A CONFIRMATION FOR THE PERIOD OF DU LEO (DHK 16)

Summary: a visual monitoring of DU Leo eclipses in 1995 afforded some times of minimum for this EA type eclipsing binary, which confirme the light elements reported in the IBVS 3999. Also the analysis of the light curve confirmed the duration of both primary and secondary eclipses, the different depth of minima and the partial eclipse which occurred in the DU Leo's binary system.

Introduction

DU Leo is a variable star discovered by D.H.Kaiser in 1990, which he designated DHK 16 in his discovery list[1]. The position is RA $9^h\ 44^m\ 14^s$ and Dec +25° 21' (2000), the spectral type is G0 and the variable star type found was EA. The star has a variation between 9.2 and 9.9 mag for the primary minimum and between 9.2 and 9.8 mag for secondary minimum. Each eclipse appears to be partial, with about 3.3 hours in duration[2]. The analysis of the discovery photo, one photoelectric minimum and six visual minima afforded the following light elements[2]:

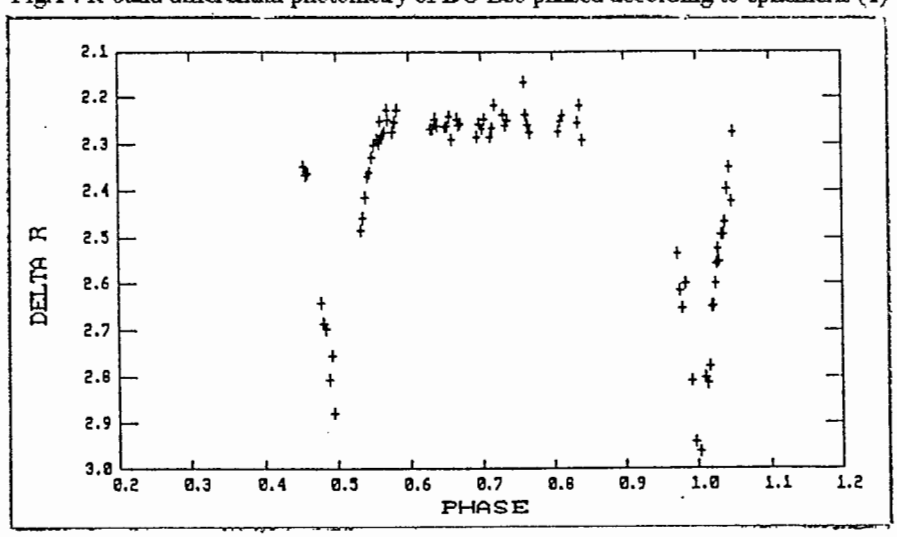
$$\text{Min. I (Hel.JD)} = 47999.617 + 1.3742 * E \qquad (1)$$
$$\pm 0.002 \pm 0.0002$$

We note the known light variation period has only 4 decimals. Successively a photoelectric timing afforded a more accurate period[3] reported in the following light elements (2):

$$\text{Min. I (Hel.JD)} = 48348.658 + 1.37418454 * E \qquad (2)$$
$$\pm 0.002 \pm 0.00000006$$

Nevertheless, due to incomplete phase coverage, the amplitudes of the two minima remained uncertain[2]. Successively, the light curve obtained by Williams[2] is presented:

