic stars. But unfortunately they measured HD 25411 instead of HD 25354, as one of them has explained in an erratum (Abt 1964). This accounts for the note by Kukarkin *et al.*. The above-mentioned error has probably its origins in that note. Indeed somebody may have believed that the data in the papers quoted in the note were concerning the variability rather than mean values of the magnitude and the colour.

Since the identifications clearly concern HD 25354 in the 57th name-list in which the variable-star number V380 Per has been first assigned, as well as in the *General Catalogue of Variable Stars*, we may conclude that V380 Per is surely HD 25354. It is also similarly identified in the *Catalogue des périodes observées pour des étoiles Ap* (Catalano & Renson 1984), as well as in the *Catalogue général des étoiles Ap et Am* (Renson 1991).

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18 ADDITIONAL HISTORICAL OUTBURSTS OF THE CATACLYSMIC VARIABLE J05.23

The dwarf nova J05.23 was discovered in an objective-prism photographic survey by Maza *et al.* (1992), at which time it was at or near minimum. Wenzel (1993) inspected plates in the Sonneberg Sky Patrol collection from 1928 to 1983, and found one distinct outburst.

A search of more than 700 plates, 1888-1989, from the Harvard College Observatory's collection (most of the plates searched were taken in the interval 1930-1952), has revealed 18 additional outbursts of J05.23. Rough *B*-magnitudes during outburst are derived from a sequence based on fields S501 and S569 from *The Guide Star Photometric Catalog* (Lasker *et al.* 1988). In the table below are given the Julian Date and *B*-magnitudes corresponding to each outburst, as well as magnitude limits for dates when the star could not be seen, where these observations serve to impose a meaningful limit on outburst duration. A (2) following a magnitude indicates it is the mean of two observations for that date.

J.D.	*B* mag	J.D.	*B* mag	J.D.	*B* mag	J.D.	*B* mag
18734	>12.5	26130	>14.9	28995	>14.9	44728	>14.9
18748	12.1	26147	12.4	29017	12.8	44748	12.5
18764	>12.5	26158	14.3	29020	>14.9		
						46178	>14.9
20511	>13.7	26505	>14.9	30157	>14.9	46195	13.2
20547	12.4	26531	12.5(2)	30159	13.7	46209	>14.9
20593	>13.7			30162	12.5		
		27093	>14.9	30163	12.2	47317	>13.7
21338	>12.5	27162	13.7			47327	13.2
21348	13.4	27194	>13.7	31643	>13.7	47349	>13.7
21361	>12.5			31655	12.1		
		27870	>12.5			47570	>13.7
23503	12.5	27890	12.5	32262	>13.7	47590	13.2
23526	>13.7	27891	>12.5	32286	14.3	47616	>14.9
		27901	>14.9	32287	12.2		
25411	>14.9			32315	>13.7		
25418	13.0	28302	>13.7				
25433	>13.7	28304	12.3(2)				
		28314	13.6(2)				
		28330	14.9				

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CARD CATALOGUE OF ECLIPSING BINARIES

The Card Catalogue of Eclipsing Binaries has been described in some of the IAU reports in recent years. Nevertheless, it has to be emphasized as strongly as possible that this is not a data center or archives. For example, if one wished to know the most reliable data such as depths of minimum for a number of systems, one would not go to this and expect a tabulated best values. Neither would you send raw data here if you wished it preserved in archival form. Actually much of this material is accessible from our catalogue, but it is in the form of literature references. We can supply these thus giving anyone interested references which in some cases can reach in number several hundred publications, and a brief summary as to the nature of the material. The user can then judge for himself as to the validity of the material after he has used the references in the catalogue. Let me emphasize again that this is not a data center, nor is it archives. As you know, there are several of these, some operating under IAU sanctions, while these present quite a different approach. The CCEB consists of a series of references to publication on eclipsing (or now "interacting") binaries, listed in the variable star nomenclature (R CMa, SX Cep, etc. but also using when appropriate other naming systems VV (Vatican Variable), HD (Henry Draper Catalogue), etc. On each card is given the fundamental data (position in RA and Dec, magnitude at max, depths of primary and secondary eclipses, duration of any total (or annular) phase when there is one, and all the other properties one would need to know when laying out an observing program. Then, for each star is given all the literature references since date of discovery. This can be quite extensive. Note that we try to limit this to interacting binaries; that is, systems which show only radial velocity changes are not included.

This catalogue has been maintained for some time. It has been at the University of Florida for more than 25 years and was maintained for about the same interval at the University of Pennsylvania. Before that it was maintained at the Princeton University Observatory by R.S. Dugan. I am not certain as to the exact date of the earliest entry but this is now at least seventy years old and I think probably closer to ninety. Publications have been made summarizing chief features. Unfortunately, since this is a major task, these have not been as frequently as we would have liked, but they are in the astronomical literature as publications of the Princeton Observatory, (Finding Lists) of the Flower and Cook Observatory of the University of Pennsylvania, and most recently of the Rosemary Hill Observatory of the University of Florida. These will almost certainly be available at any first rate astronomical library such as the Naval Observatory.

For further information you can contact either the undersigned or Dr. Kwan-Yu Chen.

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LONG-TERM LIGHT CURVE OF THE CATACLYSMIC X-RAY SOURCE 1ES1113+432=AR URSAE MAJORIS

Remillard et al. (1993) identified the highly variable Einstein Slew Survey X-ray source 1ES1113+432, by optical spectroscopy and CCD photometry, with a short-period cataclysmic variable. Perhaps because of a small error in the position given in the GCVS (Kholopov et al., 1987) the quoted authors did not perceive the identity of their object with the variable star AR UMa known for thirty years and discovered by Hoffmeister (1963) at Sonneberg as S 7744.

On the basis of a then scanty plate material H. Busch classified the object as what we now call "semiregular" (see Meinunger and Wenzel 1968), and it has not attracted the attention of others since then.

I observed the star on more than 400 plates taken since 1961 with the Sonneberg 400/1600 and 400/1900mm astrographs and arrived at the following conclusions: the long-term light curve is typical for a cataclysmic binary. The brightness is normally in the low state around $15^{m}_{.}5$ pg – see the distribution of the brightness data (night averages) given in Figure 1. Our magnitude sequence has been linked to the Mt. Wilson System of Selected Area 31. Six outbursts (or "high states") during 32 years were documented by our plates. They are distributed rather unevenly and are of differing heights, as is shown by the following table:

No	Mean observed date of outburst	Brightness	Limits of outburst duration
1	J.D. 243 7341	$13^{m}_{.}9$ pg	>8 days
2	243 7973	14.0	3....569
3	244 3222	13.3	65...637
4	244 4319	13.3	54...706
5	244 4648	12.8	28...706
6	244 7945	14.6	3.....46

Unfortunately there is no hint to the star's behaviour between the events 4 and 5. If the high states are generally eruptions of not more than several days or weeks duration, then a number of them could easily remained undetected in the sun gaps. Also by chance we have no observations showing the duration of the rise from low to high states, but only three descending branches; the upper limits of their duration were 12 (no. 1), 18 (no. 2), and about 30 (no. 5) days.

Figure 2 shows two sections of our light curve including the events 4, 5, 6. The scatter in minimum and maximum light is partly due to the normal inaccuracy of photographic photometry and the lack of suitable nearby comparison stars and partly to the small-range variations detected by Remillard et al. (1993), wich we are not willing to analyse with

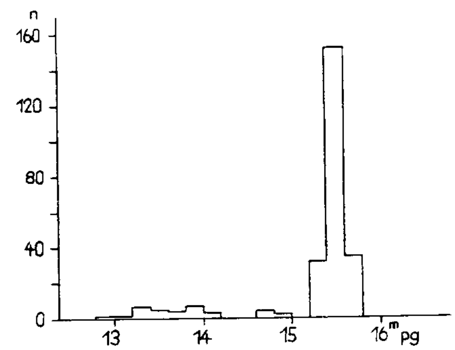

Figure 1

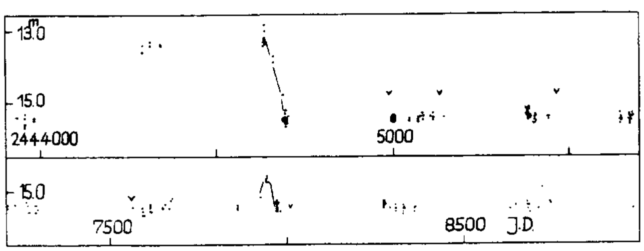

Figure 2

our present material. One should note that the whole amount of dispersion is also present in the night series (comprising up to 9 exposures per night) irrespective of the mean level of brightness.

Looking nowadays at the light curve we easily understand the classification difficulties in the sixties when the great diversity of eruptive binaries was still unknown.

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PRECISION UBVRI OBSERVATIONS OF THE VERY SHORT PERIOD ECLIPSING BINARY BC GRUIS

As a part of our current study of very short period eclipsing binary systems, we have obtained complete U,B,V,R,I light curves of the tenth magnitude (V) variable, BC Gruis (S 6498 Gru). The system was discovered by Hoffmeister (1963) in his photographic search for variable stars in southern star fields. Included in his paper is a finding chart for the variable. Later, 16 times of minimum light were published by Meinunger (1979) along with an early period determination of P = 0.26617 d. Gomez et al. (1988) published a V light curve of BC Gru, from their photoelectric observations, showing it to be a W UMa system with rather shallow eclipses. Also, they report that they have 15 unpublished epochs of minimum light and give an improved ephemeris, with a much longer orbital period than Meinunger (1979),

$$\text{JD Hel. Min. I} = 2447375.7828(1) + 0^{d}.30731(1) \times E. \qquad (1)$$

Plewa and Kaluzny (1992) reported on their 1986 U,B,V,R,I photoelectric observations and published U,V,I light and U-B, R-I, V-R and B-V color curves. From their five timings of minimum light they found a period similar to that of Gomez et al. (1988) , P = 0.30735(2) d.

