NEW VISUAL OBSERVATIONS FOR V781 TAU

Summary: several visual observations of the eclipsing binary V781 Tau in 1991-1995 confirmed the validity of ephemeris (2) and of its light variation period. A light minimum and the light curve are presented in this paper too.

Introduction

V 781 Tau is an EW type variable star discovered by Harris in 1979 on the basis of his photoelectric observations. The light variation is almost equal for both minima and is between 8.5 and 9.0 visual magnitude. Both through visual estimates and photoelectric measures, the light curve shows different height of maxima, in particular photoelectric observations carried out by L.Cereda et al.(1) put in evidence the maximum at phase 0.25 brighter than that one at phase 0.75 of about 0.03 magnitude and a small light difference between primary and secondary minimum of 0.03 magnitude. Furthermore, eclipses don't seem to be total. One of the first reported ephemeris was the (1) given by Berthold in 1983 and successively the ephemeris (2) provided by Cereda et al.(1) in 1988:

$$\text{Min.I (Berthold, 1983)} = 43874.9540 + 0.3449100 * E \quad (1)$$
$$\text{Min.I (Cereda et al., 1988)} = 43853.9096 + 0.3449094 * E \quad (2)$$

Visual minima obtained by GEOS members in years 1981/1985 put in evidence a slightly greater period, equal to 0.3449110 day(2).

Results and discussion

From 1991 to 1995 I carried out 315 visual estimates of V 781 Tau using GEOS finding chart C235. Processing data by SOP(3) program, I obtained 8 heliocentric times of light minimum, which are reported in the next table, with the O-Cs residuals concerning the 2 previous ephemerides and the type of observed minimum:

Tab.1 : V 781 Tau's times of minima in 1991-1995

DATE	U.T.	HJD	O-C(1)	O-C(2)	TYPE
23 Dec 91	20.27	48614.352 ± 0.002	- 0.010	+ 0.003	I
30 Nov 94	20.34	49687.357 ± 0.009	- 0.020	- 0.005	I
7 Jan 95	19.05	49725.295 ± 0.004	- 0.022	- 0.007	I
9 Jan 95	20.51	49727.369 ± 0.017	- 0.018	- 0.003	I
20 Jan 95	21.49	49738.409 ± 0.004	- 0.015	+ 0.000	I
29 Jan 95	21.22	49747.390 ± 0.004	- 0.002	+ 0.013	I
1 Feb 95	19.44	49750.322 ± 0.004	- 0.001	+ 0.014	II
20 Feb 95	18.52	49769.286 ± 0.003	- 0.007	+ 0.008	II

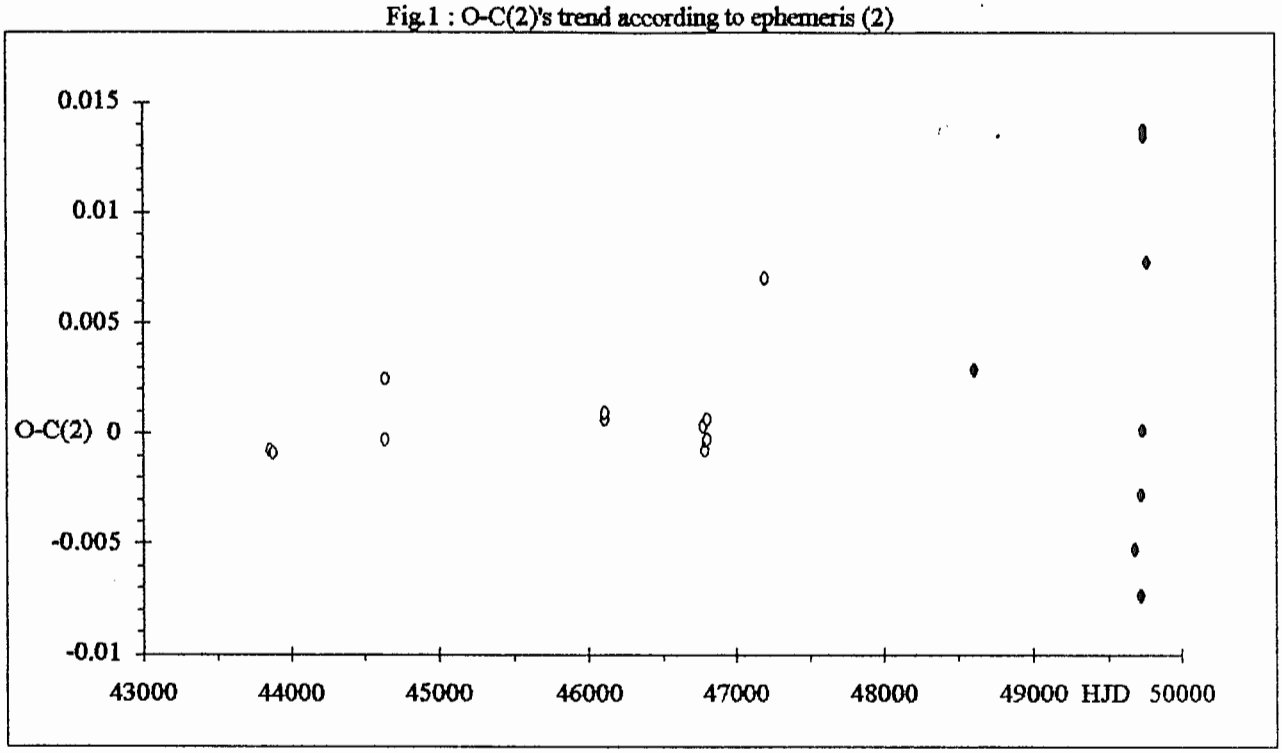
The ephemeris (1) shows very high differences and doesn't seem to be valid more, fact marked in several previous works. Instead the ephemeris (2) shows a mean O-C like:

$$O\text{-}C(2)_{mean} = +0.003 \pm 0.008 \text{ day}$$

So it seems visual minima in 1991-1995 confirm ephemeris given by Cereda et al. in 1988.

Like other times, for verifying the light variation period, I drew a graph using some photoelectric minima found in literature: 1 of Keskin et al.(4), 11 of Cereda et al.(1), marked by blank circles and the 8 visual minima in Tab.1, marked by filled circles. The graph reporting O-C(2) values versus julian day is presented in the next page:

Fig.1 : O-C(2)'s trend according to ephemeris (2)



The application of the least squares method at this set of data provided a period almost the same than that one proposed by ephemeris (2):

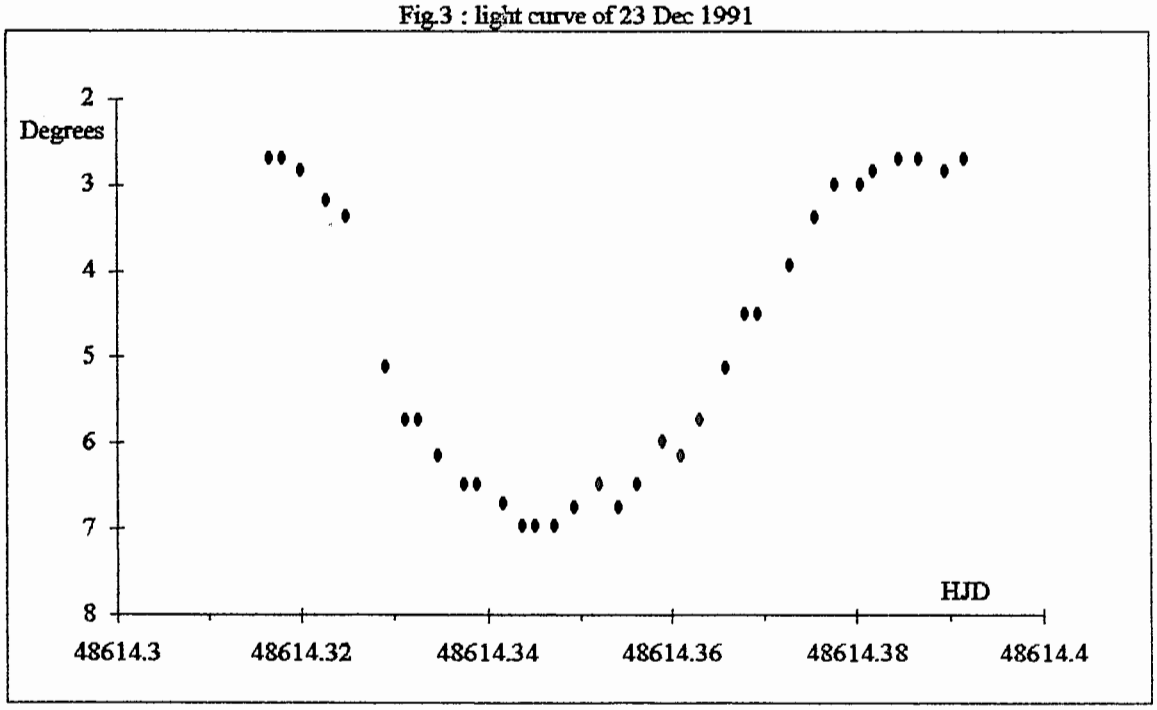
$$P = 0.3449096 \pm 0.0000002 \text{ day}$$

Again, this value confirm the validity of ephemeris (2).

