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ON THE PERIOD OF BH CENTAURI

The early type, massive contact system BH Centauri was put on a program of observations otherwise dedicated to the periods of W UMa binaries on account of recently discovered, conspicuous period variations, apparently quite different from those exhibited by other members of its group. The star has been observed on two nights at Cerro Tololo InterAmerican Observatory, in March 1981, using the No. 2 14-in. telescope and standard photoelectric equipment. 149 B and V observations define two minimum epochs:

JD 2444679.663 (Min. II)
44681.6453 (Min. I)

Table II gives 44 observations lying close to the minimum light. V, B are against the comparison star CPD-62°2179, the check star was CPD-62°2184, corrections for differential extinction remained under 0.001 magn.

Period studies of BH Centauri are severely handicapped by a long gap of photometric observations, 1928-1967. For the history of observations and period determinations the paper Sistero, Candellero and Grieco (1982) should be consulted. In brief, a "mean value" of the period can be found, connecting, although with very large residuals, Oosterhoff's early photographic epochs with the recent photoelectric values:

$$P_1 = 0^d.79158298 \quad \text{(Sistero, formula 3)}$$

The photoelectric observations at Cordoba Observatory indicated that the momentary period is much longer

$$P_1 = 0^d.7915942 \quad \text{(Sistero, formula 1)}$$

Two new minima (Sistero et al.) lead to a somewhat shorter period while the Cerro Tololo observations, combined with the two earlier series of photoelectric minima, suggest the best fitting period value:

$$P_3 = 0^d.79159441$$

virtually identical with the period in Sistero's formula 1.

Table I

BH Centauri, photoelectric min. epochs

Min I=JD2444028.5796+$0^d.79158298$E

JD2439621.7975	I	O-C=-$0^d.0397$	Leung, Schneider 1977
43987.8119	II	-0.0012	Sistero et al. 1979
43989.7917	I	-0.0003	"
43990.5835	I	-0.0001	"
44028.5796	I	0.0	"
44095.4693	II	+0.0009	"
44280.7071	II	+0.0023	Sistero et al. 1982
44429.5212	II	+0.0043	"
44679.6663	II	+0.0079	This paper
44681.6453	I	+0.0079	"

All available photoelectric O-C determinations are listed in Table I. The minimum epoch obtained by Leung and Schneider yields a very large negative residual of nearly 1 hour, the epoch itself seems, however, beyond doubt correct. Based on the relatively short time span of these observations, a surprisingly large value was derived for the period ($0^d.791616$) which is in conflict with all later data. Recognition that the period has changed considerably follows from a comparison of P_1 and P_2 or P_3.

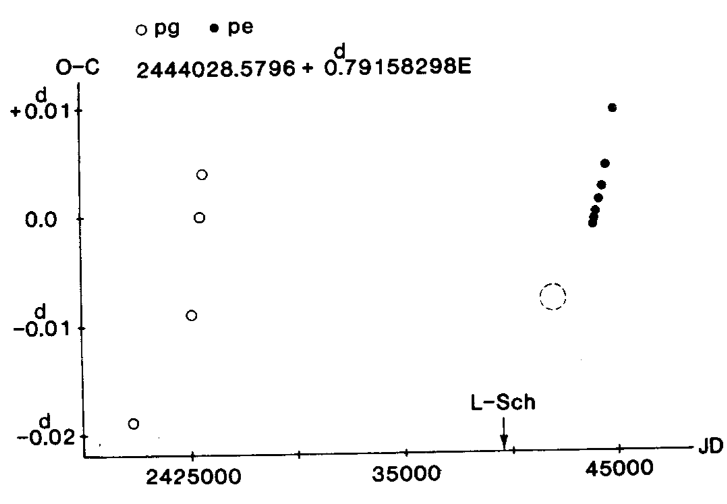

Figure 1
Timing residuals for BH Cen. Photographic data are (in part) normal points. "L-Sch" means the minimum epoch by Leung and Schneider at O-C = -0.040d. The broken circle refers to an apparent shift of the minimum found by Eggen, assuming that these observations were done in Spring 1976 (cf. Sistero' et al. 1982).

The O-C diagram of the minimum epochs (Figure 1) illustrates the background of Sistero's interesting proposal of a possible light-time effect. There is, indeed, a similarity in the system's behaviour, shown in the 1920s and 1970s. Clearly, further and continued observations are needed but the hypothesis of a third body in the system can be subjected to an order of magnitude test of reliability. (See, for example, Irwin's and Landolt's discussion of SV Centauri, 1972, or the introduction to the paper of Frieboes-Conde and Herczeg, 1973.)

Table II

Observations

JD2444679+	ΔV	JD2444679+	ΔB
.6496	−0.195	.6502	−0.195
.6532	−0.261		
.6542	−0.297	.6548	−0.272
.6562	−0.305	.6571	−0.298
.6601	−0.371	.6608	−0.352
.6624	−0.375	.6630	−0.352
.6660	−0.397	.6667	−0.352
.6679	−0.373	.6692	−0.343
.6726	−0.314	.6732	−0.297
.6777	−0.284	.6788	−0.237
.6813	−0.228	.6819	−0.195
.6834	−0.194	.6840	−0.148

JD2444681+	ΔV	JD2444681+	ΔB
.6288	−0.245	.6293	−0.218
.6326	−0.306	.6336	−0.287
.6351	−0.337	.6358	−0.315
.6396	−0.394	.6400	−0.361
.6414	−0.407	.6420	−0.410
.6457	−0.409	.6463	−0.404
.6480	−0.389	.6486	−0.383
.6520	−0.374	.6525	−0.333
.6546	−0.349	.6551	−0.307
.6605	−0.255	.6610	−0.212

The amplitude of the light time variation can only be most crudely estimated , it may be perhaps 1 2/3 hours, that is, for small eccentricity $a_1 \sin i = 6$ AU. Assuming the period P = 50 years and $M_1 + M_2 = 20M_\odot$ for the eclipsing pair, we obtain the following masses for the hypothetical third component in the system:

$$\text{if } i = 90^\circ,\ M_3 = 3.6M_\odot$$
$$i = 60^\circ,\ M_3 = 4.3M_\odot$$
$$i = 30^\circ,\ M_3 = 8.2M_\odot$$

However preliminary and uncertain these estimates might be, the resulting masses are acceptable values and they, at least, do not contradict the light time hypothesis. A distance to the system of 2 kpc would lead to a possible angular separation of the order of 0."01 to 0."02.

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