AN UPDATE ON THE PERIODICITY OF V363 CASSIOPEIAE

JEAN NOWAKOWSKI
Maria Mitchell Observatory
Nantucket, MA 02554

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Abstract

V363 Cassiopeiae, an RR Lyrae star, was studied for change in period. New elements have been determined and a finder chart has been produced.

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This study of V363 Cassiopeiae began with a search of the literature for a finding chart. Perova's (1959) work on GR13 agrees in position with the entry for V363 Cas in the **General Catalogue of Variable Stars** (Kholopov et al. 1985) (GCVS). For a finding chart, the GCVS refers to Romano (1959a; 1959b). Romano's finding chart for GR13 in the former reference does not agree with the appearance of the field and his position does not agree with the GCVS. The latter reference is not in the Maria Mitchell Library. V363 Cas could be identified, however, from a finding chart for another variable by Bezdenezhnyj (1978). Measures made of the image at this position relative to seven SAO stars give the 1950 coordinates: R.A. = $0^h\ 12^m\ 32^s.5$, Dec. = $+60^o$ 03' 49", in agreement with the GCVS position of V363 Cas. A new finding chart has also been produced. See Figure 1.

Perova (1959) and Romano (1959a) found the period of GR13 to be 0.353401 and 0.353404 day, respectively. The GCVS gives the period as 0.5465353 day, based on work by Tsessevich reported in the Krakow ephemeris (Tsessevich and Szczepanowska 1966), apparently having decided that the shorter period is spurious. The alternatives differ by one cycle per day.

This study uses data from the Maria Mitchell Observatory (1971-1986) and the Harvard College Observatory (AC series plates for 1900-1951 and Damon plates for 1967-1970) to check and refine the period. The 0.35 day period does not fit the data at all, confirming that it was a spurious period. As of fall, 1987, data from Harvard plates in 1900-1938 and Maria Mitchell plates in 1971-1986 were available to refine the 0.53 day period. Light curves were made with phases calculated from:

$$JD_{(max)} = 2436142.592 + 0.54653\ E, \qquad (1)$$

and the phases of observed maxima were read off the plots. The resulting O-C diagram (Figure 2), presented at the AAVSO meeting in October, 1987, suggested a period increase described either by a parabola or by two intersecting line segments. It was clear that data between 1938 and 1971 would be needed to confirm the nature of the period change.

The plates from 1939-1951 and 1967-1970 were inspected in January, 1988. Light curves from these sets were not as well defined as the others. To get a consistent set of O-C values, a composite light curve was produced using characteristics of light curves from each of the data sets. The composite curve was superimposed over each of the individual data subsets to define the phase of maximum as consistently as possible. Phase of maximum was determined in this way for 14 subsets of the 1900-1938 data, 4 subsets of 1939-1970, and 4 subsets of 1971-1986. Figure 3 shows the new O-C diagram. The triangle marks

the published epoch (Tsessevich and Szczepanowska 1966), placed as though it were based on observations at that date, JD 2436142.592.

Figure 3 shows that the change in period of V363 Cassiopeiae has been more complicated than Figure 2 implied. It is not clear whether the O-C in JD 2440000 to JD 2447000 is in the range of -0.3 to +0.4, or +0.7 to +1.4. The two possible placements of the points are shown. If the JD of an observation is related to phi, the calculated phase, and n, the number of cycles elapsed since the epoch, by

$$JD = Epoch + Period \times (n + phi), \quad (2)$$

then the open-circled set has n, the cycle count, chosen to make $-0.5 \leq phi < +0.5$ and the closed-circled set has $+0.5 \leq phi < 1.5$. The new elements that correspond to each of the line segments are:

for JD2415000-2429000:

$$JD_{(max)} = 2421598.215 \pm 0.011 + 0.546517 \pm 0.000013\ E; \quad (3)$$

for JD2429000-2433000:

$$JD_{(max)} = 2431623.776 \pm 0.002 + 0.546560 \pm 0.000007\ E; \quad (4)$$

and for JD2442000-2447000:

$$JD_{(max)} = 2444029.183 \pm 0.006 + 0.546549 \pm 0.000018\ E. \quad (5)$$

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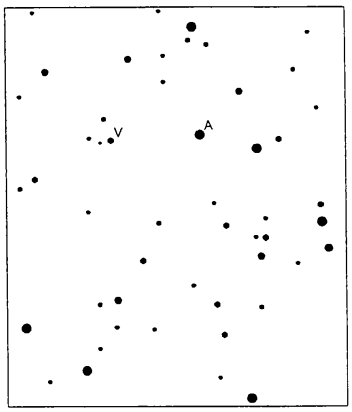

Figure 1. Finding chart for V363 Cas. North is at the top and east is at the left. The field shown is about 30 arcmin north to south. The star marked A is SAO 11051.

