PERIOD REFINEMENT FOR AP CANUM VENATICORUM

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Abstract

The RR Lyrae variable AP CVn was examined for period changes in the interval 1964-1987 on plates taken at the Maria Mitchell Observatory. There is no evidence for period change in the interval. Revised linear elements are:

$$JD_{(max)} = 2443812.358 + 0.5746399\ N.$$

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Henry (1973) found the following linear elements for AP Canum Venaticorum, a variable of type RRab:

$$JD_{(max)} = 2440022.531 + 0.57465\ N. \quad (1)$$

She rejected a period of 1.35 days (one fewer cycle per day) as spurious. We wanted to test the constancy of the period with more recent data and to see whether our larger data set supported the choice she made from fewer observations.

We estimated the magnitudes of AP CVn on all plates in the Maria Mitchell collection. All plates were estimated twice, independently, to reduce the observational error. Phases were computed and light curves drawn using equation (1).

To test the possibility of a spurious period, we chose three sets of observations, each spanning three to four years. On each set we ran two period searches, one around the frequency Henry called spurious and the other around her published value. All three sets indicated reasonable probability of a period near 1.35 days but showed markedly greater probability of one around 0.57465 day. As a further test, we calculated phases according to the two periods, and plotted light curves. Figure 1 shows the 1974-1987 data plotted according to the best period near the published one (a), and the best period near 1.35 days (b). It is unambiguously clear that Henry's decision to reject the period near 1.35 days as spurious was a good one.

To improve the elements we used the O-C method with the following definition for C, the computed JD of maximum:

$$JD_{(max)} = 2446336.716 + 0.574639\ N. \quad (2)$$

The epoch and period are from preliminary work by Rudner and McDuffie, respectively. We divided the data into eight subsets, plotted the light curves with equation (2), and found each O-C and its mean error by a nonlinear least squares method (Belserene 1986). The O-C diagram is in Figure 2. The best least-squares line through the eight data points corresponds to these improved elements:

$$JD_{(max)} = \underset{\pm 0.002}{2443812.358} + \underset{\pm 0.0000005}{0.5746399}\ N. \quad (3)$$

We also fitted a parabola by least squares. The improvement was not significant. The probability that the square term is due to chance

deviations from a line is 82%. Thus, for the twenty odd years that we studied AP CVn, the blink of an eye in the life of a star, its period was constant.

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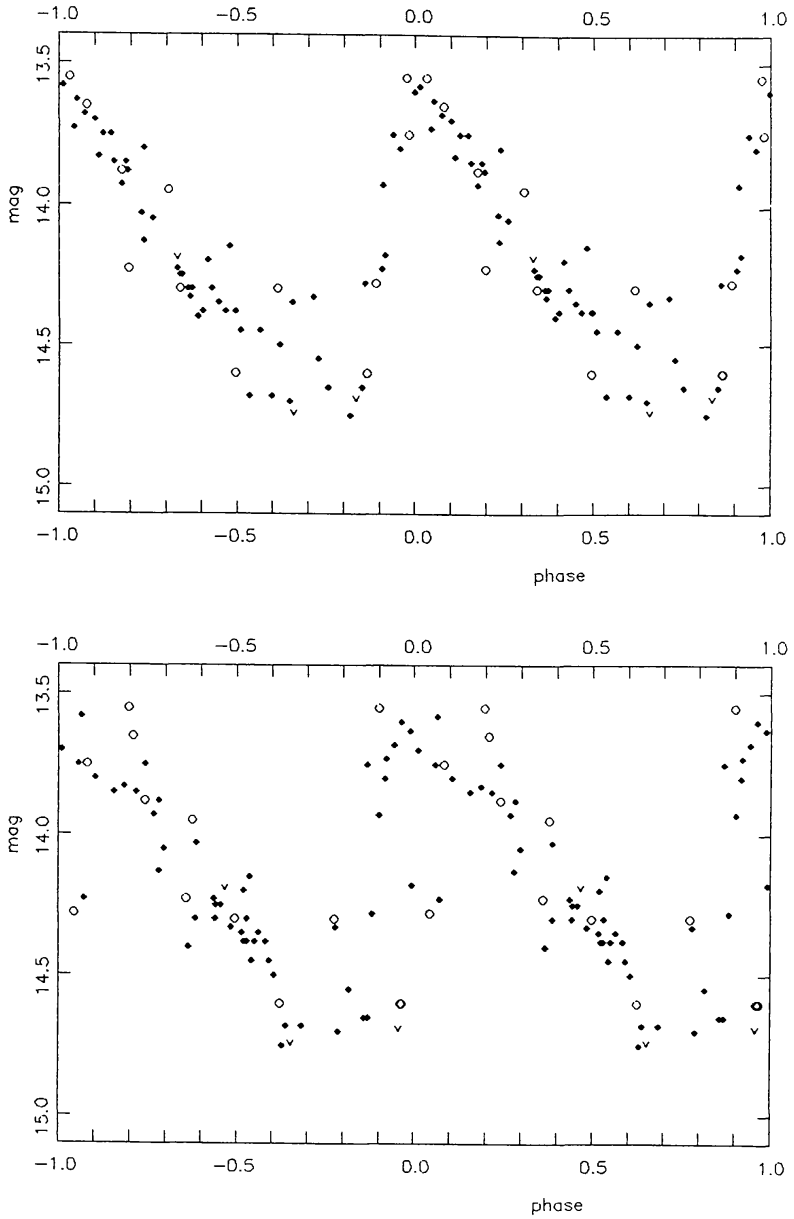

Figure 1. Light curves of AP CVn using data set 1984-1987 and best true (a) [top] and spurious (b) [bottom] period found by the period search program.

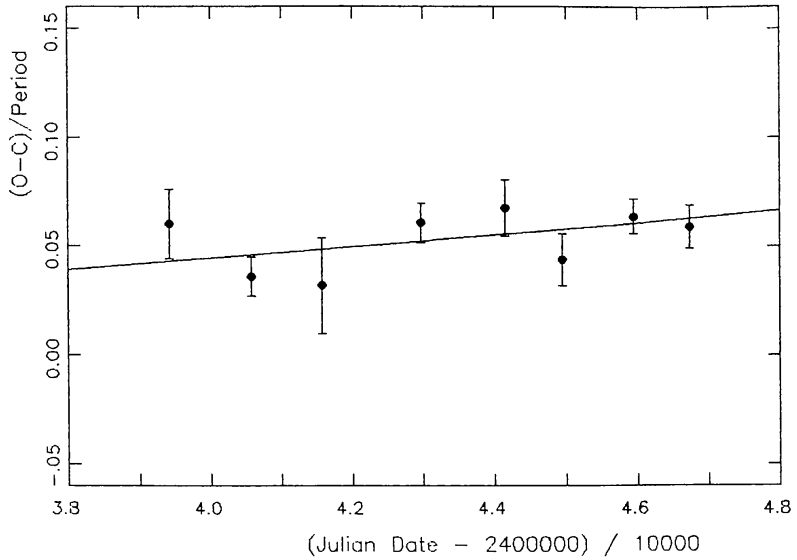

Figure 2. O-C diagram for AP CVn (1964-1987) with the best fitting straight line. C is defined by equation (2).