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Photoelectric Observations of RS Canum Venaticorum*

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Abstract

A total of 618 photoelectric observations (302 in yellow and 316 in blue) is made in 1982 at the Yonsei University Observatory. Except that of the secondary eclipse the homogeneous coverage of observations successfully secured *B*, *V*, and *B-V* light curves. Enhanced distortions in the light curves are appeared at the phases around $0^{P}.1$, which supports the wave-like migration period of 9.7 years (Rodono 1981). One epoch time of the primary minimum was made by combining the observations in three nights. This minimum time shows that the *O-C* values are still decreasing and there seems no indication of increasing. *B* and *V* light curves of the primary minimum are in strong asymmetry which show less luminous in the third and fourth contacts compared to those of the first and second ones. This asymmetry may be as a result of the reflection of the wave minimum at $0^{P}.1$, and *B-V* curve also shows asymmetry, redder at the third contact than the second one by about $0^{m}.04$. This color difference apperature distribution on the surface of cooler, larger component (KO IV star).

I. INTRODUCTION

RS Canum Venaticorum (RS CVn) is the most famous among about 40 stars with active chromospheric phenomena, so these stars are called RS CVn type stars. General instructions on these stars and RS CVn itself are available (Hall 1976; Catalano and Rodono 1969, 1974; Zeilik *et al.* 1979; Rodono 1981).

One of the most remarkable properties of RS CVn system is the outside eclipse which has a wave-like distrotion and its systematic migration on the light curve. This photometric feature

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discovered by Catania group (Catalano and Rodono 1967) turned out to be as a result of the periodic variability of the cooler and larger component (Rodono 1981). There have been a number of period studies since 1970 on RS CVn (Catalano and Rodono 1974; Hall 1975, 1980; Ahn 1970). The $O-C$ curve of the system has two outstanding features; one of them is the short-term variation with quasi-periodic of about 10 years estimated by Hall (1972), the other is the long-term variation like a sine-wave in the scale of about 80 years. The significant progress of photometric and spectroscopic works by both ground-based and satellite, had been performed in 1978 (Hall 1980). Even though the investigation of RS CVn have been carried out for a long period of time, it still has many problems to be.

In this paper we present the result of photoelectric observations of RS CVn which was made during the period of International Campaign initiated by Rodono in 1982.

II. OBSERVATIONS AND THE LIGHT CURVES

During the five months in 1982 we made B and V photoelectric observations of RS CVn with the 61-cm reflector at the Ilsan Observation Station of Yonsei University Observatory. A total of 618 observations (302 in V and 316 in B) is made using BD+36°2354 as a comparison star. The differential magnitudes, in the sense of Δ m (RS CVn – Comp. star), are all corrected with the atmospheric extinctions in each filter every night independently. The instrumental differential magnitudes are given in Table I a-b. The first column represents the heliocentric Julian date of the observation and the second column is the phase computed by the ephemeris of Catalano and Rodono (1974),

$$\text{Min. I} = \text{JD Hel } 2438889.3300 + 4^{d}.797855\,E. \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

The probable error of V magnitude is $\pm 0^{m}.012$.

The light curves in V, B, and $B-V$ given in Figure 1 show the typical nature of outside eclipse light variations of RS CVn. Although the level and the shape of light curves at phases $0^{p}.7$-$0^{p}.95$ demonstrates well the classical effects such as elipticity and reflection in Algol systems, but the remaining phses are extremely distorted. Light minimum due to the so-called wave-like distortion is appeared at phase $0^{p}.1$, and this effect is reflected in the primary minimum light. The totality part of the primary eclipse has lasted for about 4 hours and is inclined downward to the third contact as shown in Figure 2. The difference of light levels between the 2nd and 3rd contacts in the yellow curve is about $0^{m}.05$. This light variation in the total eclipse seems to be an effect of wave-like distortion centered on $0^{p}.1$.

$B-V$ curve in Figure 1 exhibits interesting features. Generally, there seems no appreciable color variation outside eclipse. Nevertheless, during the primary eclipse it is redder at the phase substantially of about $0^{m}.48$, which is the reasonable value for the difference between F4 V and KO IV stars in this RS CVn system. The asymmetricity of the eclipsed phase shows that there is about $0^{m}.4$ color difference between the 2nd and the 3rd contacts; the latter is redder. This color difference indicates the inhomogeneous temperature distribution manily on the surface of KO IV star.

