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First photoelectric BV lightcurves, improved position and ephemerides for the totally eclipsing EW type system V432 Per

[BAV Mitteilungen Nr. 61]

V432 Per = S 10154 Per was announced as a short period variable by Hoffmeister (Hoffmeister 1968a) with a range between 10.5 mag and 11 mag. He classified the star as a possibly eclipsing variable and gave two photographic plate minima (Hoffmeister 1968b). Pinto and Romano investigated the star in their photographic research. They confirmed the type of variability and found the range between 11.4 mag and 12.0 mag. They communicated six photographic plate minima, derived from them first elements as

$$\text{Min I} = \text{HJD} \quad 2438670.55 + 0.5271396 \cdot \text{E}$$

and published a first photographic light curve (Pinto and Romano 1976). Busch and Häußler (1979) investigated this star on plates of the Sonneberg sky survey and reported 32 minima. From these they derived new elements as

$$\text{Min I} = \text{HJD} \quad 2435874.376 + 0.321517 \cdot \text{E}$$

with a range between 11.0 mag and 11.7 mag. The type was given as EW. With these data V432 Per was included in the GCVS (Kholopov et al., 1987). Since that, eleven times of minimum light were published by the BBSAG (Diethelm 1990a, 1990b and 1991).

The unusually large scatter in the O–C–Diagram, derived from the BAV Database of D. Lichtenknecker and the contradictory elements made V432 Per a candidate for the program of the author.

The observations were made at the private observatory of the author with a 0.35 m automatic photoelectric telescope (Agerer 1988). The photometer was equipped with an uncooled EMI 9781A tube and Schott filters for B and V. Minimum timings are calculated using the Kwee–van Woerden method (Kwee, van Woerden 1956). V432 Per was observed on six nights between Dec. 1991 and Oct. 1992, mostly in two colors. SAO 038613 served as comparison star and SAO 038621 to check its constancy. Six primary and two secondary minima were observed (Table 1). The primary minima showed a constant phase of d = 25 min in V and somewhat less in B. The light in secondary minima was constant for 40 min in V and for 35 min in B. The amplitudes for the primary minimum were 0.62 mag in V and 0.74 mag in B. For the secondary minima the amplitudes were 0.36 mag (V) and 0.38 mag (B).

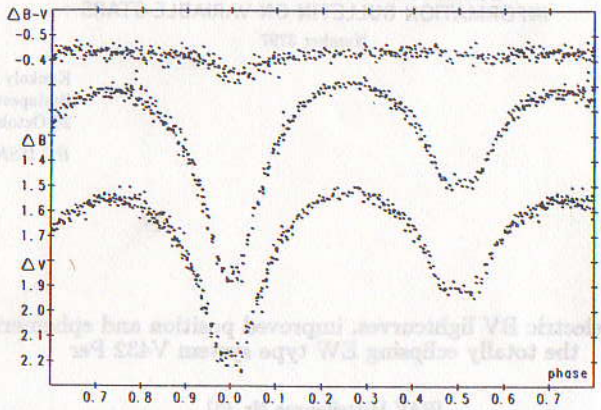

Figure 1: Differential B and V light and B–V color curves for V432 Per.

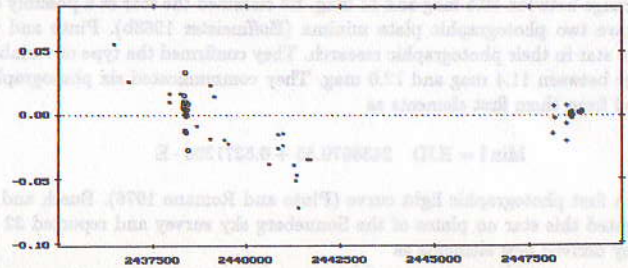

Figure 2: (O–C) Diagram for V432 Per computed with respect to the ephemeris (1). • represents photoelectric, ∘ photographic, + visual observations and ■ photographic plate minima.

Table 1: Observed times of minima for V432 Per, epochs and residuals computed with respect to the ephemeris derived in this paper.

No.	JD hel. 2400000+	Weight	Type*	Filter	Epoch	(O–C)1	(O–C)2	Observer	Source
1	35874.370	0	P::		-33203.	-0.001	0.115	[2]	VSS 9.143
2	36460.505	1	P		-31674.	0.055	0.166	[2]	"
3	36852.601	1	P		-30651.	0.026	0.133	[2]	"
4	37946.555	1	P		-27797.	0.017	0.114	[2]	"
5	37959.581	1	P		-27763.	0.010	0.107	[2]	"
6	38240.553	1	P		-27030.	0.017	0.111	[2]	"
7	38289.609	1	P		-26902.	0.009	0.103	[2]	"
8	38317.592	1	P		-26829.	0.011	0.104	[2]	"
9	38322.569	10	F		-26816.	0.005	0.098	[2]	"
10	38325.637	10	F		-26808.	0.006	0.100	[2]	"
11	38331.587	10	F		-26792.5	0.015	0.108	[2]	"
12	38356.491	10	F		-26727.5	0.004	0.097	[2]	"
13	38370.465	10	F		-26691.	-0.013	0.080	[2]	"
14	38371.278	10	F		-26689.	0.034	0.127	[2]	"

Table 1 (cont.)

