V3820 SAGITTARII

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Abstract

It is shown that the period of V3820 Sagittarii ranges from 13.04 to 13.17 days with an average of 13.098 days for the interval 1923 - 1987. The shape of the light curve also changes.

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V3820 Sgr has been announced as a possible Cepheid with a period between 13 and 15 days (Hoffleit 1972). To check these suggestions, data from the Maria Mitchell Observatory's Sagittarius plates were analyzed. In addition, unpublished data from Harvard A-series plates (Bruce 24-inch telescope) were used. A total of 778 plates ranging in JD from 2423621 to 2446997 (1923-1987) was used.

Period searches on the data gave periods close to 13 days but not the same in different years. For further study the data were grouped in 12 subsets containing 50 to 100 observations each. The periods which best represent these subsets range from 13.04 to 13.17 days. The data for each subset were plotted at the period that best fit each individual group of years. The plots of magnitude vs. phase showed changes in the shape of the light curve. Figure 1 and Figure 2 are examples.

Each of the plots was used to find a representative date of maximum during the time interval of the particular group. The method was to read the phase of maximum from the plot and use it to apply a correction to the epoch of maximum that had been used in calculating the phases. If we let C_i and P_i stand for the epoch and period used for the i^{th} plot, then the desired observed date of the i^{th} maximum, O_i. is found from the ith phase of maximum, PH_i, by using the equation:

$$O_i = C_i + P_i * PH_i \qquad (1)$$

To combine the 12 dates into a single O-C diagram, it is necessary to adopt a definition of C. I chose the average period, $\langle P \rangle$ = 13.0991 days and an arbitrary epoch, JD 2442252.641. The time interval elapsed since the epoch can be expressed as a whole number of cycles, n, and fraction, ϕ, calculated from the following equation:

$$n + \phi = (O_i - 2442252.641)/13.0991 \qquad (2)$$

These values of ϕ and their error bars plotted against JD are shown on the O-C graph in Figure 3. The error bars are from my estimates of the uncertainty in the phases of maximum read from the 12 light curves.

The values of ϕ are widely scattered on the O-C graph and neither the line nor the parabola fit very well. Deviations reach several tenths of the average period. One might question whether the values of n in equation (2) were always assigned correctly. Should some of the values of ϕ be increased or decreased by a whole cycle? The assignment of n was checked from the results of the period searches.

In conclusion, V3820 Sgr does not appear to be a typical Cepheid in its period behavior or in the shape of its light curve. The variations of the period cannot be described by simple linear or parabolic elements. More observations would be useful to examine the possiblity of long term patterns in the variations of the period and light curve.

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REFERENCE

Hoffleit, D. 1972, **Inf. Bull. Var. Stars**, No. 660.

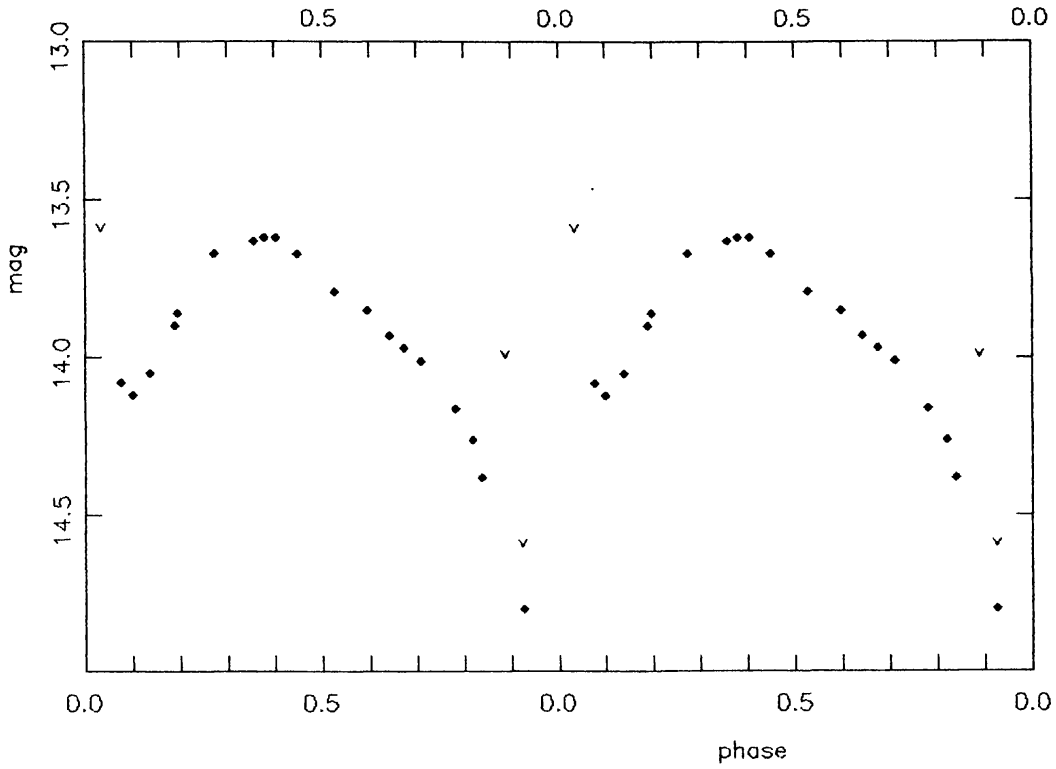

Figure 1. Smoothed light curve of V3820 Sgr in 1961-1963.