Table Ia. Yellow observations of RS CVn

JD Hel 2440000+	Phase	Δm_v	JD Hel 2440000+	Phase	Δm_v	JD Hel 2440000+	Phase	Δm_v
4985.2952	.5605	−.253	5010.2000	.7514	−.352	5015.2588	.8057	−.345
.3011	.5618	−.234	.2052	.7524	−.354	.2677	.8076	−.339
.3178	.5652	−.204	.2182	.7552	−.354	.2782	.8098	−.336
.3344	.5687	−.244	5011.1535	.9501	.806	.2867	.8116	−.357
.3400	.5699	−.237	.1613	.9517	.851	5022.0744	.2263	−.191
.3503	.5720	−.242	.1696	.9534	.884	.0848	.2285	−.206
.3560	.5732	−.243	.1789	.9554	.889	.0994	.2315	−.227
.3663	.5753	−.222	.1940	.9585	.895	.1113	.2340	−.221
.3728	.5767	−.256	.2018	.9601	.905	.1193	.2356	−.225
4992.2213	.0041	.380	.2162	.9632	.916	.1297	.2378	−.230
.2267	.0052	.290	.2239	.9648	.921	.1426	.2405	−.208
.2389	.0078	.200	5011.2393	.9680	.927	.1526	.2426	−.206
.2451	.0091	.164	.2484	.9699	.931	.1677	.2457	−.205
.2522	.0106	.108	.2601	.9723	.941	.1955	.2515	−.209
.2574	.0116	.079	.2742	.9752	.946	,2163	.2559	−.207
.2650	.0132	.028	.2818	.9768	.932	.2365	.2601	−.229
.2704	.0143	.005	.2925	.9791	.942	.2510	.2631	−.206
.2784	.0160	−.025	.2998	.9806	.980	.2602	.2650	−.204
.2845	.0173	−.039	.3109	.9829	.979	.2700	.2671	−.189
.2905	.0185	−.055	.3266	.9862	.969	.2786	.2689	−.214
.2954	.0196	−.080	.3368	.9883	.919	.2852	.2702	−.219
.3024	.0210	−.122	.3522	.9915	.830	5025.0681	.8503	−.300
.3090	.0224	−.124	.3617	.9935	.725	.0779	.8523	−.302
.3159	.0238	−.140	.3705	.9953	.670	.0860	.8540	−.308
.3224	.0252	−.140	.3840	.9981	.565	.0963	.8561	−.309
.3302	.0268	−.159	.3942	.0003	.472	.1052	.8580	−.310
5005.1735	.7037	−.341	.4015	.0018	.419	.1293	.8630	−.302
.1782	.7047	−.339	5015.1418	.7813	−.328	.1418	.8656	−.287
.1915	.7075	−.327	.1524	.7836	−.335	.1549	.8684	−.287
.2011	.7094	−.341	.1646	.7861	−.338	.1646	.8704	−.289
.2085	.7110	−.346	.1835	.7901	−.329	.1725	.8720	−.292
5010.1610	.7432	−.348	.1932	.7921	−.347	.2406	.8862	−.278
.1680	.7447	−.351	.2076	.7951	−.331	.2539	.8890	−.273
.1739	.7459	−.346	.2191	.7975	−.336	5026.0731	.0597	−.141
.1861	.7485	−.357	.2302	.7998	−.350	.0813	.0614	−.126
.1906	.7494	−.354	.2398	.8018	−.338	.0898	.0632	−.127

