THE CHANGING PERIOD OF V1303 SAGITTARII

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Abstract

V1303 Sgr, an 18-day Population II Cepheid, was studied for period changes. The deviation from a constant period was found to be statistically significant, and the data indicate that the period is decreasing at the rate of 0.0025 cycle per century. The new elements are:

$$JD_{(max)} = 2439011.426 + 18.4527\ E - 0.0000117\ E^2. \quad (1)$$

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Data from V1303 Sgr were gathered from three sources: the photographic plates at the Maria Mitchell Observatory, research by P. Th. Oosteroff and J. A. Horikx (1954), and research by K. K. Kwee and L. D. Braun (1967). The reference elements were taken from the **Second Supplement to the General Catalogue of Variable Stars** (Kukarkin et al. 1974):

$$JD_{(max)} = 2438241.176 + 18.46812\ E. \quad (2)$$

An average light curve of magnitude vs. phase was made from selected photographic data (1978-1982) and is illustrated in Figure 1. For the Maria Mitchell and Kwee data, light curves of magnitude vs. phase for intervals of less than two years were plotted. To find the O-C values, each of these plots was compared to the average light curve by a non-linear least squares analysis on the Maria Mitchell Observatory's computer. Additional O-C values were computed solely from the observed times of maximum brightness in the Oosteroff and Horikx paper.

The best fitting parabola for all of the O-C data was computed by least squares and is shown in Figure 2. The significance of the curvature was verified by a statistical F-test (Pringle 1975). Fear that the 15 Oosteroff O-C values, although given lower weight, would mold the curve into a parabola forced me to fit a parabola to the other points alone.

The new elements from all of the data are:

$$JD_{(max)} = \underset{\pm 0.077}{2439011.426} + \underset{\pm 0.0004}{18.4527}\ E - \underset{\pm 0.0000009}{0.0000117}\ E^2. \quad (3)$$

The new elements from the data without the Oosteroff points are:

$$JD_{(max)} = \underset{\pm 0.09}{2439011.46} + \underset{\pm 0.0009}{18.4533}\ E - \underset{\pm 0.0000038}{0.0000146}\ E^2. \quad (4)$$

Figure 2 shows the modern curve and its confidence limits plotted with all of the data points. The confidence interval was calculated according to an extension of the method given by Brandt (1978) for regression lines. The least squares parabola gives the best estimated O-C curve. The confidence curves, surrounding the parabola, mark an interval of plus and minus one standard deviation. Thus, the probability that a true O-C value lies within the pictured interval is 68%. Most of the older data fell directly within the derived confidence limits of the newer curve. In fact, the two curves are consistent within the expected error. This suggests that the curve is

a true representation of the recent period behavior of the star., because, as illustrated, an extrapolation of the modern curve would give the approximate position of the older points. The rate of change of period, based on all of the data, is -0.0025 cycle per century.

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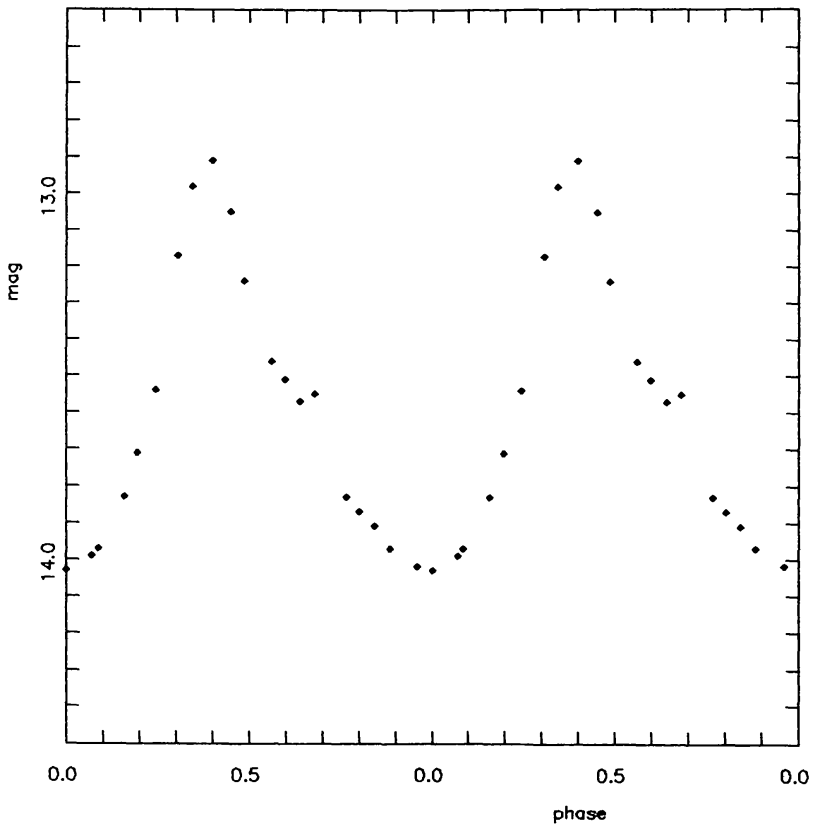

Figure 1. Average photographic light curve for V1303 Sgr. The magnitude vs. phase points were calculated by averaging 1978-1982 data in 20 overlapping intervals of width 0.01 in phase.