The present observations of BC Gru were made on 4 - 11 August, 1991 inclusive. The Yale 1M Ritchey-Cretien Telescope at Cerro Tololo InterAmerican Observatory was used. The photometry was done in the Johnson-Cousins' system with standard U,B,V,R_C,I_C filters using the Automated Single Channel Aperture Photometer with a dry-ice-cooled

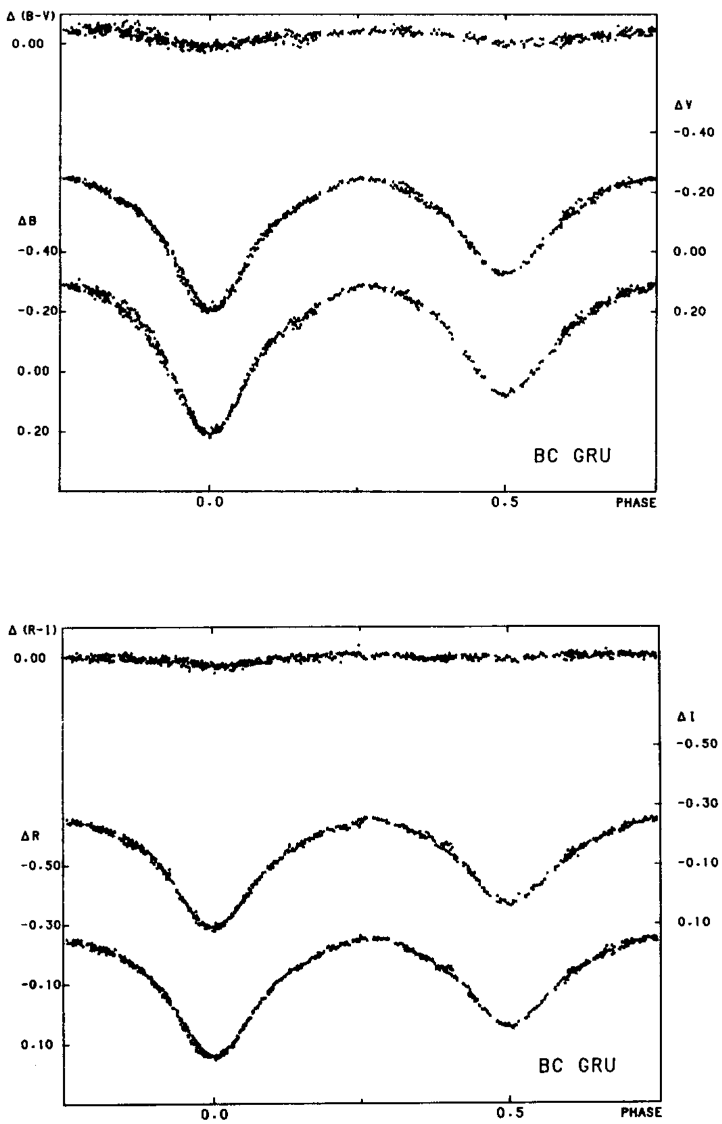

Fig. 1 - Light curves of BC Gru as defined by the individual observations.

Hamamatsu R943-02 Ga-As photomultiplier tube. The coordinates of the check, comparison, and the variable star are given in Table I. About 550 observations were taken in each pass band.

Table I

Star	R.A. (2000)	Dec. (2000)
BC Gru	$22^h 44^m 45.1^s$	-48°09'50"
Comparison	$22^h 44^m 45^s$	-48°07'22"
Check	$22^h 45^m 33^s$	-48°08'45"

Four mean epochs of minimum light were determined from our observations made during one secondary and three primary eclipses. These were determined from an iterative technique based on the Hertzsprung method (1928), except for the earliest timing in B which was done by the method of bisection-of-chords. The epochs of minimum light are given in Table II.

Table II

JD HEL. 2440000+	Minimum	Cycles	$(O-C)_2$	$(O-C)_3$
8473.7799(4)	I	-16.0	-0.0019	0.0005
8474.7021(3)	I	-13.0	-0.0018	0.0006
8478.6964(3)	I	0.0	-0.0031	0.0008
8479.7726(3)	II	3.5	-0.0026	0.0003

All published timings, including those of Meinunger (1979) were introduced into a least squares solution with visual and photoelectric epochs assigned weights of as 0.1 and 1.0, respectively, to obtain the following ephemeris:

$$\text{JD Hel. Min. I} = 2448473.782(11) + 0.^{d}3073577(7) \times E. \qquad (2)$$

The O-C residuals calculated from equation (2) appear as $(O\text{-}C)_2$ in Table II. Using available photoelectric epochs only, we calculated the *improved ephemeris*,

$$\text{JD Hel. Min I} = 2448478.7795(2) + 0.30735687(4)\ \text{d}\cdot\text{E}. \quad (3)$$

Ephemeris (3) was used to calculate $(O\text{-}C)_3$ in Table II and to phase our present observations. From our ephemerides (2) and (3), we find that the epoch given in equation (1) is a *secondary* rather than a primary eclipse. Also, it has a high O-C residual, $(O\text{-}C)_3 = +0.036$.

The B, V, R, and I light curves of BC Gru defined by individual observations are presented in Figure 1 as Δm versus phase. A very preliminary analysis of the observations shows this system to be of W-type in very shallow physical contact (if at all in contact) with a difference in component temperatures of $\Delta T \sim 400K$ with a large mass ratio of $q \sim 0.8$. Much of the preliminary analyses was done by Mr. Kirk Becker as a part of his undergraduate research project. Further results and a complete analysis of the observations will be published elsewhere.

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26 NEW Hα EMISSION OBJECTS

Between 1950 and 1953 Haro found a fair number of stars with strong emission in the Hα line of hydrogen in the region of the Orion Nebula. He also observed the occurrence of flares in some of these emission stars, as well as temporal variations in the intensity of the Hα lines. Further analysis of a large number of variable and flare stars detected in this region shows that many of the possible members of the Orion association are characterized by this flare activity and the presence of the intense emissions in Hα.

The present paper is based on a review of plates of the Tonantzintla collection that covers several regions. The set analyzed consists of six Eastman Kodak plates taken with the Schmidt telescope at Tonantzintla; all star images were dispersed with a 4 objective prism and catalogued as "Hα" in the files of the Tonantzintla Observatory. Table 1 lists the identification and characteristics of these plates as well as their corresponding regions on the plates of the Palomar Sky Survey and the number of objects with Hα in emission.

Each one was analyzed with a microscope to find conspicuous intensity in emission of the Hα line in each of the hundreds of registered spectra.

Several objects with the desired characteristics were found and in order to determine if these were "new" or had been previously reported, their counterparts in the Palomar Sky Survey were identified in order to accurately determine the coordinates of all objects found with Hα in emission. As references, at least twenty stars with well-determined positions were identified on each plate and both reference and problem stars were measured in the Zeiss stereo-comparator at the INAOE. The precision attained with such an instrument is of seven microns which corresponds, in arcsec, to 0.7 on the Tonantzintla plates. The positions were transformed from the measured x-y coordinates into equatorial coordinates by means of the RPLAS computational program (Salazar, 1989).

In Table 2 the 26 newly determined objects with strong Hα emission are listed along with their inferred 1950 coordinates. These objects were checked in the Herbig and Robbin Bell (1988) catalogue and have not yet been listed.

Table 1. Schmidt plates reviewed and the number of Hα objects found on each one.

Tonantzintla	Palomar	Hα objects on each plate
S.T. 6272	E-406 +24 5 38	1
A.C. 3102	E-1314 +30 4 46	3
S.T. 7934	E-668 +42 5 00	1
S.T. 7934	E-644 +42 4 30	3
S.T. 6245	E-1297 +12 5 12	4
A.C. 3738	E-1455 +30 5 38	12
A.C. 3738	E-1459 +30 5 12	2
S.T. 6319	No Hα objects found	

Table 2. Coordinates of the newly determined objects with Hα emission.

ID	R.A. (1950)	DEC
1	$4^h51^m47^s.4$	41°32′36″.3
2	4 53 41.9	27 38 26.2
3	4 56 52.3	29 56 43.3
4	5 00 24.5	27 32 52.6
5	4 55 36.6	44 46 13.6
6	4 53 33.1	43 09 54.5
7	4 46 40.7	41 35 31.2
8	4 42 46.2	44 08 08.3
9	5 18 17.6	14 41 12.3
10	5 09 48.8	14 53 52.0
11	5 07 27.0	14 17 54.4
12	5 08 44.5	10 28 46.4
13	5 40 28.9	28 13 22.1
14	5 40 37.8	28 45 37.7
15	5 44 26.5	31 11 49.1
16	5 33 49.4	31 42 11.9
17	5 37 12.1	30 38 52.6
18	5 36 49.5	28 41 21.0
19	5 35 46.7	27 58 29.3
20	5 35 47.3	28 26 02.1
21	5 34 51.1	28 46 19.2
22	5 35 08.2	29 02 30.6
23	5 31 57.6	31 38 44.9
24	5 32 59.7	32 55 18.9
25	5 24 14.5	31 21 30.0
26	5 23 58.0	30 11 32.0

Acknowledgements. We would like to thank G. Vazquez for assistance with the RPLAS computing, Dr. Parsamian for her critical comments and guidance and J. A. Miller for checking the English version. This was a class project in an Observational Astronomy course at the INAOE.