No.	JD hel. 2400000+	Weight	Type*	Filter	Epoch	(O–C)1	(O–C)2	Observer	Source
15	38373.353	10	F		-26683.5	0.000	0.093	[2]	VSS 9.143
16	38373.531	10	F		-26683.	-0.013	0.080	[2]	"
17	38385.426	10	F		-26652.	-0.001	0.092	[2]	"
18	38399.236	10	F		-26616.	0.010	0.103	[2]	"
19	38399.418	10	F		-26615.5	0.000	0.093	[2]	"
20	38406.495	10	F		-26597.	-0.014	0.079	[2]	"
21	38410.346	10	F		-26587.	0.004	0.097	[2]	"
22	38439.290	10	F		-26511.5	0.008	0.101	[2]	"
23	38440.404	10	F		-26508.5	-0.028	0.065	[2]	"
24	38670.60	1	P		-25908.	-0.01	0.082	[1]	AN 290.277
25	39038.566	1	P		-24948.	-0.019	0.068	[2]	VSS 9.143
26	39058.540	1	P		-24896.	0.023	0.110	[2]	"
27	39151.292	1	P		-24654.	0.014	0.100	[2]	"
28	39436.44	1	P		-23910.	-0.02	0.064	[1]	AN 290.277
29	39527.281	1	P		-23673.	-0.023	0.060	[2]	VSS 9.143
30	40624.295	1	P		-20811.	-0.039	0.034	[2]	"
31	40863.492	1	P		-20187.	-0.027	0.044	[3]	MSAI 47.236
32	40863.503	1	P		-20187.	-0.016	0.055	[3]	"
33	41008.385	1	P		-19809.	-0.024	0.045	[3]	"
34	41008.395	1	P		-19809.	-0.014	0.055	[3]	"
35	41272.470	1	P		-19120.	-0.039	0.027	[3]	"
36	41335.320	1	P		-18956.	-0.052	0.014	[2]	VSS 9.143
37	41363.306	1	P		-18883.	-0.047	0.018	[2]	"
38	41417.327	1	P		-18742.	-0.073	-0.008	[2]	"
39	41657.316	1	P		-18116.	-0.035	0.028	[3]	MSAI 47.234
40	41717.304	1	P		-17959.5	-0.035	0.028	[2]	VSS 9.143
41	47924.393	0	V::		-1766.	-0.058	-0.052	[4]	BBS 94
42	47929.376	0	V::		-1753.	-0.058	-0.052	[4]	"
43	47946.407	0	V::		-1708.5	-0.084	-0.078	[4]	"
44	47956.355	0	V::		-1683.	-0.089	0.095	[4]	"
45	48128.548	5	V		-1233.5	-0.015	-0.011	[5]	BBS 96
46	48163.451	5	V		-1142.5	0.007	0.011	[5]	"
47	48176.474	5	V		-1108.5	-0.002	0.001	[5]	"
48	48189.435	0	V::		-1074.5	-0.074	-0.070	[4]	"
49	48481.598	5	V		-312.5	0.008	0.009	[5]	BBS 98
50	48484.636	5	V		-304.5	-0.021	-0.020	[5]	"
51	48487.525	5	V		-297.	-0.007	-0.006	[5]	"
52	48601.3739	20	E	B	0.	-0.0004	-0.0006		this paper
53	48601.3741	20	E	V	0.	-0.0002	-0.0004		"
54	48602.3331	20	E	B	2.5	0.0005	0.0003		"
55	48602.3338	20	E	V	2.5	0.0012	0.0010		"
56	48602.5246	20	E	V	3.	0.0004	0.0002		"
57	48602.5247	20	E	B	3.	0.0005	0.0003		"
58	48624.3711	20	E	B	60.	-0.0017	-0.0021		"
59	48624.3713	20	E	V	60.	-0.0015	-0.0019		"
60	48624.5662	20	E	V	60.5	0.0017	0.0013		"
61	48624.5675	20	E	B	60.5	0.0030	0.0026		"
62	48645.4552	20	E	V	115.	0.0004	-0.0002		"
63	48832.5116	20	E	B	603.	0.0021	-0.0002		"
64	48832.5118	20	E	V	603.	0.0023	0.0000		"
65	48893.4584	20	E	B	762.	0.0028	-0.0001		"
66	48893.4590	20	E	V	762.	0.0034	0.0005		"

[1]: C.Hoffmeister, [2]: H.Busch & K.Häußler, [3]: G.Pinto & G.Romano, [4]: H.Peter, [5]: J.Vandenbroere.
*) P denotes pg plate min., E photoel. min., F photographic series and V visual estimates. Those marked "::" were discarded.

In compiling the light curve (Figure 1) it became evident, that the period given by Pinto and Romano, as well as the period given in the GCVS are spurious ones with the relations

$$\frac{1}{P} - \frac{1}{P_{P\&R}} = \frac{5}{7} \quad \text{and} \quad \frac{1}{P_{GCVS}} - \frac{1}{P} = \frac{1}{2}$$

respectively.

Using all available times of minima, a (weighted) least squares fit provided the following improved linear ephemeries:

$$\text{Min I} = \text{HJD } 2448601.3743 \underset{\pm 6}{} + \underset{\pm 4}{0.38330885} \cdot E \qquad (1)$$

Instantaneous elements, computed from photoelectric minima only, are:

$$\text{Min I} = \text{HJD } 2448601.3745 \underset{\pm 1}{} + \underset{\pm 22}{0.38331234} \cdot E \qquad (2)$$

Together with all previous minima, found in the BAV Database, this ephemeris indicates, there has been a distinct increase of the period since 1968 (Figure 2).

In the course of this investigation the declination given by Hoffmeister and in the GCVS was found to be somewhat erronous. From a copy of a Palomar Sky Survey print the position was redetermined through differential measurements against five SAO stars, distributed in a field of $1^\circ \times 1^\circ$ around V432 Per as:

$$\alpha_{2000} = 3^h\ 10^m\ \underset{\pm 0.1^s}{10.8^s} \qquad \delta_{2000} = +42^\circ\ 52'\ \underset{\pm 1''}{12''}$$

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