RECENT DATA ON IY CYGNI

MARGARET G. LYSAGHT
Maria Mitchell Observatory
Nantucket, MA 02554

Abstract

The Cepheid variable IY Cygni was studied, and its O-C curve was found to be a straight line when compared to the original elements found by A. A. Wachmann. The new elements are:

$$JD_{(max)} = 2444005.769 \pm 0.056 + 21.75661 \pm 0.00070\ E. \quad (1)$$

Possible changes over time in the mean light curve are indicated.

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IY Cygni is a Cepheid variable in the southwestern part of the Cygnus cloud. It was discovered by C. Hoffmeister in 1929 and later classified as a possible RR Lyrae by P. Ahnert. L. Rosino classified it as a classical Cepheid with a period of approximately 21.8 days in 1941, which was then modified by A. A. Wachmann (1961) to be

$$JD_{(max)} = 2428449.93 \pm 0.17 + 21.75257 \pm 0.00075\ E. \quad (2)$$

I compared Wachmann's elements to data from an article by O. J. Eggen (1969) and plates from the Maria Mitchell Observatory plate collection, 1974 - 1986, then plotted the light curves and found values of O-C with the Observatory's non-linear least squares analysis program. A straight line was found by least squares fit, and the new elements derived from the O-C curve were (see Figure 1a):

$$JD_{(max)} = 2444004.977 \pm 0.129 + 21.75793 \pm 0.00053\ E. \quad (3)$$

An interesting point to make about IY Cygni is that the data from each of the three sources seem to indicate three different shapes for the mean light curve. In all data sets, the light curve has a rapid rise, a sharp peak, and a prominent secondary maximum on the descending branch. This secondary maximum appears with a different phase and amplitude in each of the data sets. I am not certain whether this is due to the differing methods involved in taking data, or if the changes in the light curve are caused by something astrophysical. Wachmann and I used the same comparison stars, but he used an iris photometer and I an eyepeice. Eggen's data were obtained photometrically. I have not ruled out either of these possibilities, as the changes in secondary maximum appear to be systematic (see Figures 2a-c).

Due to these rather unusual circumstances, I felt that comparing the data from Eggen and the Observatory plates to Wachmann's light curve was not a fair test for determining values of O-C. I therefore went through the calculation of the O-C curve a second time, using my newly-obtained elements and a mean light curve of the Maria Mitchell data. The result was a nearly horizontal line (see Figure 1b). Any curvature was deemed statistically insignificant by the F-test (Pringle 1975), so that a parabola would be due only to random fluctuation in the data. This curvature would imply a rate of change of -0.00085 ± 0.00076 cycles per century. The elements obtained from the second O-C diagram are:

$$JD_{(max)} = \underset{\pm 0.056}{2444005.769} + \underset{\pm 0.00070}{21.75661}\ E. \qquad (4)$$

Although Wachmann contends that IY Cygni is a population I Cepheid, I can find no evidence that its spectrum or radial velocity curve has ever been studied. We have limited equipment at the Maria Mitchell Observatory and are therefore constrained to rely on the shape of the light curve to distinguish between Cepheids of the two types (Payne-Gaposchkin 1954). Unfortunately, the light curves of the two types become indistinguishable from one another around a period of about twenty days, and so it is impossible for me to tell to which population IY Cygni belongs. The star is located approximately 610 parsecs above the galactic plane (Fernie 1968), which leads me to believe that it is population II, but without the proper spectroscopic data, this evidence alone is hardly conclusive.

