REVISED ECLIPSE PREDICTION ELEMENTS FOR EIGHT ECLIPSING BINARY STARS

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Abstract

Evaluation of recently published times of minima of eight eclipsing binaries determined by AAVSO observers reveals significant deviations from the elements listed in the *General Catalogue of Variable Stars* (GCVS). New elements for MM Cas, SW Cyg, TU Her, EQ Ori, FL Ori, TY Peg, ST Per, and BO Vul are given here.

1. Introduction

Revised minima prediction elements defining the most recent behavior of eight stars were calculated using a linear regression method. Recently published minima (Baldwin and Samolyk 1995) were the primary source of data used in these calculations. Supplemental sources of data used to better define the behavior of EQ Ori and FL Ori, two stars in which discrete changes of period are evident, are noted below. Additional elements defining the periods of these stars during the earlier intervals of time are given. The O-C plots in Figures 1–8 show the deviation of times of minima from the GCVS elements (Kholopov *et al.* 1985). Lines shown in these figures match the elements given in the numbered equations.

2. MM Cas

All times of minima determined by AAVSO observers during the past 16 years occur later than predicted by the GCVS elements. Equation (1) represents well the observations made during this interval.

$$JD_{min} = 2443136.614 + 1.158472\ E \qquad (1)$$

3. SW Cyg

AAVSO data obtained since JD 2442960 are well represented by equation (2).

$$JD_{min} = 2442960.801 + 4.573055\ E \qquad (2)$$

4. TU Her

The current elements, represented by equation (3), are based on the last four minima obtained. The earlier data indicated a continuous change of period with no one linear period being valid over a long interval of time.

$$JD_{min} = 2448801.732 + 2.266940\ E \qquad (3)$$

5. EQ Ori

The discrete period changes in the behavior of EQ Ori permit clear definition of elements representing segments of the O-C curve. Equation (4) represents behavior from JD 2443100 to JD 2444600, equation (5) from JD 2444600 to JD 2446100, and equation (6) from JD 2446100 to JD 2449400. AAVSO data alone were insufficient to define the second segment of the O-C curve. Minima from *Bedeckungsveränderlichen Beobachter der Schweizerischen Astronomischen Gesellschaft* (BBSAG) *Bulletin* Nos. 63, 64, 68, 103, and 108 (Locher 1982b, 1983a, 1983b, 1993, 1995), including minima by Kurt Locher, George Mavrofridis, and Hermann Peter, were included to define the second segment and to better describe recent behavior in the final segment.

$$JD_{min} = 2441335.387 + 1.7460596 \ E \qquad (4)$$

$$JD_{min} = 2444605.757 + 1.7460341 \ E \qquad (5)$$

$$JD_{min} = 2446077.663 + 1.7460536 \ E \qquad (6)$$

6. FL Ori

Both star behavior and problems encountered due to a shortage of AAVSO data at a critical time were similar to those noted above for EQ Ori. Minima from *BBSAG Bulletin* Nos. 62, 63, 64, and 71 (Locher 1982a, 1982b, 1983a, 1984) by Kurt Locher, Demetrius Elias, George Mavrofridis, and Maria Andrakakou were used to supplement the AAVSO O-C curve and to define the second discrete period of FL Ori represented by equation (8). Equation (7) represents behavior from JD 2442600 to JD 2444300, equation (8) from JD 2444300 to JD 2446900, and equation (9) from JD 2446900 to JD 2449700.

$$JD_{min} = 2439442.909 + 1.550975 \ E \qquad (7)$$

$$JD_{min} = 2444286.606 + 1.550962 \ E \qquad (8)$$

$$JD_{min} = 2446479.657 + 1.550988 \ E \qquad (9)$$

7. TY Peg

TY Peg, which for several years had closely followed the GCVS elements with only minor deviation, experienced a significant change of period near JD 2445800. Its behavior has since been well represented by elements given in equation (10).

