A REVISED PERIOD FOR THE LONG-PERIOD VARIABLE, Y CAPRICORNI

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Abstract

The AAVSO's visual light curve of the long period variable, Y Capricorni, indicates that the published period should be approximately doubled, but the derived value is rejected because the data are poorly distributed, and two of the visual comparison stars are variable. Photographic data lead to a revised period of 411.76 days.

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1. Introduction

Y Capricorni ($\alpha = 21^h\ 28^m.56$, $\delta = -14^o\ 25'.1$ (1900)) is a long-period variable whose period is given in the Third Edition of the General Catalogue of Variable Stars (Kukarkin et al. 1969) as $205^d.77$. However, the AAVSO's 70-year light curve of Y Cap indicates that the true period is approximately 411 days. The project of revising the period of Y Cap was begun by Douglas Edwards, on leave from Brown University, while he was at the AAVSO. The project has now been completed by the author.

2. The Visual Light Curve

Y Cap was first noted to be variable by C. H. F. Peters in 1884. He observed it over the next four years, and in 1888 reported that he suspected the period to be approximately 413 days (Peters 1888). Over the next several years observations continued few and far between, but in 1893, H. M. Parkhurst observed a doubtful possible maximum (Parkhurst 1893). S. Chandler, deriving the elements for Y Cap at this time, incorporated these dubious observations into his calculations, and determined the period to be half of Peters', or 206 days (Müller and Hartwig 1920). Chandler's elements for Y Cap are:

$$\text{J.D. (Max)} = 2409790 + 206^d E.$$

Parkhurst, the astronomer whose observations had led Chandler to give the period as 206 days, continued to observe Y Cap, and noted that he believed the period should be doubled to 414 days (Parkhurst 1894). In fact, he states that the period of Y Cap was 412 days (Parkhurst 1898). This value was not adopted, however, apparently because of inconsistencies in the visual data.

If the very earliest visual data for Y Cap are examined, it is evident that all observations are of maxima; there are virtually no observations fainter than $13^m.0$. However, a light curve of these early data made with $p = 206^d$ shows a very wide scatter around maximum (see Figure 1). Even when the period is doubled to 412 days, and Parkhurst's doubtful possible maximum is deleted, there still is considerable scatter (see Figure 2). Although the reduction in the scatter supports the doubling of the period, the large remaining scatter indicates inconsistencies in the data.

An examination of the early AAVSO data also reveals inconsistencies, as some doubtful and definitely non-existant maxima were reported (Campbell 1907, 1912). With minimal editing of these data, a peri-

od analysis reveals a value of 415.22 days. The light curve in Figure 3 utilizes these edited AAVSO visual data. The value of 415 days was not adopted, however, because as Y Cap has always been very sparsely observed, more observations are still needed for confirmation.

3. The Photographic Light Curve

The period derived from the visual data, and, in fact, any value based on visual observations was rejected for an additional reason. The period of Y Cap is just over a year in length, and so there are spans of several years during which the maximum occurs while the star is in an unfavorable position for viewing. Thus, there are gaps in the light curve. These gaps have been intensified by stretches of low numbers of observations, no doubt resulting from the increased difficulty in observing the star. In examining the Harvard College Observatory's plate collection in an effort to reduce some of these gaps, it was discovered that two of the comparison stars in Y Cap's sequence are variables themselves. Unfortunately, these two stars, marked $13^{m}.1$ and $14^{m}.3$, would most likely be used by observers following Y Cap through a maximum. Use of these stars is undoubtedly responsible for a considerable amount of the inconsistency in the visual data. Figure 4 is a finder chart for Y Cap, and shows the two variable comparison stars as well.

The photographic data obtained, therefore, was used to revise Y Cap's period. Period analysis of these data reveals a value of 411.76 days. New elements for Y Cap are therefore given as:

$$\text{J.D. (Min)} = 2416590 + 411^{d}.76E.$$

Figure 5 is a light curve of Y Cap, obtained from photographic data and utilizing a period of 411.76 days.

Analysis of the two variable comparison stars has not yet been completed.

4. Acknowledgements

The untiring efforts of AAVSO observers, monitoring this difficult star for so many years, are acknowledged with thanks.

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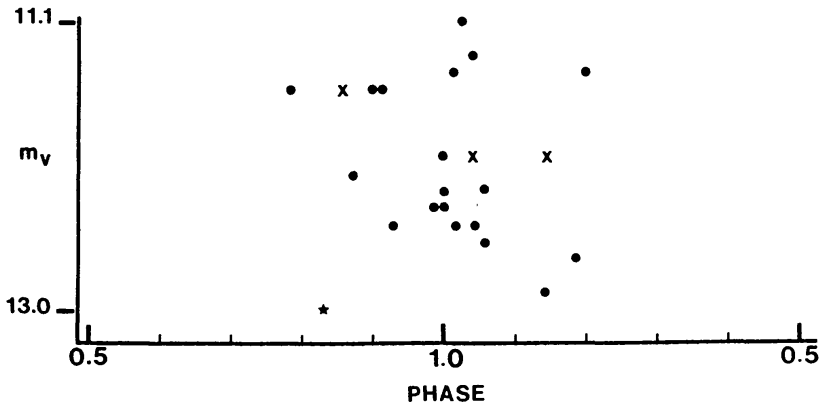

Figure 1. Light curve of Y Cap, pre-AAVSO visual data. Observations made by H. M. Parkhurst are indicated with ●; J. M. Pereira with x; and C. H. F. Peters with *. Period used is Chandler's value of 206 days.

