UBV OBSERVATIONS OF RS CANUM VENATICORUM

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(Received 7 June, 1989)

Abstract. Photoelectric observations of eclipsing binary RS CVn carried out at Uttar Pradesh State Observatory Nainital, have been reported. The light curve shows wave-like distortion. Colours and magnitudes of RS CVn and comparison stars BD + 35°2421 and BD + 35°2422 have been given.

1. Introduction

RS CVn is prototype of a group of detached close binaries with active subgiant secondaries. It is a bright ($V = 7^m.93$) eclipsing system showing wave-like distortion in the light curve with retrograde migration (Catalano *et al.*, 1980). The amplitude of the wave in V is $0^m.22$ (Hall, 1972). Spectral type of the primary componant is F5IV and of the secondary K0IV (Popper, 1980). The cool star shows moderate Ca II H and K emission (Popper, 1961). The period of the system is variable. Most of the properties of this system have been reported in Strassmeier *et al.* (1988).

Recently Popper (1988) has pointed out that though RS CVn is a totally eclipsing system and has good photometric coverage but little of that is in two wavelength bands. Observations of the system in three wavelength bands, taken by us during the year 1966, are being presented here.

2. Observations

The observations were secured on the 38-cm reflector of Uttar Pradesh State Observatory, Nainital in *UBV* filters, by use of uncooled 1P21 photomultiplier and standard d.c. techniques, on ten nights. Two comparison stars, viz., BD + 35°2421 and BD + 35°2422 were observed alongwith the programme star RS CVn. All the observations were finally reduced by using BD + 35°2422 only, as has also been done by Keller and Limber (1951). Standard differential magnitudes of RS CVn (BD + 35°2422 minus RS CVn) are listed in Table I. The differential colours and magnitudes are plotted in Figure 1. The phases have been calculated by using the ephemeris:

$$\text{J.D. } 2438889.330 + 4^d.79781E\,,$$

wherein the epoch has been taken from Catalano and Rodono (1974).

The colours of the comparison stars and those of the variable have been listed in Table II.

Astrophysics and Space Science **163**: 217–222, 1990.

TABLE I

Colour and magnitude of comparison stars and the variable

Name	$U-B$	B − V	V
BD + 35°2422	$+0^m.04 \pm 0.03$	$+0^m.54 \pm 0.01$	$8^m.51 \pm 0.02$
BD + 35°2421	0.03 ± 0.03	0.50 ± 0.02	8.03 ± 0.02
RS CVn (phase 0.75)	0.14 ± 0.03	0.56 ± 0.02	7.92 ± 0.02
Primary comp.	0.07 ± 0.03	0.45 ± 0.02	8.27 ± 0.02
Secondary comp.	0.50 ± 0.03	0.92 ± 0.03	9.32 ± 0.02

