PERIOD STUDY OF IT PERSEI

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Abstract. A new period (P = 1^d.533731) of the eclipsing binary system IT Persei has been given, which is based on all available times of minima. O–C diagrams of IT Persei, based on the period given in PPEN (1980) and based on the new period, have been given. Long-term period changes are not present in the system, however, some period fluctuations of the order of 10^{-5} d are seen around the years 1907, 1921, and 1933.

1. Introduction

Early history of IT Persei (IT Per = BD + 43°0561 = BV 11, 9^m.5) is not specifically available in the literature. However, Reim (cf. Banachiewicz, 1960, 1961) appears to be the first to work on IT Per as per literature available to us. Geyer (cf. Wood *et al.*, 1980) gave minima and photographic light curve of IT Per. Busch (cf. Wood *et al.*, 1980) presented a brief review of IT Per. Photoelectric observations of IT Per are not traceable in the literature. Detailed period study of the system has been attempted in this paper for the first time.

2. Epoch, Period and New Period

Early traces of period and epoch determinations are available in Banachiewicz (1960, 1961). Reim (cf. Banachiewicz, 1961) apears to have given a period of 0^d.76493, which is less than half the presently determined value. Strohmeier (cf. Koch *et al.*, 1963) revised the period of the system.

Strohmeier and Bauernfeind (1968) compiled minima of IT Per. Busch (1975) gave photographic minima. Diethelm (1975), Braune (1982), and Hübscher (1982) and others gave visual minima of the system. Epochs and periods of IT Per have been presented in Table I.

We have collected 44 minima of IT Per available in the literature. Out of these two minima have not been considered in the discussion as they give unusually high values of O–C. From 42 minima, a new period of IT Per has been obtained after trials, using the method of least squares. The period comes out to be 1^d.533731 ($\pm$ 0^d.000001).

3. O–C Diagrams and Period Changes

In all, forty-four minima were available in the literature, which were observed in the time interval 1902 to 1982. Only 42 minima have been considered in the present period study. Out of these three minima are secondary, while the remaining minima are primary. Except the last three visual minima, the remaining minima appear to be photographic.

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TABLE I

Epochs and periods of IT Persei

Sl. No.	Author	Epoch and period
1	Banachiewicz (1960)	– + $0^d.76493$
2	Strohmeier and Bauernfeind (1968)	J.D. 2426352.3214 + $1^d.533715$
3	Reim (cf. Banachiewicz, 1961)	J.D. 2427030.2 + $0^d.76493$
4	Geyer (cf. KPAN 1963)	J.D. 2427030.2 + $1^d.533715$
5	Geyer (cf. Banachiewicz, 1971) and also Strohmeier (cf. PPEN, 1963)	J.D. 2427030.2234 + $1^d.533715$
6	Braune (cf. Banachiewicz, 1984)	J.D. 2445022.351 + $1^d.533715$
7	Srivastava (present work)	J.D. 2415666.795 + $1^d.533731$

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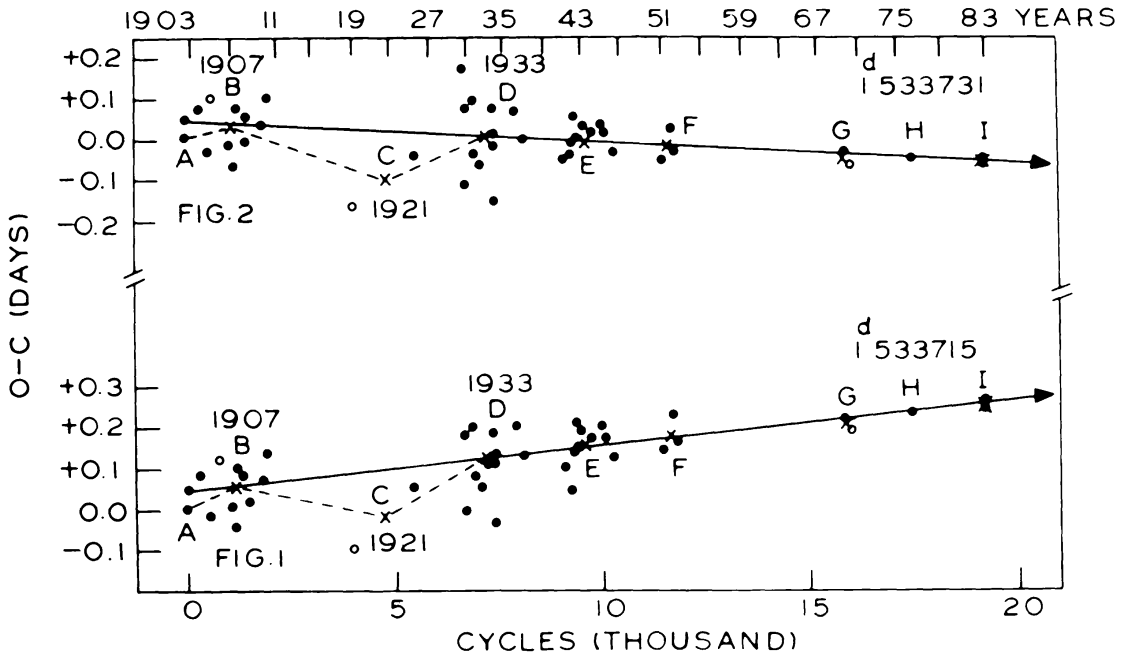

