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NEW UBV OBSERVATIONS OF BH Cen

The contact binary BH Cen was recently discussed in some detail by Sisteró et al. (1983, = SGC). We have observed it in July and August 1984 with the 20" telescope of the South African Astronomical Observatory in Sutherland. Unfortunately, only part of the light curve could be obtained. In particular, we were unable to observe a primary minimum.

Table I lists the observing dates. Figures 1 and 2 give plots of the observations in V and the colour indices B-V and U-B. The relative accuracy in all colours is estimated to be about $0\overset{m}{.}005$. The calibration should, in each night, be better than $0\overset{m}{.}01$. The comparison star was CPD-62°2186, for which we used (from comparison with E region stars) V= 8.076, B-V= .068, U-B = -.855 which is slightly different from the values adopted by SGC.

Our observations reproduce the shape of the light curve of SGC reasonably well. The star was, however, fainter in V by $0\overset{m}{.}04$, depending somewhat on the phase (Figure 3), so that a slight change of the light curve is indicated. The colour indices show, within the error tolerances, the same shape and are nearly equal: Δ(B-V) (SGC-we) = $0\overset{m}{.}002 \pm 0.002$, and Δ(U-B) (SGC-we) = $-0\overset{m}{.}011 \pm 0.002$ (p.e. of average). Considering the different assumptions on the colours of CPD-62°2186, we would however expect to find differences Δ(B-V) = $0\overset{m}{.}02$, Δ(U-B) = $0\overset{m}{.}03$. It is therefore possible that the star became slightly redder. The amplitudes in the 3 colours are the same as given by SGC within about $0\overset{m}{.}01$. This is also true for the primary minimum of which only two slopes were observed. We estimate that it was $0\overset{m}{.}04$ deeper than the secondary minimum. A slight change as compared to SGC is, however, possible.

Within the observed range, B-V is not significantly phase-dependent (in slight contrast to SGC), while U-B is definitely redder near both the primary and the secondary minimum.

Table I: Dates of observations

HJD-2445900	phase
6.21- 6.23	.96 - .98
7.21- 7.24	.22 - .26
8.21- 8.30	.48 - .60
10.22-10.29	.02 - .12
15.20-15.28	.32 - .41
18.22-18.27	.13 - .19
19.20-19.25	.37 - .43

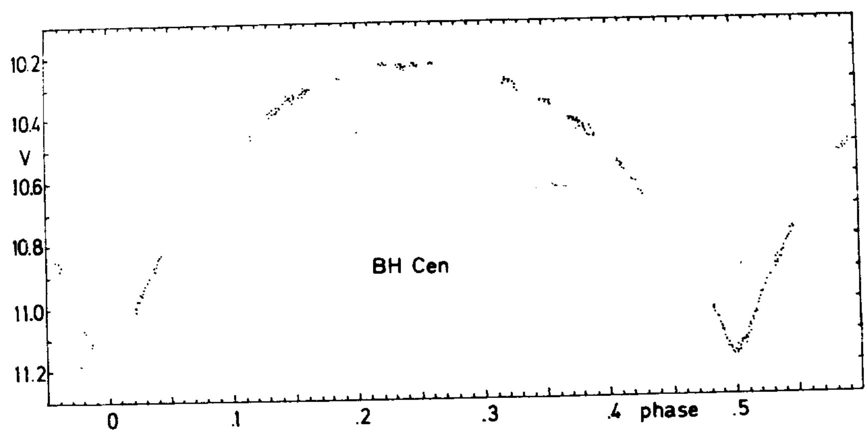

Figure 1. Individual observations in V (10 sec integration)

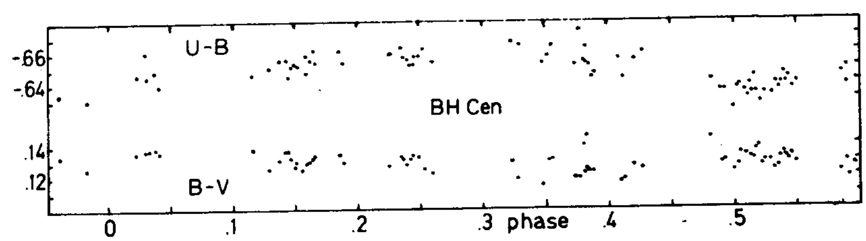

Figure 2. Observations of colour indices, averaged over about 30 sec integration

Table II: R and I observations

HJD-2445900	V-R	V-I	Ph
6.23	.13	.27	.99
7.23	.11	.22	.25
8.25	.13	.26	.54

The only overlap in our observations - near orbital phase 0.4 - is slightly discrepant with a difference of about $0^m.01$. While this is still within the observational uncertainties, the possibility cannot be ruled out that the light curve may show some small short-term variability. Such variability would possibly account for the rather long period determined by Leung and Schneider (1977, = LS) from a light curve fit.