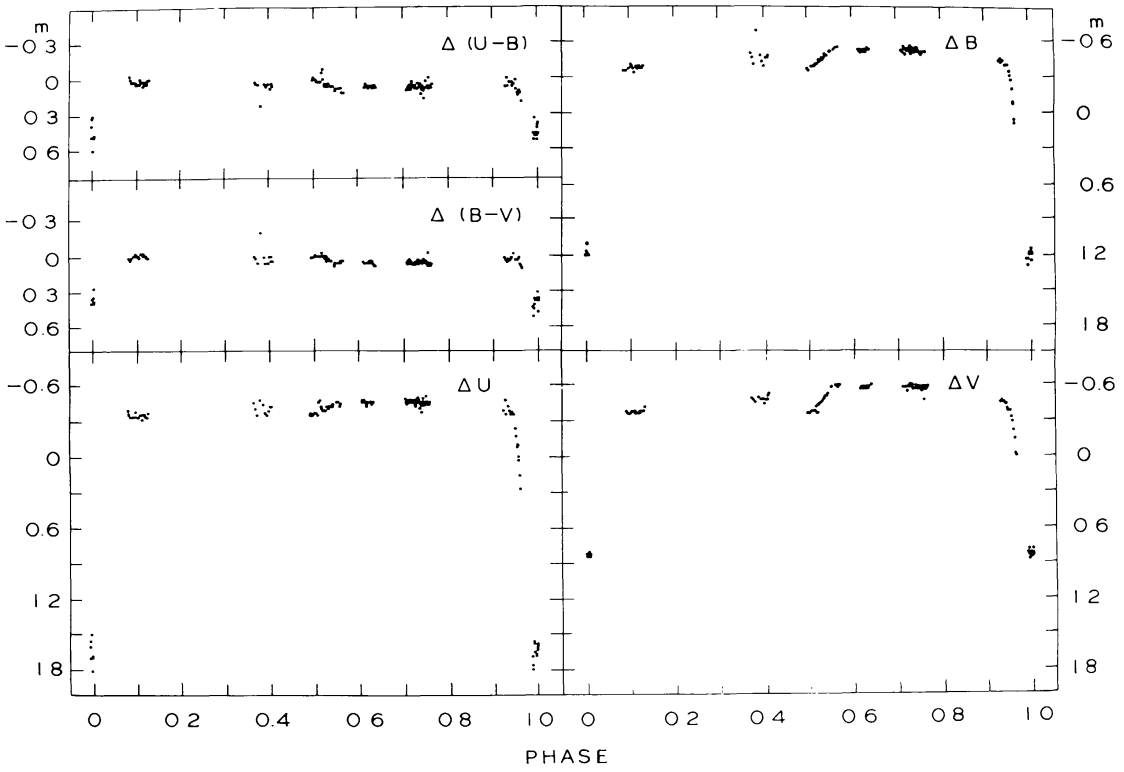

Fig. 1. Light and colour curves of RS CVn.

3. Results

Though the light curve is not fully covered, the presented observations are sufficient to show wave like distortion which is more prominent between the phases 0.0 and 0.5. The wave minimum lies at phase 0.12. The depths of the primary and the secondary minima are as under:

	U	B	V
Primary	$2^m.12$	$1^m.76$	$1^m.40$
Secondary	0.11	0.20	0.21

TABLE II

Standard differential magnitudes and colours of RS CVn

J.D. (Hel.) 2439000+	Phase	ΔU	ΔB	ΔV	$\Delta(U-B)$	$\Delta(B-V)$
196.3205	0.9855	1.673	1.218	0.802	0.455	0.416
.3298	0.9875	1.788	1.273	0.823	0.515	0.450
.3314	0.9878	1.741	1.273	0.773	0.468	0.500
.3338	0.9883	1.551	1.215	0.860	0.335	0.354
.3351	0.9886	1.561	1.226	0.828	0.335	0.397
.3424	0.9901	1.645	1.190	0.812	0.455	0.377
.3440	0.9904	1.636	1.160	0.810	0.476	0.350
.3465	0.9910	1.636	1.160	0.810	0.476	0.350
.3480	0.9913	1.636	1.161	0.811	0.475	0.350
.3622	0.9942	1.668	1.193	0.848	0.475	0.344
.3641	0.9946	1.651	1.136	0.835	0.515	0.301
.3728	0.9964	1.626	1.173	0.816	0.453	0.356
.3742	0.9967	1.605	1.233	0.767	0.372	0.466
.3775	0.9974	1.577	1.186	0.816	0.391	0.374
.3792	0.9978	1.574	1.175	0.807	0.400	0.368
.3945	0.0010	1.598	1.208	0.810	0.390	0.397
.3964	0.0014	1.697	1.201	0.826	0.495	0.375
.3993	0.0020	1.548	1.208	0.800	0.340	0.408
.4011	0.0023	1.484	1.162	0.795	0.322	0.367
.4114	0.0045	1.673	1.177	0.824	0.496	0.353
.4137	0.0050	1.806	1.202	0.790	0.604	0.412
.4173	0.0057	1.699	1.091	0.804	0.608	0.287
.4190	0.0061	1.676	1.206	0.812	0.470	0.394
199.3039	0.6074	−0.459	−0.533	−0.571	0.074	0.038
.3181	0.6103	−0.484	−0.535	−0.593	0.051	0.058
.3245	0.6117	−0.475	−0.538	−0.589	0.063	0.052
.3294	0.6127	−0.477	−0.521	−0.582	0.045	0.061
.3419	0.6153	−0.457	−0.517	−0.571	0.060	0.054
.3509	0.6172	−0.435	−0.520	−0.580	0.085	0.060
.3568	0.6184	−0.453	−0.527	−0.586	0.074	0.059
.3611	0.6193	−0.473	−0.532	−0.592	0.059	0.060
.3736	0.6219	−0.463	−0.529	−0.570	0.066	0.041
.3784	0.6229	−0.474	−0.527	−0.573	0.053	0.046
.3921	0.6258	−0.463	−0.529	−0.590	0.067	0.061
.3965	0.6267	−0.465	−0.544	−0.585	0.079	0.041
.4011	0.6276	−0.468	−0.551	−0.594	0.074	0.053
.4148	0.6305	−0.454	−0.532	−0.587	0.078	0.055
.4201	0.6316	−0.464	−0.529	−0.603	0.066	0.074
.4332	0.6343	−0.462	−0.534	−0.607	0.073	0.073
214.2130	0.7149	−0.462	−0.494	−0.564	0.032	0.069
.2258	0.7175	−0.471	−0.533	−0.593	0.061	0.060
.2306	0.7185	−0.481	−0.533	−0.594	0.053	0.061
.2361	0.7197	−0.475	−0.549	−0.602	0.064	0.064
.2478	0.7221	−0.464	−0.538	−0.593	0.074	0.055
.2533	0.7233	−0.461	−0.542	−0.592	0.081	0.049
.2644	0.7256	−0.469	−0.515	−0.582	0.046	0.067
.2762	0.7280	−0.424	−0.510	−0.568	0.086	0.058
.3070	0.7344	−0.478	−0.540	−0.574	0.062	0.034