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SERENDIPITOUS DISCOVERY OF δ SCUTI PULSATION IN THE EARLY A STAR HD 127 269

The Edinburgh-Cape Survey is a search for blue stellar and quasi-stellar objects lying at high galactic latitude in the southern hemisphere. On 24/25 February 1993 while testing the white dwarf EC 14276-2508 for pulsational light variations, we serendipitously found δ Scuti variations in an early A star, HD 127269. HD 127269 is classified A2 in the HD catalogue; Houk & Smith-Moore (1988) classify it A3V. It has V = 7.8 and B = 7.9, consistent with its early A spectral type. We monitored the brightness of HD 127269 in the second channel of the two-channel University of Cape Town photometer attached to the 1-m telescope at the Sutherland observing station of the South African Astronomical Observatory. This star was selected because of its proximity to the target white dwarf and its apparent brightness.

Observations were made through a Johnson B filter using continuous 10-s integrations with interruptions for guiding and sky measurements. The observations were corrected for coincidence losses, sky background and extinction. The times were corrected to Heliocentric Julian Date to an accuracy of 10^{-5} d. We then averaged groups of 6 observations to give 60-s integrations.

Table 1 gives the HJD and magnitudes normalized in the mean to zero for HD 127269. Fig. 1 shows the 2.5-hr long light curve. While high-speed photometry is not the best way to observe δ Scuti stars, on good photometric nights, it can detect even small light variations with confidence. We judge the night of 24/25 February 1993 to have been good enough for this at Sutherland. We thus claim that the variations seen in Fig. 1 are not atmospheric in origin, but are characteristic of HD 127269. The observations of EC 14276-2508 obtained in channel 1 cannot be used to verify this; that star is so faint that the photon statistics give the observations much more scatter than the amplitude of HD 127269.

We performed a Discrete Fourier Transform on the data listed in Table 1 which shows a clear peak at 30 d^{-1}. A least-squares fit of that frequency to the data, and then a non-linear least-squares optimization give: $f = 29.93 \pm 0.15$ d^{-1} (P = 48.1 ± 0.2 minutes); A = 4.92 ± 0.14 mmag; $\phi = -2.774 \pm 0.059$ radians; and $\sigma = 1.06$ mmag per 60-s observation, where these parameters fit the relation

$$\Delta B = A \cos [2\pi f(t-t_0) + \phi]$$

where $t_0 = 9043.50000$. The solid line fitted to the data in Fig. 1 has those parameters.

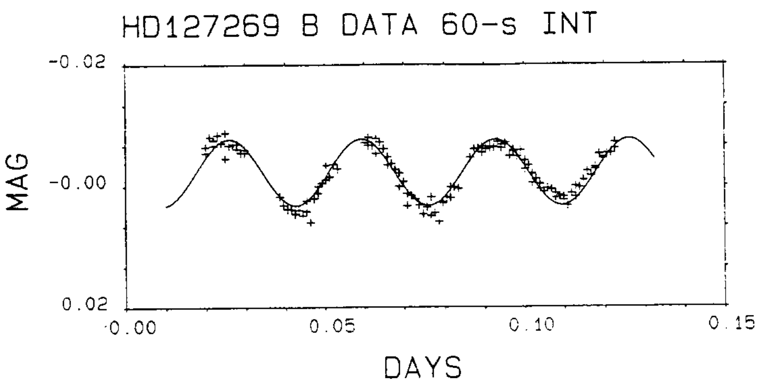

Fig. 1. The light curve of HD 127269. The plotted points are given in Table 1; the fitted curve is constructed from the parameters given in this note.

Table 1. Johnson B observations of HD 127269 normalized in the mean to zero.

HJD	B	HJD	B	HJD	B	HJD	B
9043.49179	-0.0040	9043.52142	0.0014	9043.55059	0.0071	9043.57525	0.0008
9043.49249	-0.0031	9043.52212	0.0009	9043.55129	0.0042	9043.57594	0.0016
9043.49318	-0.0055	9043.52281	-0.0012	9043.55198	0.0044	9043.57664	0.0023
9043.49388	-0.0042	9043.52351	0.0005	9043.55268	0.0035	9043.57733	0.0027
9043.49461	-0.0050	9043.52428	-0.0014	9043.55337	0.0036	9043.57803	0.0022
9043.49538	-0.0058	9043.52501	-0.0007	9043.55407	0.0020	9043.57888	0.0024
9043.49608	-0.0046	9043.53207	-0.0046	9043.55476	0.0020	9043.57965	0.0030
9043.49677	-0.0061	9043.53277	-0.0054	9043.55545	0.0022	9043.58034	0.0036
9043.49746	-0.0023	9043.53346	-0.0042	9043.55904	-0.0024	9043.58104	0.0033
9043.49816	-0.0042	9043.53416	-0.0042	9043.55974	-0.0037	9043.58173	0.0040
9043.49885	-0.0044	9043.53485	-0.0052	9043.56043	-0.0038	9043.58242	0.0035
9043.49955	-0.0037	9043.53558	-0.0030	9043.56113	-0.0032	9043.58312	0.0048
9043.50036	-0.0044	9043.53636	-0.0047	9043.56182	-0.0041	9043.58381	0.0030
9043.50105	-0.0031	9043.53707	-0.0037	9043.56251	-0.0037	9043.58451	0.0019
9043.50175	-0.0031	9043.53786	-0.0025	9043.56321	-0.0039	9043.58520	0.0035
9043.50244	-0.0036	9043.53856	-0.0013	9043.56390	-0.0041	9043.58590	0.0021
9043.51089	0.0034	9043.53925	-0.0015	9043.56460	-0.0040	9043.58659	0.0010
9043.51159	0.0047	9043.53994	-0.0006	9043.56529	-0.0048	9043.58733	0.0010
9043.51228	0.0052	9043.54064	-0.0001	9043.56599	-0.0044	9043.58810	-0.0003
9043.51297	0.0053	9043.54133	0.0019	9043.56680	-0.0039	9043.58879	0.0004
9043.51367	0.0053	9043.54203	0.0012	9043.56761	-0.0047	9043.58949	-0.0009
9043.51436	0.0059	9043.54272	0.0030	9043.56830	-0.0027	9043.59018	-0.0006
9043.51506	0.0060	9043.54342	0.0048	9043.56900	-0.0036	9043.59087	-0.0029
9043.51575	0.0054	9043.54411	0.0032	9043.56969	-0.0034	9043.59157	-0.0022
9043.51645	0.0062	9043.54481	0.0038	9043.57039	-0.0026	9043.59226	-0.0024
9043.51714	0.0040	9043.54550	0.0047	9043.57108	-0.0035	9043.59296	-0.0030
9043.51783	0.0056	9043.54666	0.0060	9043.57178	-0.0020	9043.59365	-0.0030
9043.51855	0.0072	9043.54781	0.0050	9043.57247	-0.0007	9043.59435	-0.0046
9043.51934	0.0037	9043.54851	0.0035	9043.57317	-0.0012	9043.59481	-0.0037
9043.52003	0.0029	9043.54921	0.0063	9043.57386	0.0000		
9043.52073	0.0019	9043.54990	0.0058	9043.57456	0.0014		

An A3V star has β = 2.871 and M_V = 2.4 (Crawford 1979). It is easy to rearrange the pulsation equation

$$P(\rho/\rho_{\odot})^{1/2} = Q$$

to

$$\log Q = -6.454 + \log P + \tfrac{1}{2} \log g + 0.1\, M_{bol} + \log T_{eff},$$

where P is measured in days, g is in cgs units and T_{eff} in K. The β index implies T_{eff} = 8800 K; the luminosity class implies $\log g \approx 4$. Applying the above equation gives

Q = 0.018 for T_{eff} = 8800 K and log g = 4.0, or

Q = 0.027 for T_{eff} = 9000 K and log g = 4.3.

These Q-values indicate pulsation in a low overtone - probably not the fundamental mode. That they are reasonable for an early A star supports the contention that Fig. 1 does demonstrate light variability in HD 127269 and is not an artifact. This star lies near the observed blue border of the δ Scuti instability strip where there is a tendency for the stars to pulsate in overtones higher than the fundamental (see Breger 1979).

As the reader has probably guessed, we did not expect to find δ Scuti pulsation in our comparison star. We selected it at the eyepiece of the telescope (in lazy ignorance) as the brightest convenient guide and comparison star for the program star. In retrospect, it is no surprise that we found such variability in an A3V star, since δ Scuti variability is extremely common in the instability strip.

It would be interesting to know what fraction of stars in the instability strip with normal spectra do *not* show variability when observed with the accuracy of the HD 127269 data presented here.

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V577 OPHIUCHI: AN ECLIPSING BINARY WITH A NON-CIRCULAR ORBIT AND A PULSATING COMPONENT

During the course of an observing run aimed at determining the times of minima of eclipsing binaries with non-circular orbits, the results of which will be published elsewhere (Diethelm, 1993), a secondary minimum of V577 Ophiuchi was followed with a photoelectric photometer at the 76 cm reflector of the Rosemary Hill Observatory of the University of Florida. Since the results of this investigation were rather surprising, and since they might be of considerable physical implication, we decided to publish them separately.

The observational history of V577 Ophiuchi=BD+06°3679 has been summarized by Meinunger (1981) and by Shugarov (1984). Shugarov's UBV photometry showed, that the orbit V577 Oph is non-circular (e=0.22±0.08). He determined its colours to be B−V= +0.51 and U−B= +0.22 mag, respectively. From an estimate of the interstellar reddening E_{B-V}=0.2−0.3, a spectral type of ≈A8 was inferred. A remarkable feature of Shugarov's light curve lies in the fact, that his photoelectric observations at maximum light show a scatter in excess of 0.1 mag, much larger than could be expected. Our observations will present an explanation for this.

