ECLIPSE DEPTHS AND REVISED EPHEMERIS FOR RW CORONAE BOREALIS

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Abstract

Previously published photoelectric data by Carr (1971) have been condensed into normal points, analysed, and the resulting light curve plotted. The full range of brightness from quadrature to minimum light is $0^m.556$ in V, $0^m.566$ in B, and $0^m.577$ in U; the brightness range from quadrature to secondary minimum is $0^m.070$ in V, $0^m.048$ in B, and $0^m.041$ in U. The formula for predicting mid-eclipse is

$$JD(hel.) = 2440334.7702 + 0^d.72641121\ E.$$

* * * * *

RW Corona Borealis, a tenth magnitude Algol type binary, was observed photoelectrically for the first time by Carr (1971), who used the No. 3, 16-inch telescope at Kitt Peak National Observatory. He obtained 1008 observations with each of the three UBV filters on a total of twelve nights in 1969. For the comparison star Carr chose BD +29°2691, which lies about one-half degree south of the variable. The observations were corrected for differential extinction. No transformation to the standard UBV system was made; however, the very close color match between the comparison and variable (ΔB-V = $0^m.05$) suggests that the instrumental differential magnitudes are very close to those on the standard system. (The instrumental differential magnitudes in the visual, for example, will be within $0^m.005$ of the standard differential V magnitudes providing the transformation coefficient, ε, is less than about 0.1, which would correspond to an unusually poor match between the two color systems.)

The phase for each observation was computed using the epoch and period given below, which were obtained by Carr from an analysis of his own times of minimum light.

$$JD(hel.) = 2440334.7702 + 0^d.72641629\ E$$

Next, the light curve was plotted for each color, and the individual data points were grouped into 100 average or "normal" points, which are listed in Table 1.

Eclipse depths determined from these averages are listed in Table 2. The light curve and color curve are plotted in Figure 1. The light curve shows a moderately deep primary eclipse and a shallow secondary, indicating a considerable temperature difference between the binary star components. The eclipse appears to be partial. The out-of-eclipse portion of the curve reveals moderate curvature implying that the light curve is complicated by the ellipticity of the component stars and differential reflection effects. The color curve is constant except for a slight tendency ($\sim 0^m.03$) toward redness during primary eclipse and a similar tendency toward blueness during secondary.

The epoch and period listed in GCVS 1969 are

$$JD(hel.) = 2420401.3223 + 0^d.7264114\ E.$$

Carr's adopted epoch shows that this formula predicts minima that are later than those actually being observed, the difference being 0.0073 days. The Eclipsing Binary Observers of the Swiss Astronomical Society (BBSAG) observed five eclipses of this star between 1973 and

1975, and their results are roughly in concurrence with Carr's. Using Carr's epoch and revising the period with respect to Carr's data and the BBSAG data we find that the formula

$$JD(hel.) = 2440334.7702 + 0^{d}.72641121\ E$$

should be used to predict eclipses.

TABLE 1

NORMAL POINTS FOR RW CrB

phase	ΔV	ΔB	ΔU	phase	ΔV	ΔB	ΔU
.0025	+.377	+.331	+.357	.505	-.104	-.182	-.182
.0075	+.364	+.318	+.308	.514	-.113	-.185	-.208
.013	+.338	+.286	+.283	.524	-.126	-.184	-.184
.021	+.299	+.262	+.246	.535	-.122	-.188	-.186
.026	+.254	+.212	+.219	.545	-.127	-.192	-.191
.031	+.221	+.172	+.183	.555	-.134	-.201	-.186
.038	+.179	+.128	+.123	.568	-.148	-.209	-.202
.044	+.118	+.081	+.081	.582	-.152	-.213	-.215
.050	+.082	+.022	+.046	.594	-.168	-.218	-.228
.057	+.047	-.006	-.002	.605	-.167	-.218	-.192
.061	+.007	-.049	-.042	.615	-.169	-.222	-.227
.067	-.029	-.080	-.083	.625	-.169	-.224	-.234
.073	-.061	-.115	-.113	.636	-.171	-.217	-.213
.083	-.087	-.147	-.142	.653	-.177	-.219	-.219
.099	-.127	-.192	-.209	.670	-.167	-.226	-.228
.111	-.157	-.204	-.182	.686	-.178	-.226	-.233
.126	-.148	-.200	-.188	.698	-.178	-.235	-.227
.136	-.153	-.214	-.202	.717	-.178	-.227	-.223
.147	-.162	-.204	-.208	.734	-.172	-.227	-.228
.156	-.156	-.223	-.214	.750	-.177	-.232	-.216
.163	-.155	-.216	-.221	.761	-.169	-.227	-.213
.173	-.168	-.213	-.207	.771	-.176	-.231	-.222
.186	-.176	-.225	-.228	.784	-.174	-.236	-.232
.196	-.168	-.227	-.222	.797	- .182	-.228	-.212
.207	-.167	-.231	-.209	.807	-.176	-.228	-.216
.217	-.178	-.224	-.237	.817	-.173	-.226	-.217
.226	-.171	-.226	-.228	.826	-.172	-.228	-.218
.234	-.176	-.228	-.226	.833	-.167	-.212	-.226
.241	-.187	-.232	-.227	.840	-.164	-.214	-.209
.250	-.187	-.229	-.223	.847	-.168	-.215	-.194
.258	-.183	-.236	-.241	.854	-.153	-.207	-.202
.267	-.178	-.233	-.238	.862	-.159	-.209	-.199
.274	-.192	-.228	-.232	.870	-.156	-.202	-.184
.281	-.184	-.231	-.224	.879	-.156	-.204	-.188
.287	-.185	-.236	-.214	.888	-.154	-.208	-.194
.296	-.184	-.234	-.213	.894	-.157	-.205	-.187
.302	-.174	-.233	-.212	.901	-.139	-.187	-.185
.314	-.183	-.227	-.229	.909	-.126	-.180	-.172
.333	-.184	-.223	-.213	.917	-.101	-.162	-.138
.347	-.174	-.226	-.218	.923	-.081	-.134	-.117
.359	-.178	-.218	-.222	.929	-.047	-.089	-.068
.371	-.174	-.232	-.214	.937	-.007	-.041	-.032
.388	-.169	-.227	-.209	.944	+.048	+.009	+.036
.412	-.164	-.224	-.208	.952	+.106	+.064	+.097
.438	-.154	-.198	-.186	.960	+.146	+.126	+.161
.457	-.133	-.187	-.188	.967	+.212	+.173	+.217
.468	-.109	-.184	-.189	.974	+.266	+.234	+.274
.477	-.124	-.180	-.193	.982	+.316	+.283	+.311
.486	-.122	-.184	-.187	.988	+.352	+.314	+.333
.496	-.119	-.184	-.192	.996	+.371	+.339	+.341