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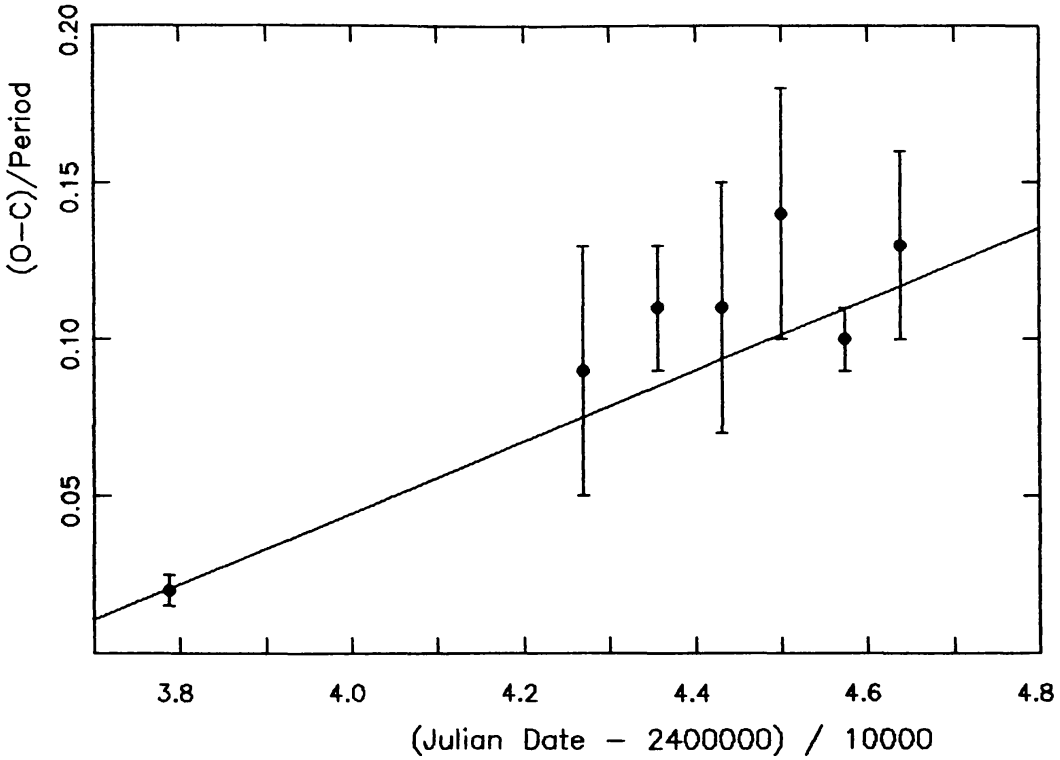

Figure 1a. Original O-C diagram for IY Cygni. Data from O. J. Eggen (1969) and Maria Mitchell plates were compared to A. A. Wachmann's (1961) original elements and light curve.

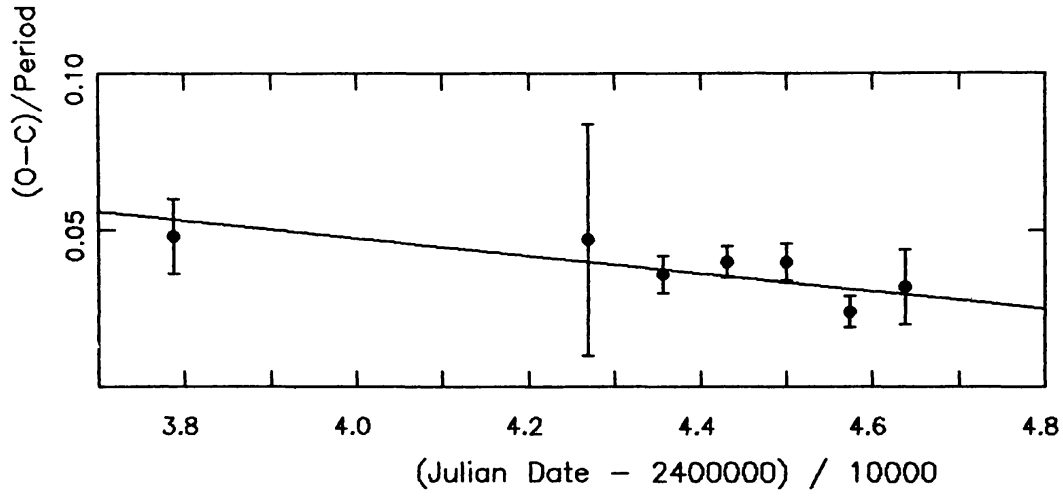

Figure 1b. Second O-C diagram for IY Cygni. The data were compared to the new elements and the mean light curve of the Maria Mitchell data.