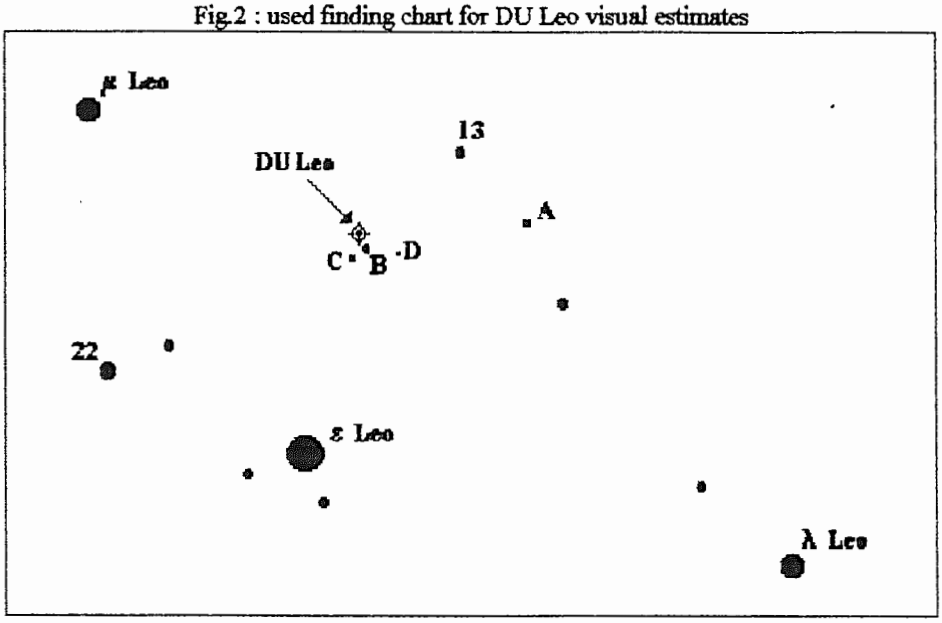
Fig.1 : R-band differential photometry of DU Leo phased according to ephemeris (1)



Results and discussion

In 1995 I carried out about 200 visual estimates of DU Leo using the finding chart reported below, provided me by D.H.Kaiser[4]:

Fig.2 : used finding chart for DU Leo visual estimates



Processing visual estimates by VARIA[5] and successively by SOP[6] program, I obtained 3 heliocentric times of minimum forcing symmetry, which are reported in the next table together with error bars, O-C residuals according to the more accurate light elements (2) and the type of minimum:

Tab.1 : DU Leo times of minimum in 1995

DATE	U.T.	HJD	O-C(2)	TYPE
21 Apr	20.05	49829.342 ± 0.007	0.000	II
4 May	21.30	49842.396 ± 0.009	0.000	I
6 Jun	20.54	49875.371 ± 0.006	- 0.006	I

Even if 3 visual minima could be too few data, it seems evident the best ephemeris for DU Leo is that one reported in the IBVS 3999. Infact, in 1995, we obtain a mean O-C value of:

$$O\text{-}C(2)_{mean} = - 0.002 \pm 0.007 \text{ day}$$

Therefore, DU Leo doesn't need another ephemeris.

Light curves and the *compositage*

21 April's and 4 May's minima are presented below. It is important to note that no total eclipse appears in these figures in accordance with analogous photometric data of Williams[2]. Furthermore, calculated duration of each eclipses is 3.2 hours, like found by others[2]. These facts are a confirmation of what said D.H.Kaiser in the IBVS 3514: "The eclipses appear to be partial, with duration of eclipse close to 0.10 P or 3.3 hours".

Fig.3 : light curve of 21 Apr (secondary minimum)

