

ON THE PERIODICITY OF UZ COMAE BERENICES

DMITRY SVETLOV
P.O. Box 825
Amherst College
Amherst, MA 01002

Abstract

A study of the periodicity of UZ Comae Berenices employing data gathered over the past 75 years has revealed a constantly increasing period from 1957 to 1985. Discrimination between a changing and constant period is ambiguous from the data in the interval 1910 to 1957.

* * * * *

1. Introduction

N. Perova (1957) studied the data on the RR Lyr star UZ Comae Berenices between 1910 and 1957, finding no evidence for change in the periodicity described by

$$JD_{(\max)} = 2435577.460 + 0.7369265 E. \quad (1)$$

(All times quoted in this work are heliocentric.) UZ Com was included as number 48 in the RR Lyrae variable star survey carried out by Kinman *et al.* in 1966 and was classified by Kinman as an RR Lyrae star of type a. Kinman had found in his independent investigation the modified equation:

$$JD_{(\max)} = 2437351.255 + 0.73693 E. \quad (2)$$

More recently, UZ Com was included in a survey by Butler *et al.* (1977). Combining his data with Kinman's earlier observations, Butler introduced a correction, changing the value of period to $P = 0.736941 \text{ day} \pm 0.000004$.

2. Analysis

This study combines the data of these previous works with the recent data obtained from the survey of 50 plates from the Maria Mitchell Observatory collection covering the years 1981-1984. In my study I have adopted Kinman's values of the magnitudes of the comparison stars. The values used for calibration by Perova are brighter than Kinman's on the average by -0.17 magnitude. As a result, a constant correction of +0.17 magnitude has been applied to Perova's data. The best value and the standard deviation of the period have been obtained from the Maria Mitchell Observatory data by the method described by Belserene (1983) when applied to the results of a search program based on the algorithm described by Stellingwerf (1978). The search program tested the range of periods from 0.7368000 day to 0.7369707 day, giving:

$$JD_{(\max)} = 2435577.460 + 0.736956 E. \quad (3) \\ \pm 0.000020$$

An O-C diagram constructed on the basis of all of the available data clearly indicates a variability of the period. See Figure 1. A light curve constructed from the Lick Observatory data has been used to obtain the O-C residuals from all of the available data. Perova's data have been divided into four subsets, the Lick Observatory data into two subsets, and the Maria Mitchell Observatory data into two subsets, comprising the eight points on the O-C diagram. Perova's values of

epoch 2435577.460 and period 0.7369265 day have been used to define the computed time of maximum for the construction of the O-C plot. The values derived from other data (and reduced with other values for epoch and period) have been transposed for these specific values of epoch and period and then plotted on the O-C diagram. The light curve obtained from Perova's data has been plotted on a smaller scale relative to other light curves in order to account for the systematic difference in amplitude due to difference in calibration. The resulting O-C diagram has been evaluated by the least-square analysis procedure. A parabola gives the values:

$$JD_{(\max)} = 2444796.650 + 0.7369518 E + 5.15 \times 10^{-10} E^2 \pm 0.45 \times 10^{-10} \quad (4)$$

with a mean deviation of 0.0132. No direct proof of variability of the period can be obtained from Perova's results alone. Thus, if we chose to postulate a recent origin of the phenomenon, points of the given O-C diagram could be approximated by a straight line and a rising branch of a different parabola (See Figure 2) given by

$$JD_{(\max)} = 2444796.650 + 0.7369509 E + 7.85 \times 10^{-10} E^2 \pm 0.98 \times 10^{-10} \quad (5)$$

with a mean deviation of 0.00495. Both parabolic segments give nearly similar predictions at the present epoch. However, they differ in the value of β , defined as $(1/P)dP/dT$ and expressed in cycles per million years, giving $\beta = 0.69$ and $\beta = 1.13$, respectively. Perova's data are too sparse before 1940 to indicate a preference for either possibility; an additional study of earlier data is required to clarify the ambiguity.

3. Discussion

UZ Com's position in the Period-amplitude plane corresponds to the position of a star in a globular cluster of Oosterhoff's Type II. A further subdivision of RR Lyrae variables in nebular clusters into two sequences has been observed by Belserene (1954) for M3 and ω Centauri, and by B. Szeidl (1965) for the Galactic RR Lyrae variables, as based on a sample of 50 field variables. UZ Com exhibits properties of the stars of Szeidl's Group II variables. The metallicity parameter $\Delta s = 10.6$ assigned to UZ Com by Butler *et al.* (1977) lies within the range $9 < \Delta s < 11$ given by Szeidl for RRab variables of Group II. In addition, the range of the values of β quoted by Szeidl in his study for Group II RRab variables contains the value obtained for UZ Com.

4. Conclusions

A constant increase in the period of UZ Com has been identified in the years 1957-1985. A further study is needed to confirm the exact behavior of UZ Com in 1910-1957. Considerations of various observed properties of UZ Com place it among the RRab Group II variables, as suggested by Szeidl.

