PERIOD VARIATIONS IN BZ ERIDANI

R. K. SRIVASTAVA

Uttar Pradesh State Observatory, Manora Peak, Naini Tal, India

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Abstract. The O–C diagram of BZ Eri has been presented for the first time, and the period variations present in the system have been analysed. In all, eight period decreases and eight period increases are noticed. Of these, four period decreases and seven period increases are appreciable. The strongest period changes are noticed in the interval 1960 to 1962. The total period change in different portions of the O–C diagram ranges from 1.17×10^{-3} d to 3.96×10^{-6} d. The trend of the period variation appears to have reversed around the year 1980.

1. Introduction

The eclipsing binary BZ Eri (= BD − 6°841) was discovered to be an Algol type variable by Hoffmeister (1934). Kippenhahn (1955) presented the epoch of the system; Götz and Wenzel (1961) gave the spectral type of the system; Diethelm (1975), Locher (1975), and Mavrofridis (1981, 1982) gave minima of BZ Eri; Srivastava and Sinha (1981) presented the first photoelectric results of the system; Wolf *et al.* (1982) gave the time of primary minimum; and, recently, Srivastava and Uddin (1985) derived the geometrical elements of BZ Eri and discussed its colour in detail.

Meinunger (1966) was the first to present the period of BZ Eri, which was improved by Srivastava and Sinha (1981). No period variation study is available in the literature. It is being presented for the first time in this communication.

2. O–C Diagram and Period Variations

All the available primary and secondary minima that have been observed between 1928 and 1981 have been collected, and an O–C diagram has been constructed from the O–C values calculated from the ephemeris given by Meinunger (1966), viz.:

$$\text{Primary Minimum} = \text{J.D. } 2425558.445 + 0^{d}.6641704E\,.$$

The times of minima, together with O–C values, have been listed in Table I, and the O–C values are plotted against phases in Figure 1. An inspection of the O–C diagram reveals that the time interval (1928 to 1981) is divided into sixteen portions between points A to Q.

Some portions of the O–C diagram are scantily covered and, thus, our discussion of the period variation of BZ Eri is based on the assumption that the period of the system varies linearly. Here, it is important to mention that the system has been photoelectrically neglected since its discovery. Appreciable period changes are noticed around the years 1942, 1953, 1956, 1961, 1964, 1980, and 1981. The extent of the period decrease and

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TABLE I

Minima of BZ Eri

Minima ($JD_{\odot}$)	Cycle	O–C	Reference
2425558.445	0	$0^{d}.000$	7
.558	0	+0.011	3
6224.604	1003	−0.004	7
7101.318	2323	+0.005	3
421.438	2805	−0.005	3
30378.322	7257	−0.008	7
730.350	7787	+0.010	7
2795.575	10896.5	−0.003	7
3154.558	11437	−0.004	7
4665.547	13712	−0.003	7
709.408	13778	+0.023	7
5721.580	15302	0.000	7
892.282	15559	+0.010	7
6085.578	15850	+0.032	7
904.452	17083	−0.016	7
7235.549	17581.5	−0.008	7
312.444	17697	+0.175	2
584.578	18107	0.000	7
942.565	18646	−0.001	7
992.374	18721	−0.005	7
8328.438	19227	−0.011	7
439.381	19394	+0.015	7
441.350	19397	−0.008	7
42448.302	25430	+0.004	1
450.289	25433	−0.002	1
452.278	25436	−0.005	1
.284	25436	+0.001	4
835.172	26012.5	−0.006	8
836.164	26014	−0.009	8
840.154	26020	−0.003	8
4233.580	28118	−0.008	9
902.460	29125	+0.052	5
908.391	29134	+0.006	6
910.361	29137	−0.017	6
912.370	29140	0.000	6
914.368	29143	+0.005	6
928.313	29164	+0.002	6
930.301	29167	−0.002	6

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).

increase has been estimated in different portions of the O–C diagram (Figure 1). The total change of period in different portions of the O–C diagram are listed in Table II.

A very strong period increase and decrease appear to have occurred in the time interval 1960 to 1962. In this time interval the period variation has the steepest slope. However, the reality of this steepest slope is open to question as there is only a solitary