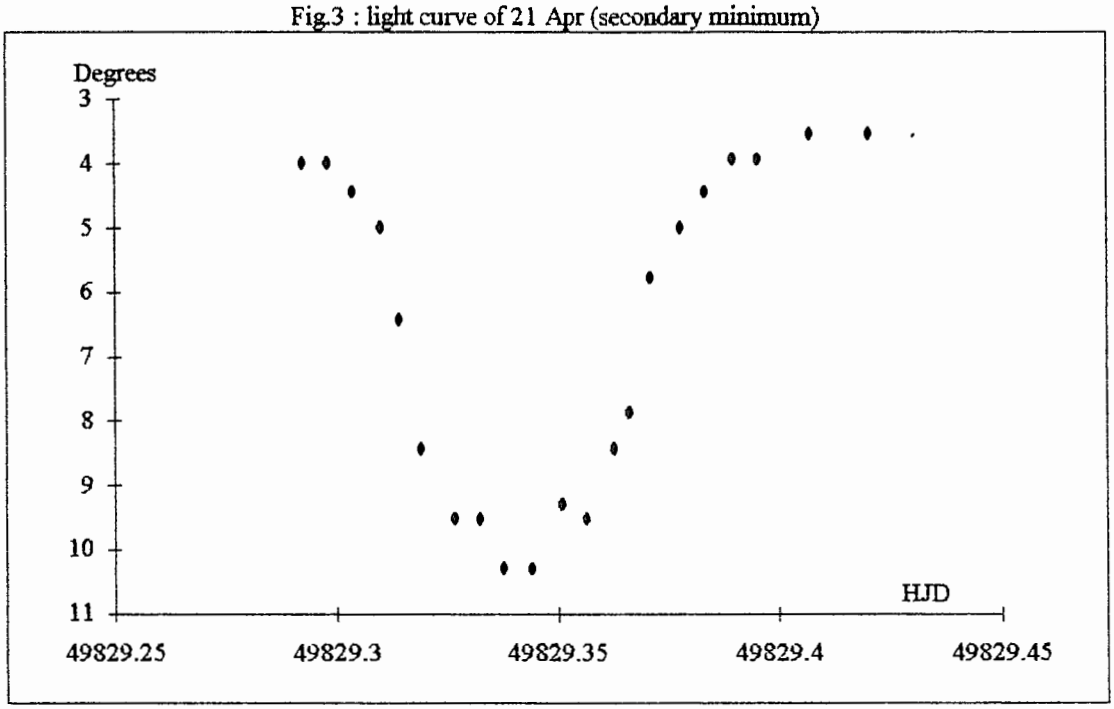
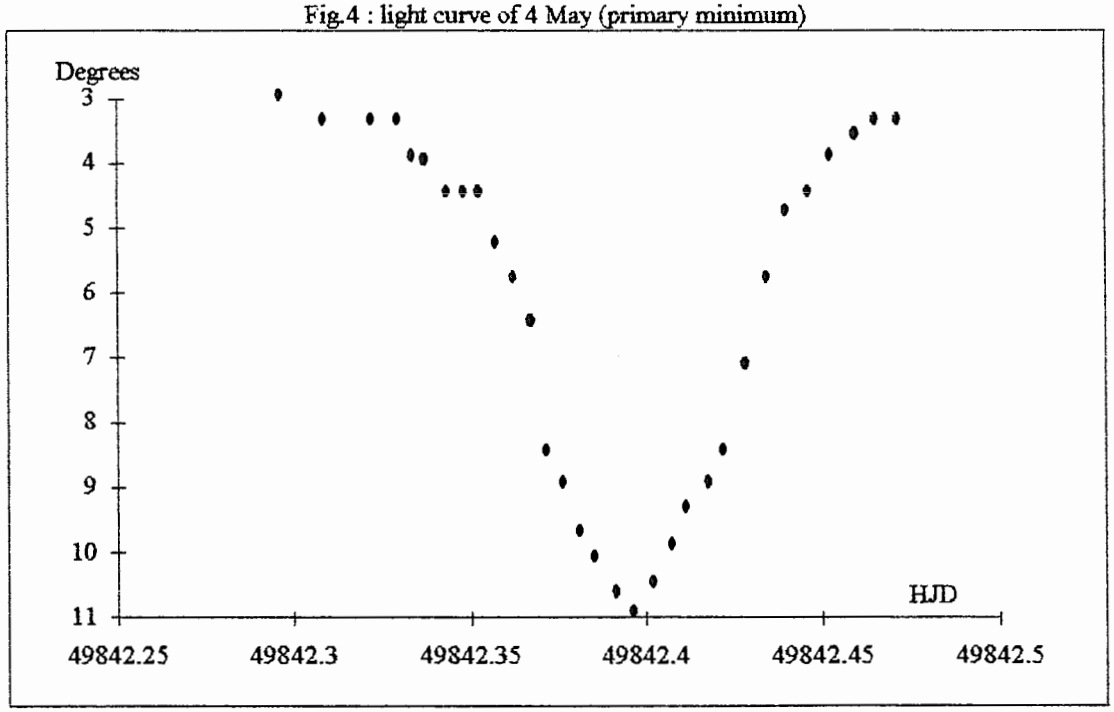
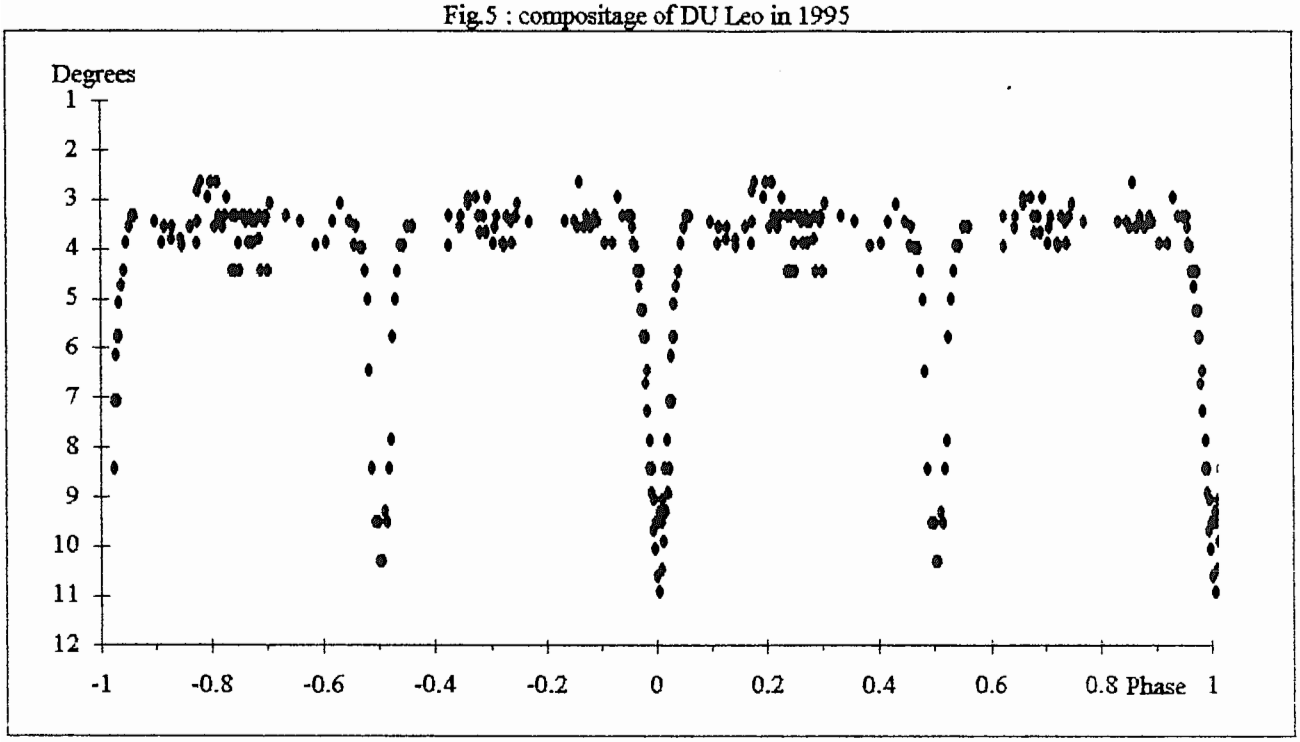