JD Hel 2440000+	Phase	Δm_v	JD Hel 2440000+	Phase	Δm_v	JD Hel 2440000+	Phase	Δm_v
5026.0898	.0632	−.127	5041.2121	.2151	−.179	5057.0447	.5150	−.213
.0976	.0648	−.129	.2195	.2166	−.203	.0534	.5168	−.216
.1098	.0674	−.127	.2457	.2221	−.162	.0617	.5186	−.197
.1242	.0704	−.131	.2578	.2246	−.154	.0700	.5203	−.231
.1305	.0717	−.132	.2660	.2263	−.176	.0979	.5261	−.208
.1382	.0733	−.123	.2730	.2278	−.200	.1061	.5278	−.209
.1506	.0759	−.124	.2830	.2299	−.228	.1140	.5295	−.192
.1615	.0782	−.129	.2930	.2320	−.190	.1193	.5306	−.222
.1716	.0802	−.125	.3019	.2338	−.184	.1436	.5356	−.224
.1803	.0821	−.131	.3078	.2350	−.195	.1502	.5370	−.204
.1866	.0834	−.121	.3163	.2368	−.211	.1593	.5389	−.201
.1955	.0852	−.132	.3269	.2390	−.191	5057.1732	.5418	−.319
.2020	.0866	−.124	.3338	.2405	−.193	.1823	.5437	−.258
.2140	.0891	−.136	5053.1124	.6954	−.343	.1914	.5456	−.226
.0366	.1785	−.150	.1206	.6971	−.343	.2010	.5476	−.256
.0467	.1806	−.155	5054.0692	.8949	−.285	.2088	.5492	−.221
.0573	.1828	−.164	.1289	.9073	−.289	.2156	.5506	−.218
.0621	.1838	−.140	.1407	.9098	−.257	.2297	.5536	−.253
.0696	.1854	−.159	.1483	.9113	−.260	.2388	.5555	−.221
.0763	.1868	−.162	.1561	.9130	−.263	.2473	.5573	−.230
.0862	.1888	−.166	.1645	.9147	−.218	.2537	.5586	−.254
.0941	.1905	−.162	5056.2277	.3447	−.189	.2623	.5604	−.269
.1003	.1918	−.175	.2366	.3466	−.196	.2711	.5622	−.256
.1116	.1941	−.166	.2440	.3481	−.210	.2783	.5637	−.261
.1188	.1956	−.170	.2520	.3498	−.209	.2870	.5655	−.262
.1256	.1971	−.164	.2585	.3512	−.214	.2956	.5673	−.261
.1344	.1989	−.163	.2714	.3539	−.207	.3024	.5687	−.276
.1423	.2005	−.166	.2800	.3557	−.192	.3105	.5704	−.257
.1486	.2019	−.188	.2875	.3572	−.204	.3171	.5718	−.252
.1580	.2038	−.186	.2948	.3587	−.196	.3234	.5731	−.264
.1688	.2061	−.170	.3007	.3600	−.186	.3291	.5743	−.273
.1772	.2078	−.180	.3089	.3617	−.202	.3368	.5759	−.251
.1837	.2092	−.181	.3183	.3636	−.200	.3433	.5773	−.261
.1918	.2109	−.176	.3249	.3650	−.223	.3492	.5785	−.272
.1980	.2122	−.184	5057.0284	.5116	−.197	5074.9814	.2535	−.177
5041.2062	.2139	−.179	.0370	.5134	−.216	.9883	.2549	−.185

JD Hel 2440000+	Phase	Δm_v	JD Hel 2440000+	Phase	Δm_v	JD Hel 2440000+	Phase	Δm_v
5074.9953	.2564	−.185	5075.2549	.3105	−.198	5078.2153	.9275	−.004
5075.0026	.2579	−.185	.2619	.3120	−.197	.2227	.9291	.037
.0092	.2593	−.189	.2684	.3133	−.197	.2329	.9312	.104
.0147	.2604	−.183	.2782	.3154	−.200	.2407	.9328	.159
.0217	.2619	−.189	.2853	.3168	−.192	.2473	.9342	.191
.0293	.2635	−.188	.2919	.3182	−.189	.2579	.9364	.323
.0351	.2647	−.184	.2985	.3196	−.204	.2648	.9379	.4037
.0423	.2662	−.188	5078.0281	.8885	−.246	.2714	.9392	.471
.0483	.2675	−.183	.0340	.8897	−.244	.2927	.9437	.598
.0556	.2690	−.188	.0427	.8916	−.246	.2985	.9449	.647
.0616	.2702	−.190	.0488	.8928	−.245	5096.0703	.6490	−.316
.0679	.2715	−.195	.0547	.8941	−.239	.0792	.6509	−.300
.0750	.2730	−.197	.0632	.8958	−.240	.0865	.6524	−.290
.0829	.2747	−.183	.0699	.8972	−.238	.0957	.6543	−.315
.0893	.2760	−.184	.0763	.8986	−.236	.1046	.6561	−.305
.0968	.2776	−.182	.0826	.8999	−.242	.1450	.6646	−.319
.1028	.2788	−.181	.0917	.9018	−.240	.1588	.6674	−.332
.1190	.2822	−.180	.0986	.9032	−.240	.1683	.6694	−.329
.1414	.2869	−.176	.1051	.9046	−.227	.1857	.6730	−.368
.1488	.2884	−.195	.1362	.9110	−.221	.1966	.6753	−.322
.1572	.2901	−.175	.1430	.9125	−.208	.2046	.6770	−.366
.1653	.2918	−.188	.1490	.9137	−.223	.2145	.6790	−.385
.1731	.2935	−.182	.1548	.9149	−.205	.2235	.6809	−.341
.1815	.2952	−.180	.1626	.9166	−.180	.2334	.6830	−.366
.2119	.3015	−.191	.1682	.9177	−.181	.2412	.6846	−.366
.2208	.3034	−.204	.1755	.9192	−.181	.2491	.6863	−.358
.2289	.3051	−.191	.1822	.9206	−.142	.2600	.6885	−.373
.2370	.3068	−.179	.1903	.9223	−.131	.2673	.6900	−.338
.2461	.3087	−.185	.2013	.9246	−.078	.2754	.6917	−.356

