PERIOD CHANGES IN V726 CYGNI

ERICA ELLINGSON
Maria Mitchell Observatory
Nantucket, MA 02554

Abstract

The period of V726 Cygni is refined. Parabolic and cubic elements are evaluated. New estimates of maximum and minimum are determined.

* * * * *

V726 Cygni is an Algol-type eclipsing variable at $\alpha = 20^h\ 09^m\ 29^s$, $\delta = +40^\circ 20'.6$ (1900). Elements by Miller (1953) are

$$JD_{min} = 2433337.4894 + 0.49796837\ E, \quad (1)$$

and magnitudes of maximum and minimum are listed as 12.7 and 13.7, respectively.

Since the duration of minimum is only about one-fifth of the total cycle, it was feared that usable data (photographic plates taken at or near minimum) would be difficult to find. A preliminary correction to Miller's elements was made, therefore, and epochs of minimum were calculated so that plates offering significant data could be selected quickly from the Maria Mitchell Observatory (MMO) collection.

Complete light curves for eighteen separate years between 1932 and 1981 were plotted from MMO plates and from observations published by Miller, using the elements in equation (1). The differences between the phases of observed and calculated minima (O-C) were then plotted against time and new elements were indicated:

$$JD_{min} = 2434878.704 + 0.49797192\ E. \quad (2)$$

Estimates of brightness on about 450 MMO plates were then combined with 96 observations by Miller and 23 by Romano (1969), and plotted as light curves using these new elements. A mean light curve near minimum was drawn on tracing paper and aligned over each of these curves. Fifteen O-C values were determined by the difference in phase between the minimum of this curve and the predicted minimum, and plotted against time. They are shown in Figure 1.

A straight line, a parabola, and a cubic were fitted to these points using the least-squares method. The line indicates the elements

$$JD_{min} = 2435886.604 + 0.49797185\ E. \quad (3)$$
$$\pm 0.001 \quad \pm 1.2 \times 10^{-7}$$

The parabola corresponds to the elements

$$JD_{min} = 2435886.608 + 0.497971920\ E - 2.89 \times 10^{-11}\ E^2. \quad (4)$$
$$\pm 0.001 \quad \pm 9.2 \times 10^{-8} \qquad \pm 0.83 \times 10^{-11}$$

Comparison of the parabolic term with its mean error can be used to estimate its significance. In this case, it is over three times its error, which implies a high probability that the parabolic term is

real. This significance was also tested using the method of Pringle (1975), and was found to be at the 99.48% confidence level. There is less than 1% chance that the non-zero parabolic term is due to random fluctuation.

This functional form implies a constantly decreasing period which may be interpreted as evidence of interaction (for example, mass transfer) between the two members of the eclipsing binary. The data, however, exhibit a definite increase in period after about JD 2440000, so the cubic elements were evaluated in order to represent this change. These elements are

$$JD_{min} = 2435860.712 + 0.497971091E - 4.38\times10^{-11}E^2 + 1.902\times10^{-14}E^3, \quad (5)$$
$$\pm 0.001 \quad \pm 1.2\times10^{-8} \qquad \pm 0.21\times10^{-11} \qquad +0.016\times10^{-14}$$

The significance of the cubic term can be estimated by comparison with its error. In this case, it is more than 100 times its error, suggesting high significance and implying change in the interaction of the binary pair.

An alternate functional form suggested by Figure 1 is a parabola before JD 2440000 and a straight line thereafter. The theoretical value of this model, however, is questionable and therefore was not seriously investigated.

All estimates of photographic magnitude were made by comparison with five stars located near V726 Cyg, whose magnitudes were determined by Miller (1953). They are given in Table I.

When these stars were compared to A. Landolt's unpublished sequence near η Cyg, their magnitudes were revised. These revised magnitudes are also given in Table I.

The use of these new estimates results in a corrected light curve with maximum at magnitude 12.8 and minimum at magnitude 14.3.

I would like to thank Dr. A. Landolt for the use of his photoelectric data, and Dr. Emilia P. Belserene, Director of the Maria Mitchell Observatory, who provided much guidance and support. This work was funded by NSF Grant AST 80 05162 A01.

REFERENCES

Miller, W. J. 1953, Ric. Astron. 3, 1, 22-32.