Table II (continued)

J.D. (Hel.) 2439000 +	Phase	ΔU	ΔB	ΔV	$\Delta(U-B)$	$\Delta(B-V)$
214.3108	0.7352	−0.460	−0.523	−0.582	0.063	0.059
.3238	0.7379	−0.464	−0.526	−0.584	0.062	0.058
.3282	0.7389	−0.469	−0.541	−0.591	0.072	0.051
.3443	0.7422	−0.471	−0.553	−0.581	0.082	0.028
.3479	0.7430	−0.508	−0.536	−0.586	0.028	0.049
.3702	0.7476	−0.447	−0.522	−0.564	0.075	0.042
.3742	0.7485	−0.457	−0.510	−0.580	0.053	0.069
.3864	0.7510	−0.525	−0.519	−0.481	−0.005	−0.039
.3905	0.7518	−0.467	−0.519	−0.590	0.052	0.071
.3962	0.7530	−0.445	−0.517	−0.600	0.072	0.083
.4095	0.7558	−0.464	−0.523	−0.576	0.060	0.053
.4139	0.7567	−0.452	−0.522	−0.597	0.070	0.075
.4302	0.7601	−0.471	−0.517	−0.584	0.046	0.067
235.1804	0.0851	−0.396	−0.365	−0.389	−0.031	0.024
.1957	0.0882	−0.348	−0.357	−0.392	0.009	0.035
.2134	0.0919	−0.343	−0.358	−0.382	0.016	0.024
.2380	0.0971	−0.340	−0.369	−0.374	0.029	0.005
.2585	0.1013	−0.378	−0.413	−0.394	0.035	−0.019
.2714	0.1040	−0.342	−0.391	−0.388	0.049	−0.002
.2834	0.1065	−0.341	−0.377	−0.388	0.037	0.011
.2964	0.1092	−0.345	−0.346	−0.379	0.001	0.033
.3157	0.1133	−0.361	−0.391	−0.382	0.031	−0.009
.3294	0.1162	−0.323	−0.379	−0.376	0.055	−0.002
.3421	0.1187	−0.348	−0.394	−0.386	0.046	−0.008
.3551	0.1215	−0.348	−0.378	−0.389	0.031	0.011
.3678	0.1241	−0.336	−0.370	−0.386	0.037	0.015
.3808	0.1268	−0.337	−0.369	−0.390	0.032	0.021
.3924	0.1292	−0.382	−0.394	−0.427	0.012	0.033
239.1997	0.9228	−0.387	−0.448	−0.464	0.061	0.015
.2149	0.9260	−0.478	−0.464	−0.486	−0.015	0.022
.2283	0.9288	−0.359	−0.422	−0.463	0.063	0.041
.2478	0.9328	−0.432	−0.448	−0.470	0.016	0.022
.2630	0.9360	−0.394	−0.418	−0.448	0.024	0.031
.2773	0.9390	−0.365	−0.418	−0.419	0.053	0.001
.2923	0.9421	−0.368	−0.416	−0.394	0.048	−0.022
.3065	0.9451	−0.353	−0.362	−0.390	0.009	0.028
.3214	0.9482	−0.243	−0.314	−0.342	0.071	0.028
.3264	0.9492	−0.174	−0.282	−0.304	0.109	0.021
.3391	0.9518	−0.091	−0.217	−0.234	0.126	0.016
.3438	0.9528	−0.101	−0.218	−0.234	0.117	0.015
.3557	0.9553	−0.005	−0.100	−0.162	0.095	0.062
.3598	0.9562	0.033	−0.087	−0.148	0.120	0.061
.3713	0.9586	0.152	0.045	−0.039	0.107	0.085
.3755	0.9594	0.266	0.084	−0.020	0.182	0.103
246.1236	0.3659	−0.470	−0.496	−0.497	0.025	0.001
.1447	0.3703	−0.413	−0.456	−0.475	0.044	0.019
.1617	0.3739	−0.356	−0.405	−0.456	0.049	0.052
.2269	0.3875	−0.440	−0.489	−0.488	0.049	−0.001
.2455	0.3913	−0.371	−0.437	−0.490	0.067	0.053

