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A PHOTOELECTRIC LIGHT CURVE AND PERIOD STUDY FOR CZ Aqr

CZ Aqr is a relatively neglected short-period eclipsing binary of the Algol type in the southern sky. Its magnitude range has been given variously as $9^m.5$ - $11^m.0$ (Hoffmeister 1933) and $11^m.10$ - $12^m.03$ (Payne-Gaposchkin 1953). Its spectral type is A5 (Payne-Gaposchkin 1953) and Table I gives its coordinates.

The variability of the system was discovered by Hoffmeister back in 1932. The most recent determination of the period, $0^d.8627540$ by Gaposchkin (1953), is not recent at all. No previous photoelectric photometry of CZ Aqr has been published, but there are three light curves in the literature: one photographic (Gaposchkin 1953) and two visual (Tsesevich 1953, Szafraniec 1970). Also, one previous period study has been published, by Szafraniec (1970), but there has been no solution of the light curve.

Photoelectric observations were made at the Mt. John University Observatory in New Zealand in 1984 on the nights of September 1, 3, and 6 (UT). A pulse-counting photometer was used with filters selected to match the UBV photometric system. The telescope was a 0.6-meter Optical Craftsmen reflector. Each observation required a 20-second integration time, and three successive integrations were averaged for one measurement. The comparison star was BD $-16^\circ 6271$, the coordinates of which are given in Table I.

The results include approximately 90 measurements in each bandpass. The differential magnitudes were reduced to the UBV system, using a program written by C. R. Chambliss, and have been sent to the I.A.U. Commission 27 Archive of Unpublished Observations of Variable Stars (Breger 1985) where they are available as file no. 152. There was one complete run through minimum light, and the entire light curve in blue is plotted in Figure 1.

A time of mid eclipse, for which there was no obvious indication of a flat bottom, was determined graphically from the light curve. A mean from the three bandpasses was JD(hel.) = 2,445,945.056, uncertain by approximately one minute.

Table I

Coordinates

Star	BD	α (1984)	δ (1984)
CZ Aqr	$-16^{\circ}6270$	$23^{h}21^{m}33^{s}$	$-16^{\circ}01.'1$
Comp.	$-16^{\circ}6271$	23 21 37	-16 04.0
Check	$-16^{\circ}6266$	23 20 27	-16 02.0

Table II

Times of Primary Minimum for CZ Aqr

JD (hel.)	E	O–C	Type	Observer
2420773.36	-17392	0.00852	pg	Soloviev
20786.34	-17377	.04722	pg	"
25506.46	-11906	.04196	pg	Hoffmeister
25512.45	-11899	-.00732	pg	"
25864.46	-11491	-.00081	pg	"
25883.47	-11469	.02861	pg	"
25909.33	-11439	.00600	pg	"
26242.37	-11053	.02309	pg	Soloviev
26267.36	-11024	-.00677	pg	Hoffmeister
26625.38	-10609	-.02954	pg	"
26651.30	-10579	.00785	pg	"
27413.972	-9695	.00562	pg	Kanda & Kanamori
30003.117	-6694	.02690	pg	Gaposchkin
30969.370	-5574	-.00420	v	Tsesevich
30976.269	-5566	-.00723	v	"
31001.288	-5537	-.00808	v	"
32823.422	-3425	-.00981	v	Szafraniec
33514.487	-2624	-.01049	v	"
33539.513	-2595	-.00434	v	"
33872.528	-2209	-.01226	v	"
34576.541	-1393	-.00624	v	"
35011.366	-889	-.00908	v	"
35401.333	-437	-.00674	v	"
35721.416	-66	-.00534	v	Tsesevich
35778.357	0	-.00608	v	Szafraniec
43371.472	8801	.01398	v	Locher
2445945.056	11784	0.00382	pe	Bruton

