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THE PERIOD OF TW DRACONIS FROM 1880 TO 1970

It is long known that the period of this eclipsing binary is increasing. In 1910 Graff found the period

2^d80654 (1910)

In the last edition of Rocznik Astronomiczny (SAC 40, 1969) the following period is given:

2^d806687 (1958)

If new elements were calculated in the past 50 years, a few years later the O-C has become positive.

As a part of a joint photoelectric programme of the Observatories Nürnberg (Germany) and Izmir (Turkey) a few minima of TW Dra were determined. Table 1 gives the observed time of minima and the O-C against the elements given in SAC 40.

Table 1

Min (helioc)	O-C (SAC 40)	
2438 539.4451	+ 0 ^d 009	Nürnberg, pe
671.3698	+ 0.011	" "
39 979.3515	- 0.009	Izmir, "
40 080.3995	- 0.009	" "
473.352	- 0.018	Nürnberg, "

The last 3 minima show negative (O-C)-values. It appears that the period of TW Dra is now becoming shorter. That is why we reconsider here the O-C diagram using all published minima.

From 134 published minima I formed 14 normal minima listed in Table 2. The minima 15 to 19 are the photoelectric minima from Table 1.

Table 2

Normalminima and photoelectric minima

No.	Min (helioc.)	E	n	O-C(P)	O-C (I-IV)	
1	2414 935.225	0	2 pg	0.000	+0.005	
2	18 754.885	1361	5 pg	-0.253	-0.019	
3	19 543.538	1642	39 vis	-0.282	0.000	I
4	20 169.407	1865	28 vis	-0.306	+0.014	
5	22 810.398	2806	5 vis	-0.416	+0.005	
6	23 711.324	3127	6 vis	-0.439	+0.002	II
7	24 746.958	3496	5 vis	-0.476	-0.012	
8	26 627.422	4166	3 vis	-0.499	+0.007	
9	27 629.414:	4523	3 pg	-0.497:	-	
10	33 310.238	6547	8 vis	-0.426	0.000	
11	33 759.340	6707	13 vis	-0.395	+0.002	
12	34 208.438	6867	8 vis	-0.369	0.000	III
13	34 876.4683	7105	1 pe	-0.332	-0.005	
14	35 951.510	7488	7 vis	-0.255	+0.003	
15	38 539.4451	8410	1 pe	-0.093	-0.0006	
16	38 671.3698	8457	1 pe	-0.083	+0.0028	
17	39 979.3515	8923	1 pe	-0.021	-0.0006	IV
18	40 080.3995	8959	1 pe	-0.015	+0.0013	
19	40 473.352	9099	1 pe	0.000	-0.003	

Column 4 (n) gives the number of single minima used for forming a normalminimum. The O-C values in column 5 were calculated with a mean period and the normalminimum 1 as E = 0, i.e.

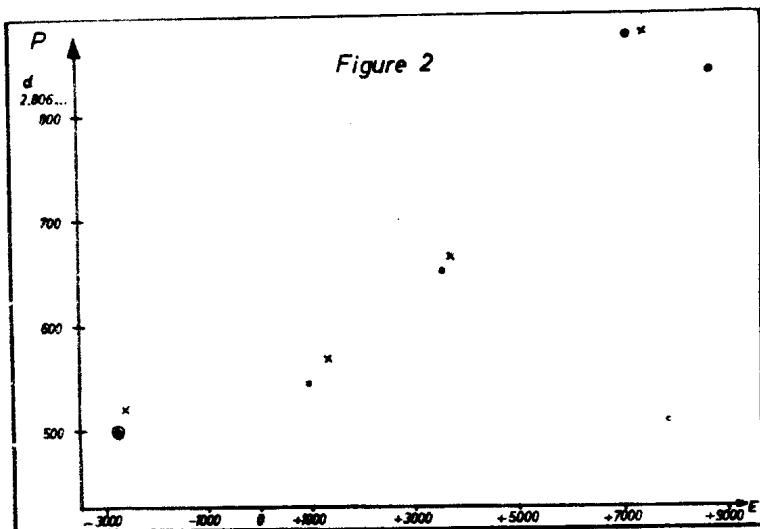
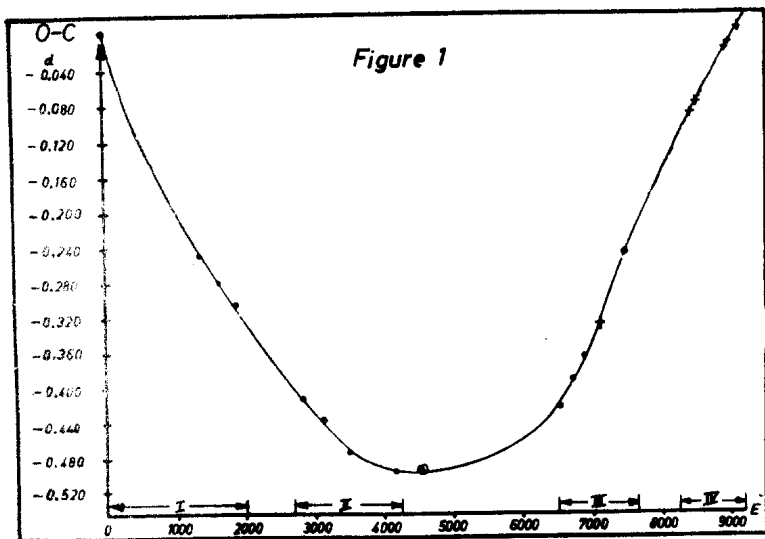
$$\text{Min} = 2414.935.225 + 2^d 8066960.E$$

(s. Figure 1.)

For the epochs I to IV linear elements were calculated using the method of least squares. Table 3 gives the corresponding elements together with the mean errors and the mean epochs.

Table 3

Min = 2414 935.220	+ 2 ^d 806527.E (I)	\bar{E} = 930
+16	+12	
Min = 2422 810.393	+ 2 ^d 806634.E (II)	\bar{E} = 3490
+ 8	+10	
Min = 2433 310.238	+ 2 ^d 8068742.E (III)	\bar{E} = 7020
+26	+43	
Min = 2438 539.4457	+ 2 ^d 8068352.E (IV)	\bar{E} = 8750



The O-C values are given in column 6 of Table 2; the elements (IV) give a good representation of the observed minima from 1964-1970.

Figure 2 shows the change of period; dots give the periods I to IV (Table 3), the period represented by a dot in circle at $E = -2800$ was calculated only from 2 minima. Crosses represent the periods published by Schneller (MVS 1, page 187; 1966) which are in very good accordance with our values.

Figure 2 and Table 3 show very clearly that

- 1) Between $E = -3000$ and $+1000$ (1876-1907) the period of TW Dra was nearly constant.
- 2) Between $E = +1000$ and $+7500$ (1908-1958) the period has considerably increased.
- 3) At present ($E > 8000$) the period of TW Dra is decreasing.

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BD +28°838

Dans le Bulletin No.409, j'ai publié une liste de 13 variables nouvelles, dont l'une, BD +28°838, était signalée comme Algolide avec un seul minimum observé le j.j. 2440 267. Trois observateurs suisses, N.N. Locher, Disthelm et Wälke, n'ayant pas remarqué d'éclipse, j'ai fait un fort agrandissement de la photo du minimum (x17): une légère auréole blanche autour de BD +28°838 indique peut-être un défaut dans l'émulsion, ce qui fait que la variable est douteuse.

A. BRUN

03, Le Breuil
France