A RECENT STUDY OF V783 CYGNI

Julie Cross
Maria Mitchell Observatory
Nantucket, MA 02554

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Abstract

The addition of recent observations to earlier data lead to the conclusion that a single parabolic O-C curve may explain the past behavior of the RR Lyrae variable V783 Cygni, rather than two separate line segments as previously suspected. These new parabolic elements,

$$JD_{max} = 2436394.332 + 0.62069669\,E + 7.5 \times 10^{-11}\,E^2,$$

imply a gradual period increase at the rate of 0.088 $\pm$ 0.023 day/million years.

1. Introduction

V783 Cygni, (R. A. = $19^h\,51^m\,09^s$, Decl. = 40° 40′.4 (1950)) is an RR Lyrae variable of type RRab. The star was listed in the third edition of the *General Catalogue of Variable Stars* (GCVS)(Kukarkin *et al.* 1969) with the following elements:

$$JD_{max} = 2433261.0374 + 0.62069443\,E. \tag{1}$$

Loser (1979) revised this calculation and suggested a period increase from the proposed elements. Loser showed that the period of the star could be defined by two separate sets of elements:

for Julian Date 2424695 - 2433919:

$$JD_{max} = \underset{\pm 0.004}{2433261.029} + \underset{\pm 0.00000041}{0.62069487}\,E; \tag{2}$$

and for Julian Date 2438973 - 2444089:

$$JD_{max} = \underset{\pm 0.035}{2441122.778} + \underset{\pm 0.0000012}{0.6206994}\,E. \tag{3}$$

2. New Observations

To see if more recent observations would follow the same trends, plates at the Maria Mitchell Observatory dating from 1979 to 1990 were inspected and magnitudes estimated. Folded light curves of the data, grouped in sets of years according to an average number of data points, were created for both the newer estimates and for Loser's data, using heliocentric phases calculated with the use of equation (1).

3. Analysis

The comparison of the two sets of data revealed that the light curves maintained the same shape over time, but that period of the star had increased since Kukarkin's publication (1969).

By smoothing the folded light curves with an averaging program and building a mean light curve from the estimates from 1933 to 1960, O-C values were visually approximated. The graphs were then individually superimposed on the mean light curve and shifted to the right and left to determine the range in which the mean light curve would still correspond to the data. These measurements furnished O-C values and error bar lengths needed to construct the O-C diagram. A least squares program then used these values to calculate equations of a line and a curve that would give the smallest sum of the squares of the residuals for the provided values (Figure 1).

The parabola's calculations presented a coefficient for the squared term that was nearly four times larger than its mean error. The parabolic equation was then compared to the best single line in an F-test to verify the certainty that the squared term for the star's elements differ from zero (Pringle 1975). The results indicated that the probability that the coefficient of the squared term equaled zero amounted to one-half of one percent. Such a small uncertainty lends confidence to the hypothesis that the best elements to fit the data are indeed defined by a parabolic equation.

The new elements

$$\begin{array}{lllll} JD_{max} = & 2436394.332 & + 0.62069669\,E & + 7.5 \times 10^{-11}\,E^2 & (4) \\ & \pm 0.003 & \pm 0.00000016 & \pm 2.0 \times 10^{-11} & \end{array}$$

imply that the star is still undergoing a period increase at the rate of 0.088 $\pm$ 0.023 day/million years.

4. Acknowledgements

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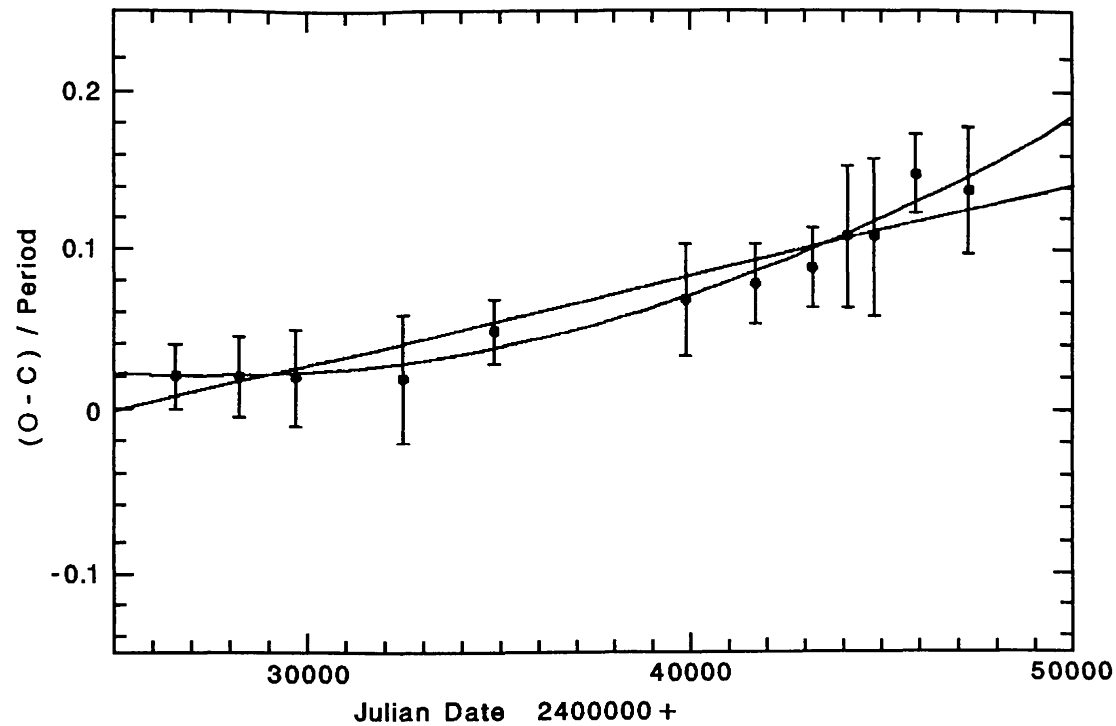

Figure 1. O-C vs. Julian Day for V783 Cygni, based on the elements in equation (4). The O-C diagram suggests that a parabolic curve fits the data better than two separate line segments as previously concluded.