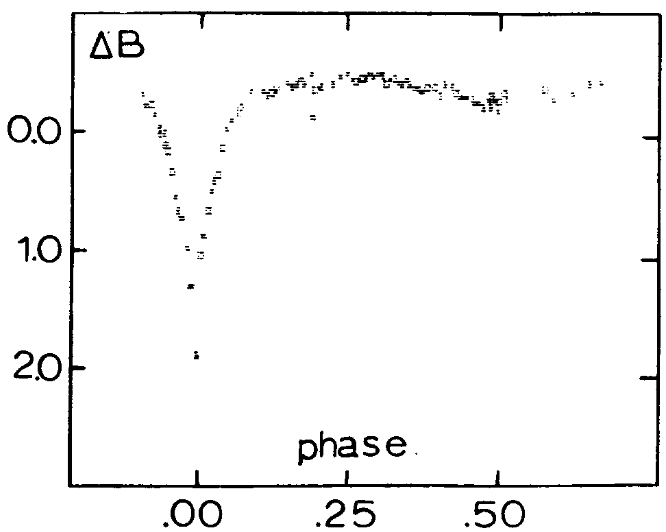

Figure 1

The light curve of CZ Aqr, where the ordinate is differential magnitude in the blue bandpass and the abscissa is orbital phase.

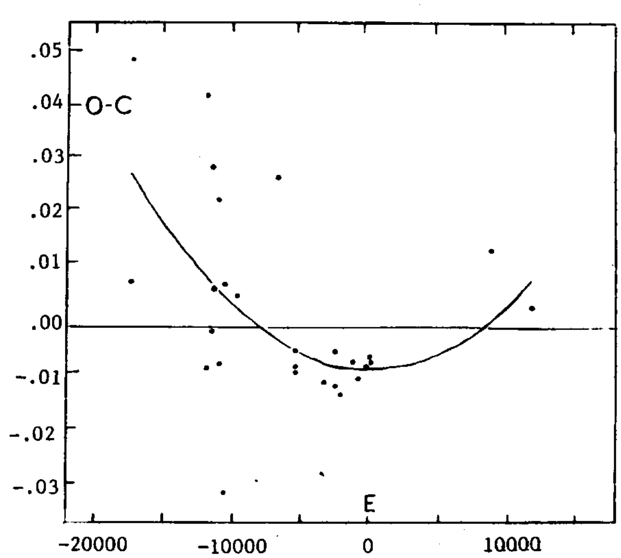

Figure 2

The O–C residuals from Table 2 plotted against E. The curve represents the best quadratic fit to the data, as explained in the text.

An analysis of O-C residuals shows that the period may be changing. Table II tabulates all available times of primary minimum: those appearing in Szafraniec (1970), one determined by Locher (1977), and the recent one determined in this paper. The O-C residuals have been computed with the ephemeris

$$\text{JD (hel.)} = 2{,}435{,}778.3631 + 0^{d}.86275366\ E\ , \qquad (1)$$

which is the best linear fit to those residuals using weights of 20, 3, and 1 for the photoelectric, visual, and photographic times, respectively.

Figure 2 shows the contents of Table II plotted with O-C as the ordinate and E as the abscissa. The solid curve in that figure represents the best quadratic fit using the same weights. When the corrections

$-0^{d}.007485$ (constant term)
-3.12×10^{-8} (first power term)
$+1.164 \times 10^{-10}$ (second power term)

are made to the linear ephemeris in equation (1), the result is

$$\text{JD (hel.)} = 2{,}435{,}778.3536 + 0^{d}.86275363\ E + 1^{d}.164 \times 10^{-10}\ E^{2}. \qquad (2)$$

The correlation coefficient in this fit was 0.61.

While it would seem at this point that the system's period is probably increasing in some fashion, the quadratic solution above is only a tentative approximation. More data, in the form of photoelectric times, are needed.

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References:

Breger, M. 1985, P.A.S.P. 97, 85.
Gaposchkin, S. 1953, Harvard Ann. 113, no. 2, 69.
Hoffmeister, C. 1933, Astr. Nachr. 247, no. 5919, 286.
Locher, K. 1977, B.B.S.A.G. no. 34.
Payne-Gaposchkin, C. 1953, Harvard Ann. 115, no. 10, 121.
Szafraniec, R. 1970, Acta Astr. 20, 29.
Tsesevich, W. 1953, Odessa Isvestia 4, 56.