5. Acknowledgements

This work has been carried out at the Maria Mitchell Observatory under the guidance of Dr. Emilia P. Belserene. This study was made possible by grant AST 83-20491 from the National Science Foundation.

REFERENCES

- Belserene, E. P. 1954, *Astron. Journ.* 59, 406.
 . 1983, *Microcomputers in Astronomy* 8, 229.
 Butler, D., Kinman, T., and Kraft, R. 1979, *Astron. Journ.* 84, 993.
 Kinman, T., Wirtanen, C., and Janes, K. 1966, *Astrophys. Journ. Suppl.*
 13, 379.
 Perova, N. 1957, *Perem. Zvezdy* 12, 44.
 Szeidl, B. 1965, *Mitteil. der Stern. der Ungarin. Acad.* 58.

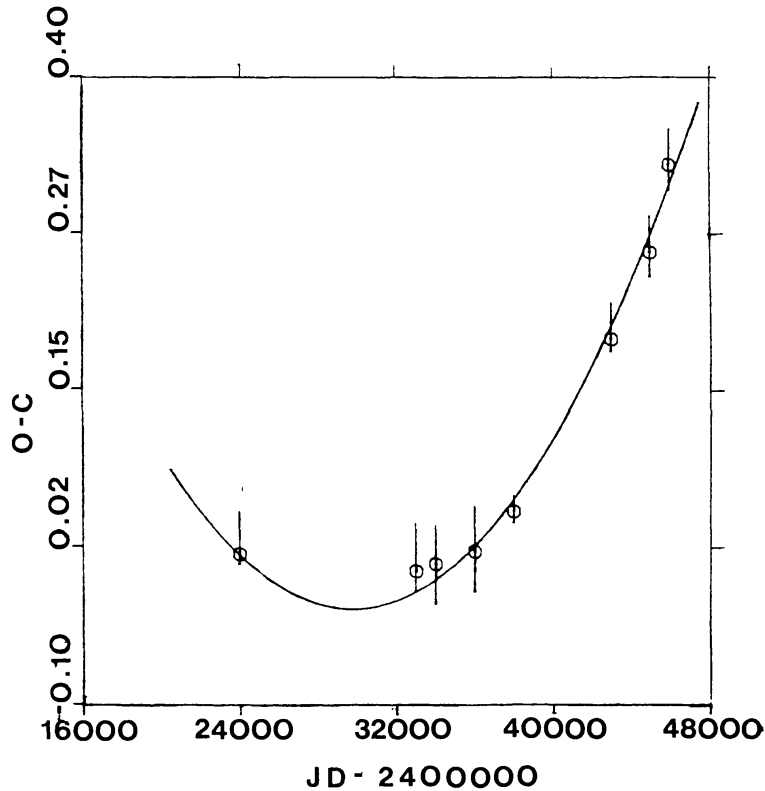


Figure 1. O-C diagram of UZ Comae Berenices. Elements of the parabola are given by equation 4.

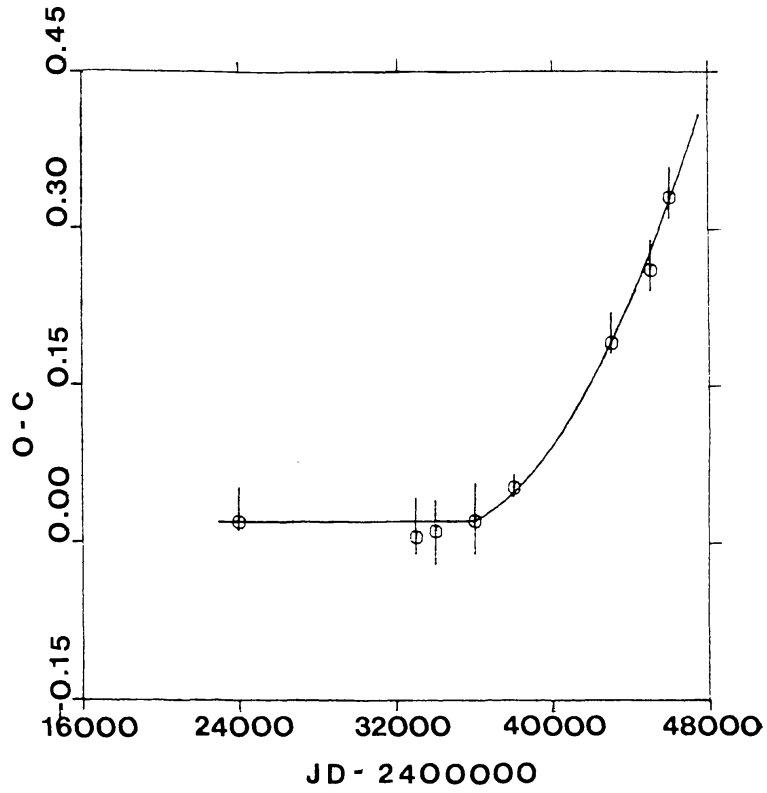


Figure 2. A possible interpretation of the O-C diagram of UZ Comae Berenices, incorporating a straight line and the parabola given by equation 5.