

UBV PHOTOMETRY OF THE ECLIPSING BINARY RZ ERIDANI

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Abstract. *U, B, and V* observations of RZ Eri have been reported. Colours of comparison stars BD – 10°994, BD – 10°996 and of the variable RZ Eri have been presented. The observations of RZ Eri do not indicate the distortion wave in the light curve beyond observational scatter.

1. Introduction

RZ Eri (BD – 10°993 = HD 30050) is a well-known Algol-type variable. Spectroscopic orbital elements of the system were determined by Cesco and Sahade (1945). They found that the system consists of a metallic line F5V primary and G8IV secondary showing Ca II H and K emission lines. Gaposchkin (1951) and Gadoski (1957) determined the elements of the system. Gronbech (1975) has obtained the photometric indices for the two components from the observations taken during total eclipse. Hall and Kreiner (1980) have listed the times of minima and determined the period variations. Caton (1986) has analysed outside eclipse observations for distortion wave and suggested a wave of a few hundredths of a magnitude in total amplitude. Sarma (1985) has reported improved ephemeris and preliminary analysis of the light curve. The purpose of the present work is to study the presence of distortion wave in the outside the eclipse portion of the light curve of RZ Eri.

2. Observations

Observations of the star RZ Eri were secured on 40 nights through an 38-cm reflector and on 3 nights through an 52-cm reflector of the Uttar Pradesh State Observatory during the years 1964–1967. An uncooled 1P21 photomultiplier, standard, *U, B, and V* filters of the Johnson and Morgan system and *dc* techniques have been used to record the observations. RZ Eri was observed along with two comparison stars, viz., BD – 10°996 and BD – 10°994. BD – 10°994 has been taken as the final comparison as its magnitude is closer to that of the variable as compared to BD – 10°996. The differential standard magnitude in the sense variable *minus* comparison have been listed in Table I. This table gives the Julian days of *V* observations as the time of observation for all the three filters *U, B, and V*. This has been done for the sake of brevity as *V* observations lie in between *B* and *U*. Its difference in time from *B* and *V* hardly exceeds 1.5 min. Phases were computed from the ephemeris

$$\text{J.D. } 2443\,574.083 + 39^{\text{d}}28238E,$$

(*General Catalogue of Variable Stars*, Vol. II, 1985, Editor-in-Chief Dr P. N. Kholopov).