Table II gives the few additional observations in R and I. Again, reddening near the minima is indicated.

Table III: Average period $\bar{P}$ to 1984

Year	HJD 2400000+	ref.	number	$\bar{P}$	error
1919	22084	Oosterhoff 1928	1	0.7915845	± 10
1927	25025	Oosterhoff 1930	1	844	10
1928	∼25364	Oosterhoff 1930	7	842	6
1929	25714	Oosterhoff 1930	1	848	10
1967	39621	LS	1	914	2
1979	∼44018	Sisterò 1979	5	945	2
1980	∼44355	SGC	2	951	2
1981	∼44680	Herczeg 1984	2	945	2

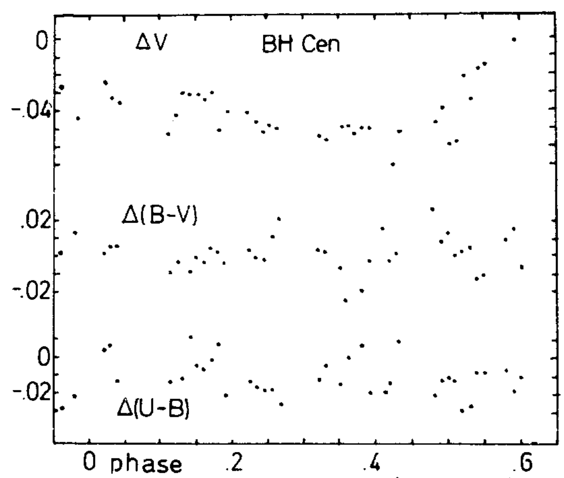

Figure 3. Differences in light curve, SGC minus our observations

The observed secondary minimum was symmetric within the uncertainties. The minimum occurred at HJD = 2445908.2209±0.0001.

We were unable to evaluate the present period with sufficient accuracy. Table III gives average periods for our minimum combined with those published earlier. Between 1918 and 1984, the period increase seems to be nearly quadratic.

SGC suggested a triple system with a period of about 50 years (see also Herczeg 1984). We rather propose a secondary period of slightly more than a hundred years, with which it is possible to reproduce all the 11 known photoelectric minima within about 1.2 minutes, and nine out of the 10 photographic minima within about 20 minutes (the minimum at HJD 2425351.536 seems to be early by about 1 hour). A good fit is

$$P = 0\overset{d}{.}7915883 + 0\overset{d}{.}0000094 \sin(2\pi(t-2440800)/100 \text{ years}).$$

It places the half-amplitude of the light time variation at about 100 minutes, corresponding, for $i = 90^{\circ}$, to an orbital radius of about 12 AU. The mass of the tertiary component would be 5 $M_\odot$, its distance to BH Cen about 60 AU.

We found, however, that a constant intrinsic period combined with nearly any secondary period between about 60 and about 160 years, as well as a quadratic approximation to the period of BH Cen can also, within reasonable uncertainties, fit the data. All fits place the time of minimum period between the photographic and the photoelectric observations. Further observations are obviously necessary to decide definitely whether or not the period change is intrinsic, or how large the secondary period is.

The present period and period change is little affected by this uncertainty. Our best estimate for the prediction of further minima is

$$PM = HJD\ 2445907.8251 + 0.7915957\ E + 10^{-9}\ E^2.$$

In conclusion, we find the light curve of BH Cen to be variable by a few hundredth of a magnitude within a few years, with the unverified possibility of variations within a few periods. The period change is strongly nonlinear. A periodic period change, with constant intrinsic period, can well reproduce all observations but the data are still inconclusive.

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References:

Herczeg,T., 1984, IBVS No. 2477
Oosterhoff,P.T., 1928, BAN 4, 183
Oosterhoff,P.T., 1930, BAN 5, 156
Leung,F.C., Schneider,D.P., 1977, Ap.J. 211, 844
Sisteró,R.F., Candellero,B.A., Grieco,A., 1979, IBVS No. 1700
Sisteró,R.F., Grieco,A., Candellero,B., 1983, Astrophys.Space Sci. 91, 427