$$JD_{min} = 2447056.737 + 3.092122 \ E \qquad (10)$$

8. ST Per

Twenty-eight years of AAVSO data imply that the period of ST Per is probably experiencing continuous change. However, the most recent data are well represented by the elements of equation (11), which should be sufficient to predict near-term minima.

$$JD_{min} = 2446795.729 + 2.648372 \ E \qquad (11)$$

9. BO Vul

This star has undergone several changes of period. Since JD 2448400, its behavior is well represented by the elements of equation (12).

$$JD_{min} = 2448454.701 + 1.945860\ E \qquad (12)$$

References

Baldwin, M. E. and Samolyk, G. 1995, *Observed Minima Timings of Eclipsing Binaries No. 2*, AAVSO, Cambridge, MA.

Kholopov, P. N. *et al.* 1985, *General Catalogue of Variable Stars*, 4th ed., Moscow.

Locher, K. 1982a, *BBSAG Bull.*, No. 62.

Locher, K. 1982b, *BBSAG Bull.*, No. 63.

Locher, K. 1983a, *BBSAG Bull.*, No. 64.

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Locher, K. 1984, *BBSAG Bull.*, No. 71.

Locher, K. 1993, *BBSAG Bull.*, No. 103.

Locher, K. 1995, *BBSAG Bull.*, No. 108.
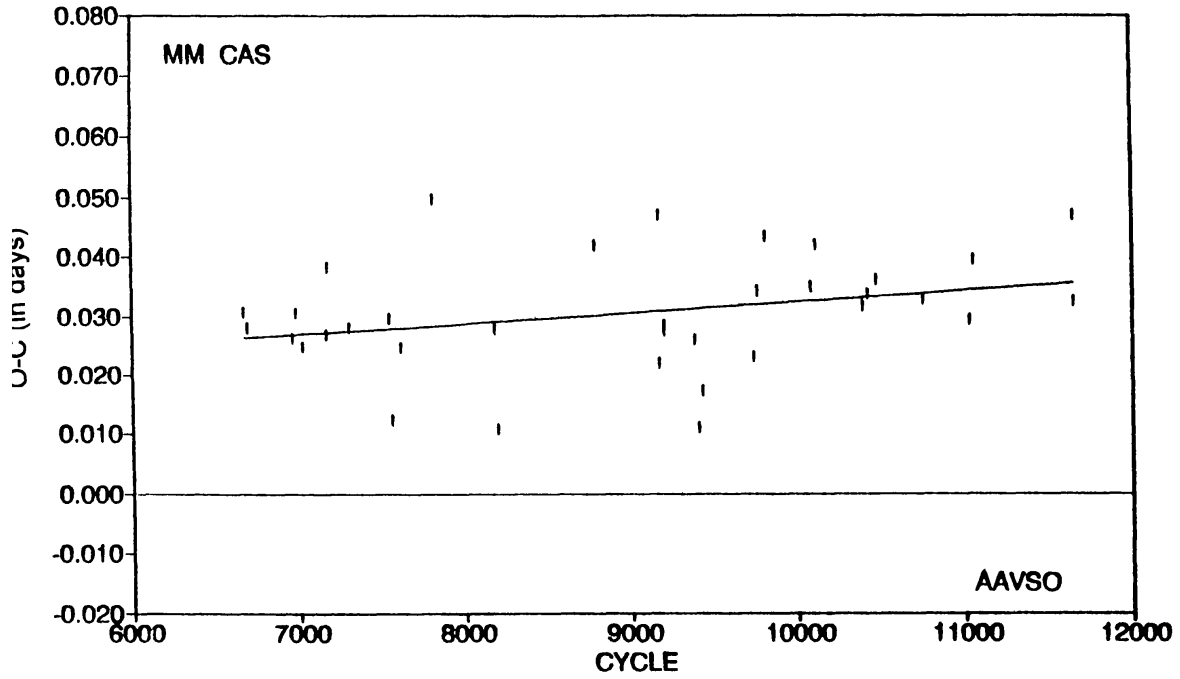
Figure 1. O-C plot of MM Cas based on the GCVS elements. The sloping line represents equation (1).
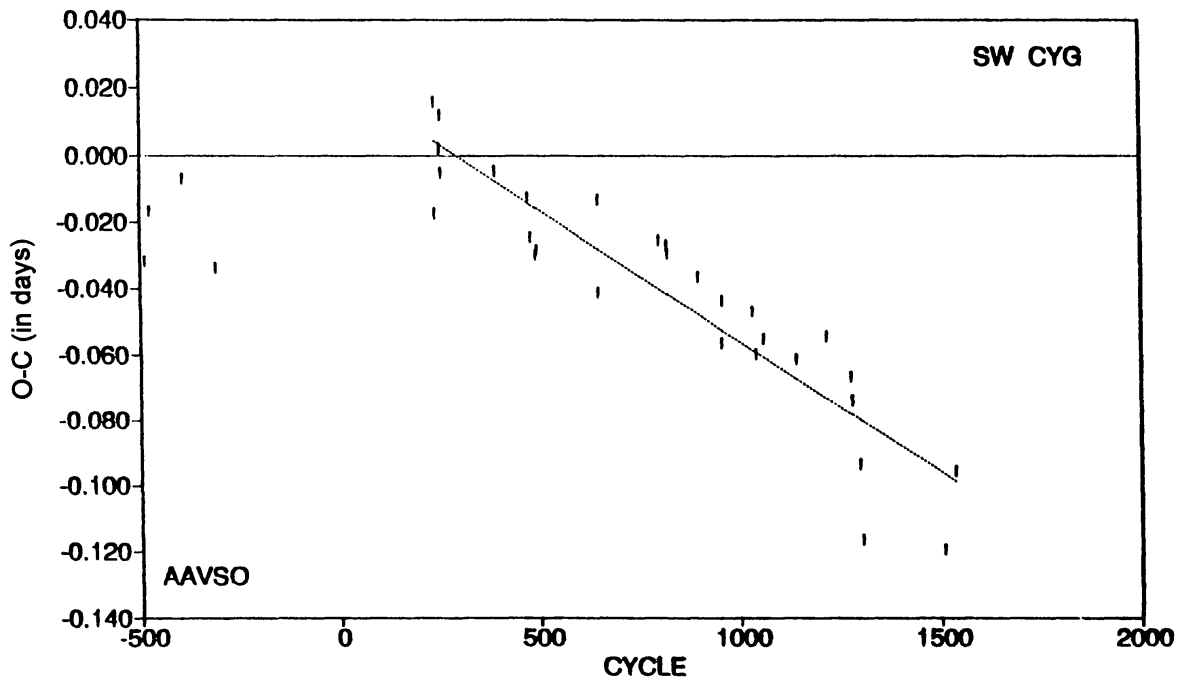
Figure 2. O-C plot of SW Cyg based on the GCVS elements. The sloping line represents equation (2).
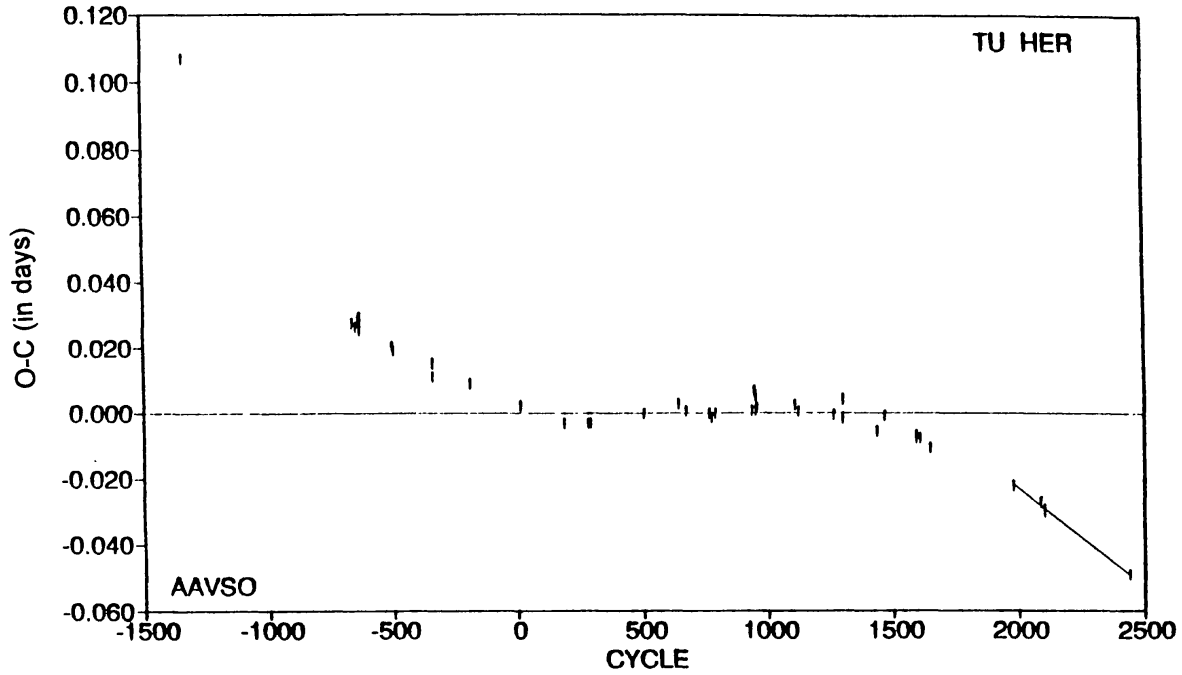
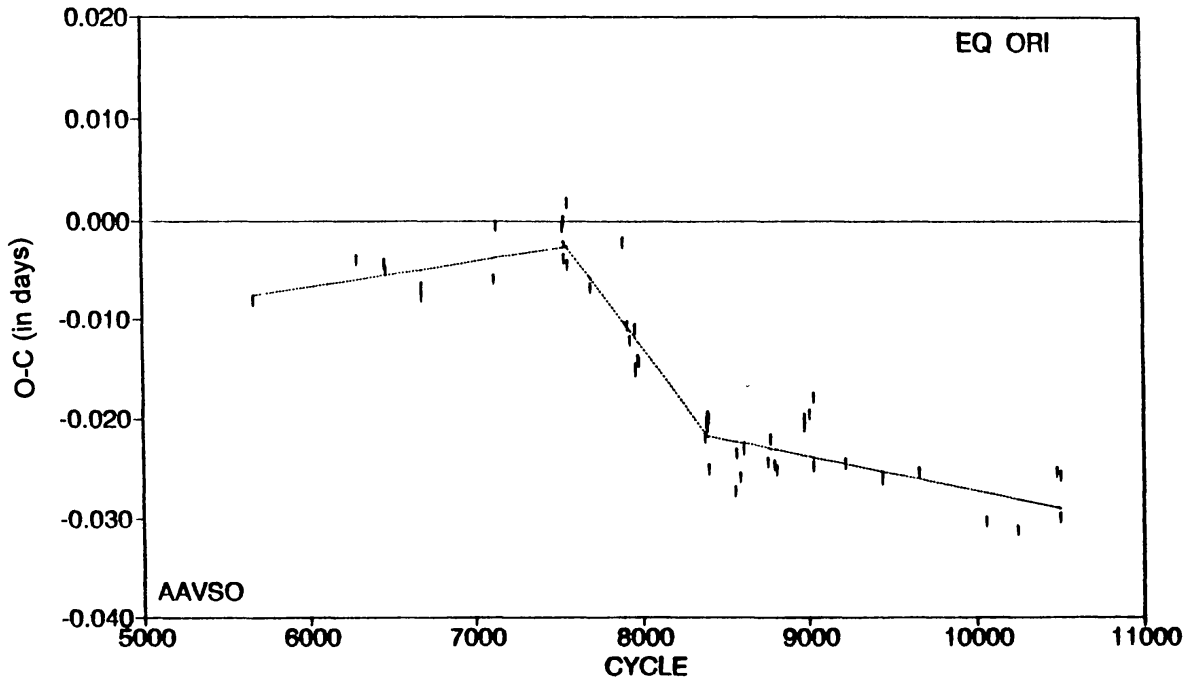Figure 3. O-C plot of TU Her based on the GCVS elements. The short sloping line represents equation (3).