Table II (continued)

J.D. (Hel.) 2439000+	Phase	ΔU	ΔB	ΔV	$\Delta(U-B)$	$\Delta(B-V)$
246.2676	0.3959	−0.360	−0.397	−0.452	0.037	0.055
.2831	0.3992	−0.387	−0.473	−0.482	0.086	0.009
.2922	0.4011	−0.385	−0.471	−0.484	0.086	0.013
.3063	0.4040	−0.426	−0.464	−0.513	0.039	0.048
.3188	0.4066	−0.427	−0.490	−0.539	0.063	0.048
261.1187	0.4913	−0.360	−0.375	−0.380	0.015	0.005
.1344	0.4946	−0.372	−0.369	−0.382	−0.004	0.013
.1472	0.4973	−0.358	−0.364	−0.376	0.006	0.012
.1744	0.5029	−0.369	−0.398	−0.393	0.029	−0.005
.1858	0.5053	−0.368	−0.392	−0.392	0.025	0.000
.2097	0.5103	−0.364	−0.384	−0.393	0.020	0.009
.2207	0.5126	−0.457	−0.410	−0.423	−0.047	0.013
.2325	0.5151	−0.479	−0.403	−0.379	−0.076	−0.024
.2440	0.5175	−0.431	−0.445	−0.444	0.014	−0.001
.2556	0.5199	−0.402	−0.454	−0.451	0.052	−0.002
.2679	0.5224	−0.395	−0.434	−0.459	0.039	0.025
.2803	0.5250	−0.398	−0.459	−0.471	0.061	0.012
.2915	0.5274	−0.401	−0.445	−0.486	0.044	0.041
.3032	0.5298	−0.422	−0.472	−0.502	0.050	0.031
.3149	0.5322	−0.437	−0.495	−0.517	0.058	0.022
.3274	0.5348	−0.419	−0.478	−0.525	0.059	0.047
.3427	0.5380	−0.430	−0.484	−0.534	0.053	0.043
262.1370	0.7036	−0.499	−0.537	−0.590	0.088	0.053
.1473	0.7057	−0.458	−0.538	−0.588	0.080	0.049
.1560	0.7075	−0.454	−0.522	−0.589	0.068	0.067
.1657	0.7096	−0.466	−0.566	−0.600	0.100	0.029
.1764	0.7118	−0.484	−0.548	−0.597	0.065	0.041
.2475	0.7266	−0.486	−0.567	−0.614	0.081	0.047
.2560	0.7284	−0.450	−0.532	−0.566	0.081	0.034
.2648	0.7302	−0.470	−0.553	−0.578	0.083	0.025
.2741	0.7322	−0.489	−0.537	−0.592	0.048	0.055
.2828	0.7340	−0.503	−0.555	−0.617	0.053	0.062
.2923	0.7359	−0.407	−0.541	−0.596	0.134	0.055
.3039	0.7384	−0.445	−0.540	−0.582	0.095	0.042
.3140	0.7405	−0.448	−0.551	−0.596	0.103	0.045
.3227	0.7423	−0.366	−0.535	−0.576	0.169	0.041
.3355	0.7445	−0.465	−0.540	−0.586	0.075	0.046
.3429	0.7465	−0.451	−0.523	−0.586	0.072	0.064
266.1673	0.5436	−0.435	−0.524	−0.598	0.089	0.074
.1736	0.5449	−0.448	−0.528	−0.590	0.081	0.062
.2119	0.5529	−0.471	−0.541	−0.607	0.070	0.066
.2284	0.5563	−0.464	−0.548	−0.602	0.084	0.054
.2456	0.5599	−0.436	−0.557	−0.600	0.121	0.044
.2610	0.5631	−0.449	−0.556	−0.603	0.107	0.047
270.1793	0.3798	−0.478	−0.704	−0.510	0.226	0.194

Light variations are also seen during totality-phase. The primary minimum is deeper in shorter wavelengths while the reverse is true for the secondary minimum. The presented light curve shows the same pattern of variations as revealed by the light curve given by Catalano *et al.* (1980).

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