DHK 40 HER IS JUST WAITING FOR A DESIGNATION

Summary: about 600 visual estimates of DHK 40 Her, a new eclipsing binary, shows the need for a new light variation period, shorter than that one proposed by D.H.Kaiser in 1994. Hence, new light elements are calculated and are reported in this work. The shape of visual light curve is very similar to the photoelectric light curve.

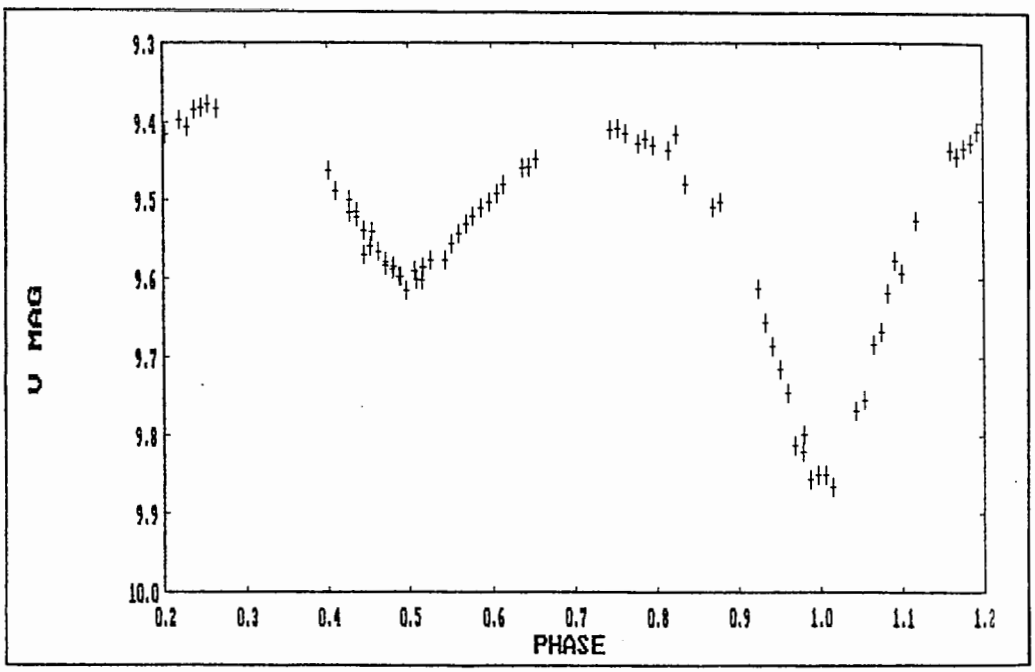
Introduction

In 1994 the continuing photographic patrol on Harvard plates, carried out by D.H.Kaiser, resulted in the discovery of a new variable star in Hercules' constellation. D.B.Williams, photoelectrically observing the star, confirmed its variability and provided its photographic magnitude range. Furthermore, M.E.Baldwin visually monitored the new variable star and detected additional minima, helping to determine the period. The star, SAO 46698 denoted DHK 40, is at position RA $17^h\ 23^m\ 09^s$ and Dec 49° 41' 16"*), the variability range found is 9.38 to 9.87 (min II to 9.62) in V-band, the spectrum is an F8, the type EB and the period about 0.530 day[1]. Further observations, carried out by Kaiser and Terrell, provided a more accurate value of the period and the first light elements[2]:

$$\text{Min. I (HJD)} = 49545.6894 + 0.52964 * E \qquad (1)$$

The eclipsing binary type was found to be more similar to a W UMa's than a β Lyr's system. In figure 1 is shown the photoelectric light curve obtained by D.H.Kaiser who phased his data according to light elements (1):

Fig.1: DHK 40 Her's photoelectric light curve (D.H.Kaiser, 1994)