Figure 4. O-C plot of EQ Ori based on the GCVS elements. The three sloping lines represent equations (4), (5), and (6).
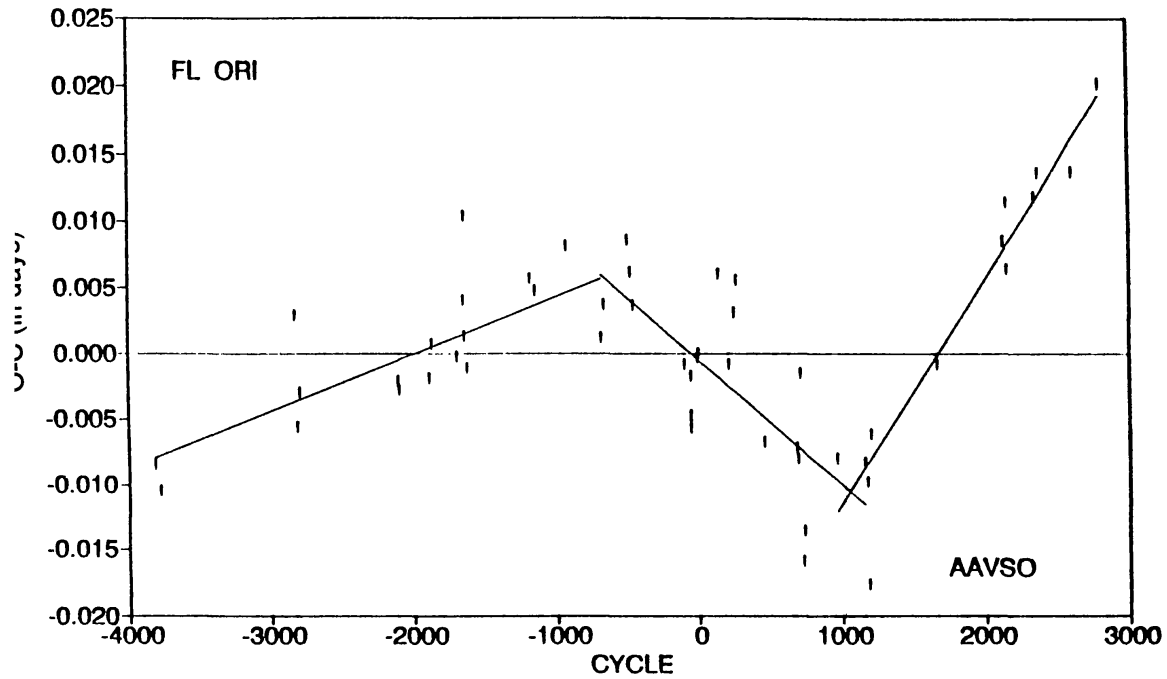
Figure 5. O-C plot of FL Ori based on the GCVS elements. The three sloping