Light curves

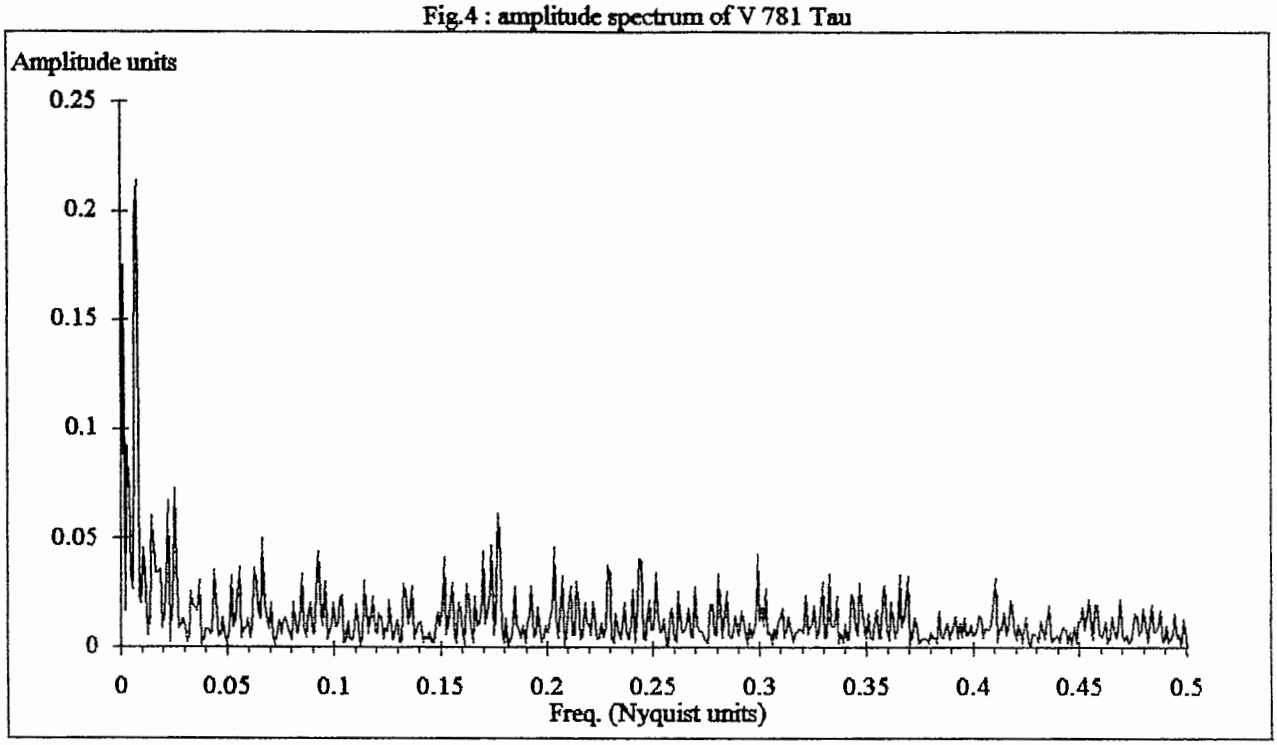
As previously remarked, the V 781 Tau's eclipses don't seem to show features of totality. In the fig. 3 23 Dec 91's light curve is presented:

Fig.3 : light curve of 23 Dec 1991



Observative data in 1994-1995 were used for drawing a compositage and for restoring, by FDGFP[5,6] program, the V 781 Tau's light curve. Successively the amplitude spectrum of V 781 Tau is presented. The used filtering band shape was a 10th order exponential type with a width of 0.013 Nyquist units.

Fig.4 : amplitude spectrum of V 781 Tau



The previous spectrum put in evidence the very high noise level, so we have to expect a remarkable loss of amplitude in the restored signal. The noise spectrum N(f) seems to be non-white with a trend like:

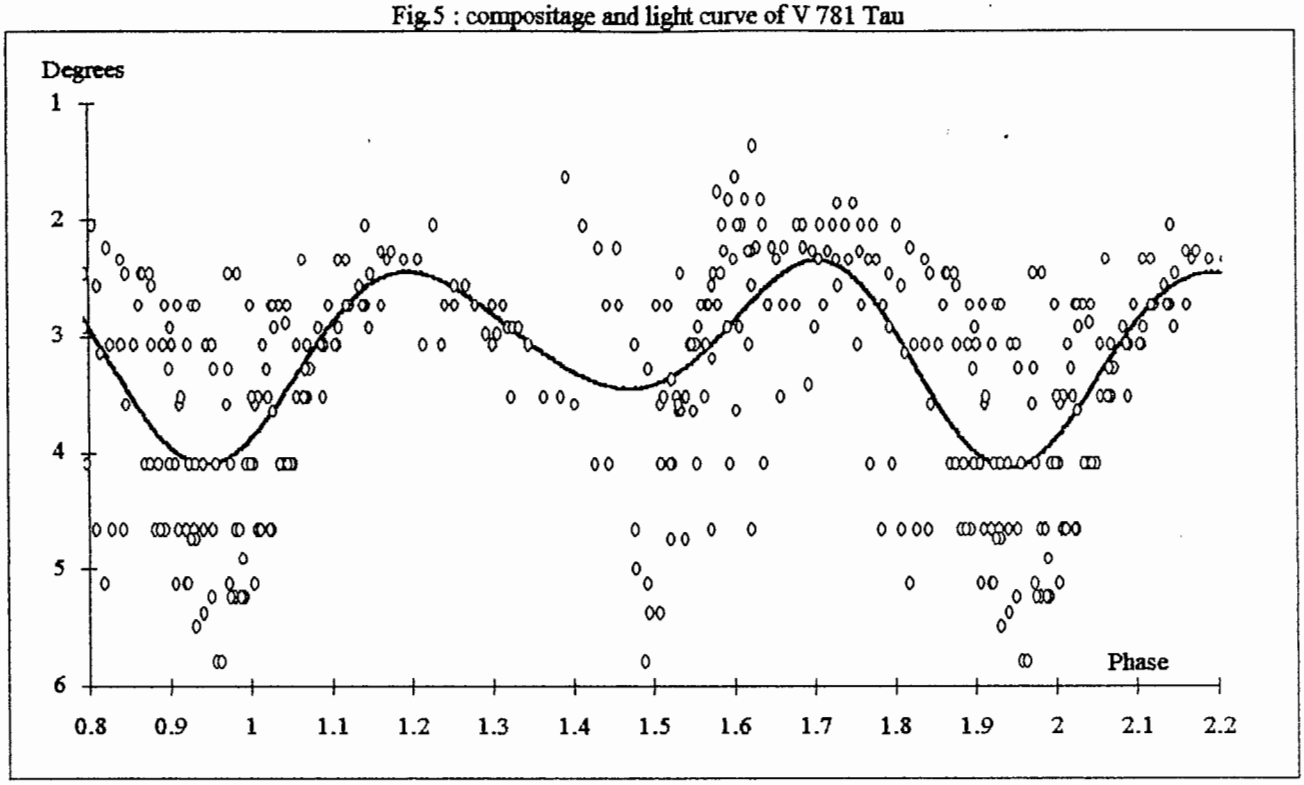
$$N(f) = \sim A\, f^{-m}$$

with an high "m" value. Hence, an efficient light curve restoration will be very difficult through linear filters like previous one. Perhaps, application of Wiener filter or a neural network will be better.

In the fig.5 the compositage and the V 781 Tau's light curve is reported.

In the restored light curve, we note a remarkable difference between primary and secondary minimum, while height of maxima are almost the same. Unfortunately, the points dispersion don't let us to get a clearer conclusion. If we increase bandwidth the light curve suffers too many distorsions, owing to coloured noise in low frequencies, even if minima become deeper and more similar.

Fig.5 : compositage and light curve of V 781 Tau



Conclusions

Visual observations of V 781 Tau carried out in years 1991-1995 confirmed the validity of ephemeris (2) and of its period. Furthermore, light curves didn't show a flat minimum and thence the possibility of a total eclipse was excluded. However, the analysis of compositage and light curve obtained by filtering method applied to Fourier spectra, didn't show a difference between heights of maxima, probably owing to the great dispersion of points and their arrangement in the compositage.

Davide DALMAZIO -DDL-

References:

(1) L.CEREDA et al., *Astronomy and Astrophysics Suppl. Ser.*, **76**(1988), 255-261
(2) P.BARUFFETTI, *l'Astronomia*, **74**(1988), 50-51
(3) A.GASPANI, *Stochastic Optimization Program*,**5** (priv.comm.)
(4) V.KESKIN et al., *Information Bullettin on Variable Stars*, **3355**
(5) A.GASPANI, *Frequencies Domain Generalized Filtering Program*, (priv.comm.)
(6) A.GASPANI, *Fiche Technique GEOS*, **FT 54-55-56**