The secondary minimum of V577 Oph at JD 2449105 was observed by us with the photoelectric photometer at the 76 cm reflector of the Rosemary Hill Observatory of the University of Florida. The details of the observing procedure will be published separately (Diethelm, 1993). Because we were primarily interested in the determination of the time of minimum, no filter was used, in order to get the best signal to noise ratio possible, although the night of JD 2449105 was of exceptional photometric quality. The nearby star BD+06°3680 served as comparison star, while the UBV standard HR 6629=γ Oph was used as check star. In Figure 1, we present the differential photometry in the sense variable minus comparison.

Evidently, some sort of pulsational variation is superimposed on the eclipse light curve. For reasons given below, this variation is intrinsic to V577 Oph, and since it is observable throughout the secondary minimum, it is very likely connected to the component not eclipsed in this minimum. In order to give a better representation of this secondary variation, we have subtracted the best quadratic fit to the observations, simulating the eclipse light curve, from the measurements. Figure 2 shows these residuals. We conclude, that the primary component of V577 Oph not eclipsed at secondary minimum is a δ Scuti variable with a period of about 0.07 days. The spectral type found by Shugarov supports this conclusion.

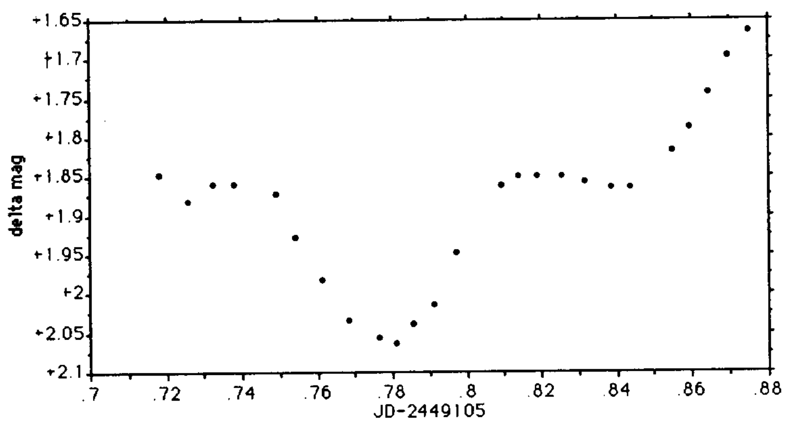

Figure 1. Unfiltered differential photometry of the secondary minimum of V577 Oph relative to BD+06°3680 on JD 2449105.

As a measure to check this conclusion, we decided to observe V577 Oph outside eclipse during the night of JD 2449122 (phase 0.357 to 0.372 according to the elements of Shugarov, 1984). The night was again of good photometric quality. This time, we used a filter which together with the EMI 6256S photomultiplier tube yields magnitudes very close to the standard Johnson B system at the Rosemary Hill Observatory. In Figure 3 we depict the resulting light curve, using the same scales as in Figure 2. As special care was taken to ensure that the variation was not due to the comparison star, these data serve to prove the conclusion reached above.

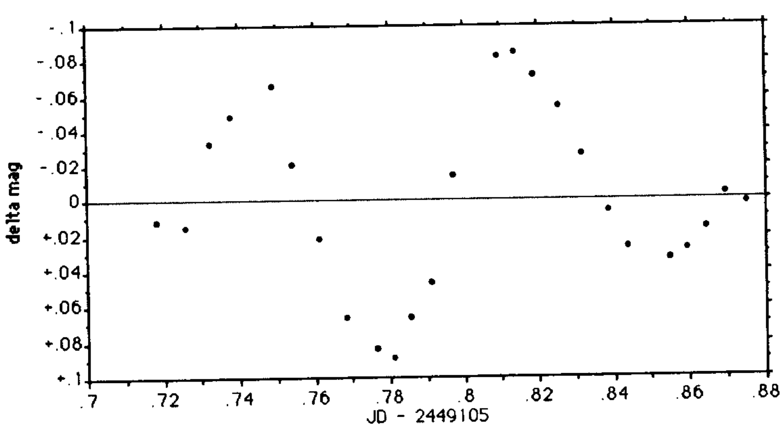

Figure 2. Residual variation after subtracting the eclipse light curve.

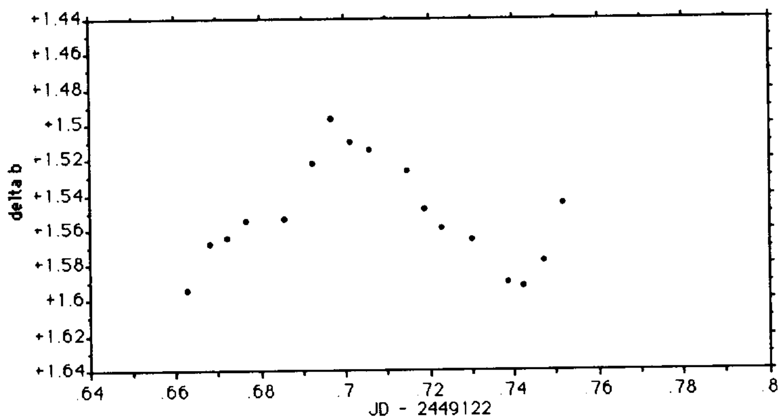

Figure 3. Differential observations of V577 Oph in the instrumental b system at maximum light (JD 2449122).

The physical implication of our finding makes V577 Oph worthy of more thorough investigation. Especially the question, to what extent the variable gravitational field due to the non-circular orbit in this binary has an influence on the characteristics of the pulsation should yield some further insight into the reliability of the models of stellar pulsation.

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LIGHT CURVE PECULIARITIES OF AS 442=NSV 13308

Herbig Ae/Be star AS 442=NSV 13308 lies close to V517 Cyg, AS 441, LkHα 134, 135 and other Herbig Ae/Be stars in the extensive star forming region RSF 4 Cyg B associated with NGC 7000/IC 5070 (Shevchenko et al., 1988).

The spectral type of B3-A0 was assigned to AS 442 (Finkenzeller, 1985; Shevchenko, 1989), Hα emission line EW=18−23 Å, double peak type (Finkenzeller and Mundt, 1984) and strong polarization near light maximum, P_v=3% (Petrova and Shevchenko, 1987) are present.

Our observations of AS 442 were made in 1984-1991 on Mt. Maidanak using a 0.5 m reflector with UBVR pulse counting photometer. Two 100 Å/mm spectrograms were obtained in June 1990 using the Byurakan 2.6-m reflector "ZTA" with UAGS spectrograph equipped with an image tube.

800 UBVR-magnitudes were measured during 8 years of observations. Observational data are listed in Table 1. The summary light curve is plotted in Figure 1. Figure 2 shows the annual light curves for 1988-1991. The same data for 1984-1985 can be found in Shevchenko (1989). The annual light curves for 1986-1987 are similar to the light curve for 1988.

The light curves contain Algol-like nonperiodic minima and waves of different durations. The periodicity of AS 442 light curve is analysed by modern methods of digital spectral analysis (Marple, 1987). A reliable period is not found but there are a number of low possibility (Π) periods, e. g. P=16.2 day, Π=0.76, V=$0^m.2$, on 1984-1985 epoch.

