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UZ CVn: a Century of Period Increase

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Object(s): UZ CVn

Type(s): RRab

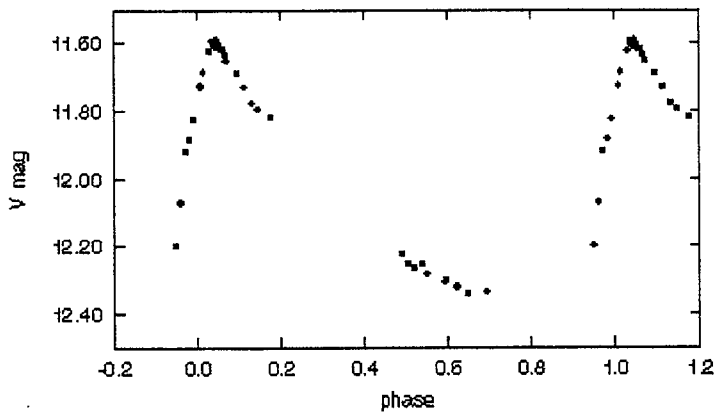
UZ CVn (= BV 96 = HIP 61029 = GSC 3018 255, $12^h30^m27^s.7$, +40°30'31".9, 2000.0), was discovered by Kippenhahn (1955) and found to be a pulsating star of RRab type by Strohmeier and Knigge (1961). Their elements, listed in the GCVS (Kholopov, 1985),

Max. = HJD 2426427.3806 + $0^d.6977829$ ×E

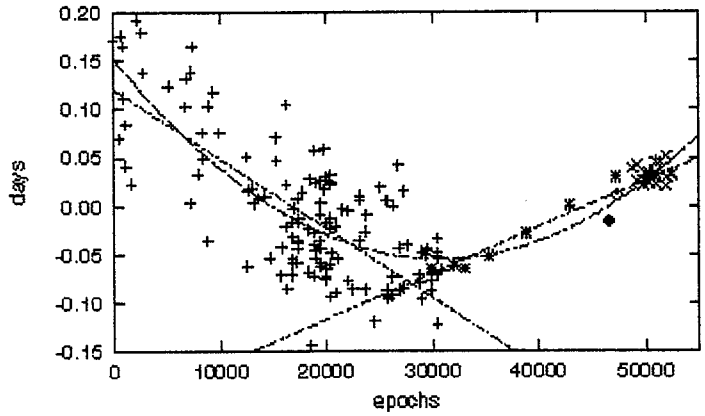
were derived from photographic plates They are obviously no longer valuable because the period has changed continuously. In order to study the evolution of the period of UZ CVn during the last century, we have gathered all the instants of maximum light published in the literature and we have also performed our own measurements.

There are only 13 photoelectric measurements in V and R made between March 1990 and December 1991 resulting in the determination of one instant of maximum (Schmidt et al., 1995). The 127 CCD transits accepted from the Hipparcos satellite measurements (1990-1993) were studied by Fernley et al. (1998) who obtained a period of $0^d.697783$ with a very scattered light curve. We took into account the epoch of the Hipparcos catalogue only. The photographic data are very scattered instants of bright light obtained from the inspection of sky patrol plates. The

first 59 times of maximum found from Bamberg and Sonneberg plates taken between 1931 and 1960, including 5 instants published before by Filatov (1960) and 38 instants derived by Döppner from Sonneberg plates, were published by Strohmeier and Knigge (1961), establishing ephemeris (1). A re-inspection of the Sonneberg plates done by one of us (T.B.) has evidenced the timings assigned to Döppner to be in fact geocentric! They have been corrected for further analysis. Later on, a further set of 80 instants of bright light was published by Strohmeier and Bauernfeind (1968) as a result of the investigation of Harvard photographic plates taken between 1901 and 1953.



V lightcurve of UZ CVn according to ephemeris (2)



O-C diagram of UZ CVn according ephemeris (2).
The symbols refer to the kind of observation: × (visual), + (photographic), * (photographic normal maxima), o (HIPPARCOS), {bullet} (photoelectric)

A GEOS team made 26 photoelectric measurements of UZ CVn in the B and V filters of the Geneva system at the Jungfraujoch observatory during two nights in January 1997. A new time of maximum could be determined. Seven additional measurements were obtained at the same observatory in 1998 (see Figure 1). Two visual observers, J.-P. Verrot and J. Vandenbroere, determined 20 further instants of maximum from their estimates made between 1994 and 2001. To close the remaining gap in the data between 1960 and 1990, T.B. has used 554 Sonneberg Observatory sky patrol plates taken between 1959 and 1993. From 69 newly found instants, 7 normal maxima in consecutive intervals were derived for further analysis.

Taking into account all the available material, we are able to document the behaviour of the period of an RR Lyrae star over a whole century. The complete list of all the observed times of maximum is available from the IBVS website as file 5170-t1.txt. A linear least-squares fit, made with 163 instants of maximum, consisting of two photoelectric instants (w=10), seven photographic normal maxima (w=4), one Hipparcos and 20 visual instants (w=3) and 133

photographic instants (w=1), covering the years from 1901 to 2001, has yielded the following ephemeris:

Max. = HJD 2415423.9927 + 0^d.69778714 ×E.
±74 ±47

Data file: /pub/ibvs/5101/5170-t1.txt

As Figure 2 points out, the trend of the O-C values can be represented either by an abrupt period change around epoch 28000 or by a parabolic fit.

From JD 2415400 (approx.) to JD 2435000 (approx.):

Max. = HJD 2415424.1137 + 0^d.69777993 ×E.
±120 ±66

From JD 2435000 (approx.) to JD 2452100 (approx.):

Max. = HJD 2450460.6095 + 0^d.69779191 ×E.
±67 ±15

Alternatively, the quadratic least squares fit yields the following elements:

Max. = HJD 2415424.1453 + 0^d.69777362 ×E + 2.19 ×10^-10 ×E^2.
±91 ±69 ±11

Assuming the last case, the period of UZ CVn has been established to have increased by a constant rate of dP = $6^d.28 \times 10^{-10}$ per day during the last century and thus has increased by 1.98s in the same time. Such rates are found to be typical in numerous cases among RR Lyrae variables.

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