Table Ib. Blue observations of RS CVn

JD Hel 2440000+	Phase	Δm_b	JD Hel 2440000+	Phase	Δm_b	JD Hel 2440000+	Phase	Δm_b
4985.2945	.5604	−.299	4985.3185	.5654	−.265	4985.3496	.5719	−.300
.3017	.5619	−.284	.3407	.5700	−.294	.3567	.5733	−.294

JD Hel 2440000+	Phase	Δm_b	JD Hel. 2440000+	Phase	Δm_b	JD Hel 2440000+	Phase	Δm_b
4985.3669	.5755	−.287	5011.1703	.9536	1.238	5022.0761	.2267	−.263
.3719	.5765	−.262	.1796	.9555	1.235	.0860	.2287	−.268
4992.2205	.0040	.457	.1948	.9587	1.247	.1016	.2320	−.247
.2274	.0054	.308	.2026	.9603	1.262	.1100	.2337	−.258
.2380	.0076	.214	.2171	.9633	1.274	.1202	.2358	−.260
.2458	.0092	.137	.2247	.9649	1.265	.1286	.2376	−.277
.2515	.0104	.096	.2403	.9682	1.299	.1416	.2403	−.271
.2582	.0118	.045	.2484	.9699	1.297	.1515	.2424	−.267
.2643	.0131	.001	.2593	.9721	1.292	.1691	.2460	−.276
.2711	.0145	−.041	.2751	.9754	1.307	.1769	.2477	−.273
.2776	.0158	−.080	.2826	.9770	1.318	.1883	.2500	−.263
.2854	.0175	−.107	.2932	.9792	1.326	.1946	.2513	−.276
.2897	.0184	−.124	.3006	.9807	1.370	.2174	.2561	−.282
.2946	.0194	−.154	.3099	.9827	1.357	.2250	.2577	−.278
.3031	.0212	−.196	.3258	.9860	1.348	.2354	.2598	−.510
.3083	.0222	−.201	.3360	.9881	1.286	.2520	.2633	−.338
.3155	.0238	−.223	.3511	.9913	1.141	.2589	.2648	−.245
.3231	.0253	−.225	.3607	.9933	1.030	.2709	.2672	−.273
.3295	.0267	−.237	.3695	.9951	.901	.2776	.2686	−.277
.3357	.0280	−.232	.3831	.9979	.712	.2861	.2704	−.270
5005.1741	.7038	−.367	.3929	.0000	.648	5025.0700	.8507	−.342
.1788	.7048	−.372	.4007	.0016	.516	.0778	.8523	−.344
.1908	.7073	−.356	5015.1428	.7816	−.344	.8052	.8538	−.352
.2002	.7093	−.367	.1535	.7838	−.357	.0973	.8563	−.331
.2078	.7108	−.357	.1664	.7865	−.368	.1043	.8578	−.343
5010.1620	.7434	−.394	.1845	.7902	−.359	.1130	.8596	−.352
.1675	.7446	−.398	.1922	.7919	−.379	.1308	.8633	−.344
.1746	.7461	−.385	.2091	.7954	−.405	.1426	.8658	−.331
.1853	.7483	−.375	.2178	.7972	−.355	.1538	.8681	−.330
.1913	.7495	−.390	.2291	.7996	−.371	.1655	.8706	−.337
.1992	.7512	−.393	.2407	.8020	−.359	.1716	.8718	−.338
.2059	.7526	−.389	.2577	.8055	−.371	.2428	.8867	−.338
.2383	.7593	−.367	.2772	.8096	−.364	.2528	.8888	−.297
5011.1543	.9503	1.133	.2667	.8074	−.266	5026.0742	.0600	−.199
.1621	.9519	1.159	.2877	.8118	−.394	.0805	.0613	−.194

