PERIOD VARIATION OF BZ ERIDANI

(Letter to the Editor)

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Abstract. The present letter contains some comments on the preceding communication by Kämper (1986) concerning the period variations of BZ Eridani.

There is no real difference of opinion between Kämper (1987) and myself that the period changes (up to $\Delta P/P \simeq 10^{-3}$) must be considered questionable, which fact I have already mentioned in my paper (cf. Srivastava, 1986). Kämper's (1987) reference to Götz and Wenzel's (1961) epoch may or may not be true in the sense that neither their communication mentions it as a primary minimum nor mentions it otherwise. However, I have already mentioned it as doubtful, which is related to the above fact. Their spectral type does not match with ours (cf. Srivastava and Sinha, 1981).

I do not agree with Kämper's statement that, due to an amplitude of only $0^m.4$ in V, BZ Eri is not a favourable object for visual observers. Even lesser-amplitude objects like DX Aqr (cf. Srivastava and Sinha, 1985; Srivastava, 1985) and AW UMa (cf. Srivastava and Padalia, 1986), and many others, have been favourable for visual observers. I also, do not agree with Kämper's (1986) contention that due to faintness and owing to long exposure times (1^h), the errors of the order of $\pm 0^d.02$ and $\pm 0^d.03$, respectively, are introduced. Of course, some errors may enter in the times of minima depending upon the coverage of minima. Even 1^h coverage centered around the mid-eclipse is sufficient for consideration (cf. van Woerden, 1957). Van Woerden (1957) has stated that the photographic and visual epochs are estimated to have mean errors of one or two thousands of a day.

Kämper is right to say that the consideration of errors of different types of minima is important in period studies. This can only be done when either the observations and exposure times are available or the errors are given. Mere presumption of errors without basis is unjustified.

I have used both the graphical method using the bisection procedure and, Kwee and van Woerden's method for determining the times of minima and have found that the errors come out to be $\pm 0^d.001$ (in many of our earlier papers) and $\pm 0^d.007$ (cf. Srivastava and Uddin, 1985), respectively. One may take any type of observation, once a particular method is used, the errors will depend on the method used. It is also strange to note that visual observers, sometimes, introduce an error of 1^h in conversion to UT. Such observations are of no use. Such times may be in error when either the heliocentric

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corrections are neglected or applied with opposite algebraic sign (Hall and Kreiner, 1980).

I have calculated the O–C values of all the minima (Table I) from the improved ephemeris:

$$\text{Min. I} = \text{J.D. } 2425558.449 + 0^{d}.6641701\,E\,,$$

TABLE I

Minima of BZ Eri

Sl. No.	Minima (J.D.)	Cycle	O–C	O–C(I)	Reference	Type of observations
1	2425558.445	0	$0^{d}.000$	$-0^{d}.004$	7	pg
2	.456	0	+0.011	+0.007	3	pg
3	6224.604	1003	−0.004	−0.008	7	pg
4	7101.318	2323	+0.005	+0.002	3	pg
5	421.438	2805	−0.005	−0.008	3	pg
6	30378.322	7257	−0.008	−0.009	7	pg
7	730.350	7787	+0.010	+0.008	7	pg
8	2795.575	10896.5	−0.003	−0.003	7	pg
9	3154.558	11437	−0.004	−0.004	7	pg
10	4665.547	13712	−0.003	−0.002	7	pg
11	709.408	13778	+0.023	+0.023	7	pg
12	5721.580	15302	0.000	0.000	7	pg
13	892.282	15559	+0.010	+0.010	7	pg
14	6085.578	15850	+0.032	+0.033	7	pg
15	904.452	17083	−0.016	−0.015	7	pg
16	7235.549	17581.5	−0.008	−0.007	7	pg
17	312.444 (?)	17697	+0.175	+0.177	2	Sp
18	584.578	18107	0.000	+0.001	7	pg
19	942.565	18646	−0.001	0.000	7	pg
20	992.374	18721	−0.005	−0.003	7	pg
21	8328.438	19227	−0.011	−0.010	7	pg
22	439.381	19394	+0.015	+0.017	7	pg
23	441.350	19397	−0.008	−0.006	7	pg
24	42448.302	25430	+0.004	+0.007	1	V
25	450.289	25433	−0.002	+0.002	1	V
26	452.278	25436	−0.005	−0.002	1	V
27	.284	25436	+0.001	+0.004	4	V
28	835.172	26012.5	−0.006	−0.002	8	pe
29	836.164	26014	−0.009	−0.006	8	pe
30	840.154	26020	−0.003	−0.001	8	pe
31	4233.580	28118	−0.008	−0.004	9	pe
32	902.460	29125	+0.052	+0.057	5	V
33	908.391	29134	+0.006	+0.010	6	V
34	910.361	29137	−0.017	−0.012	6	V
35	912.370	29140	0.000	+0.004	6	V
36	914.368	29143	+0.005	+0.010	6	V
37	928.313	29164	+0.002	+0.007	6	V
38	930.301	29167	−0.002	+0.003	6	V