TABLE I
Standard differential magnitudes of RZ Eri

J.D. Hel.	<i>U</i>	<i>B</i>	<i>V</i>	J.D. Hel.	<i>U</i>	<i>B</i>	<i>V</i>
2438000 +							
737.3383	-2 ^m .178	-1 ^m .563	-1 ^m .086	806.1274	-2 ^m .206	-1 ^m .559	-1 ^m .091
737.3576	-2.217	-1.583	-1.084	806.1363	-2.253	-1.591	-1.116
737.3718	-1.755	-1.567	-1.122	813.0885	-2.238	-1.508	-1.042
737.3896	-	-1.548	-1.103	813.1072	-2.155	-1.530	-1.028
737.4073	-2.336	-1.592	-1.151	813.1984	-2.160	-1.504	-1.008
744.2934	-2.144	-1.532	-0.903	817.0963	-2.164	-1.495	-1.035
744.3044	-2.172	-1.526	-1.022	817.0969	-2.209	-1.543	-1.070
744.3169	-1.814	-1.465	-1.059	818.0995	-2.281	-1.613	-1.115
744.3329	-2.225	-1.534	-1.050	818.1114	-2.245	-1.508	-1.045
744.3458	-2.265	-1.560	-1.021	818.1245	-2.238	-1.470	-0.998
744.3590	-2.319	-1.598	-1.094	819.1095	-2.175	-1.518	-1.059
744.3827	-2.317	-1.542	-1.075	819.1259	-2.150	-1.530	-1.058
744.4004	-2.330	-1.517	-1.093	820.1055	-1.696	-1.159	-0.760
747.2434	-2.561	-1.397	-1.159	820.1173	-1.704	-1.173	-0.778
747.2581	-2.611	-1.483	-1.129	820.1297	-1.687	-1.157	-0.802
747.2731	-2.500	-1.488	-1.182	828.1082	-2.205	-1.506	-1.093
747.2847	-2.518	-1.451	-1.111	828.1214	-2.249	-1.541	-1.114
747.2967	-2.478	-1.478	-1.131	829.1040	-1.968	-1.502	-1.080
755.3268	-2.236	-1.568	-1.072	829.1159	-2.032	-1.536	-1.065
755.3419	-2.219	-1.574	-1.077				
755.3587	-2.471	-1.661	-1.134	2439000 +			
757.3074	-1.993	-1.260	-0.860	060.4268	-2.413	-1.550	-1.077
757.3213	-2.008	-1.276	-0.863	067.3341	-2.223	-1.552	-1.097
757.3383	-2.027	-1.251	-0.838	068.4242	-2.254	-1.579	-1.107
758.3033	-1.909	-1.286	-0.820	076.4249	-2.412	-1.609	-1.102
758.3252	-2.199	-1.552	-1.095	080.3958	-2.439	-1.572	-1.122
758.3436	-2.294	-1.583	-1.138	080.4110	-2.221	-1.348	-0.888
760.2709	-2.309	-1.552	-1.111	082.4151	-2.160	-1.547	-1.010
760.2878	-2.239	-1.535	-1.083	083.4060	-2.330	-1.596	-1.106
760.3023	-2.311	-1.526	-1.073	086.2964	-2.294	-1.601	-1.130
766.3329	-2.236	-1.522	-1.094	091.3157	-2.237	-1.568	-1.113
766.3504	-2.349	-1.625	-1.196	106.3284	-2.832	-1.645	-1.138
767.2753	-2.485	-1.651	-1.239	112.3599	-2.527	-1.594	-1.102
769.2621	-2.070	-1.536	-1.097	142.1681	-2.730	-1.616	-1.173
769.2781	-2.108	-1.590	-1.131	145.1494	-2.327	-1.621	-1.148
769.2949	-2.160	-1.590	-1.160	155.1412	-2.267	-1.536	-1.079
770.2436	-2.273	-1.553	-1.113	158.0748	-2.179	-1.547	-1.114
781.2850	-0.235	-0.109	-0.006	159.0875	-2.143	-1.681	-1.088
781.2905	-0.298	+0.015	-0.029	177.0905	-2.251	-1.608	-1.162
781.2992	-0.100	+0.029	-0.033	792.4150	-2.396	-1.529	-1.087
783.2731	-2.729	-1.552	-1.008	792.4341	-2.587	-1.553	-1.141
785.2166	-2.224	-1.504	-1.043	792.4479	-2.577	-1.542	-1.175
802.1432	-2.665	-1.578	-1.080	798.4120	-2.250	-1.477	-1.129
802.1579	-2.681	-1.538	-1.066	798.4320	-2.299	-1.711	-1.129
802.1761	-2.759	-1.601	-1.090	800.3928	-2.337	-1.562	-1.140
802.1890	-2.742	-1.614	-1.132	800.4241	-2.293	-1.559	-1.095
806.1184	-2.026	-1.518	-1.055	800.4567	-2.305	-1.668	-1.058

The mean differential magnitudes in U , B , V of individual nights have been plotted in Figure 1. The dotted lines indicate the descending branch of primary minimum. The integrated light curve shows a scatter of about $\pm 0^m.05$ in B and V observations which may be due to the observational quality of the nights. It is difficult to assign it to the intrinsic variability of the components.