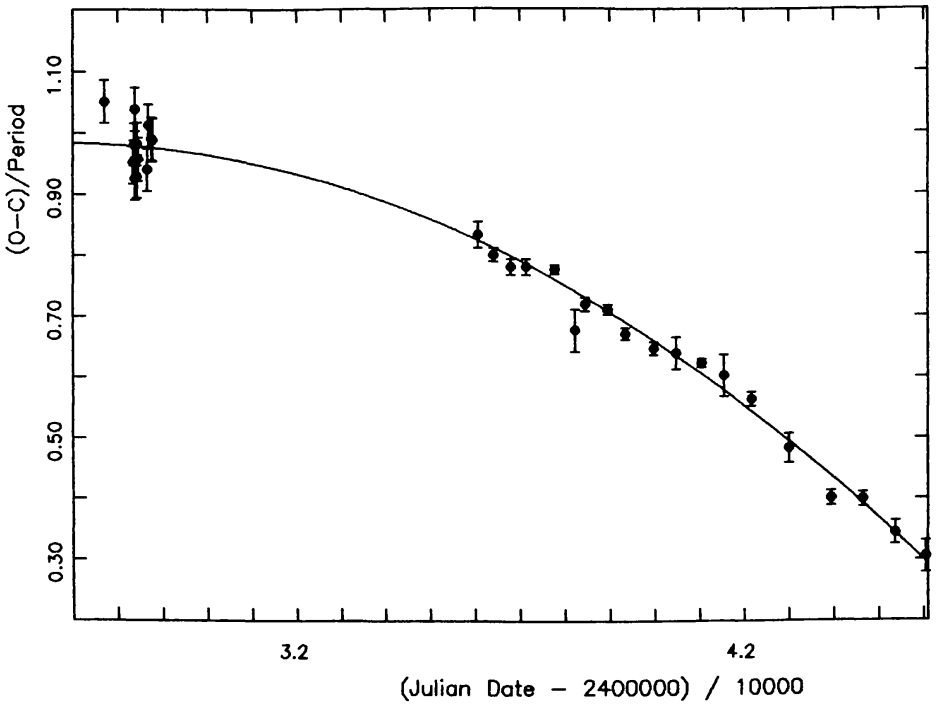

Figure 2. O-C graph for V1303 Sgr with least squares parabola, using all of the available data. The data within the range JD 2427000-2429000 are by Oosteroff and Horikx (1954). The point at JD 2438230 is from Kwee and Braun. The rest are from Maria Mitchell Observatory plates.

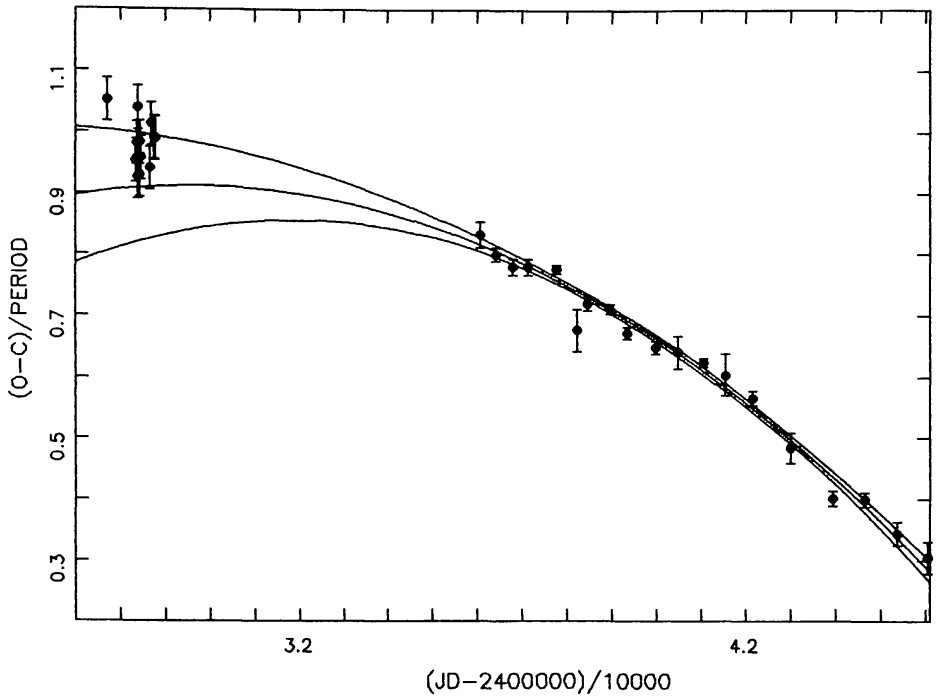

Figure 3. O-C graph for V1303 Sgr, phase shift vs. Julian Date, containing the same data points as Figure 2. The three curves are the least squares fit to the modern data (JD 2434000-2446100) and its upper and lower confidence limits.