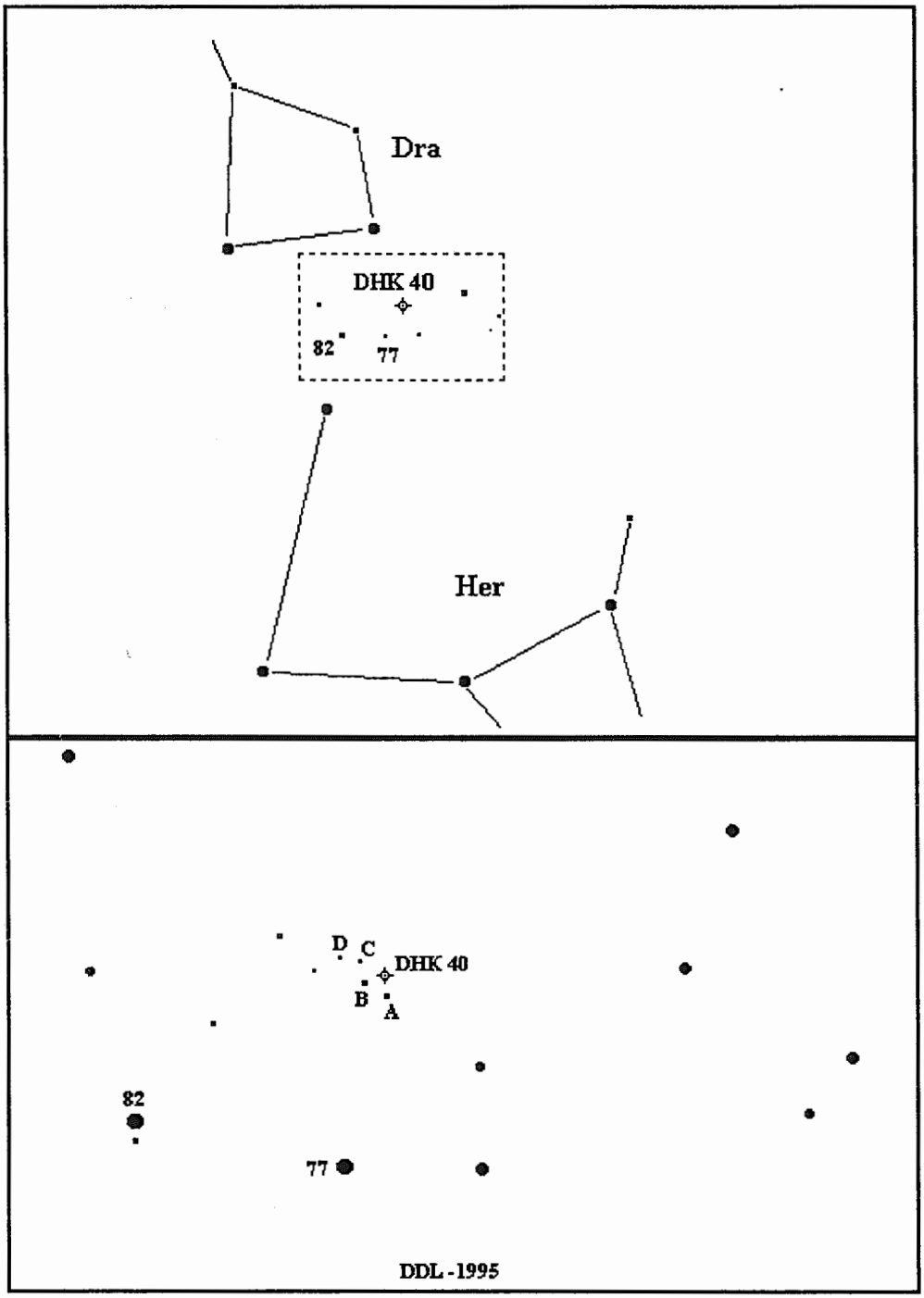


(*) coordinates for 1950

Results and discussion

In 1995 I observed DHK 40 Her, collecting about 600 visual estimates from March to August. This was possible using a finding chart provided by D.H.Kaiser and adapted for visual estimates. The finding chart, with comparison stars, is shown in the following page:

Fig.2 : DHK 40 Her's finding chart



The set of data were processed by SOP program[3] providing 25 heliocentric timings of light minimum. These timings, in julian days, O-Cs according to light elements (1) and the type of observed minimum are reported in table 1:

Table 1: timings of minimum observed in 1995

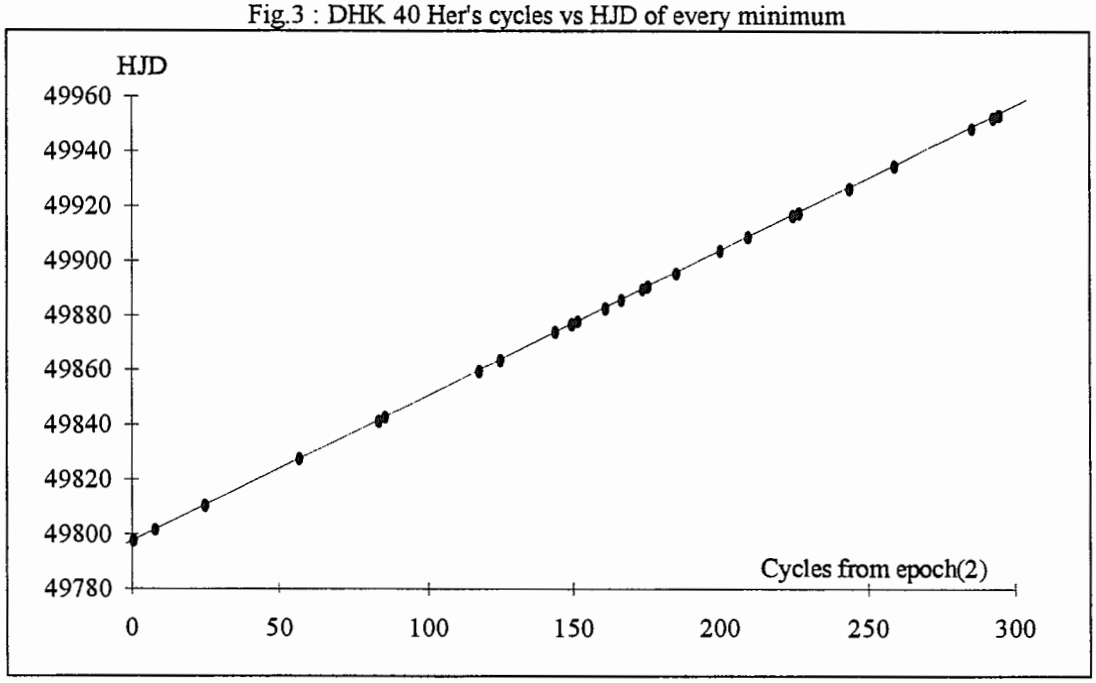
HJD	O-C(1)	TYPE
49797.465 ± 0.008	-0.068	II
49801.439 ± 0.007	-0.067	I
49810.454 ± 0.006	-0.055	I

Table 1: timings of minimum observed in 1995

HJD	O-C(1)	TYPE
49827.393 ± 0.017	-0.065	I
49841.433 ± 0.053	-0.060	II
49842.492 ± 0.004	-0.061	II
49859.414 ± 0.024	-0.087	II
49863.402 ± 0.009	-0.071	I
49873.462 ± 0.015	-0.075	I
49876.378 ± 0.021	-0.072	II
49877.440 ± 0.003	-0.069	II
49882.463 ± 0.010	-0.077	I
49885.378 ± 0.019	-0.075	II
49889.352 ± 0.003	-0.074	I
49890.414 ± 0.007	-0.071	I
49895.441 ± 0.007	-0.076	II
49903.391 ± 0.007	-0.070	II
49908.417 ± 0.004	-0.076	I
49916.360 ± 0.002	-0.077	I
49917.414 ± 0.017	-0.083	I
49926.421 ± 0.010	-0.080	II
49934.370 ± 0.013	-0.075	I
49948.387 ± 0.004	-0.094	II
49952.365 ± 0.008	-0.088	I
49953.420 ± 0.012	-0.092	I