Fig.4 : light curve of 4 May (primary minimum)



Finally, observative data in 1995, were used to plot a *compositage* phased according to light elements (2). In this way we can see the light curve of DU Leo in all its extent. This one is characterized by an almost flat maximum and a fall of brightness close to eclipses: a typical EA light shape. Moreover, the amplitudes of the two minima are little different and their magnitude differs very little but in a marked way. Since an estimation degree of mine is equal to about 0.12 mag, we can estimate the different brightness of the two minima in about 0.06-0.10 mag. This fact confirm again what found D.H.Kaiser in 1990.

Fig.5 : compositage of DU Leo in 1995



Conclusions

Visual estimates of DU Leo in 1995 afforded a confirmation for the light elements (2) reported in the IBVS 3999 and confirmed some features of the light curve. Infact, the light curve of this EA type variable star presents primary and secondary minima differing only for 0.1 mag in depth and eclipses seems to be partial with a duration of about 3.2 hours.

Thanks

I'm very grateful to Daniel H. Kaiser, for his support to me and for the latest informations on DU Leo, and Massimiliano Martignoni, for some references on this star.

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References:

(1) D.H.KAISER, *Information Bullettin on Variable Stars*, **3480** (1990)
(2) D.H.KAISER, M.E.BALDWIN, D.B.WILLIAMS, *Information Bullettin on Variable Stars*, **3514** (1990)
(3) D.H.KAISER et al., *Information Bullettin on Variable Stars*, **3999** (1994)
(4) D.H.KAISER, finding chart and other informations (priv. comm.)
(5) A.GASPANI, *Visual Estimates Varia Processing*, (priv. comm.)
(6) A.GASPANI, *Stochastic Optimization Program*, ver. **5** (priv. comm.)