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FURTHER OBSERVATIONS, IMPROVED POSITION AND EPHEMERIS FOR THE
EW TYPE SYSTEM V728 HERCULIS

(BAV Mitteilungen Nr. 51)

Recently, Nelson, Milone and Penfold (1988) reported on BVI photometry and spectroscopy of the short-period eclipsing binary V 728 Her (= SVS 2086). They noted that the period $P = 0^d446250$ quoted by its discoverer (Kurochkin 1977), fails to represent the observations. However, the preliminary period of $P = 0^d471302$ obtained by Nelson *et al.* was still inadequate to fit the observed times of minimum. Differential UBV photometry - albeit of very poor quality - of V 728 Her had already been secured by Ciardo *et al.* (1985) who also suggested a longer period (around 0^d4747).

To derive an adequate ephemeris for V 728 Her, we have collected all available epochs of minima from the literature (Table 1). For the photographic observations, these are epochs of faint light on photographic plates. Application of a simple least-squares period search algorithm led to a period close to that found by Nelson *et al.* (1988). Both the periods quoted by Kurochkin and Ciardo *et al.* turned out to be spurious periods caused by interference with the sidereal day and a gap of one month between successive observational series, respectively. The time span covered by photoelectric observations proved adequate to define the period with an accuracy sufficient to bridge the gap of 11 years to Kurochkin's estimates on plates obtained with the 40cm astrograph at the Krim station of the Sternberg Institute, and, subsequently, even 80 years backward in time, to the old plate collection ("S" series) of Moscow Observatory (cf. Kurochkin, 1977).

To test the new ephemeris, we reobserved V 728 Her with the automatic photoelectric telescope at F. Agerer's private observatory (for a description see Agerer 1988a). The telescope used was a 0.35 m Schmidt-Cassegrain. The photometer was equipped with an EMI 9781B tube and Schott filters BG12 (1mm) + GG385(2mm) for the B and GG495(1mm) for the V colour, the size of the diaphragm was 32". The differential instrumental magnitudes have been transformed to the international UBV system. The light curve, reduced with the new period, is shown in Fig.1. The amplitudes in B and V are $0^m39(0^m38)$ resp. $0^m36(0^m35)$; the values given in parentheses apply to minimum II which

Table 1. Observed times of minima for V 728 Her, epochs and residuals computed with respect to the ephemeris (1) and (2) derived in this paper

No.	JD helioc.	Min	Type*	Epoch	(O-C)1	(O-C)2	Observer	Source
1	2417796.394	II	P:	-61860	+0.024		N.E.Kurochkin	PZP 3.212
2	40361.509	II	P	-13980	+0.003			
3	40809.460	I	P	-13029	-0.002			
4	40810.405	I	P	-13027	+0.000			
5	40827.372	I	P	-12991	+0.001			
6	41062.573	I	P::	-12492	+0.031			
7	41533.337	I	P:	-11493	-0.019			
8	41567.287	I	P	-11421	-0.002			
9	41571.292	II	P	-11413	-0.003			
10	41957.241	II	P::	-10594	-0.036			
11	45882.375	I	E:	- 2265	-0.001	+0.0024	Ciaro <i>et al.</i>	ASS 111.123
12	46257.7518	II	E	- 1469	-0.003	-0.0006	D.R.Faulkner	PASP 98.691
13	46612.868	I	E	- 715	+0.000	+0.0011	Nelson <i>et al.</i>	IBVS 3201
14	46613.809	I	E	- 713	-0.002	-0.0005		
15	46949.835	I	E	0	-0.002	-0.0019		
16	47304.469	II	E::	752	-0.010	-0.0111	R.Diethelm	BBSAG 88
17	47353.4937 B	II	E	856	+0.001	-0.0002	F.Agerer	this paper
	.4937 V				+0.001	-0.0002		
18	47365.5121 B	I	E	882	+0.002	+0.0003		
	.5128 V				+0.003	+0.0010		
19	47366.4537 B	I	E	884	+0.001	-0.0006		
	.4565 V				+0.004	+0.0022		
20	47378.4726 B	II	E	909	+0.002	+0.0004		
	.4733 V				+0.003	+0.0011		

*) P denotes pg plate min. (weight 2 or 1), E photoelectric min. (weight 100 or 25). Minima marked ":" received reduced weight, while those marked "::" were discarded, as outliers. The epoch given by Diethelm (1988) is based on a very small number of measurements and was therefore considered unreliable.

is only marginally shallower. Four epochs of minima derived from our observations are listed in Table 1; these were used to further refine the orbital period of V728 Her by the method of least squares. We give as best overall linear ephemeris, covering an interval of eighty years,

$$\text{Min I} = 2446949.837 + 0^d4712852 * E \quad (1906-1988). \quad (1)$$

Instantaneous elements, computed from photoelectric minima only, are

$$\text{Min I} = 2446949.8370 + 0^d4712868 * E \quad (1984-1988). \quad (2)$$

$$\pm 4 \qquad \qquad \pm 4$$

It seems that the period has been constant within $2 \cdot 10^{-5}$ days during the last 80 years. Contrary to the suggestion of Nelson *et al.* (1988), there is no need to include a quadratic term in the ephemeris formula.

