NEW PERIODS FOR TWO W VIRGINIS TYPE VARIABLES

MELANIE MITCHELL
Maria Mitchell Observatory
Nantucket, MA 02554

Abstract

Brightness estimates of V377 Sgr and V741 Sgr, two W Virginis type variables, were made for 650 Nantucket plates. Variations in the period of V377 Sgr were discovered and four new sets of elements are given to satisfy observations made over four separate intervals of time. A newly refined period is given for V741 Sgr.

* * * * *

1. Introduction

V377 Sgr and V741 Sgr are two W Virginis (population II Cepheid) type variables. During the summer of 1979 I estimated the brightnesses of these variables on 650 Nantucket plates. Estimates were made in steps between comparison stars and were later converted into magnitudes for V377 Sgr.

2. V377 Sagittarii

This star is listed in the 1974 supplement to the General Catalog of Variable Stars as having a period of $16^{d}.19647$, with a note that the period may be increasing. Using the elements

$$J.D.(Rise) = 2437171.60 + 16.19647\ E \qquad (1)$$

I obtained a mean light curve from my estimates in the years 1960-1964. This light curve exhibited a broad, flat maximum typical of some W Virginis stars (Figure 1). Thus it is difficult to give an exact epoch of maximum (Kwee and Braun 1967). An approximate epoch of maximum is J.D. 2437175. For my analysis I defined a new epoch as the time on the rising branch at which the brightness of the variable equals the brightness on the descending branch 4/10 cycle later. By fitting observations from individual seasons to the mean light curve, I determined the phase of this rising branch point for each season. This point is called the"observed phase" for a certain season. I plotted this observed phase minus the computed phase (O-C) of rising branches from each observing season versus Julian day. In successive seasons there were appreciable shifts of the rising branch in both directions, which indicated that the period was not constant. It was possible to draw a sequence of four straight line segments through the O-C points (Figure 1). The method of least squares was used to obtain three of the lines; one line is defined by only two points. A line segment with positive slope indicates that the period for that time interval was larger than the period used in computing the phase; a negative slope means a shorter period than the period used.

From the slopes of these lines I determined new elements for the four included time intervals.

Years	Elements	Mean Error in Period
1958-1960	J.D.(Rise) 2436363.50 + 16.1575 E	$\pm 0^d.0035$
1962-1965	J.D.(Rise) 2437867.62 + 16.1925 E	$\pm 0^d.0008$
1969	J.D.(Rise) 2440119.36 + 16.2407 E	
1971-1978	J.D.(Rise) 2441157.64 + 16.19160 E	$\pm 0^d.00038$

The point at J.D. 2438240 and O-C = 0.96 was obtained from photoelectric observations made by Kwee and Braun. The points at J.D. 2443376 and J.D. 2443748 are uncertain due to the small number of available observations in those seasons (2 and 3 respectively).

In summary, the above observations can be explained by three period changes: two increases and one decrease (by an average of 0.27% of the period) over a time span of approximately twenty years.

3. V741 Sagittarii

This star has a published period of $15^d.1651 \pm 0^d.0008$ m.e. (Kwee and Braun, 1967). I chose as the epoch of this star the time of maximum brightness defined by a hump in the light curve (Figure 3). The observed minus calculated (O-C) phase of a maximum point for each season was plotted versus Julian day (Figure 4). A single line with positive slope was fitted to these points by the method of least squares. Revised elements for V741 Sgr are:

$$\text{J.D.(Max.)} = 2436213.58 + 15.16817\ E \pm 0.00007 \text{ m.e.}$$

The relative difference between the new and old periods is 0.02%.

This work was done at the Maria Mitchell Observatory under the direction of Dr. Emilia P. Belserene and was supported by National Science Foundation grant number AST 7807405 A01. I would like to thank Dr. Belserene for her assistance and counsel throughout this project.

REFERENCES

Kukarkin, B. V. et al., 1974, General Catalog of Variable Stars, Second Supplement, Moscow.

Kwee, K. K. and Braun, L. D. 1967, Bull. Astron. Inst. Netherlands, Supp. Ser., 2, No. 3, p. 91.

