NEW ELEMENTS FOR V1182 SAGITTARII

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Received 15 December 1988

Abstract

V1182 Sagittarii, an RR-Lyrae type variable, subclass ab, was examined for deviations from the published elements. The new elements are:

$$JD_{(max)} = 2439964.3626 + 0.44086588\ E.$$

Based on new magnitude determinations for a comparison sequence, the variable was found to range in magnitude from 11.9 to 13.1, photographic.

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1. Introduction

V1182 Sagittarii is an RR-Lyrae type variable, subclass ab. Elements are listed by Oosterhoff and Horikx (1952):

$$JD_{(max)} = 2428461.284 + 0.440866\ E. \quad (1)$$

In this study, the star is examined for deviations from the published elements.

2. Data

Data on V1182 Sgr were gathered from two sources: the plate collection at the Maria Mitchell Observatory (MMO) and times of maximum published by Oosterhoff and Horikx (1952).

Over 900 photographic plates with centers in the Sagittarius field have been taken at MMO since 1924. Most of these contain images of V1182 Sgr. Magnitudes were estimated by comparing V1182 Sgr with the sequence stars identified in Figure 1.

The magnitudes of the sequence stars were determined by iris photometry calibrated by photoelectric **B** magnitudes in Sequence 1804-3053 (Warren et al. 1976). Photometry in the Sagittarius field is very difficult due to the large variation of background light within the field. In the case of V1182 Sgr, the field surrounding the variable is in a more crowded region of the sky than the field of known magnitudes. Iris readings of the background in the two fields differ by approximately 50-60 iris units, too large to ignore; on a typical calibration curve, 50-60 iris units correspond approximately to 0.45 magnitude. However, if it is assumed that the background variations are negligible over a field of 10 or 20 arcminutes, the following method should correct for the difference between the background densities in two such fields.

A section of clear sky near the stars of known magnitudes is brought in range of the iris, and the iris is set to an appropriate size. (See Cuffey 1956 for an explanation of iris photometry). The reference beam is then adjusted until its brightness equals the brightness of the light coming through the iris. This setting is maintained while readings are taken of the stars of known magnitude.

When the data for this field have been taken, the field is changed to a region of clear sky near V1182 Sgr. Instead of proceeding with photometric readings, however, the iris is reset to the same size it had on clear sky in the other field, and the brightness of the reference beam is adjusted until it equals the brightness of the light coming through the iris at this position on the plate. Readings of the V1182 Sgr sequence stars are taken with this new setting of the reference beam.

Using the data from the stars of known magnitude, a calibration curve of Iris Reading vs. **B** Magnitude was plotted. This curve was used to determine the photographic magnitudes of the sequence stars. Magnitudes of the sequence stars are given in Table I, Column 2. Column 3 lists photographic magnitudes for three of the sequence stars, which had been previously determined by means of star counts (Oosterhoff and Horikx 1952).

Admittedly, the difference between the two sets of magnitudes is quite large. It should be noted, however, that the Oosterhoff and Horikx magnitudes had been determined only by means of star counts, rather than photometry (Oosterhoff and Horikx 1952). For this analysis I have adopted the magnitudes determined by iris photometry.

3. Data Reduction and Analysis

The MMO data were partitioned into bins consisting of observations from two-year periods. Each of these bins was used to create folded light curves using the elements in equation (1). A mean light curve was constructed, using data from 1924 through 1978, and is illustrated in Figure 2. The light curve shows the range of magnitude variation to be 11.9 to 13.1 photographic.

O-C values were calculated for each of the bins from a non-linear least-squares fit, using the mean light curve as the basis for comparison. This method, discussed in detail by Belserene (1986), determines the best fit for the entire curve, rather than just maximum or just the rising or descending branch. It is consistent in the way it locates the maximum on the separate curves.

The Oosterhoff and Horikx paper listed observed times of maximum brightness. Using these data, O-C values were calculated and averaged in bins of two to three years. They are plotted in Figure 3 together with the MMO data.

The method of least squares was used to determine the best fitting line and parabola for all the O-C data. Of the two functions, the resulting line appeared to be the best fit (see Figure 3). A straight line implies a constant period, and the negative slope indicates that the period has been shorter than that given in equation (1). The revised elements are listed below:

$$JD_{(max)} = \underset{\pm 0.0008}{2439961.3626} + \underset{\pm 0.00000010}{0.44086588}\ E. \qquad (2)$$

The least-squares parabola is also illustrated in Figure 3, and it appears to fit the data reasonably well. The parabolic elements are:

$$JD_{(max)} = \underset{\pm 0.009}{2439964.363} + \underset{\pm 0.00000010}{0.44086583}\ E \ - \underset{\pm 0.06 \times 10^{-11}}{0.10 \times 10^{-10}}\ E^2. \qquad (3)$$

However, the F-Test (Pringle 1975) yielded a probability of 12 percent that the curvature is due to chance deviations from the line. Since this is larger than 5 percent, the parabola is not considered a significant improvement.