JD Hel 2440000+	Phase	Δm_b	JD Hel 2440000+	Phase	Δm_b	JD Hel 2440000+	Phase	Δm_b
5026.0907	.0634	−.201	5041.2130	.2153	−.242	5056.3257	.3652	−.284
.0968	.0647	−.204	.2188	.2165	−.255	5057.0292	.5118	−.232
.1107	.0676	−.204	.2329	.2194	−.245	.0387	.5136	−.267
.1233	.0702	−.210	.2381	.2205	−.240	.0437	.5148	−.282
.1313	.0718	−.199	.2469	.2224	−.246	.0543	.5170	−.258
.1375	.0731	−.198	.2571	.2245	−.208	5057.0608	.5184	−.246
.1522	.0762	−.206	.2653	.2262	−.235	.0707	.5205	−.272
.1606	.0780	−.202	.2741	.2280	−.251	.0971	.5259	−.284
.1734	.0806	−.209	.2852	.2303	−.271	.1069	.5280	−.258
.1795	.0819	−.214	.2923	.2318	−.237	.1137	.5294	−.278
.1875	.0836	−.198	.3011	.2336	−.246	.1426	.5354	−.265
.1945	.0850	−.202	.3087	.2352	−.234	.1510	.5372	−.244
.2020	.0866	−.208	.3155	.2366	−.274	.1603	.5391	−.294
.2125	.0888	−.215	.3260	.2388	−.259	.1663	.5404	−.308
5041.0358	.1783	−.216	.3347	.2407	−.265	.1741	.5420	−.290
.0459	.1805	−.210	5053.1029	.6935	−.342	.1831	.5439	−.273
.0566	.1827	−.228	.1133	.6956	−.366	.1900	.5453	−.288
.0630	.1840	−.211	.1195	.6969	−.351	.2017	.5477	−.281
.0688	.1852	−.233	5054.1302	.9076	−.318	.2079	.5490	−.292
.0711	.1869	−.233	.1415	.9099	−.320	.2163	.5508	−.279
.0934	.1904	−.228	.1474	.9112	−.297	.2221	.5520	−.281
.1011	.1920	−.225	.1569	.9131	−.275	.2306	.5538	−.284
.1031	.1924	−.257	.1634	.9145	−.308	.2397	.5557	−.263
.1124	.1943	−.214	.1757	.9170	−.224	.2464	.5571	−.305
.1179	.1955	−.373	5056.2290	.3450	−.243	.2546	.5588	−.305
.1265	.1972	−.221	.2357	.3464	−.197	.2631	.5606	−.296
.1352	.1991	−.219	.2449	.3483	−.264	.2701	.5620	−.303
.1416	.2004	−.231	.2513	.3497	−.267	.2792	.5639	−.312
.1495	.2020	−.241	.2593	.3513	−.259	.2876	.5657	−.302
.1572	.2036	−.248	.2725	.3541	−.252	.2947	.5671	−.300
.1698	.2063	−.236	.2790	.3554	−.241	.3033	.5689	−.408
.1763	.2076	−.246	.2883	.3574	−.256	.3094	.5702	−.312
.1846	.2094	−.249	.2939	.3585	−.265	.3180	.5720	−.296
.1908	.2107	−.240	.3016	.3601	−.231	.3226	.5729	−.304
.1989	.2123	−.240	.3097	.3618	−.260	.3299	.5745	−.314
.2053	.2137	−.247	.3168	.3633	−.280	.3376	.5761	−.298

