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ON THE DECREASING PERIOD AND ASYMMETRIC LIGHT CURVE OF RT SCULPTORIS

RT Scl is a southern EB-type eclipsing binary whose light curve has been studied fairly regularly since the turn of the century. An asymmetry is present in all light curves, which manifests itself in the different heights of the maxima and the shape of the secondary minimum. It is therefore interesting to study the stability of the period in order to decide on the presence and strength of mass flow between the components. A new study of the period is also important because recent visual minimum determinations suggest very large period changes.

We present here a new UBV light curve, obtained with the ESO 50 cm telescope in 1977, and new photographic minima, derived from plates of the Bamberg sky patrol for the years 1964 to 1972.

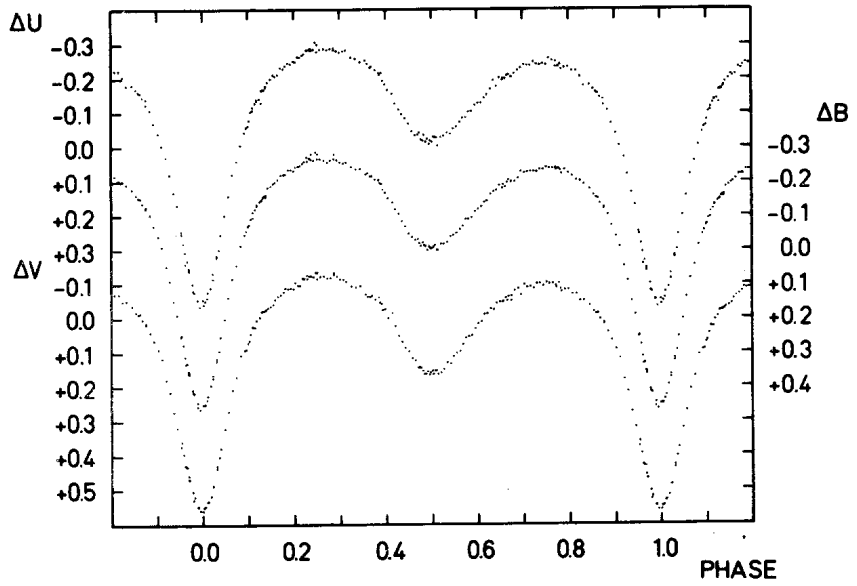

Fig. 1. U B V light curves of RT Scl, relative to CoD -26°193 (CPD -26°49)

The new light curves, as compared with the photoelectric light curves of Cillié and Lindsay (1958), and Clausen and Grønbech (1977), show no obvious change in the asymmetric disturbance (Fig. 1). A detailed analysis will be published later.

All available minimum times are collected in Table 1. A new linear ephemeris, derived from the existing photoelectric observations, yields

$$\text{J.D.hel. (primary minimum)} = 2\,443\,450.6370 \pm 0.0007 + 0.51156208 \pm .00000007 \cdot E$$

Table 1. Minimum times of RT Scl

J.D.hel. (2 400 000+)	E	$(O-C)_1$	$(O-C)_2$	type	source
11 736.1140	-61995	-0.2319	-0.0019	pg	Pickering/Whiteside (1908)
23 761.5806	-38488	-0.0551	+0.0073	pg	Dugan (1928)
24 116.6056	-37794	-0.0542	+0.0048	pg	"
24 147.2980	-37734	-0.0555	+0.0032	pg	Schilt (1925)
34 222.5660	-18038	-0.0026	-0.0047	pe	Cillié and Lindsay (1958)
34 991.4463	-16536	-0.0002	-0.0040	pe	"
35 014.4661	-16491	-0.0006	-0.0045	pe	"
35 030.3257	-16460	+0.0005	-0.0034	pe	"
35 031.3501	-16458	+0.0018	-0.0021	pe	"
38 621.5180	- 9440	+0.0270	+0.0204	pg	Bamberg
38 641.4470	- 9401	+0.0051	-0.0015	pg	"
38 701.3030	- 9284	+0.0084	+0.0018	pg	"
38 721.2650	- 9245	+0.0194	+0.0129	pg	"
38 722.2650	- 9243	-0.0037	-0.0103	pg	"
40 469.7610	- 5827	-0.0038	-0.0083	pg	"
40 509.6570	- 5749	-0.0096	-0.0141	pg	"
40 555.2860	- 5660	+0.0904		vis	Diethelm and Locher (1970)
40 572.0620	- 5627	-0.0152	-0.0195	pg	Bamberg
41 580.4620	- 3656	+0.0960		vis	Locher (1972)
41 623.3901	- 3572	+0.0529		vis	"
41 624.4160	- 3570	+0.0556		vis	"
41 987.5718	- 2860	+0.0024	+0.0013	pe	Clausen and Grønbech (1976)
41 989.6177	- 2856	+0.0020	+0.0010	pe	"
42 415.2470	- 2024	+0.0117		vis	Locher (1975)
42 417.3020	- 2020	+0.0204		vis	"
43 143.2150	- 601	+0.0268		vis	Locher (1977)
43 450.6352	0	-0.0018	+0.0020	pe	this paper