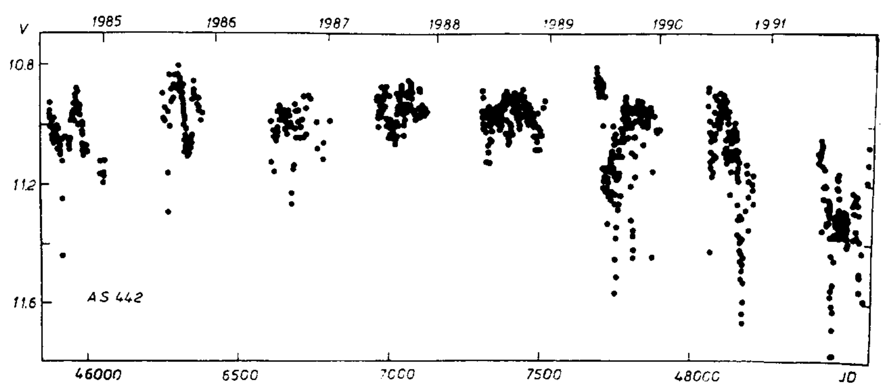

Figure 1. The summary light curve of AS 442

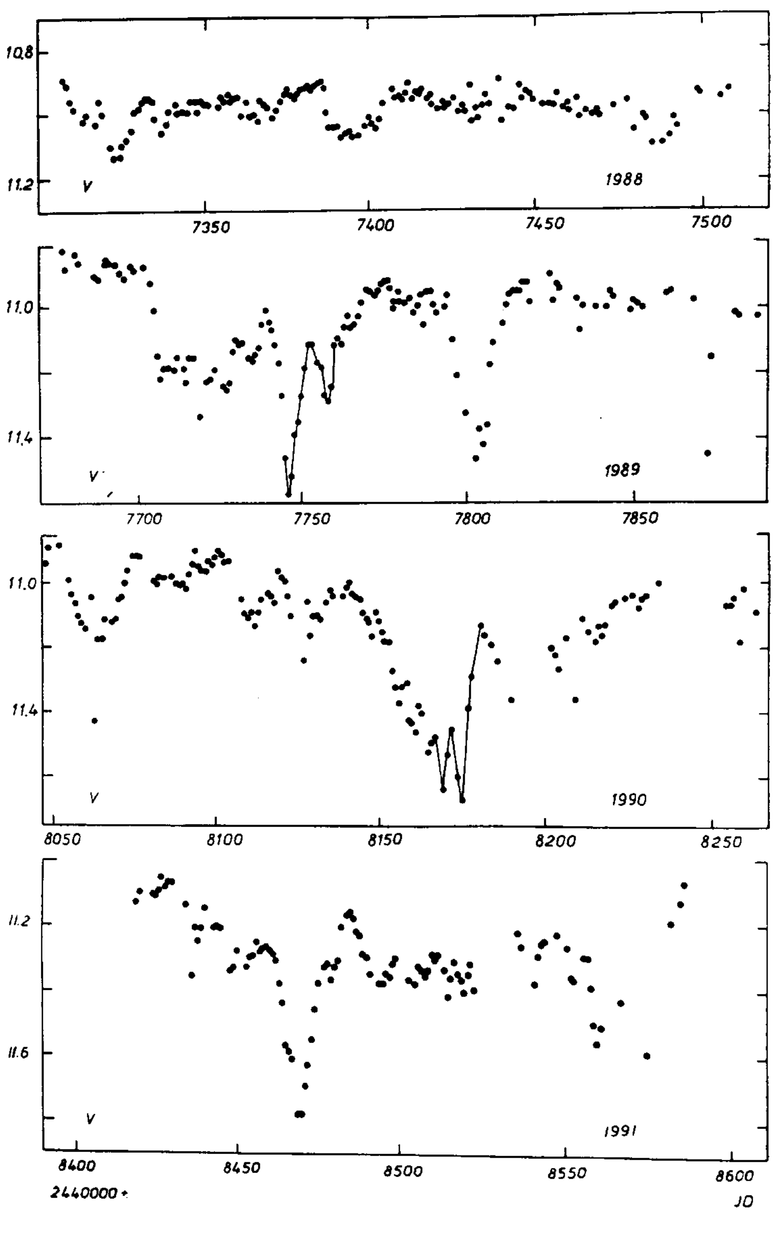

Figure 2. The light curves of AS 442 for 1988-1991

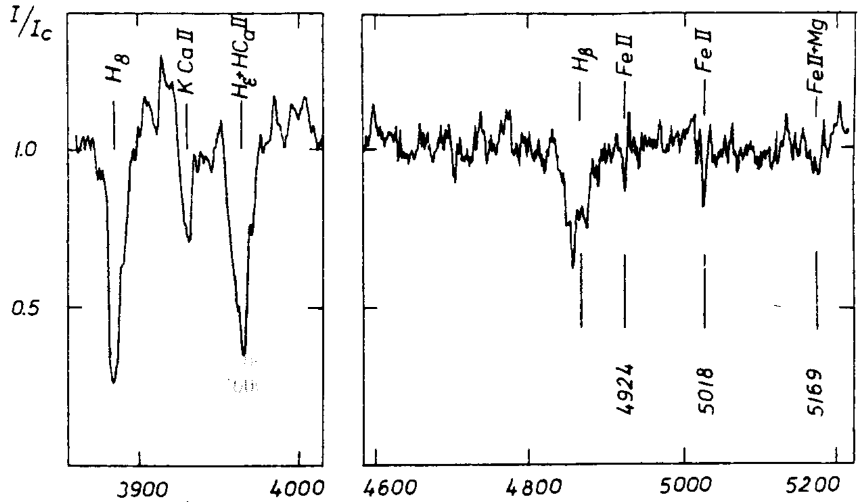

Figure 3. Fragments of the spectra of AS 442.

Table 1. AS 442 photometry data for 1984-1991.

Year	Epoch JD 2440000+	n	V	<V>	<U−B>	<B−V>	<V−R>
1984	5879−6061	69	10.89−11.44	11.03	0.35	0.67	0.72
1985	6255−6383	63	10.81−11.30	10.96	0.34	0.67	0.73
1986	6613−6802	54	10.91−11.28	11.01	0.32	0.68	0.74
1987	6958−7124	90	10.87−11.07	10.96	0.31	0.65	0.72
1988	7307−7507	147	10.89−11.13	10.96	0.29	0.66	0.72
1989	7677−7887	136	10.82−11.57	11.07	0.31	0.68	0.74
1990	8048−8271	138	10.88−11.67	11.12	0.34	0.69	0.75
1991	8419−8586	103	11.07−11.78	11.32	0.33	0.72	0.78

The annual average and minimum V values decreased from 1989 to 1991. No analogous case was found in the photometric history of AS 442.

The spectral fragments are plotted in Figure 3. It shows the relative intensity of CaII K-line and complex line Hε+CaII H, Hβ line with emission component and three strong FeII-lines: 4924, 5018 and 5169.

The spectral type of AS 442 on 28 June 1990 was A2-3 IV-III, $E_{B-V}=0^m.60$, $E_{V-R}=0^m.65$, $A_V=2^m.0$. Intrinsic stellar excess (without interstellar extinction) $E^*_{U-B}=-0^m.3$, seems to be caused by circumstellar dust scattering. The light curve of Herbig Ae-star AS 442 is similar to that of V517 Cyg (Abramian et al., 1990) and V373 Cep (Shevchenko et al., 1991).

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UBV PHOTOELECTRIC OBSERVATIONS OF UV PISCIUM

The eclipsing binary UV Psc (=BD +6°189) has been listed by Hall (1976) in the table of short period group of the RS CVn-type binaries. This inclusion comes from discussion of Oliver (1974) who argued in favour of a subgiant companion to the main sequence G2 primary. According to Popper's spectroscopic observations (1969, 1976) the system is a double-lined binary with emission from both components present in the H and K line of CaII. Sadik (1978), Zeilik et al. (1981, 1982), Vive Kananda Rao and Sarma (1984), and finally Keskin et al. (1987) have presented photometric observations for this star. As in the light curves of all other RS CVn-type binaries, a continuous light variation due to the wave-like distortion has been recognized by most of the investigators. According to his light curve analysis Sadik (1979) stated that a locally hotter (rather than cooler) region was responsible for irregularities in the light curve. Extensive studies of this wave-like distortion have been carried out by Akan (1990) and a migration period towards the decreasing orbital phases of one year has been suggested. UBV photoelectric observations of UV Psc were made from September 1992 until November 1992 at Khadjeh Nassir Alldin Observatory of Tabriz University. The observations were carried out using a 40 cm Cassegrain-telescope. A photoelectric photometer equipped with an unrefrigerated

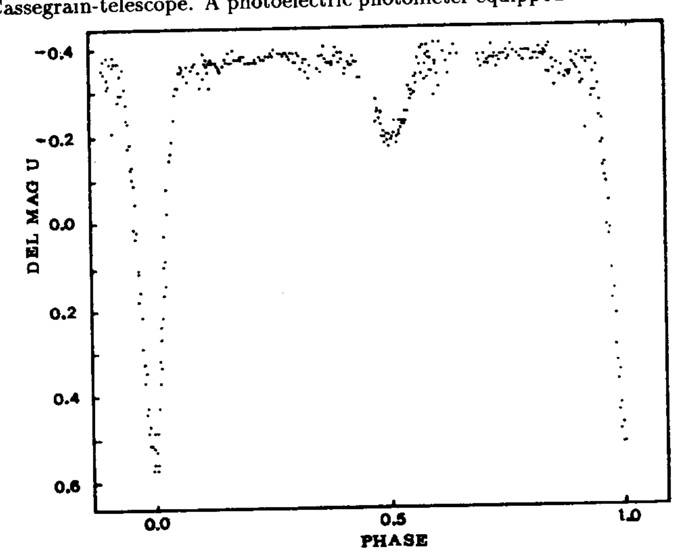

Figure 1

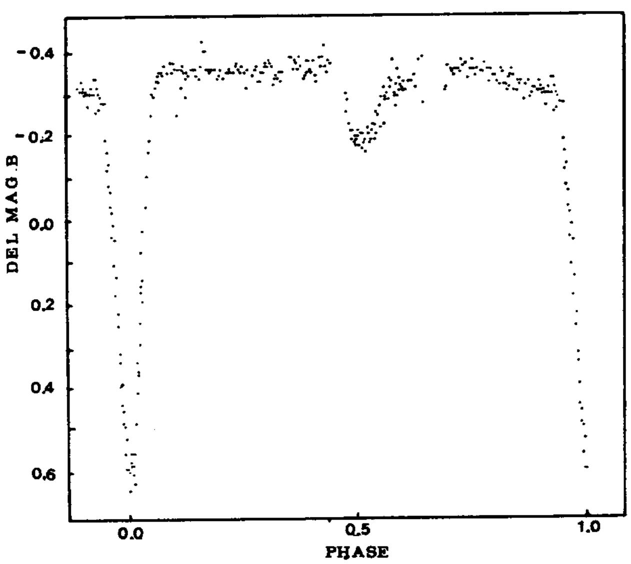

Figure 2

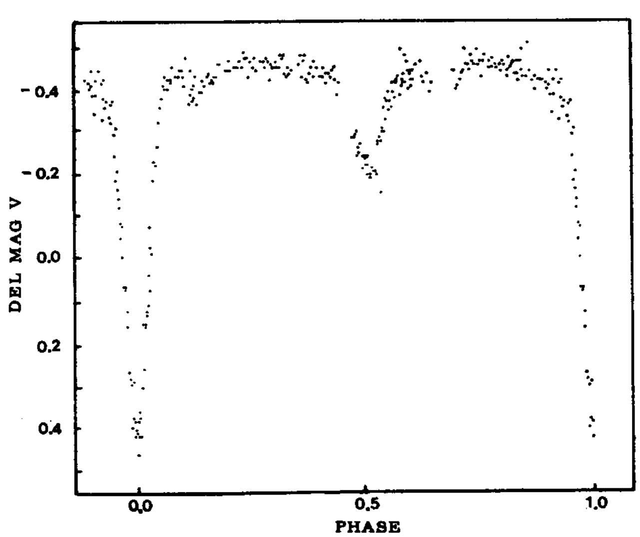

Figure 3

Table I

Date	Phase
22 Sept. 1992	0.45-0.63
24 Sept. 1992	0.82-0.02
1 Oct. 1992	0.89-0.11
3 Oct. 1992	0.10-0.44
17 Oct. 1992	0.45-0.59
19 Oct. 1992	0.68-0.86