As we can see, the epoch or the period of light elements (1) has to be corrected because of the regular occurrence of a relevant O-C for every timing of minimum. I treated my set of data by the least squares method. Reporting cycles versus HJD of every minimum I obtain a set of points, which were fitted by a straight line. So, the intercept indicates the epoch and the gradient indicates the period, whose values are the elements of the new equation (2):

Fig.3 : DHK 40 Her's cycles vs HJD of every minimum



$$\text{Min. I (HJD)} = 49797.208 + 0.52955 * E \qquad (2)$$
$$\pm 0.003 \quad \pm 0.00001 \qquad \text{(95\% of confidence)}$$

The value of the so calculated period is minor than that obtained by D.H.Kaiser in light elements (1). In fig.4 and fig.5 there are graphs showing the O-C's trend in time according to the old light elements (1) and the new light elements (2):

Fig.4 : O-C's trend in time according to light elements (1)

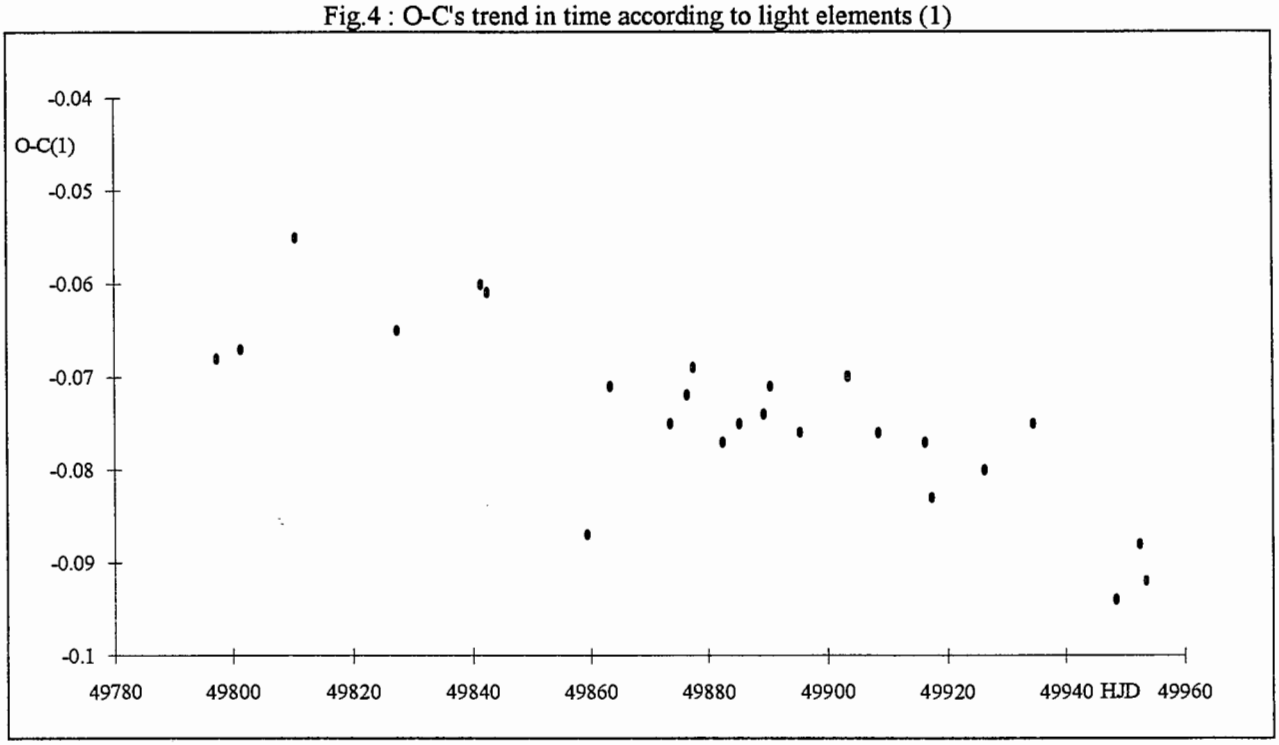
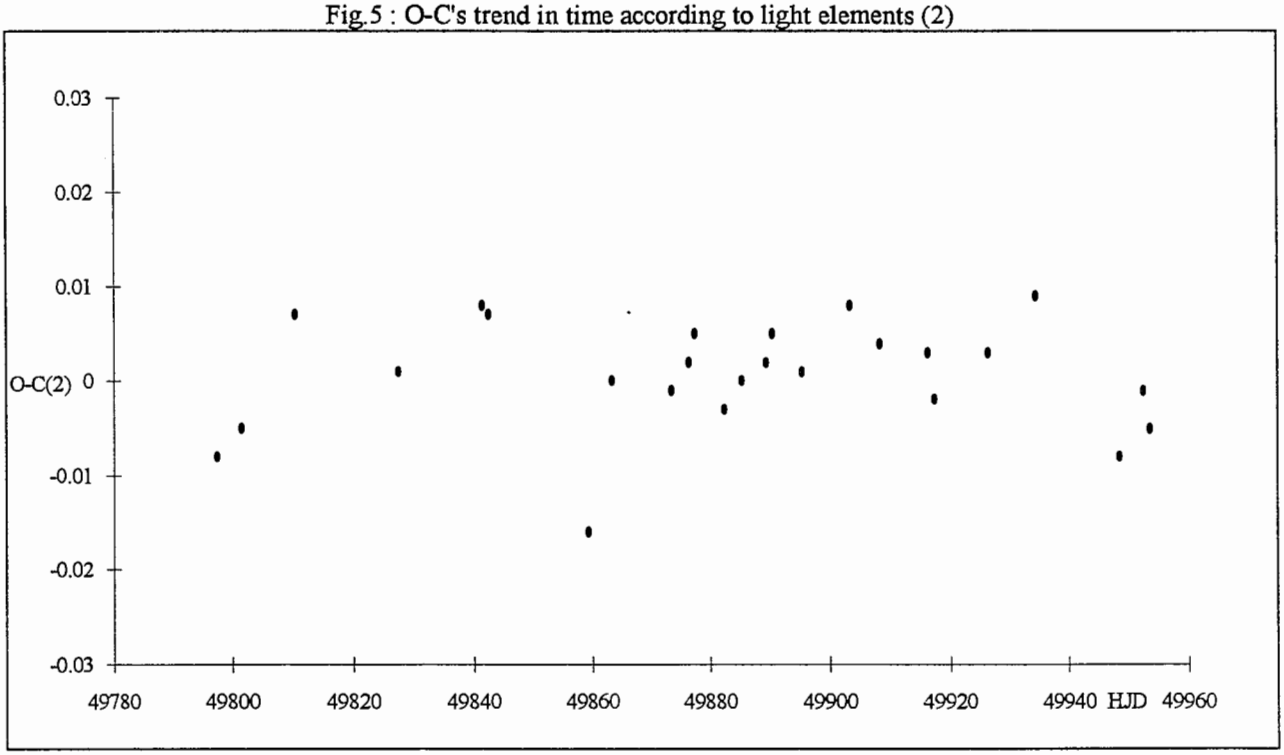