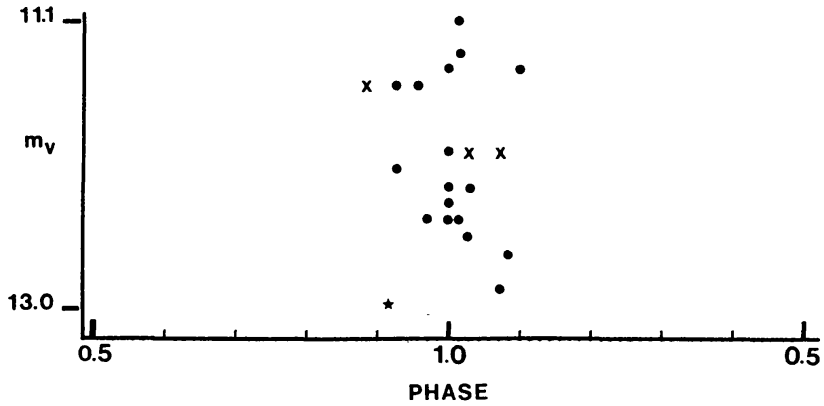

Figure 2. Light curve of Y Cap, pre-AAVSO visual data. Observations made by Parkhurst are indicated with ●; Pereira with x; and Peters with * . Period used is double Chandler's, or 412 days. Doubtful possible maximum of Parkhurst's has been deleted (see text).

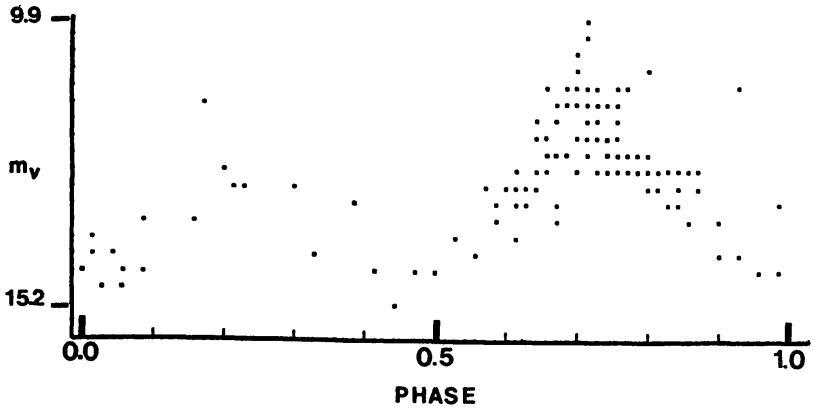

Figure 3. Light curve of Y Cap, AAVSO visual data. Period used is best fit to visual data, 415.2 days. This value is rejected as the suggested revised period for Y Cap because of variability of comparison stars.

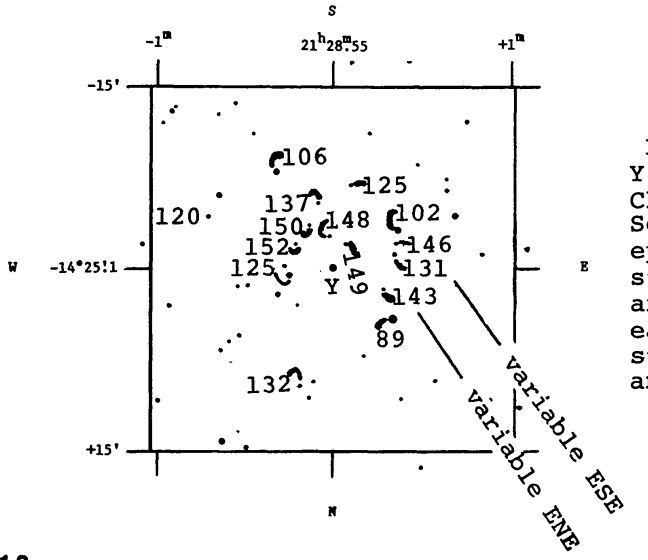

Figure 4. Finder chart for Y Cap, from AAVSO Standard Chart "d" for Y Cap, 2128-14. Scale is 20" - 1 mm, and epoch is 1900.0. Comparison stars found to be variable are the $13^m.1$ star to the east southeast and the $14^m.3$ star to the east northeast, and are so marked.

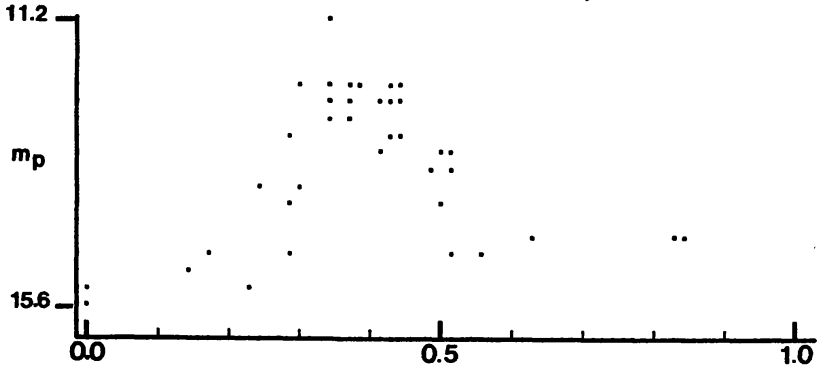

Figure 5. Light curve of Y Cap, photographic data from Harvard College Observatory plate collection. Period used is best fit to photographic data, 411.76 days. This value is the suggested revised period for Y Cap.