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1991 ECLIPSE TIMINGS FOR 44 i BOOTIS AND UP-TO-DATE EPHEMERIS

The eclipsing binary 44 i Boo was observed photoelectrically by our group in the summer of 1991. We wanted to see whether the recent period increase suggested by Oprescu et al. (1991) would be confirmed.

Our observations were made at Braeside Observatory near Flagstaff, Arizona using the computer-controlled 16-inch Cassegrain telescope and photoelectric equipment of the second author. The last three authors are high school students who did much of the observing and initial analysis for this project under the guidance of the first author as part of an N.S.F. summer program conducted by Northern Arizona University.

Times of both primary and secondary minima derived from our photometry are presented in Table 1, where cycle numbers and O-C residuals are computed with the ephemeris

$$C_1 = 2443604.5880 + 0^d.26781753\ E \qquad (1)$$

given by Oprescu et al. (1991) to describe eclipse times after an earlier period increase suggested by Oprescu et al. (1989). It will be seen that primary eclipse was observed on two of the nights and secondary on the other.

Figure 1 is an O-C curve based on the ephemeris in equation (1). Plotted are all of the times listed by Oprescu et al. (1991) with $E > 0$, along with our new times from Table 1. We were forced to recompute O-C values from the Julian dates given because of numerous errors and omissions. The largest error was at JD 2445473.8187, given as O-C = $+0^d.0085$ when it should have been O-C = $-0^d.0018$. The most serious omission was the five times of Willmitch and Hall (1989). Coincidently, this was the reference which the bibliography of Oprescu et al. (1991) mistakenly attributes to Willmitch and Douglas.

Oprescu et al. (1991) claimed that the period increased "after 1987" but did not specify the epoch more precisely than that. They estimated the size of the increase to be $\Delta P = 1^s.02666 \times 10^{-6}$, although surely 5 decimal places of accuracy are not warranted. For the new ephemeris "after 1987" they proposed

$$C_2 = 2443604.5880 + 0^d.26781856\ E\ , \qquad (2)$$

although the initial epoch in this ephemeris must be grossly in error, as one can see by inspection of their second figure.

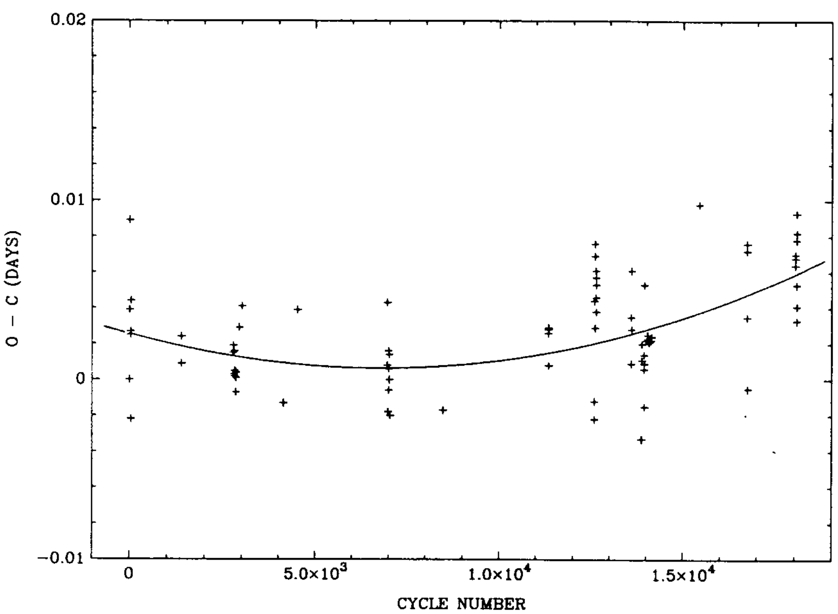

Figure 1. O-C curve for 44 i Boo, with residuals based on the ephemeris in equation (1). Points are from the Julian dates given by Oprescu et al. (1991) with E > 0, and from our Table 1. The solid curve represents the quadratic ephemeris in equation (3). Note the increasing period.

Table 1. New times of minimum of 44 i Boo.

JD(hel.) 2440000+	E	O-C (days)	Filter
8429.8634	18017	+0.0070	V
8429.8629	18017	+0.0064	B
8429.8632	18017	+0.0068	U
8437.7649	18046.5	+0.0078	V
8437.7663	18046.5	+0.0093	B
8437.7623	18046.5	+0.0053	U
8439.7698	18054	+0.0041	V
8439.7739	18054	+0.0082	B
8439.7690	18054	+0.0033	U

We found that points in Figure 1 are fit better with a quadratic ephemeris than with two straight-line segments, although both fitting techniques indicate a period increase. Our quadratic ephemeris, determined by least squares with all points given equal weight, is

$$C_3 = 2443604.844 + 0^d.26781696\,E + 0^d.42 \times 10^{-10}\,E^2 ,$$
$$\pm.077 \quad \pm.00000020 \quad \pm.11$$

where the algebraic sign of the quadratic term does indicate an increasing period. In this fit two points rejected by the 3-sigma test were not included in the fit and are not plotted in Figure 1.

Our recent timings do confirm the period increase suggested by Oprescu et al. (1991), in that they fall in line with the solid curve in Figure 1 which represents the quadratic ephemeris in equation (3). Moreover, our fit itself is consistent with the value of the current period suggested by Oprescu et al. (1991). One can write

$$P = dC/dE , \tag{4}$$

where C is the computed eclipse time given by any ephemeris and P is the instantaneous period at any epoch. For the ephemeris in equation (3) one gets

$$P = 0^d.26781696 + 0^d.84 \times 10^{-10}\,E , \tag{5}$$

which, at E = 18054, yields P = $0^d.26781848 \pm 0^d.00000045$. This is perfectly consistent with the value $0^d.26781856$ suggested (with no uncertainty indicated) by Oprescu et al. (1991).

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