lines represent equations (7), (8), and (9).
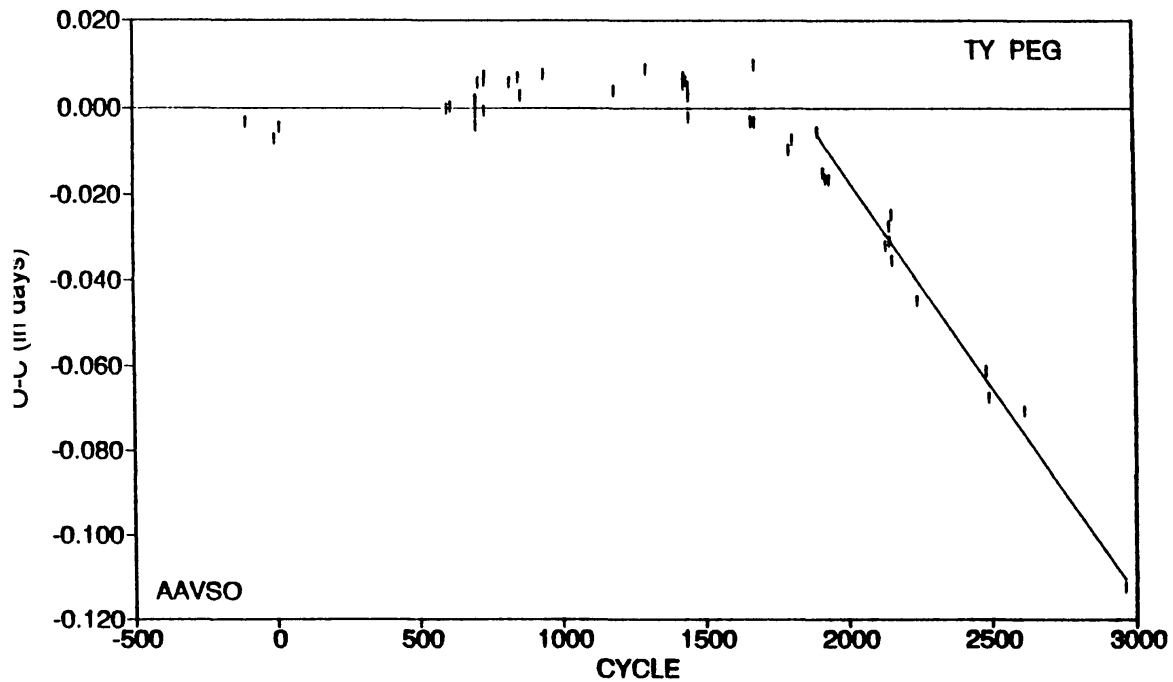
Figure 6. O-C plot of TY Peg based on the GCVS elements. The sloping line represents equation (10).
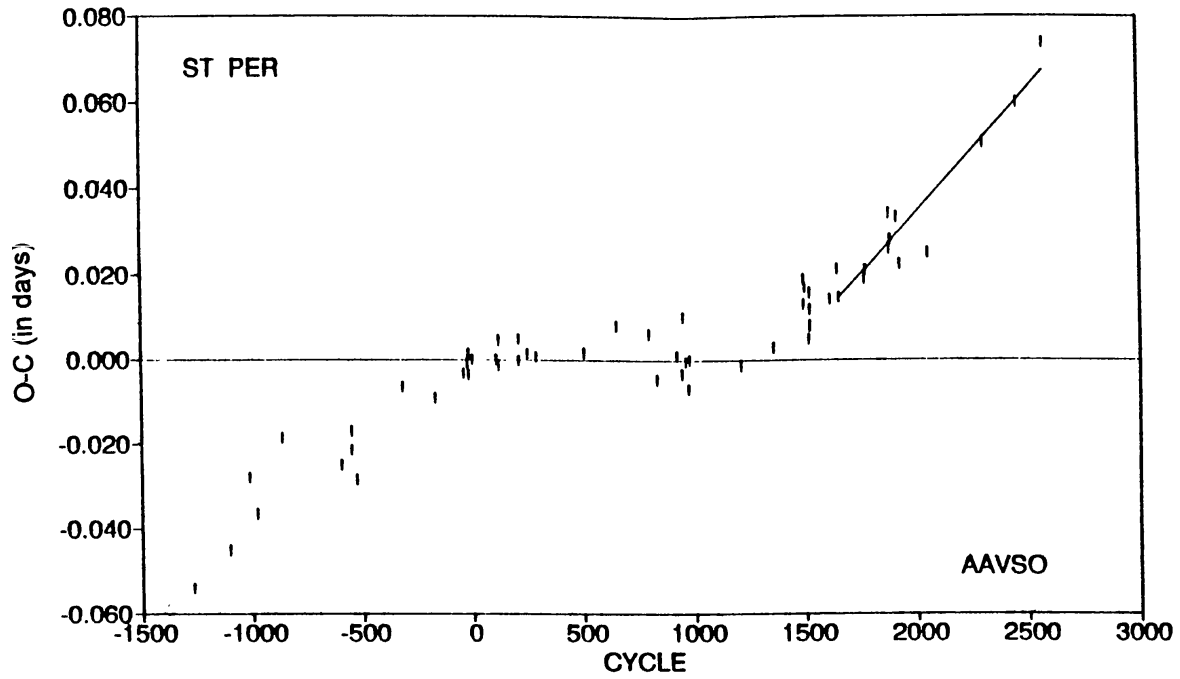