References:

(1) Diethelm (1975); (2) Götz and Wenzel (1961); (3) Kippenhahn (1955); (4) Locher (1975); (5) Mavrofridis (1981); (6) Mavrofridis (1982); (7) Meinunger (1966); (8) Srivastava and Sinha (1981); (9) Wolf *et al.* (1982).

given by Kämper (1987), which he has derived after giving weights to different type of observations, and listed in Table I as O–C(I), and plotted in Figure 1. He has given the least weight to the photographic observations instead to the visual observations, which is not the usual practice. However, in order to differentiate between different types of minima the quantum of weights are given arbitrarily, which is also unjustified. Due to this reason and also up to which decimal place of epochs are given will decide the errors to some extent.

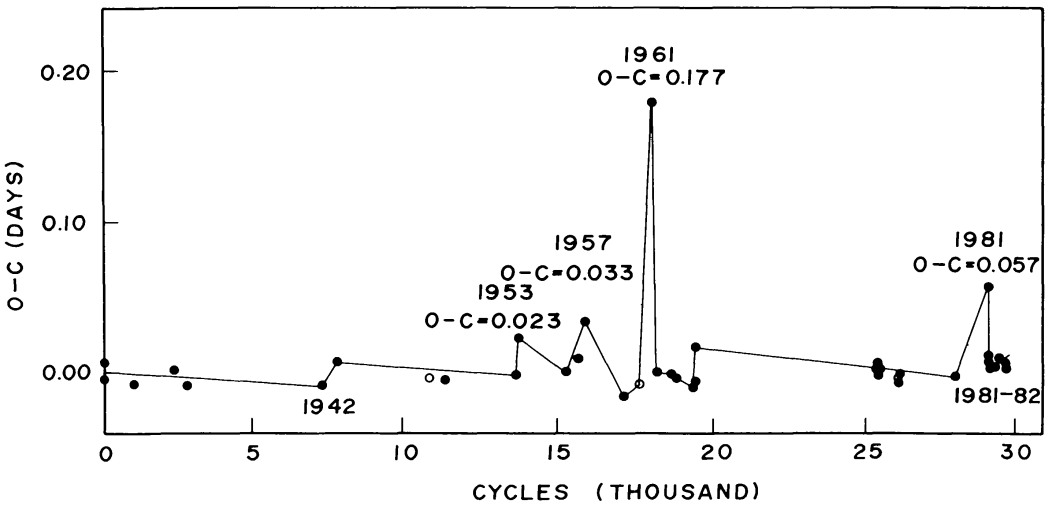

Fig. 1. O–C diagram of BZ Eridani.

Sometimes, some corrections are not possible to consider due to conformity reasons. Mallama's nomograms for estimating the uncertainty of minima point out that an error of 0.1 in magnitude determinations may introduce an error of nearly $0^d.01$ in epochs. Thus, O–C(S) > $0^d.01$ are important in period studies.

Even if Kämper's contention of errors of $\pm 0^d.02$ and $\pm 0^d.03$ at the maximum are accepted, the minima Nos. 11 and 14 exceed these limits, and as such they should be considered as the epochs of real period change. Similarly, if Kämper's (1987) statement is accepted that the visual observers commit an error of 1^h in conversion to UT, which corresponds to nearly $0^d.04$, the O–C of minimum No. 32 comes out to be $0^d.06$ from his ephemeris, and thus, it must also be considered as the epoch of real period change, and not an 'outlier'. Most interesting is the present O–C diagram (Figure 1) based on Kämper's (1986) ephemeris. It is similar to the one given by me earlier (cf. Srivastava, 1986).

When one presents the period, study of any system for the first time, it depicts the gross features and not the refinements. Thus, its importance cannot be overlooked.

If Kämper's (1987) contentions are accepted then, I think, the period variations of the order of 10^{-7} to 10^{-9} d will hardly be detected.

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