JD Hel 2440000+	Phase	Δm_b	JD Hel 2440000+	Phase	Δm_b	JDHel 2440000+	Phase	Δm_b
5057.3423	.5771	−.300	5075.2198	.3032	−.295	5078.2022	.9248	−.066
.3504	.5787	−.321	.2281	.3049	−.252	.2095	.9263	−.033
5074.9822	.2537	−.231	5075.2385	.3071	−.245	.2163	.9278	−.001
9876	.2548	−.241	.2453	.3085	−.255	.2236	.9293	0.051
.9960	.2566	−.241	.2556	.3107	−.274	.2337	.9314	0.130
5075.0034	.2581	−.240	.2628	.3122	−.258	.2414	.9330	0.229
.0086	.2592	−.249	.2692	.3135	−.253	.2482	.9344	0.273
.0140	.2603	−.240	.2774	.3152	−.428	.2587	.9366	0.390
.0210	.2618	−.246	.2842	.3166	−.264	.2658	.9381	0.469
.0283	.2633	−.243	.2912	.3181	−.264	.2722	.9394	0.566
.0343	.2645	−.248	.2979	.3195	−.259	.2935	.9438	0.811
.0412	.2660	−.249	5078.0288	.8887	−.304	.2990	.9450	0.908
.0474	.2673	−.239	.0348	.8899	−.294	5096.0714	.6492	−.317
.0548	.2688	−.244	.0435	.8917	−.285	.0801	.6510	−.298
.0607	.2700	−.246	.0495	.8930	−.287	.0874	.6526	−.321
.0669	.2713	−.247	.0554	.8942	−.293	.0948	.6541	−.368
.0742	.2729	−.250	.0640	.8960	−.293	.1054	.6563	−.362
.0821	.2745	−.252	.0708	.8974	−.282	.1475	.6651	−.350
.0883	.2758	−.249	.0773	.8988	−.285	.1604	.6678	−.335
.0957	.2773	−.249	.0834	.9001	−.300	.1673	.6692	−.407
.1019	.2786	−.249	.0927	.9020	−.282	.1877	.6735	−.324
.1182	.2820	−.229	.0996	.9034	−.277	.1979	.6756	−.316
.1247	.2834	−.261	.1068	.9049	−.280	.2057	.6772	−.347
.1326	.2850	−.265	.1273	.9092	−.284	.2160	.6794	−.365
.1405	.2867	−.257	.1353	.9109	−.279	.2245	.6811	−.372
.1483	.2883	−.245	.1423	.9123	−.270	.2345	.6832	−.389
.1563	.2900	−.263	.1498	.9139	−.247	.2421	.6848	−.365
.1645	.2917	−.263	.1555	.9151	−.252	.2503	.6865	−.356
.1720	.2932	−.252	.1634	.9167	−.187	.2591	.6883	−.395
.1806	.2950	−.231	.1693	.9180	−.212	.2664	.6899	−.348
.1978	.2986	−.248	.1762	.9194	−.202	.2745	.6916	−.391
.2042	.3000	−.249	.1831	.9208	−.185			
.2110	.3014	−.255	.1893	.9221	−.200			