Figure 7. O-C plot of ST Per based on the GCVS elements. The sloping line represents equation (11).
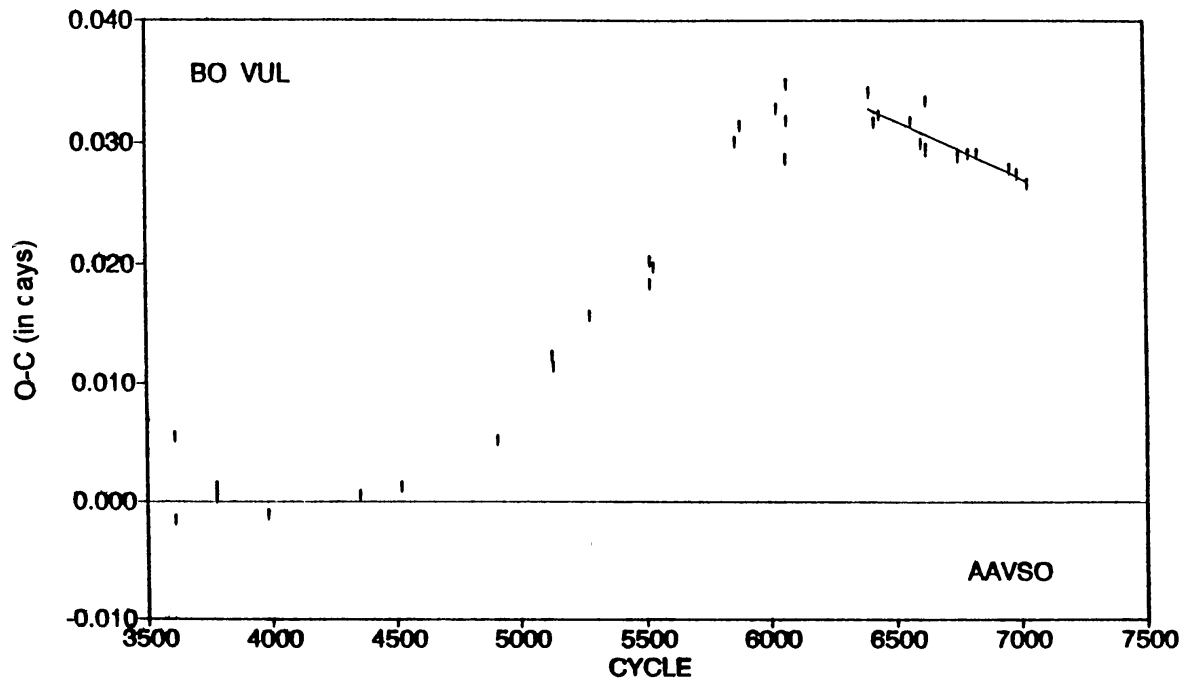

Figure 8. O-C plot of BO Vul based on the GCVS elements. The sloping line represents equation (12).