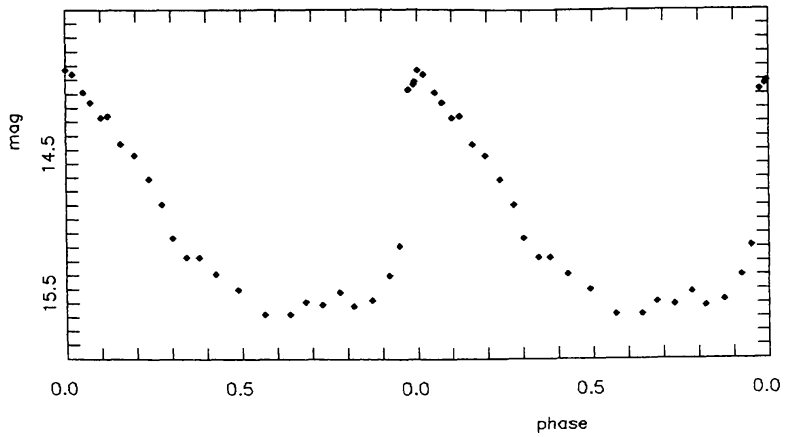

Figure 2a. Mean light curve of IY Cyg, calculated by A. A. Wachmann (1961). The data run from roughly 1936 to 1956. Abscissae are in photographic magnitudes, ordinates are in fractions of period.

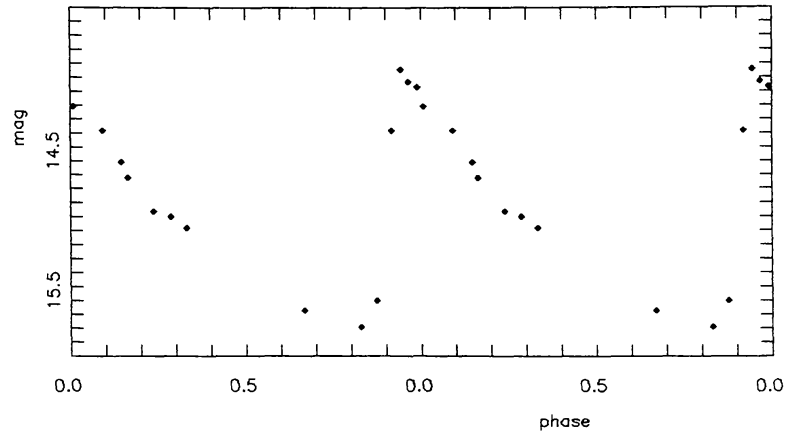

Figure 2b. Photoelectric data (B magnitudes) of IY Cyg taken by O. J. Eggen (1969) in 1963. I found no offset between photographic and B magnitudes. Abscissae are in photographic magnitudes, ordinates are in fractions of period.

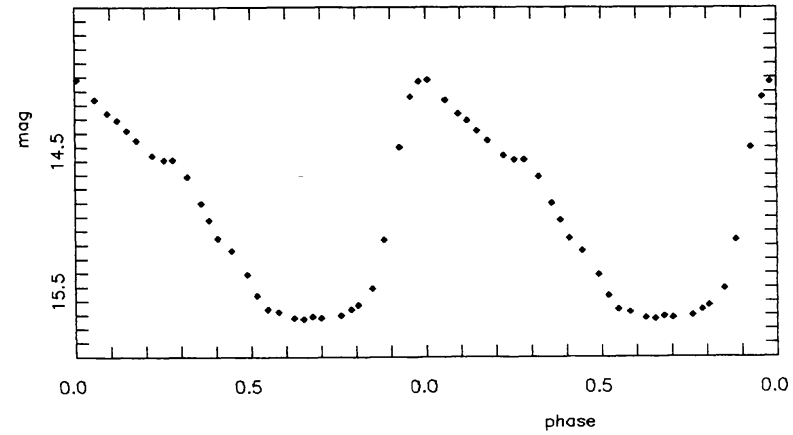

Figure 2c. Mean light curve of IY Cyg calculated by the author using data from the plate collection of the Maria Mitchell Observatory in the years 1974 - 1986. Abscissae are in photographic magnitudes, ordinates are in fractions of period.