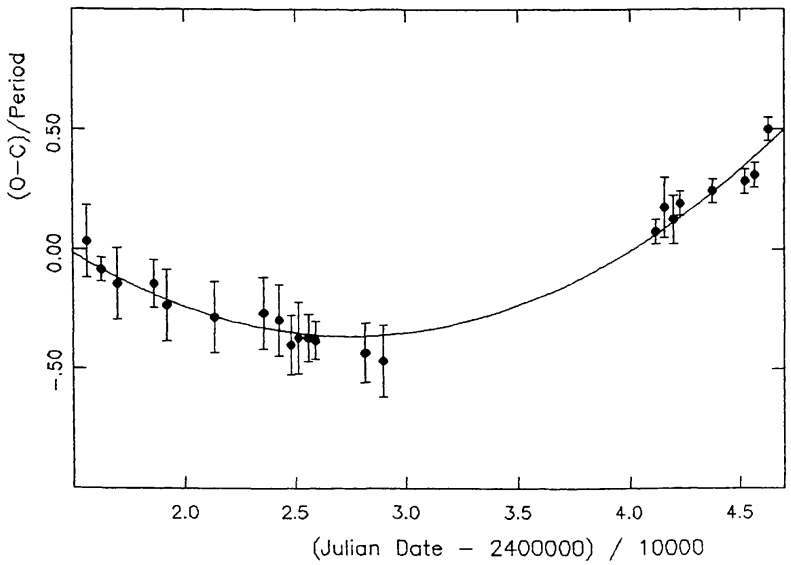

Figure 2. O-C vs. Julian Day diagram for V363 Cas as of fall 1987, based on the elements $JD_{(max)}$ = 2436142.592 + 0.54653 E. O-C is given in fractions of the period. The curve is the best-fitting parabola by least squares.

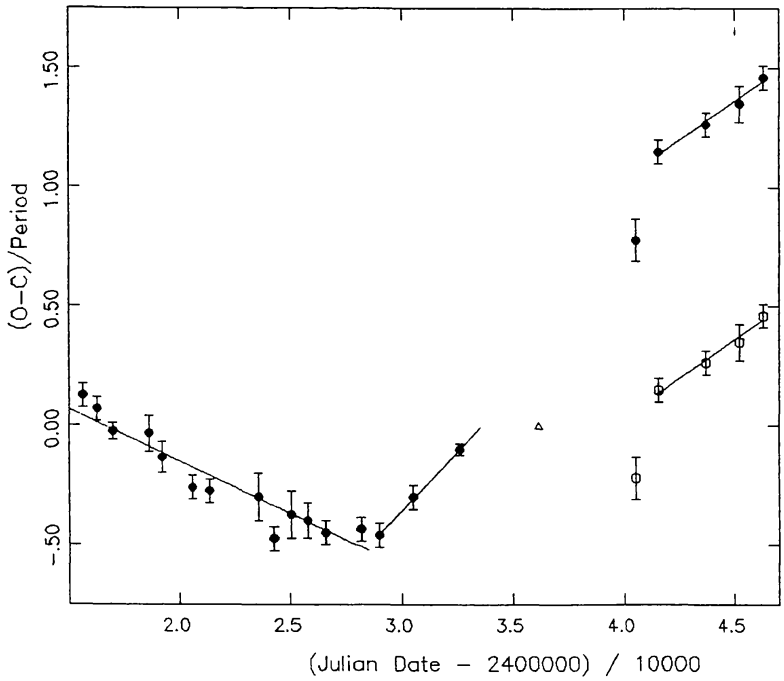

Figure 3. Revised and expanded O-C diagram for V363 Cas. The triangle is the published epoch of maximum. The different symbols between JD 2440000 and JD 2447000 present two possible placements of the same points, as discussed in the text. The line segments represent constant-period approximations to stretches of the data.