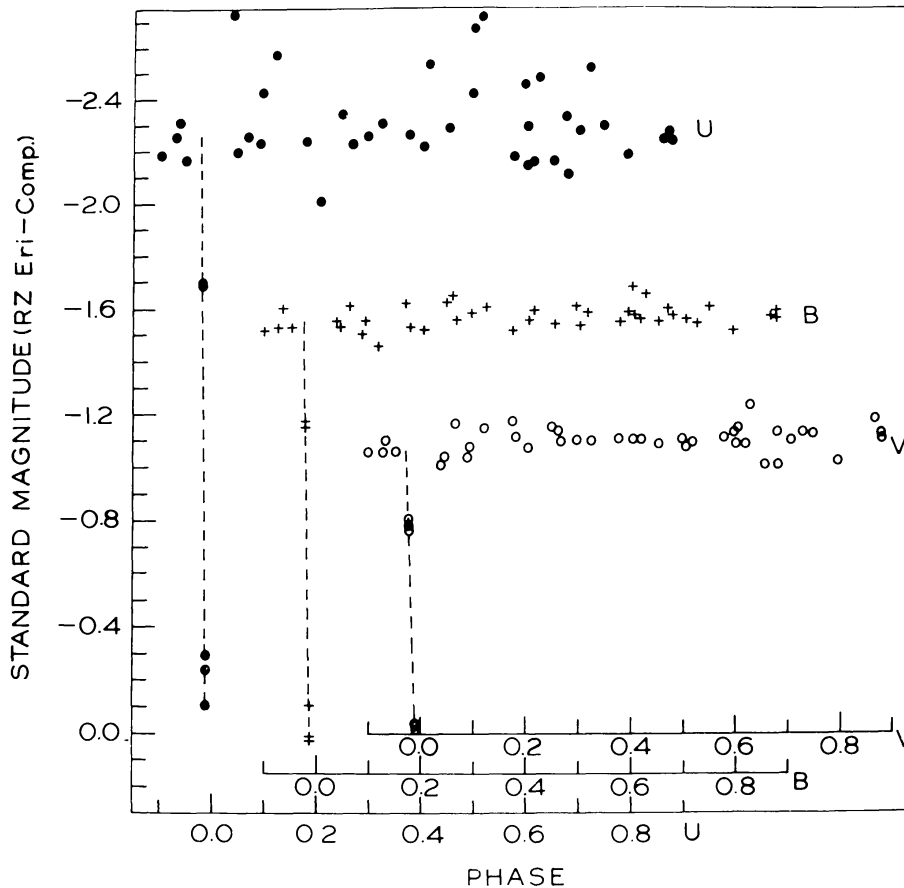


Fig. 1. Light curves of RZ Eri in U , B , and V filters. Dotted lines indicate the descending branch of primary minimum.

3. Results

Only on two nights the programme star was observed during primary minimum phase. On the basis of these observations the colour of the primary component and its spectral type has been determined as $B - V = 0^m.44$, $U - B = 0^m.37$, and F6. The corresponding values for the secondary component, viz., $B - V = 1^m.12$, $U - B = 1^m.08$, and K5, were obtained by assuming the observations at phase 0.9915 to be within the phase of totality. Colours of the variable and comparison stars are given in Table II.

TABLE II
Colour and magnitude of comparison and variable stars

Name	$B - V$	$U - B$	V
BD - 10°996	0 ^m .54	0 ^m .16	9 ^m .97
BD - 10°994	1.09	1.20	8.91
RZ Eri (Phase 0.508)	0.77	0.43	7.76

The secondary minimum is not noticeable in the light curve which is essentially flat outside the eclipse. Caton and Oliver's (1979) study of the system did not reveal any distortion wave, but later on Caton (1986) found a wave of a few hundredths of magnitude in total amplitude. Sarma (1985) has also found small distortion in the UBV light curves of the system suggesting the presence of stellar spots. On the contrary there is no indication of distortion wave in the present curves of 1964–1965 and 1965–1966 beyond the observational scatter.

References

- Caton, D. B.: 1986, *Astron. J.* **91**, 132.
 Caton, D. B. and Oliver, J. P.: 1979, *Inf. Bull. Var. Stars*, No. 1665.
 Cesco, C. U. and Sahade, J.: 1945, *Astrophys. J.* **101**, 370.
 Gadoski, J.: 1957, *Acta Astron.* **7**, 83.
 Gaposchkin, S.: 1951, *Bull. Harv. Coll. Obs.*, No. 920, p. 22.
 Gronbech, B.: 1975, *Inf. Bull. Var. Stars*, No. 956.
 Hall, D. S. and Kreiner, J. M.: 1980, *Acta Astron.* **30**, 387.
 Sarma, M. B. K.: 1985, in *Highlights in Astron.* **7**, 443.