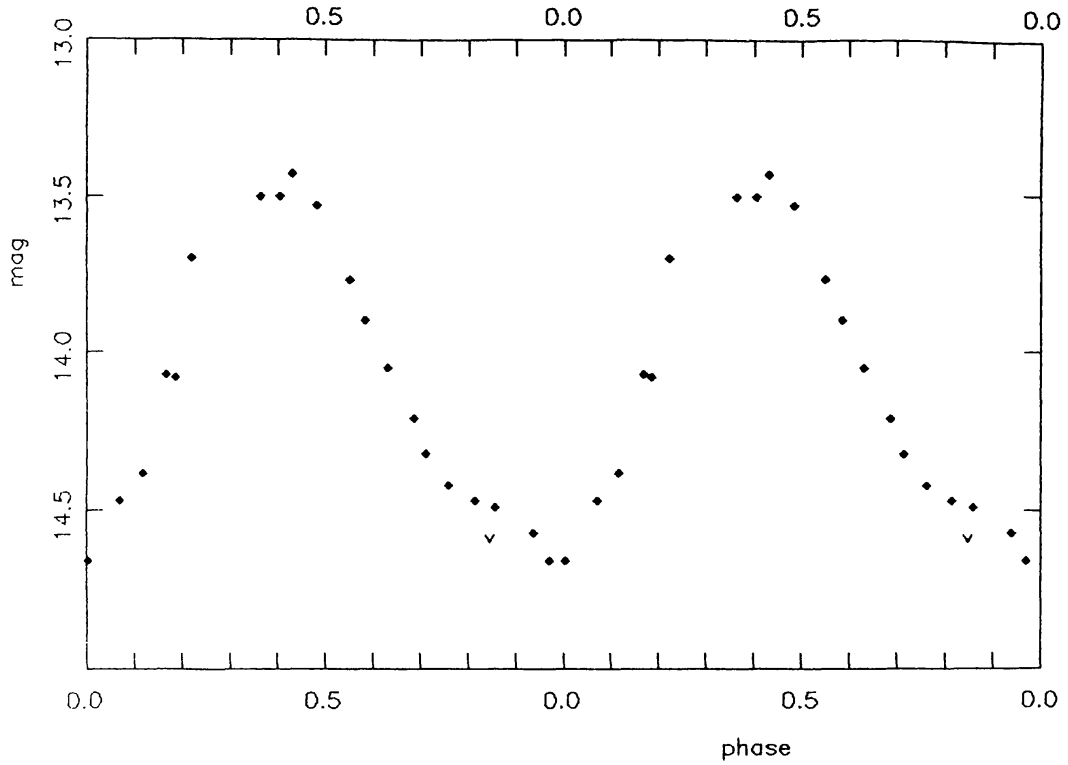

Figure 2. Smoothed light curve of V3820 Sgr in 1923-1925. Here the shape is very different; both rise and fall in magnitude are sharper.

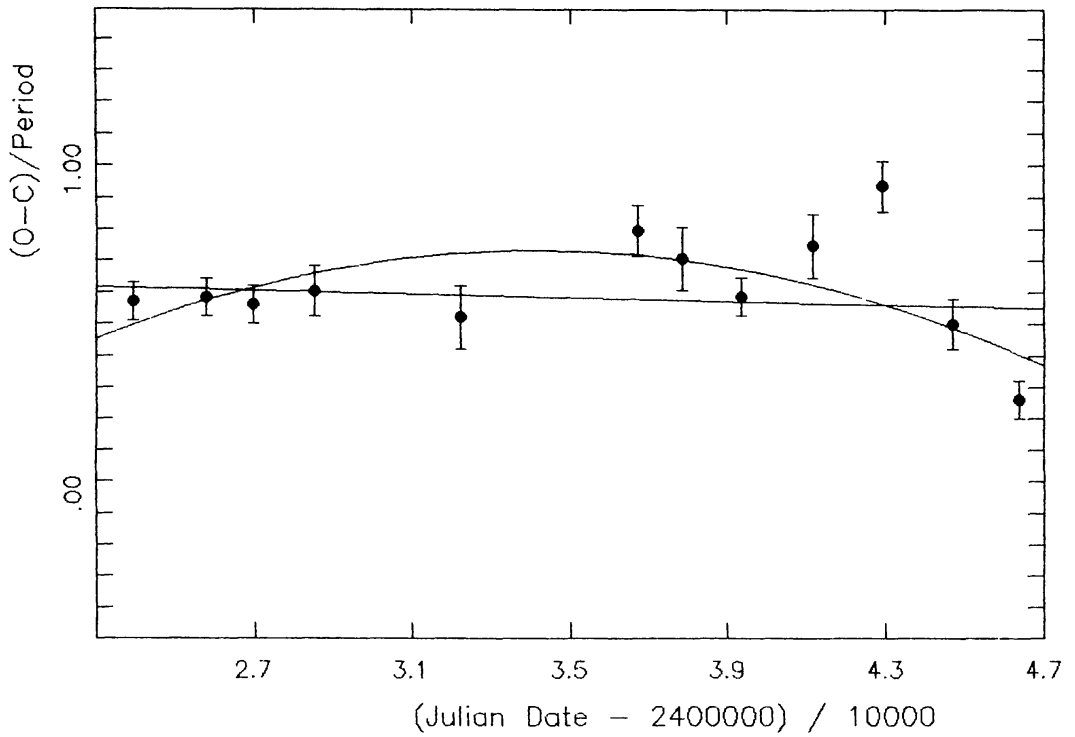

Figure 3. O-C diagram for V3820 Sgr for 1923-1987, with C = 2442252.641 + 13.0991 E. The large dispersion of the points results in a poorly fitted line and parabola.