Pringle, J. E. 1975, Month. Not. Roy. Astron. Soc. 170, 633.

Romano, G. 1969, Padova Publ. 156, 398.

TABLE I

Comparison Star Magnitudes for V726 Cygni

Star	Magnitude (Miller)	Magnitude (Ellingson)
a	12.23	12.0
b	12.79	12.9
c	13.14	13.3
d	13.45	14.0
e	13.71	14.2

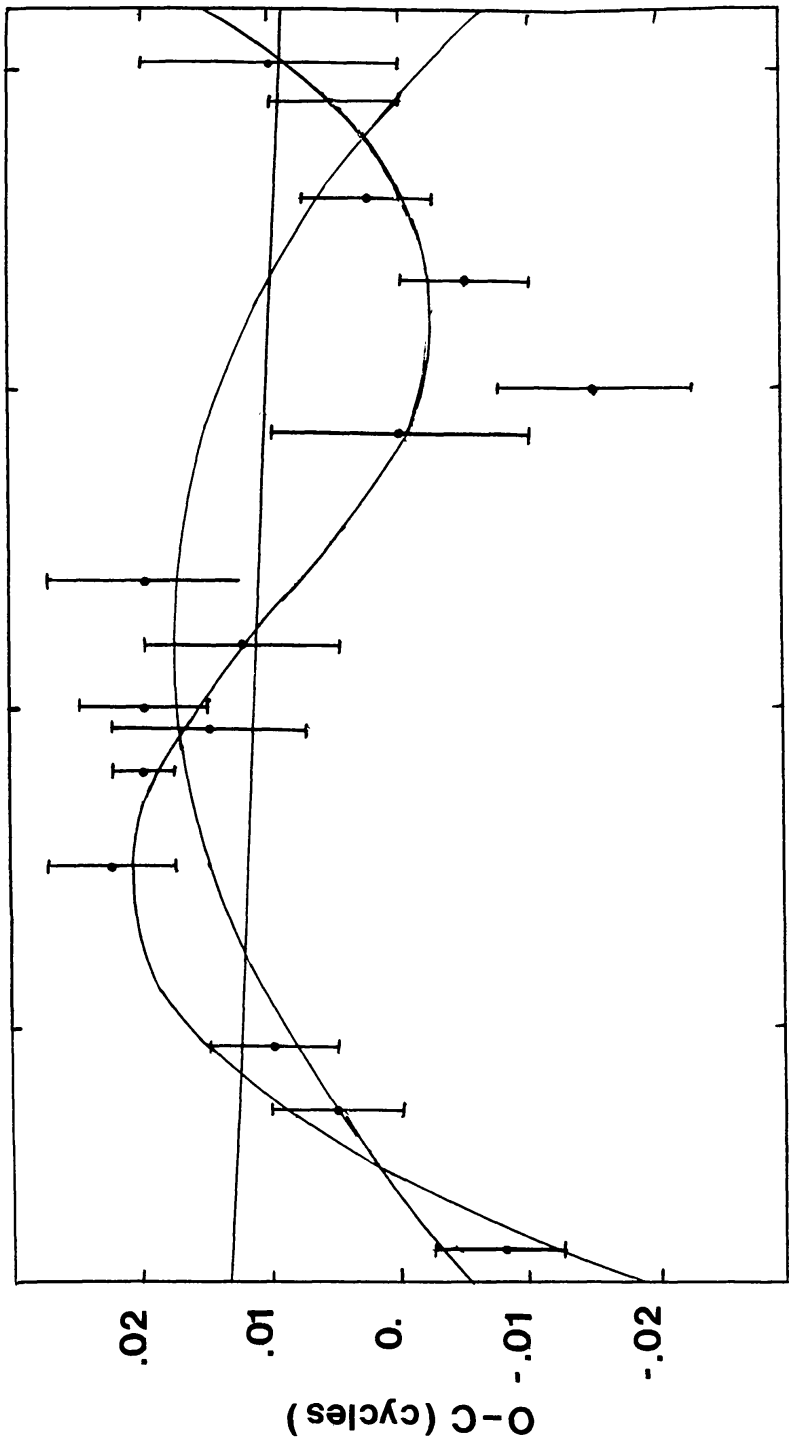

Figure 1. O-C diagram for V726 Cygni. Linear, parabolic, and cubic fits to the data are all shown above.