Table II

JD Hel 2448000+	Filter	m. e.	rem.
888.3754	U	0.0006	II
888.3754	B	0.0007	II
888.3754	V	0.0007	II
897.4161	U	0.0007	I
897.4161	B	0.0006	I
897.4161	V	0.0007	I
913.3460	U	0.0006	II
913.3460	B	0.0007	II
913.3460	V	0.0008	II

photometer tube RCA 1P21 and Johnson's standard UBV filters were employed during the observations. The stars BD+6°191 and BD+6°197 were used as comparison and check stars respectively. Phases were calculated using

$$HJD=2444932.2985+0^{d}.86104771\times E$$

Table I lists the dates of observations and phases covered whereas Figures 1-3 summarize the results for U, B and V colours. Magnitudes are given in the instrumental UBV system. The data has been folded so that both primary and secondary minima are clearly visible. These observations do indicate the presence of an asymmetrical distortion wave with a minimum amplitude near the mid point of the primary eclipse as well as the presence of asymmetry in the secondary eclipse.

The moments of minimum light determined with Kwee and Van Woerden's method are given in Table II.

In a further paper, we will present the results of the analysis of these light curves.

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UBV PHOTOMETRY OF GO Cyg

The short period eclipsing binary GO Cyg (=HD 196628=BD+34°4095) was photoelectrically observed during July and September 1992. The observations were made using a 40 cm Cassegrain-telescope and a photoelectric photometer equipped with an unrefrigerated photomultiplier tube RCA 1P21 Johnson's standard U, B, V filters. The phases were calculated using

$$\text{Min. I.=JD Hel } 2445865.4056+0^{d}.71776707\times E$$

(Sezer et al., 1985). The stars BD +35°4180 and BD +34°4098 were used as the comparison and the check stars respectively. A total of 192 individual points were obtained in each colour. Figures 1, 2 and 3 summarize the results for U, B and V colours respectively.

The times of minimum light determined with Kwee and Van Woerden's method are given in Table I.

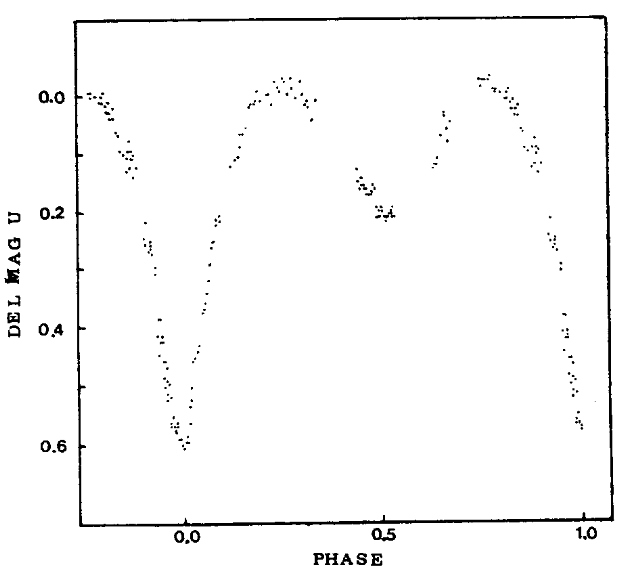

Figure 1

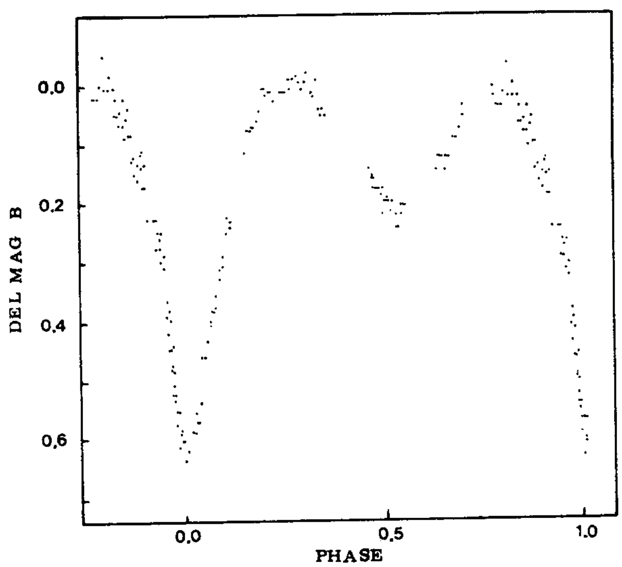

Figure 2

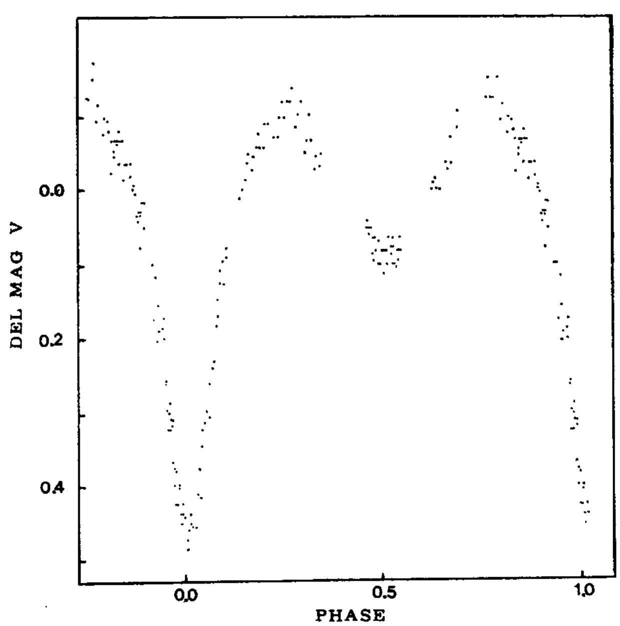

Figure 3

Table I

JD Hel. 2448000.+	Filter	m.e.	rem
855.2584	U	0.0004	II
855.2584	B	0.0004	II
855.2584	V	0.0004	II
856.3347	B	0.0004	I
856.3345	V	0.0003	I

Few observations of GO Cyg have been published to date. The visual observations made by Kukarkin (1932) showed β Lyrae type variations. Ovenden (1954), Mannino (1963) and Sezer (1985) presented complete two colour photometric light curves for this star. Our present light curves show β Lyrae type variations with no asymmetry in the minima, no displacement in the secondary minimum and the maxima are equal. The depth of the primary minimum is 0.615, 0.605, 0.600 mag. and the depth of the secondary is 0.230, 0.228, 0.200 mag. in U, B and V respectively. The analysis of these light curves is being carried out and the results will be presented in a further paper.

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BVR PHOTOMETRY OF SIX PRE-MAIN-SEQUENCE SPECTROSCOPIC BINARIES

The spectroscopic binaries (G8-K7) among the the naked T Tau stars (NTTS) population of the Taurus-Auriga, Scorpius-Ophiuchus and Corona Australis star-formation regions were discovered and spectroscopically investigated by Mathieu et al. (1989). They have orbital periods of about $2^d.42$ or longer. If their orbital planes are orientated along the line-of-sight, then an eclipse of components can be expected. In this case, we are able to determine the radii and masses of the pre-main-sequence stars using the spectroscopic data. A search for any variability of the stars is of interest. Some NTTS are known to have a periodic variability connected with stellar spots on their surfaces (Rydgren and Vrba, 1983; Grankin, 1993). Our aim was to discover any variability among the six spectroscopic binaries with the help of BVR photometry. The observations of the binaries were carried out in 1991/1992 with the 48 and 60 cm telescopes at the Mt. Maidanak. The comparison stars were chosen in the neighbourhood of the binaries. Their data are listed in Table 1.

Table 1

Star	Comparison star	V	B−V	V−R
045251+3016	BD +30°742	7.61	0.11	0.06
155913−2233	BD −22°4069	7.46	0.13	0.08
160814−1857				
160905−1859	BD −18°4243	7.98	0.18	0.18
162814−2427				
162819−2423S	CoD −24°12691	7.55	0.63	0.38

All the observational results of these six binaries were carefully analyzed but we failed to detect any eclipsing effects. However, three stars are shown to be variable and one of them is suspected in variability. The results of our photometry are given in Table 2 (n: number of the observations, P_{orb}: the orbital period, P_{rot}: the axial rotational one).

Table 2

Star	V		B−V	V−R	n	P_{orb}	P_{rot}
	Max	Min					
045251+3016	11.46	11.71	1.26	1.12	46	>1000^d	$9^d.32$
155913−2233	11.22		1.07	0.99	79	2.42378	
160814−1857	11.90	12.06	1.32	1.29	34	144.7	3.81
160905−1859	11.65		1.09	1.08	33	10.400	
162814−2427	11.92	12.24	1.50	1.49	43	35.95	
162819−2423S	10.82	var?	1.09	1.14	31	89.1	3.2?