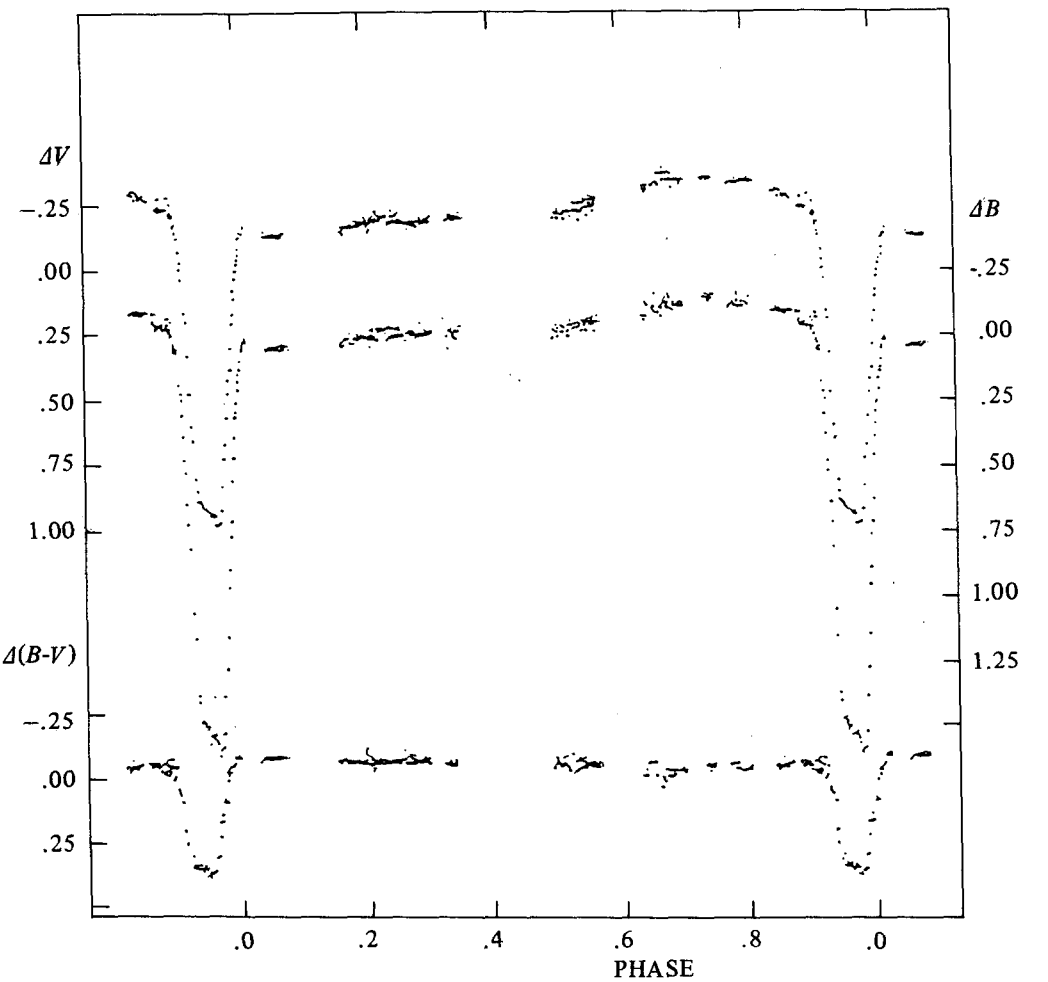

Fig. 1. Yellow, blue and color curves of RS CVn in the instrumental magnitude system.

III. ORBITAL PERIOD VARIATION

One minimum time of the primary eclipse is determined using a graphical method from the light curve in Figure 2 which was made with the three nights observations (April 18-19, February 10-11, January 22-23 in 1982). The obtained minimum time of this system is

JD Hel 2445011.2515 ± .0004.

To find the tendency of the *O-C* curve we have collected all available times of primary minimum. These were plotted with our minimum time in Figure 3 constructed by the Eq. (1). The crosses, filled and open circles in this figure represent visual, photographic and photoelectric observations, respectively. Our data is marked with ⊙. The long term variation like a sine-wave

no longer can be seen, because the residuals (O-C) are still decreasing and there seems no indication of the turning toward the increasing. Beside this, if we confine ourselves with only photoelectric observations (o and ⊙) the feature of short term period variation indicated in Figure 3 with a solid curve fails to prove the 10 year period suggested by Hall (1972).

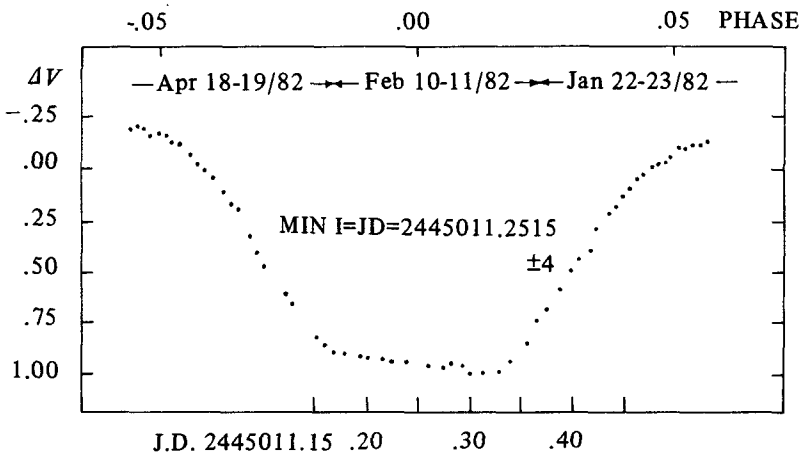

Fig. 2. The combined light curve for the determination of the time of minimum.