4. **Acknowledgements**

I would like to thank Dr. Emilia P. Belserene for all of her time, assistance, support, and patience. This research was funded by National Science Foundation grant AST 86-19885.

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TABLE I

Comparison Sequence for V1182 Sgr

Star	Iris Photometer Magnitude	Oosterhoff and Horikx Magnitude
A	11.6	--
B	12.3	13.0
C	12.4	13.4
D	13.1	14.1
E	14.0	--

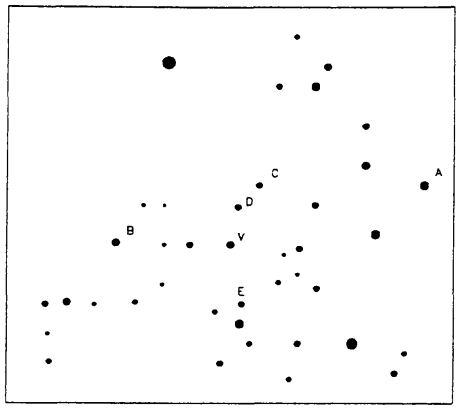

Figure 1. Finder chart for V1182 Sgr. The variable is labelled V, and the sequence of comparison stars is marked in the figure. The field shown is approximately 20.6 arcminutes in diameter.

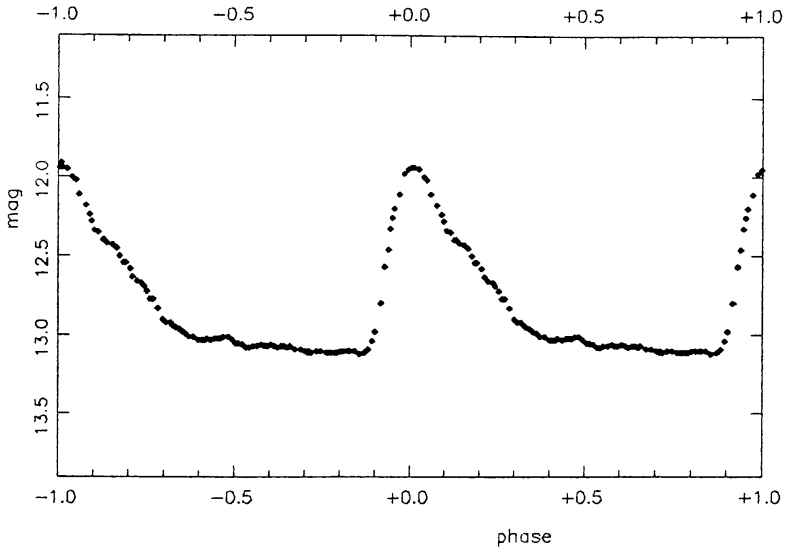

Figure 2. Mean light curve for V1182 Sgr, calculated using data from the MMO plate collection. Phase is in fractions of the period. The magnitudes are photographic, in the system of Table I, Column 2.

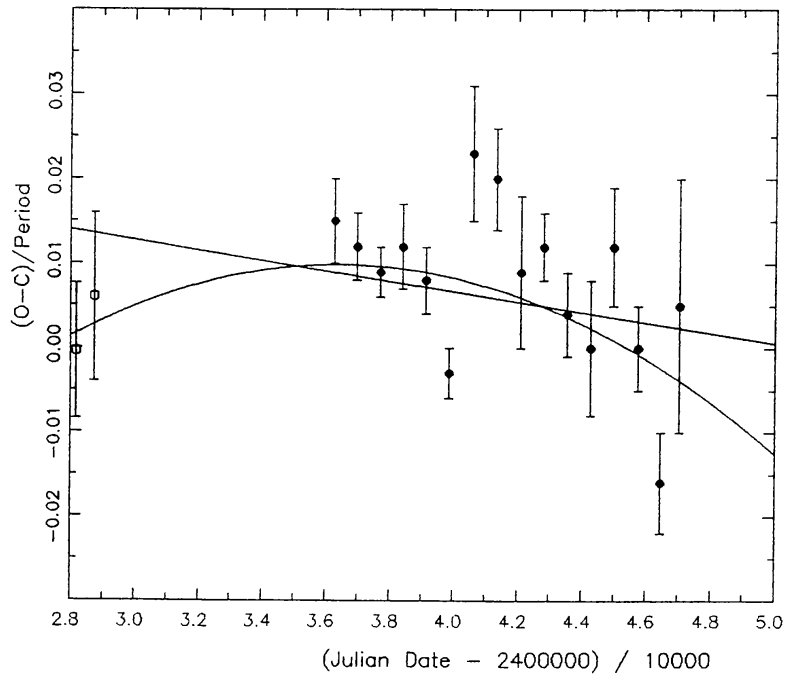

Figure 3. O-C curve for V1182 Sgr, using both the Oosterhoff and Horikx data (open circles) and the MMO data (filled circles). The two curves are the best fitting least-squares line and parabola.