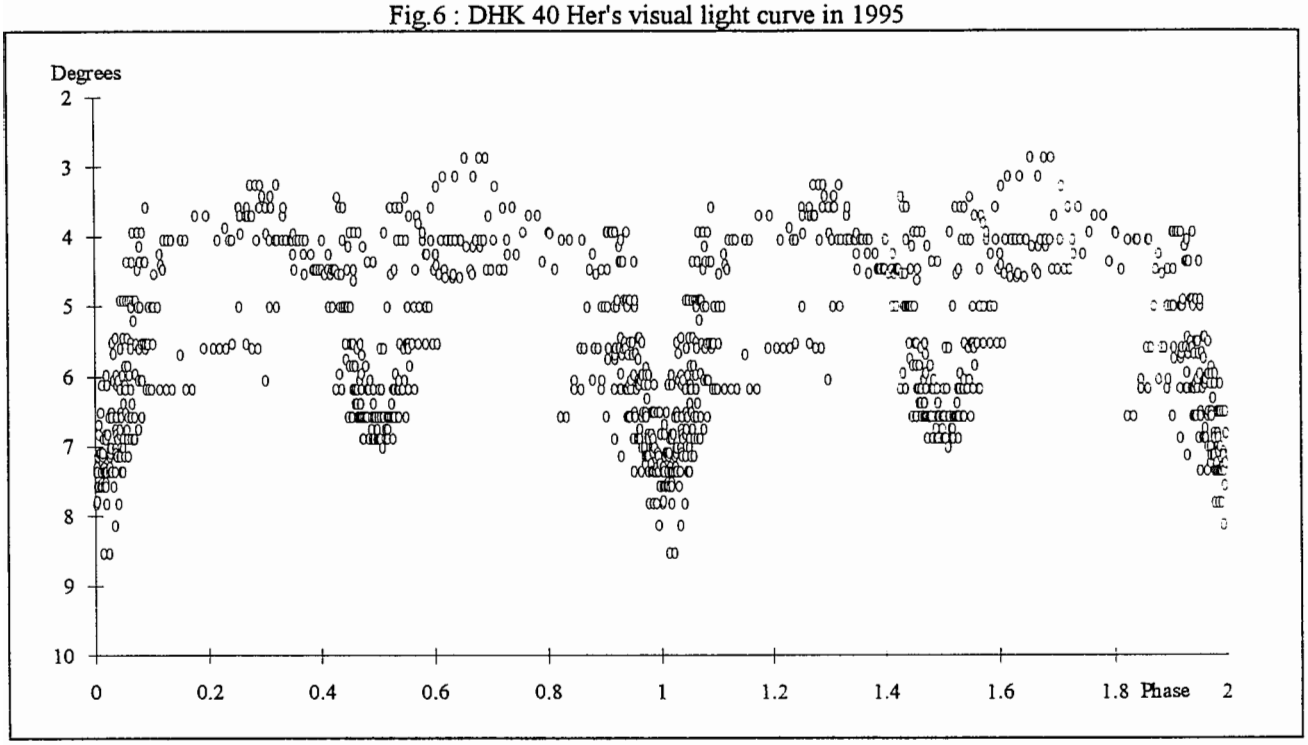
Fig.5 : O-C's trend in time according to light elements (2)



The light curve

The small range of light amplitude doesn't allow to achieve an accurate light curve. Nevertheless the light curve, obtained phasing observative data in 1995 by light elements (2), shows the same shape of the one found by D.H.Kaiser (see fig.1), i.e. a continuous curve characterized by a primary minimum deeper than secondary one. This behaviour is clearly showed in fig.6:

Fig.6 : DHK 40 Her's visual light curve in 1995



Conclusions

DHK 40 Her is confirmed to be a very interesting eclipsing binary of EW type. The observative data collected in 1995 let us to redefine light elements in order to explain the large observed O-C; the period seems to be shorter than that previously proposed but, as usual, other intensive visual and photoelectric observations help us to complete this work in 1996. The light curve, although not very accurate, shows a continuous shape and a marked difference between primary and secondary eclipses. DHK 40 Her only needs an official designation to really enter in the world of variable stars!

Acknowledgments

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Davide DALMAZIO (DDL)

References:

(1) D.H.KAISER, *Information Bulletin on Variable Stars,* **4119** (1994)
(2) D.H.KAISER, TERRELL, *BAAS,* **26,** nr 4, 1461 (1994)
(3) A.GASPANI, *Stochastic Optimization Program,* (priv.comm.)