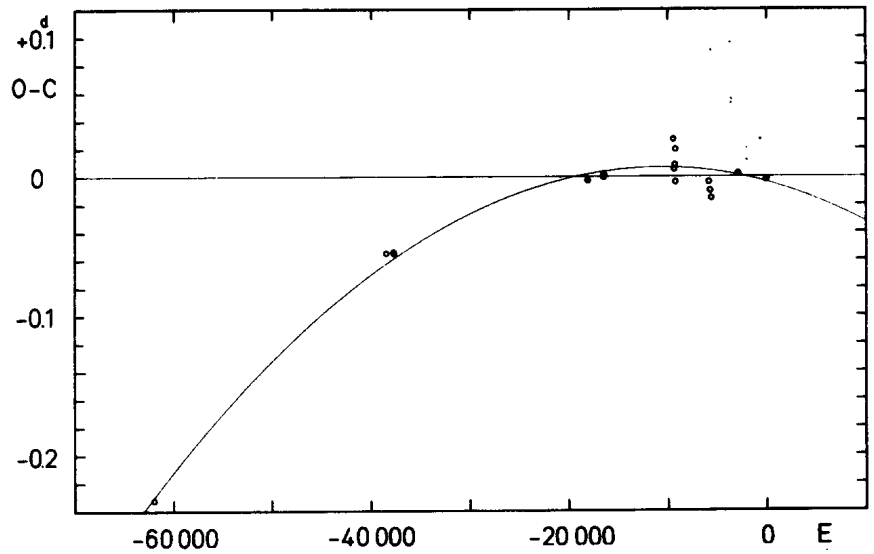

Fig. 2. O - C diagram of RT Scl. The quadratic ephemeris is also indicated. Open circles represent photographic, filled circles photoelectric, and dots visual minima.

The O - C diagram is shown in Fig. 2. It is noted that the visual minima deviate strongly, especially the early ones, while nearly simultaneous photographic minima confirm the period variation obtained from the photoelectric data. Thus it must be stated that at least the early visual minimum times must be grossly in error. The O - C diagram thus does not show dramatic irregularities of the period, but merely a continuous decrease of the length of the period.

A thorough period study, taking into account also the early observations, was published by Cillié and Lindsay (1958). They proposed the introduction of a quadratic term into the ephemeris to represent the minimum times between 1891 and 1954.

The photoelectric minimum times obtained between 1952 and 1977 are also not well represented by a linear ephemeris. Thus we have introduced a new quadratic term. Surprisingly it differs only by about 10% from the one derived from the early minima. We propose therefore that a general quadratic term really exists which is determined from all observed minimum times of good quality (with proper weighting):

$$\text{J.D.hel. (prim. min.)} = \underset{\pm.0037}{2\,443\,450.6332} + (\underset{\pm.00000034}{0.51156012} - \underset{\pm.53}{9.04 \cdot 10^{-11}}\,E)\,E$$

This ephemeris might be suited to describe future minimum times with some confidence.

It should be noted that this ephemeris cannot describe the "fine structure" of period variations, which are certainly superimposed on the general trend, but are difficult to determine because of the scarcity of data of high precision. We only want to draw attention to this star whose period, like that of SV Cen, is continuously decreasing in a roughly predictable way.

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