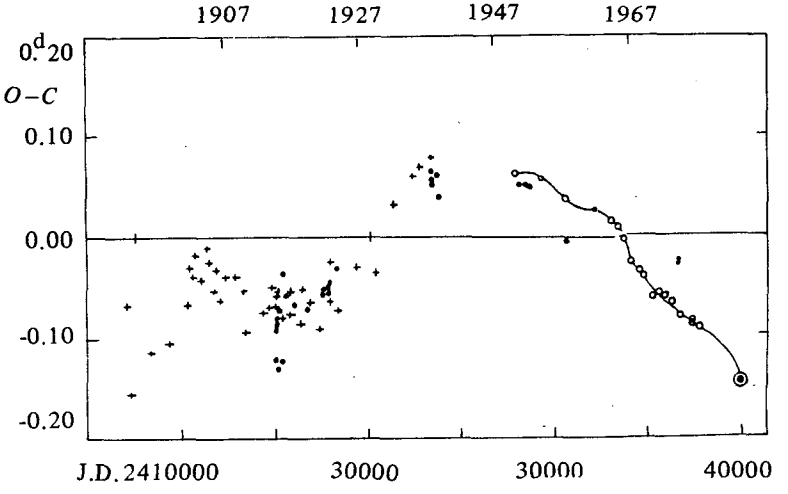

Fig. 3. $O-C$ diagram of RS CVn. The crosses, filled and open circles represent visual, photographic and photoelectric observations, respectively. The solid line indicate the feature of short term period variation.

IV. RESULTS

B and *V* light curves of RS CVn made at the Ilsan Observation Station have homogeneous phase coverage successfully except the secondary minimum light. Since these observations were made in 1982, the international campaign period, it is expected the data.

Light levels at the second and the third contacts of the primary minimum are different, the former is brighter by about $0.^{m}05$ in *V* than the latter. This difference can be interpreted as the result of a wave-like distotion appeared at phase $0.^{p}1$. This interpretation is supported by the reddening effect at the third contact of the primary eclipse. The fact that the redder in *B-V* and the fainter in *V* indicates the inhomogeneous temperature distribution on the surface of KO IV star. This is a typical phenomenun in most of RS CVn stars except the brightest eclipsing RS CVn-type star AR Lac in which the contradiction to this is found, the redder in *B-V* the brighter in *V* (Nha and Kang 1982).

Concerning the period variations existing in RS CVn, there have been a number of theories and predictions reported. Among these two major period variations, the long-term of 80 years and the short-term of 10 years, are particularly. These variations, are, however, strongly in doubt, because our data can not support any of these. The *O-C* computed with Eq. (1) indicates much more negative value than any previously known photoelectric minima since 1947.

Further monitering of this star for its light variations and orbital period changes is urgentry needed.

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REFERENCES

Ahn, Y. S. 1981, Master's thesis, Yonsei University.

Catalano, S.,and Rodono, M. 1967, *Mem. Soc. Astron. Ital.*, **38**, 345.

————, 1969, in *Non-periodic Phenomena in Variable Stars, ed* L. Detre etre (Budapest: Academic) p. 345.

————, 1974, *Pub. A. S. P.*, **86**, 390.

Hall, D. S. 1972, *Pub. A. S. P* **84**, 323.

————, 1975, *Acta Astronomica*, **25**, 215.

————, 1976, in *Multiple Periodic Variable Star Part I, ed.* W. S. Fitch (Dordrecht: Reidel), p. 287.

————, 1980, *Acta Astronomica*, **30**(3), 387.

Nha, I.-S., and Kang, Y.-W. 1982, *Pub. A. S. P.*, **94**, 496.

Rodono, M. 1981, in *Photometric and Spectoscopic Binary Systems, ed.* E.B. Carling and Z. Kopal (Dordrecht: Reidel), p.285.