Fig. 1. The O–C diagram based on the initial epoch and $P = 1^d.533715$. The solid and open circles represent primary and secondary minima respectively, while the crosses represent mean O–C values. The solid line with an arrow at one end shows the smoothened line drawn through the O–C values, while the dashed lines represent the period fluctuations.

Fig. 2. The O–C diagram based on the initial epoch and $P = 1^d.533731$. The solid and open circles represent primary and secondary minima, respectively, while the crosses represent mean O–C values. The solid line with an arrow at one end shows a smooth line drawn through the O–C values, while the dashed lines represent the period fluctuations.

TABLE II

Minima of IT Per

J.D.$_\odot$	Min.	Based on $P = 1^d.533715$				Based on $P = 1^d.533731$				Reference
		Cycle	Mean of cycles	O–C	Mean of O–C values	Cycle	Mean of cycles	O–C	Mean of O–C values	
2415666.795	I	0		$0^d.000$		0		$0^d.000$		1
2416111.650	I	290		+0.078		290		+0.073		1
2416499.587	I	543		−0.015		543		−0.024		1
2416719.809	II	686.5		+0.119		686.5		+0.108		1
2417292.536	I	1060		+0.003		1060		−0.014		1
2417531.750	I	1216		−0.042		1216		−0.062		1
			1174		$+0^d.056$		1174		$+0^d.037$	
2417548.765	I	1227		+0.102		1227		+0.082		1
2417867.759	I	1435		+0.083		1435		+0.060		1
2417890.703	I	1450		+0.021		1450		−0.002		1
2418531.845	I	1868		+0.070		1868		+0.040		1
2418680.686	I	1965		+0.141		1965		+0.110		1
2418950.832	I	2141		+0.353(?)		2141		+0.319(?)		1
2421826.866	II	4016.5		−0.095		4016.5		−0.160		1
			4750		−0.021		4750		−0.098	
2424077.741	I	5484		+0.053		5484		−0.035		1
2424424.670	I	5710		+0.362(?)		5710		+0.271(?)		1
2425890.817	I	6666		+0.278		6666		+0.172		1
2425936.546	I	6696		−0.004		6696		−0.111		1
2425950.536	I	6705		+0.182		6705		+0.075		1
2426189.814	I	6861		+0.201		6861		+0.091		1
2426304.717	I	6936		+0.075		6936		−0.036		1
2426352.3214	I	6967		+0.1344		6967		−0.0234		1
2426603.768	I	7131	7214	+0.052	+0.126	7131	7214	−0.062	$+0^d.010$	1
2426939.789	I	7350		+0.189		7350		+0.072		1
2426994.781	I	7386		−0.033		7386		−0.151		1
2427014.860	I	7399		+0.108		7399		−0.010		1
2427030.2234	I	7409		+0.1344		7409		+0.0154		1
2427815.548	I	7921		+0.197		7921		+0.070		1
2428100.750	I	8107		$+0^d.128$		8107		$-0^d.002$		1

Table II (continued)