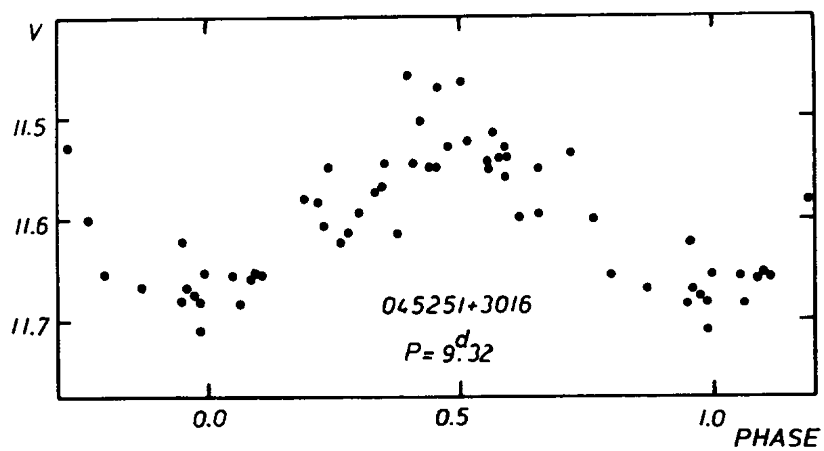

Figure 1

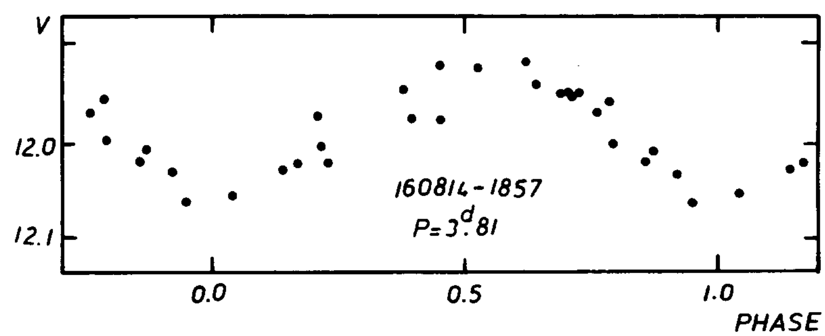

Figure 2

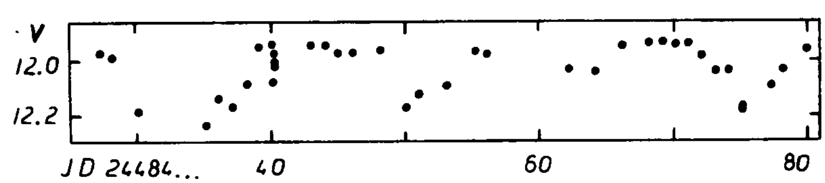

Figure 3

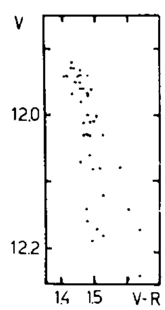

Figure 4

045251+3016. The star had brightness variations with an amplitude of $0^m_.25$(V). This variability can be interpreted in terms of axial rotation of a spotted bright component.

160814−1857. The reason of variability of this binary is the same as that of the previous one. Its brightness changes with an amplitude of $0^m_.16$(V). The light curve of the star is shown in Figure 2. It is also interesting, that the orbital period of the binary and the rotational one of the brighter component are commensurable (P_{orb}/P_{rot}=38).

162814−2427. The light curve of the variable is represented in Figure 3. The amplitude of the star reaches $0^m_.32$(V). We have not found any reasonable explanation for the brightness variations. However, regular light changes are clearly seen in the Figure. The diagram V versus V−R color of the star is plotted in Figure 4. The T Tau type stars have the same diagrams.

162819-2423S. The star seems to be variable with small amplitude ($0^m_.1$ in V), its rotational period being roughly $3^d_.2$.

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NSV 13679 : A DETAILED INVESTIGATION OF ITS SUSPECTED VARIABILITY

Two previous reports concerning NSV 13679 = BD+ 49°3511 at $21^h21^m07^s$ +50°17'46".7(1950) have been made by D. Hoffleit (1991) and W. Wenzel (1992). D. Hoffleit reported that the star - mentioned by F. Schlesinger to be absent on one of the Allegheny Zone Catalog plates (126.2 arcsec/mm , 6°.3 x 7°) - actually was present but at a fainter magnitude m_{pg}= 11.5 - 12. She investigated about 200 Harvard patrol plates taken between 1898 and 1921 finding no further minima, the star being constant at $9^m.1$. W. Wenzel reported on the inspection of 1148 Sonnenberg patrol plates taken between 1928 and 1990 (except 1934-1935) and an additional 35 plates of the 400/1600mm GC astrograph taken between 1974 and 1982. He also found the star to be constant at $9^m.1$.

To answer the question of whether the star had a real minimum or the plate had a defect required further investigation by microscopic techniques. We have therefore scanned the three overlapping Allegheny Zone Catalog plates (Table 1) with the Yale PDS microdensitometer. The plate with the "minimum image" is plate 2104. The PDS input catalog consisted of 537 Astrographic Catalog of Reference Stars (Corbin and Urban 1989) that are included in a rectangular area covered by the plates and 550 Hubble Space Telescope Guide Star Catalog (Lasker et al. 1990) stars in an area of approximately 1°x 1° centered on the NSV star and having a limiting magnitude of 13^m.

TABLE 1

Allegheny plate	Epoch (1915)	Plate center		NSV 13679 position	
		R.A.(1950) 21^h	DEC. (1950) 52°	R.A.(1950) $21^h 21^m$	DEC.(1950) 50° 17
2104	Sept. 16	$6^m 38^s.10$	44' 05"	$6^s.80$	48".68 *
2120	Aug. 31	$22^m 43^s.10$	44' 26"	$7^s.46$	46".67
2136	Sept. 19	$36^m 34^s.90$	43' 46"	$7^s.47$	46".97

* position of the highest peaked image on this plate

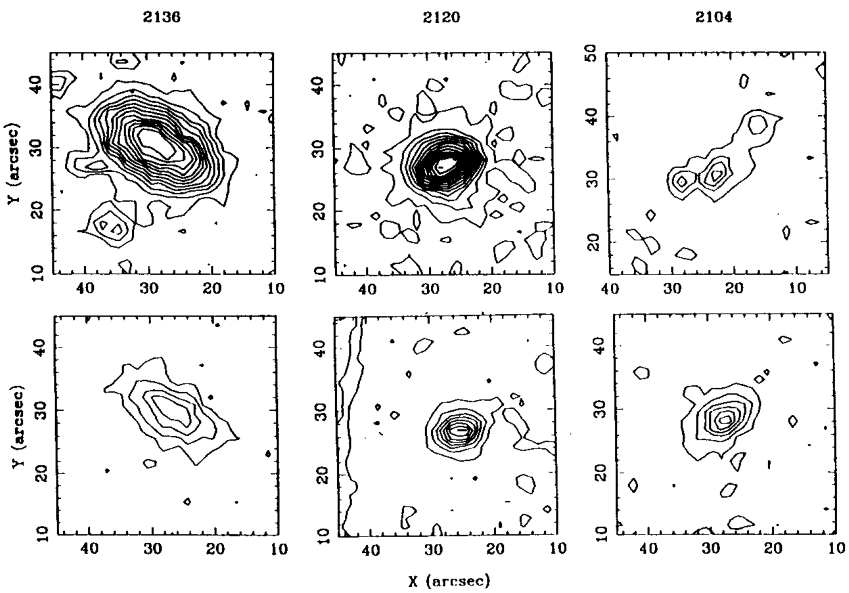

Fig. 1 Density contours of NSV 13679 (top panels) and a nearby star (bottom panels) on the three Allegheny plates. The orientation is north upward and east to the left.

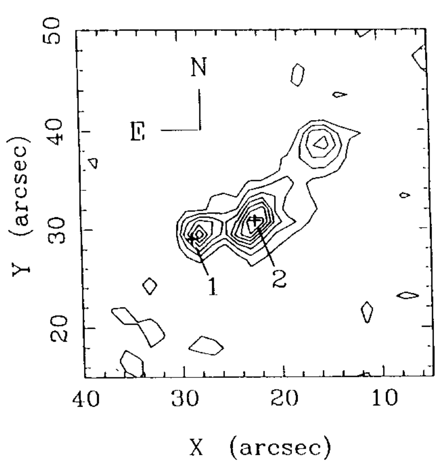

Fig. 2 Density contours of NSV 13679 on plate 2104. The position of the NSV star, as determined from plates 2120 and 2136, is indicated and labeled "1". The centering algorithm converged to the point labeled "2" for the image on plate 2104.

All plates were measured with the PDS and the image centers were obtained with the two dimensional elliptical Gaussian fitting program described by Lee and van Altena (1983). Repeat measures of five stars were made to correct for drifts in the measurement system during the individual plate scans. Also for plate 2104 a raster scan was made of an area of about 1cm^2 centered on the suspected variable. The linearly spaced density contours for the NSV star on the three plates are shown in the top panels of Fig. 1. For comparison, the density contours of a nearby star are shown in the lower panels. On plates 2104 and 2136 these two stars are near the plate corners; note the elongated images on those plates.