Although the variable is correctly identified on the chart provided by Kurochkin (1977), the position quoted in that paper (and in the GCVS) pertains to another star, much fainter and about 3 arc minutes south of V 728 Her. From a Palomar Sky Survey print (PSS E-1135, +42° 17h 00m) we have re-

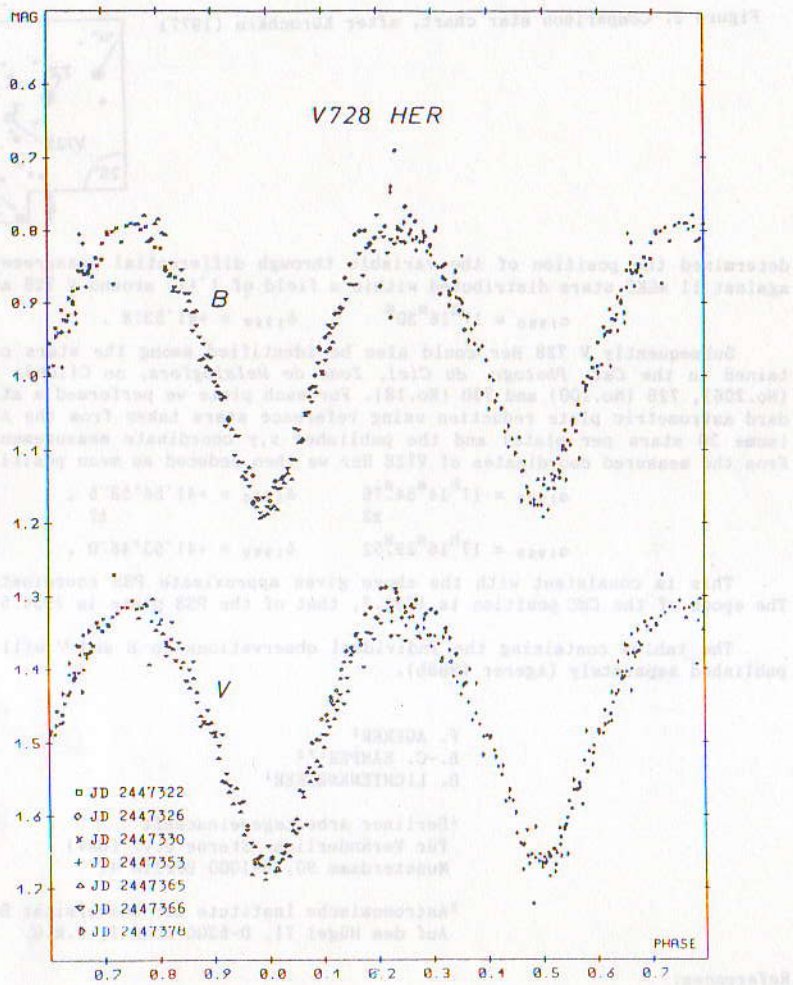
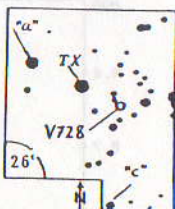


Figure 1. Differential B and V light curves of V 728 Her.
The comparison star is the star marked "a" in Fig. 2

Figure 2. Comparison star chart, after Kurochkin (1977)



determined the position of the variable through differential measurements against 11 AGK3 stars distributed within a field of $1' \times 1'$ around V 728 as

$$\alpha_{1950} = 17^{\text{h}} 16^{\text{m}} 30^{\text{s}} \quad \delta_{1950} = +41^{\circ} 53' 8'' .$$

Subsequently V 728 Her could also be identified among the stars contained in the *Cat. Photograph. du Ciel, Zone de Helsingfors*, on Clichés 723 (No.206), 726 (No.100) and 730 (No.18). For each plate we performed a standard astrometric plate reduction using reference stars taken from the AGK3 (some 30 stars per plate) and the published x,y coordinate measurements. From the measured coordinates of V728 Her we then deduced as mean position

$$\alpha_{1900} = 17^{\text{h}} 14^{\text{m}} 54^{\text{s}} .76 \quad \delta_{1900} = +41^{\circ} 56' 58'' .5 ,$$

$$\quad \quad \quad \pm 2 \quad \quad \quad \pm 2$$

$$\alpha_{1950} = 17^{\text{h}} 16^{\text{m}} 29^{\text{s}} .52 \quad \delta_{1950} = +41^{\circ} 53' 46'' .0 .$$

This is consistent with the above given approximate PSS coordinates. The epoch of the CdC position is 1892.7, that of the PSS plate is 1954.5.

The tables containing the individual observations in B and V will be published separately (Agerer 1988b).

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