J.D.$_{\odot}$	Min.	Based on $P = 1^{d}.533715$				Based on $P = 1^{d}.533731$				Reference
		Cycle	Mean of cycles	O–C	Mean of O–C values	Cycle	Mean of cycles	O–C	Mean of O–C values	
2429657.442	I	9122		+0.099		9122		−0.047		1
2429856.832	I	9252		+0.044		9252		−0.042		1
2429959.627	I	9319		+0.142		9319		−0.007		1
2429996.504	I	9343		+0.210		9343		+0.061		1
2430048.584	I	9377		+0.144		9377		−0.006		1
			9605		$+0^{d}.151$		9605		$+0^{d}.003$	
2430321.630	I	9555		+0.189		9555		+0.036		1
2430646.765	I	9767		+0.176		9767		+0.020		1
2431048.620	I	10029		+0.198		10029		+0.037		1
2431071.603	I	10044		+0.175		10044		+0.014		1
2431376.769	I	10243		+0.132		10243		−0.032		1
2433212.628	I	11440		+0.134		11440		−0.049		1
2433574.674	I	11676	11621	+0.223	+0.174	11676	11621	+0.036	−0.012	1
2433683.510	I	11747		+0.165		11747		−0.023		1
2439904.307	I	15803		+0.214		15803		−0.039		2
			15883		+0.204		15883		−0.050	
2440150.449	II	15963.5		+0.194		15963.5		−0.061		2
2442453.350	I	17465		+0.223		17465		−0.056		3
2445022.343	I	19140		+0.243		19140		−0.063		4
			19140		+0.247		19140		−0.059	
2445022.351	I	19140		+0.259		19140		−0.055		5

? = Unusual value, not considered in the means.

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2. Busch, H.: 1975, *MHAR*, Heft 3.
3. Diethelm, R.: 1975, *BBS* **21**, 4.
4. Hübscher, J.: 1982, *BAV* **34**, 4.
5. Braune, W.: 1982, *BAV* **34**, 4.

BAV – Beobachtungsergebnisse der Berliner Arbeitsgemeinschaft für Veränderliche Sterne Mitteilungen.
BBS – Bedeckungs-Veränderlichen Beobachter der Schweizerischen Gesellschaft Bulletin.
MHAR – Mitteilungen der Bruno H. Burgel Sternwarte, Hartha.
VBAM – Veröffentlichungen der Remeis-Sternwarte, Bamberg (Astronomische Institute der Universität Erlangen-Nürnberg).

Two O–C diagrams (Figures 1 and 2) have been constructed based on the following ephemeris:

$$\text{Primary minimum} = \text{J.D. } 2415666.795 + 1^{d}.533715E, \quad \text{(Strohmeier, 1963)}$$

and

$$\text{Primary minimum} = \text{J.D. } 2415666.795 + 1^{d}.533731E, \quad \text{(present period)}$$

respectively.

Figure 1 shows that the period ($1^{d}.533715$), given earlier, was underestimated. The period behaviour has been discussed on the bases of O–C diagram (Figure 2). This O–C diagram splits up into eight portions (*AB*, *BC*, *CD*, *DE*, *EF*, *FG*, *GH*, *HI*) between points *A* to *I*. The individual observations have been grouped as shown in Table II. Their mean O–C values are shown by crosses in the figures.

The system IT Per shows considerable scatter till 1945. Although, a detailed period study and estimates of the period changes in different portions of the O–C diagram are not fruitful in the absence of photoelectric observations, yet some fluctuations of the period (of the order of 10^{-5} d) are apparent in Figure 2, around the years 1907, 1921, and 1933. After 1933, considering the point *C* as significant, the period seems to have stabilized and shows a constant trend. GCVS (1985) classifies IT Per as EA/SD, indicating that IT Per is a semi-detached system. Thus, period changes of the order of 10^{-5} d are possible in the system. The O–C values of secondary minima are at larger variance than those of primary minima.

4. Summary

The O–C diagram based on the new period shows that the period of the system is fairly constant. Some fluctuations of the order of 10^{-5} d are seen between the points *A* and *D*. O–C values of secondary minima are more deviated compared to the O–C values of primary minima. Photoelectric minima of IT Per are badly needed for any detailed period study.

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