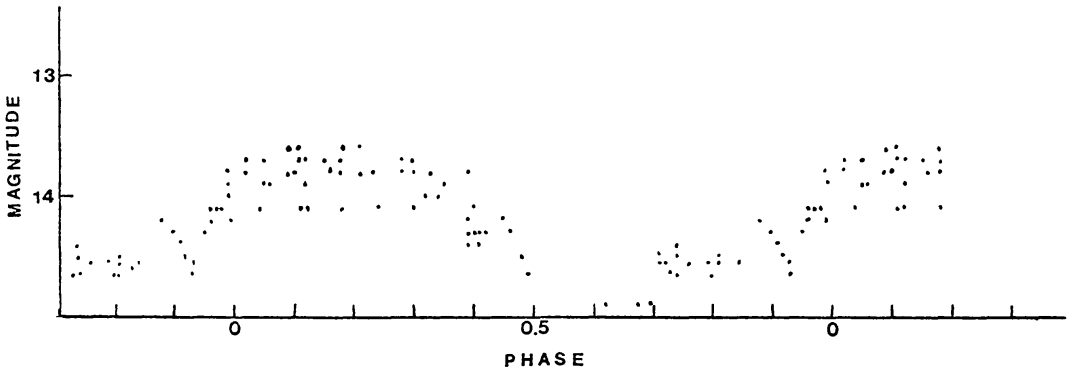

Figure 1. Photographic light curve of V377 Sagittarii.

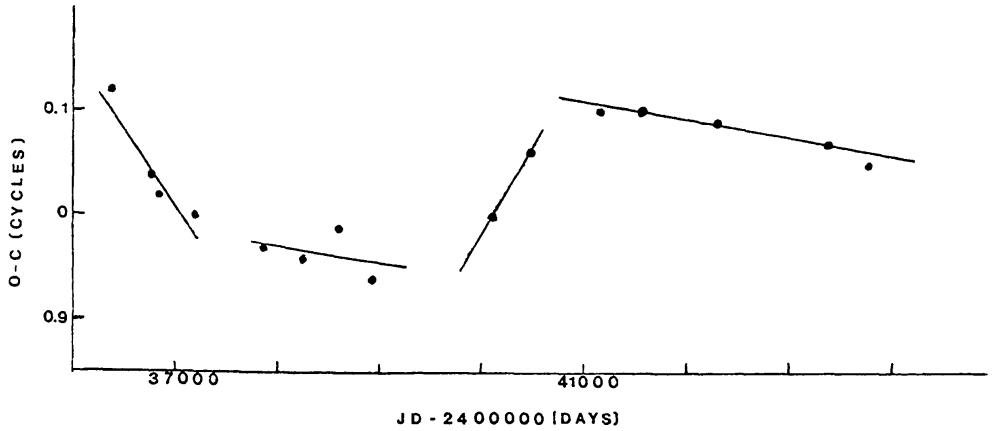

Figure 2. O-C diagram of V377 Sagittarii.

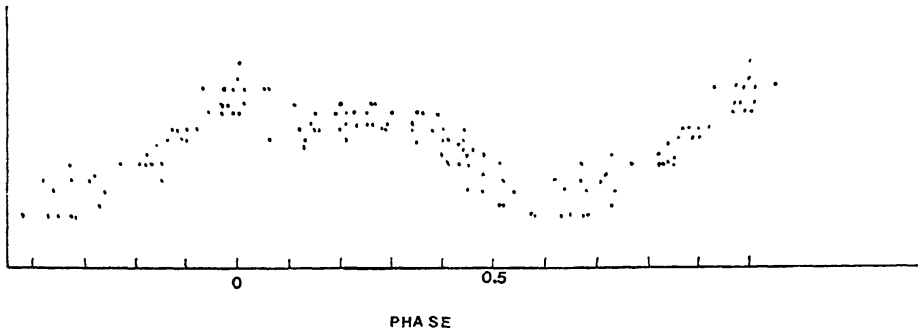

Figure 3. Photographic light curve of V741 Sagittarii. Brightness is in arbitrary units.

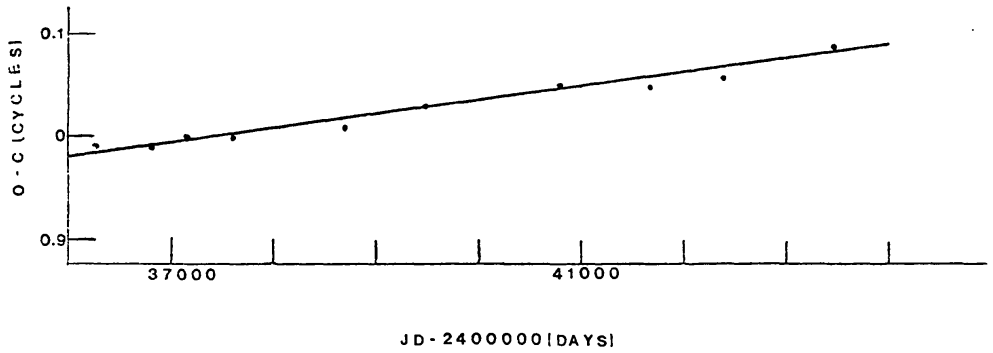

Figure 4. O-C diagram of V741 Sagittarii.