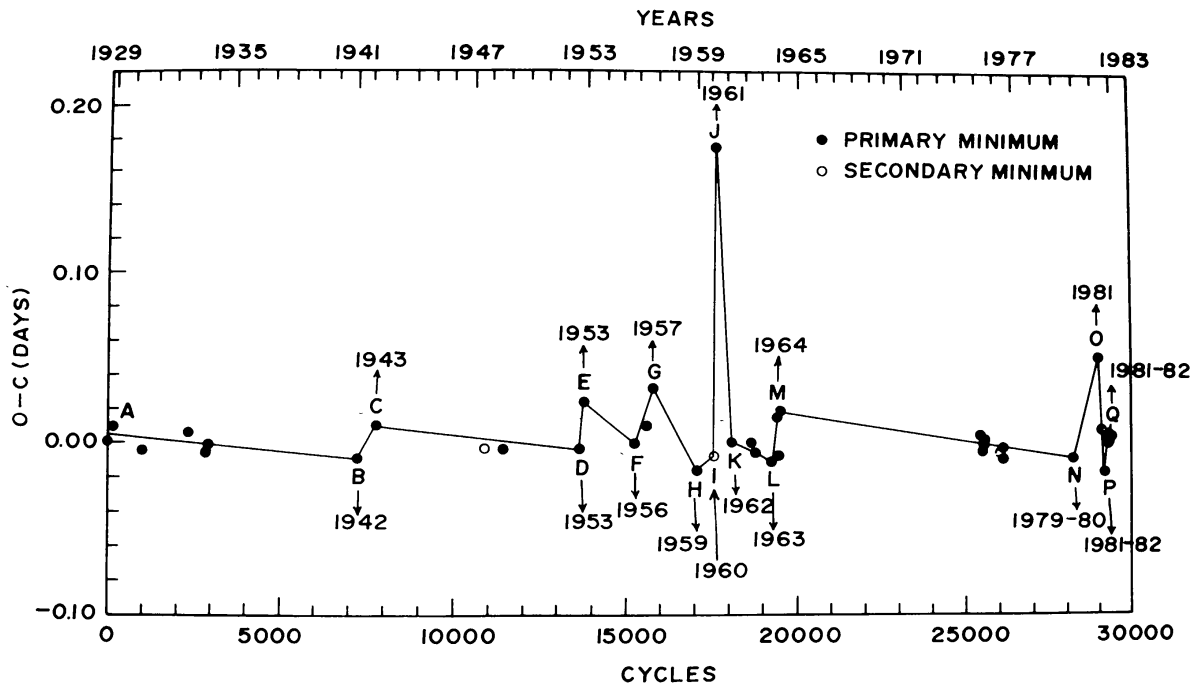

Fig. 1. O–C diagram of BZ Eri. Arrows represent the increasing and decreasing trends of the period variation.

TABLE II

Changes in the period of BZ Eri

Portion	Interval of cycles	Total change in period (days)	Period trend I = increase D = decrease
AB	$E = 0$ to $E = 7257$	2.22×10^{-6}	D
BC	$E = 7257$ to $E = 7787$	3.33×10^{-5}	I
CD	$E = 7787$ to $E = 13712$	2.63×10^{-6}	D
DE	$E = 13712$ to $E = 13778$	2.30×10^{-4}	I
EF	$E = 13778$ to $E = 15302$	1.48×10^{-5}	D
FG	$E = 15302$ to $E = 15850$	5.33×10^{-5}	I
GH	$E = 15850$ to $E = 17083$	4.00×10^{-5}	D
HI	$E = 17083$ to $E = 17582$	1.78×10^{-5}	I
IJ	$E = 17582$ to $E = 17697$	1.17×10^{-3}	I
JK	$E = 17697$ to $E = 18107$	4.38×10^{-4}	D
KL	$E = 18107$ to $E = 19227$	1.00×10^{-5}	D
LM	$E = 19227$ to $E = 19429$	1.27×10^{-4}	I
MN	$E = 19429$ to $E = 28118$	3.96×10^{-6}	D
NO	$E = 28118$ to $E = 29125$	2.90×10^{-6}	I
OP	$E = 29125$ to $E = 29134$	5.20×10^{-4}	D
PQ	$E = 29134$ to $E = 29167$	1.70×10^{-4}	I (incomplete)

point around 1961, which is responsible for indicating the steepest increase and decrease.

A sufficiently strong period increase and a period decrease have occurred in 1980–1981. The period shows no significant variation in the portions AB (1928 to 1942), CD (1943–1953), and MN (1964 to 1980) of the O–C diagram. The variation appears to have reversed its trend around 1980. Before 1980, the period increases have steeper slopes than those of the decreases, while after 1980, the period increases have slightly shallower slopes than those of the decreases. The period variations, which are reflected in the O–C diagram, do not show any regularity in the amplitudes and time intervals.

Since the system BZ Eri is thought to be of Algol type by Hoffmeister (1934), Srivastava and Sinha (1981), and Srivastava and Uddin (1985), the period variations present in the system can be interpreted on the basis of mass transfer between the components. Although some evidence of mass transfer – such as changes in the depths, humps, and asymmetries in the branches of minima – are noticed in U, B, and V light curves (Srivastava and Uddin, 1985), this fact remains to be confirmed from future observations.

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