TABLE 2

DEPTH* OF ECLIPSES FOR RW CrB

	V	B	U
primary	0.556	0.566	0.577
secondary	0.070	0.048	0.041

*Measured from maximum light (quadrature) to primary and secondary minimum.

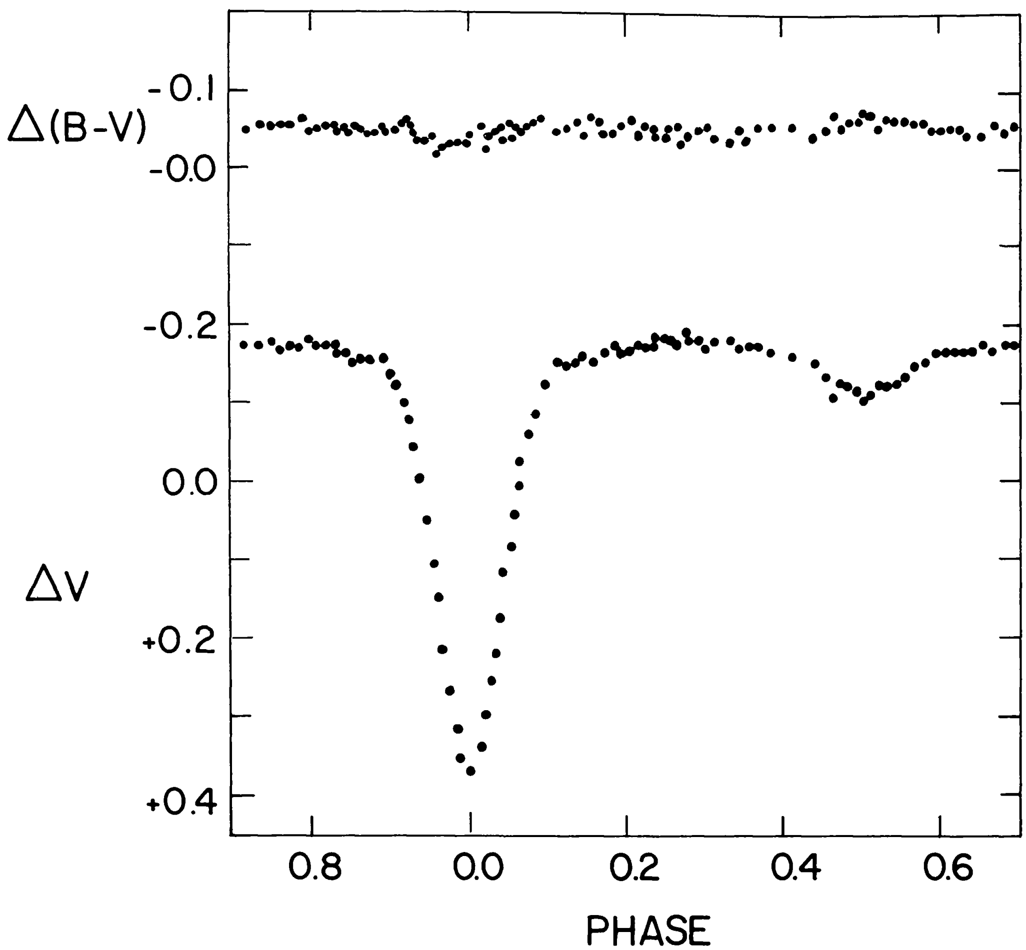

Figure 1. The visual light curve and color curve for RW CrB. Notice the slight color change near phases 0.0 and 0.5.

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REFERENCE

Carr, R. B. 1971, Publications of Goodsell Observatory, No. 16.