NEW LIGHT ELEMENTS FOR THE LONG-PERIOD ECLIPSING VARIABLE CF SCT

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Abstract

Using minima derived from photographic observations on the plates of the Maria Mitchell Observatory and Sternberg Institute collections or found in the literature, covering a very wide range of Julian dates (2420300–2448120), we find that the eclipsing variable CF Sct, with two previously reported period values somewhat contradicting each other

(31.9415 and 31.9384 days), actually shows a quite constant period of 31.94036 days over decades.

1. Discussion

The variable star CF Sct (HV 6112) was discovered by E. Robinson (Harwood 1933) and attributed by Harwood to be an eclipsing variable with the light elements:

$$JD_{Min.} = 2426177.1 + 31.9415\ E.$$

Oosterhoff (1943), from a larger number of photographic estimates, confirmed that the star was an Algol-type variable with the photographic magnitude range from 13.4 to 15.0 and suggested essentially the same ephemeris:

$$JD_{Min.} = 2429434.9 + 31.9415\ E.$$

He published only those individual observations showing the star fainter than usual and plotted the corresponding light curve revealing the shape of the minimum rather well.

The finding charts for the variable were presented by Harwood (1962) and by Tsesevich and Kazanasmas (1971). They show that the star is identical to GSC 5693.3453, with coordinates for equinox 2000.0 $18^h48^m27^s.9$, -08°22'12".

Robinson and Harwood (1971) published a new study of the star, not mentioning either its name (CF Sct) as given in the *General Catalogue of Variable Stars* (GCVS) or its Harvard preliminary designation (HV 6112), however, but using only its Maria Mitchell Observatory (MMO) preliminary designation (MMO 705), which was not found in any of the earlier publications. They give approximately the same magnitude range (13.3 to 15.6 mpg) but, from 23 minima listed in their paper, derive rather different light elements:

$$JD_{Min.} = 2427805.94 + 31.9384\ E.$$

One of us (Hoffleit), noticing this contradiction in the period value, suggested the object for a more detailed study, having in mind possible period variations.

We estimated the star's brightness on numerous plates of the MMO and Sternberg Institute plate collections. In minimum brightness, the star is usually below the plate limit for MMO plates. The star was found faint on 66 plates, listed in Tables 1 and 2. We also took into account the initial epoch from Harwood (1933) and seven epochs of the faintest observations from Oosterhoff (1943) as well as the minima from Robinson and Harwood (1971). The O-C diagram for the individual fadings and published minima, plotted with the light elements from Oosterhoff (1943), shows, quite expectedly for the star's long period, a considerable scatter, but obviously indicates a period value shorter than that given by Oosterhoff, with no

signs of period variations in a wide range of Julian dates (2420300–2448120). Using the least squares solution, we derive the following light elements:

$$JD_{Min.} = 2429434.86 + 31.94036\ E. \quad (1)$$
$$\pm 0.05 \quad \pm 0.00020$$

The new period value is much closer to Oosterhoff's value than to the value from Robinson and Harwood (1971). Note that, for the more than two-day duration of the eclipse (Oosterhoff 1943), the difference between the correct period value and the value suggested by Robinson and Harwood (1971) could not be reliably noticed in their observations covering only about 500 orbital cycles.

The star's light curve, from Sternberg Institute plates, is shown in Figure 1. These observations were calibrated using the photoelectric sequence in the open cluster NGC 6694 (Hoag *et al.* 1961). The light curve shows indications of a secondary minimum, never mentioned in earlier publications.

2. Acknowledgements

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Table 1. Dates of MMO plates showing CF Sct faint.

JD 24...	*JD 24...*	*JD 24...*	*JD 24...*	*JD 24...*	*JD 24...*	*JD 24...*
24388.60	26208.64	26399.91	26943.56	33236.46	43009.72	46267.78
25154.55	26208.68	26400.91	27326.56	33586.48	43041.55	46586.67
25155.56	26208.72	26528.64	29849.73	33586.51	43041.57	47033.65
25409.73	26208.76	26559.62	29881.66	34608.67	43775.57	47066.59
25473.61	26209.55	26560.63	32373.60	41571.58	44127.59	47384.67
25889.51	26209.60	26591.59	32405.60	42306.54	44733.74	47736.58
26208.55	26209.64	26592.63	32500.48	42307.55	46267.60	48119.68
26208.59	26272.52	26592.67	33171.57	43009.69	46267.62	48120.58

Table 2. Fadings of CF Sct on Sternberg Institute plates.

JD 24...	B_{pg}	*JD 24...*	B_{pg}
39687.41	14.84	41188.34	14.84
40390.44	14.84	41188.37	14.84
40774.36	14.34	41508.39	14.90
40774.39	14.35	41508.43	14.84
40838.29	14.32	41924.54	14.11

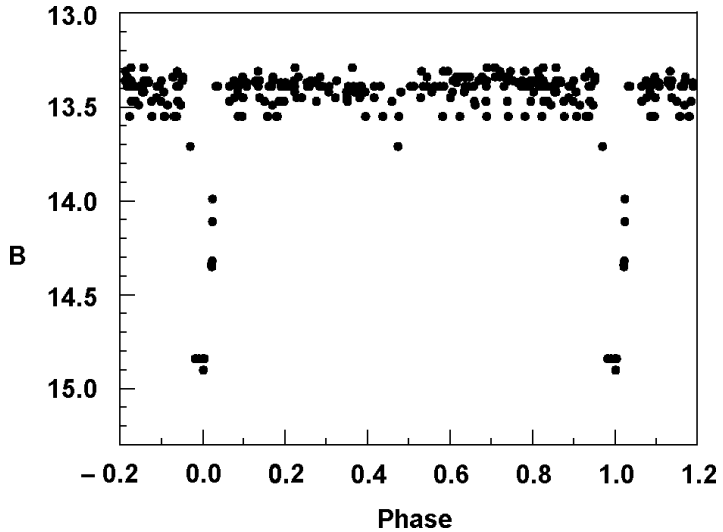

Figure 1. The *B* light curve of CF Sct from Sternberg Institute plates.