The right ascension and declination of the NSV star were determined – on the system of the ACRS - from images on each of the three plates. The derived positions are given in Table 1. Figure 2 shows the density contours for the star on plate 2104, the position of the star given by the centering algorithm (2) (the centering algorithm converged to the highest peak) and the position of the star based on its average position on the other two plates (1). The separation between the two points is 6.6 arcsec. The position of point (1) seems to be almost coincident with the center of the lower peak. However the actual separation relative to the estimated uncertainty (0.2 arcsec) is very large; the size of the marker is three times the estimated uncertainty.

The centering algorithm also estimates the pseudomagnitudes of the stars as the volume under the Gaussian fit to the data. Assuming that the lower peak on plate 2104 is about 0.5 pseudomagnitudes fainter than the one that centered, we searched for stars with pseudomagnitudes in this range in order to estimate the magnitude of the fainter image. All showed density contours with flatter peaks than that of the "second" star. After calibrating the blue pseudomagnitudes with the V magnitudes of the Guide Star Catalog converted approximately to photographic magnitudes, and assuming a constant (B-V) for the star, the difference between the normal brightness and the minimum was found to be $\Delta m_{pg} \sim 1.9$. For the other two plates the magnitude of the star is $m_{pg} = 9.2$. The derived magnitudes have an estimated uncertainty of 0.3.

Since the star appears to be double on plate 2104 we asked Dr. A. R. Klemola to check on Lick astrograph plates (55.1arcsec/mm) to see if the NSV star showed a companion at this separation. He found on a yellow plate (epoch = Sept. 8, 1975) a well-separated companion at a separation of 6.2 arcsec with position angle 197° - about 90° different from our result - with a visual magnitude difference of about 2^m.

We have also inspected the image of the NSV star given by the quick V Palomar Sky Survey GSC scan (1984) and it appeared elongated in a direction that had a position angle close to the value given by Dr. Klemola (≈ 190°). Though the image was at the edge of the field, other stars of comparable magnitude didn't have the elongated shape.

Another possibility is that the faint companion has a proper motion of about 0.15 arcsec/yr so its position relative to the bright star had changed correspondingly from 1915 to 1975 yielding the different position angles. In order to test this possibility another plate of this region was taken (May 15, 1993) with the Van Vleck 20 inch refractor (24.53 arcsec/mm, 7x5 inch). The NSV star showed a companion at the position angle measured by Klemola from the Lick plate (≈ 190°). We have scanned the Van Vleck plate following a similar procedure as for the Allegheny plates, in order to determine the separation and the position angle. We obtained a separation of 5.8± 0.5 arcsec and a position angle of 193°± 5°. So, the faint companion has not changed its position from 1975 (Lick plates) to 1993 (Van Vleck plate) as would be expected from a proper motion of 0.15 arcsec/yr.

In summary, the image on the plate that led Schlesinger to suggest that the star was variable, appears to be double, but with a profile that is steeper than those of images on the same plate with approximately the same peak density. The star is double as supported by the Lick astrograph plate and by the quick V Palomar Sky Survey, but its position angle differs by 90° from that of the image on the suspect Allegheny plate. Interpreting the position angle change as being due to orbital motion leads to the unlikely conclusion that the A7 star has an impossibly large mass, while interpreting the position angle change as being due to the relative proper motion of an optical double is inconsistent with the results given by the 1993 Van Vleck plate. Thus, our conclusion is that the apparently faint image of NSV 13679 on Allegheny plate 2104 is most likely due to a plate defect as opposed to any variability of the star.

Acknowledgments.

We would like to thank Dr. A. R. Klemola for inspecting the Lick astrograph plates and for providing us with useful information. We also thank Dr. M. Lattanzi for making available the digital copy of the GSC scan containing the NSV star and to Dr. A. Upgren and Mr. J. Lee for obtaining the Van Vleck plate.

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TIMES OF MINIMUM LIGHT FOR 35 ECLIPSES OF 21 APSIDAL MOTION BINARIES

We report here on the continuation of a program of observing eclipsing binary systems suggested by Gimenez and Delgado (1980), and by Gimenez (1985), as candidates for possible detection of general-relativistic apsidal motion. Additional systems were observed from the table of Hegedüs (1988). This paper tabulates results since the last publication by Caton et al. (1989). The observations were made with the same equipment described in that paper.

The observations for a given eclipse were made through the V filter only, to maximize the number of data points. The observations have not been transformed to the Johnson system, since they were only intended for timing analysis. The observations are available from the IAU Archives, file number 248.

The times of minimum light and standard errors given in Table I were calculated using the method of Kwee and van Woerden (1956), using a program written by Ghedini (1982). This algorithm has been shown by Caton (1989) to give the most accurate estimation of time of conjunction for asymmetric light curves. The values of O−C were computed using the epoch and period in the fourth edition of the General Catalog of Variable Stars (Kholopov, 1985-87). The value of each O−C is listed to a precision usually limited by the precision of the published epoch.

Table I

System	Type of Eclipse	Heliocentric (−2400000)	O−C (days)	Comparison Star
BW Boo	Primary	48341.66516 ±0.00020	−0.0109	BD+37°2551
UW Boo	Primary	48362.65544 ±0.00029	+0.0074	BD+47°2135
AS Cam	Primary	48191.80069 ±0.00028	−0.01443	BD+69°0323
	Secondary	48601.60190 ±0.00025		"
PV Cas	Secondary	48208.65307 ±0.00013		BD+58°2555
	Primary	48237.54912 ±0.00093	−0.0054	"

Table I (cont.)

System	Type of Eclipse	Heliocentric (−2400000)	O−C (days)	Comparison Star
PV Cas	Primary	48538.61836 ±0.00058	−0.0169	BD+58°2555
V459 Cas	Primary	48209.67110 ±0.00009	−0.072	BD+60°0178
EK Cep	Primary	47840.60313 ±0.00049	+0.0051	BD+68°1239
	Primary	48234.67627 ±0.00012	+0.0047	"
CW Cep	Primary	48197.65350 ±0.00017	−0.0250	BD+62°2162
V1143 Cyg	Primary	48019.73800 ±0.00011	−0.0057	BD+54°2187
Y Cyg	Primary	48528.73157 ±0.00043	+0.1363	BD+34°4190
HS Her	Primary	48744.77194 ±0.00031	−0.0073	BD+24°3538
	Secondary	49105.81612 ±0.00025		
DI Her	Primary	48816.65450 ±0.00043	+0.0021	BD+24°3567
u Her	Secondary	48746.74837 ±0.00019		BD+32°2896
	Secondary	48022.72852 ±0.00092		BD+32°2896
TX Leo	Primary	49037.78855 ±0.00009	+0.0421	BD+10°2166
XX Leo	Primary	48352.70823 ±0.00018	See note	BD+14°2198
	Primary	48690.66135 ±0.00039		"
	Secondary	48705.71009 ±0.00049		"
	Secondary	48741.64571 ±0.00019		"
RR Lyn	Primary	48936.69194 ±0.00026	−0.0107	BD+56°1136
U Oph	Primary	48765.75180 ±0.00015	+0.0068	BD+02°3283
FT Ori	Secondary	47840.80454 ±0.00017		BD+21°1161

Table I cont.

System	Type of Eclipse	Heliocentric (−2400000)	O−C (days)	Comparison Star
FT Ori	Primary	48279.59924 ±0.00020	+0.00252	BD+21°1161
	Primary	48282.75125 ±0.00047	+0.00412	"
AG Per	Primary	48195.71090 ±0.00019	+0.026	BD+33°776
	Secondary	48196.81694 ±0.00131		"
	Secondary	47843.81937 ±0.00125		"
IQ Per	Primary	48183.74166 ±0.00028	+0.0035	BD+47°923
	Secondary	48196.81612 ±0.00142		"
TX UMa	Primary	48324.90636 ±0.00017	+0.0822	BD+46°1658
DR Vul	Primary	48536.69947 ±0.00078	+0.118	BD+26°3827

Notes

(1) The primary for AS Cam has a residual of −0.0156 days, and the secondary has a residual of −0.0098 when computed from the light elements of Maloney et al. (1989), continuing the slow migration to negative residuals that they noted.

(2) The times of minimum for the primaries of PV Cas are in reasonable agreement with the ephemerides of Gimenez and Margrave (1982), with (O−C)s of +0.0014 and −0.0004 days for JD 48237 and 48538, respectively. These are within the formal errors shown in Table I. The secondary's O−C from Gimenez and Margrave's prediction is −0.0013 days. We note that this is an order of magnitude larger than the formal error, the latter being determined from over a hundred measurements taken over 4.5 hours with good observing conditions (the V extinction coefficient, determined from the comparison star, was 0.12 mag/air mass with a standard error of 0.006). The mean difference in magnitude between the comparison and check star (BD +58°2561) for 24 measurements during the event was 0.088 ±0.009 magnitudes.

(3) In observing XX Leo it was found that the light elements in the General Catalog lead to an eclipse prediction off by about a half a cycle. We were able to observe enough events to determine that the current period is 0.9711296 days.

(4) Sharp-eyed readers will note two virtually simultaneous events observed on JD 2449196 – AG Per and IQ Per. On that night both events were observed by taking two variable measurements, bracketed by comparisons and skies, alternately on one system and the other. This reduced the number of data points but appears to not have greatly affected the result. The error, for 29 points was half the error for JD 2447843, which had

over a hundred measurements. However, the seeing conditions on that night, with (check star minus comparison) residuals of 0.008 magnitudes, were apparently not as good as on the two-event night, which had residuals of 0.004 magnitudes. On both nights the check star, BD +32°0714, was measured to be 0.223 magnitudes fainter than the comparison.

(5) The residual for TX UMa is −0.202 days when computed from the linear formula used by Todoran and Roman (1992), placing it a little above the last and lowest point in their O−C diagram (their Figure 1).

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