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CONFIRMATION OF THE PERIOD OF GW Cep FOUND BY HOUGH TRANSFORM

In two previous papers (Ragazzoni & Barbieri 1993, 1994, RB94), we have shown how the application of the Hough Transform HT (Hough 1962, Ballester 1991, Leavers 1992) can help to detect cycle–numbering errors in sparsely observed time series, leading to incorrect values of the periods and to spuriously high time derivatives. Whilst the correct value of the period is *per se* not of utmost physical importance, a spurious time derivative can led to incorrect conclusions about for instance the mass loss rate or the geometrical variations of the system. As an example, we applied those considerations to the eclipsing binary GW Cep, showing that an error of one cycle every ≈ 16600 could have lead to a wrong period, the commonly accepted one being 0.31885 days, and the most likely one given by the HT, and that at the same time minimizes the time derivative, being 0.31883 days. In the present paper, using the new observations, we reinforce those conclusions and add further weight to the value of the HT to handle this class of problems. The recent determination by Agerer and Hübscher (1995, AH95) of the time of an eclipse provides the opportunity to verify our prediction. The data by AH95 were taken at $(JD - 2400000) = 49592.545$ whilst the latest available ones by Landolt (1992, L92) were at $(JD - 2400000) = 48544.871$; using the commonly accepted period of 0.31885 days, the number of cycles between the two dates is estimated as:

$$\left[\frac{49592.545 - 48544.871}{0.3188}\right] = [3286.305] = 3286 \qquad (1)$$

where $[x]$ is the nearest integer of x, and the expected time difference between the observed and the calculated minimum (in the present case, a delay) after one cycle is lost is therefore approximately given by:

$$\frac{3286}{16600} \times 0.3188 = 0.0631\,\mathrm{days} = 1.51\,\mathrm{hours} \qquad (2)$$

Notice that the delays in the observations are of this order, being 0.048 days at the date of L92, and of 0.054 at the date of AH95, thus reinforcing our determination.

As a further check, we report in Table 1 the O−C for the *General Catalogue of Variable Stars* GCVS, Hoffman 1992 (H92), L92 and RB94. Whilst they show an erratic behaviour in the three first papers, they are consistent with the constant $dP/dt = -2.327 \times 10^{-10}$ as given in RB94 (see Figure 1).

Finally the sum of their squares is one order of magnitude smaller in RB94. We conclude therefore that the application of HT can be very beneficial to the proper analysis of sparsely sampled light curves, helping to put the physics of the phenomena on sounder grounds.

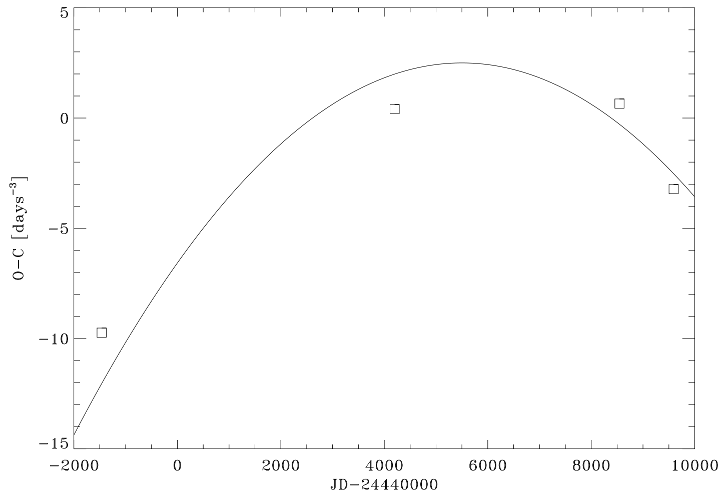

Figure 1. The $O-C$ for the grouped data available in the literature fitted by the 1^{st} order ephemeris given in RB94. The 2^{nd} order given in RB94 is here shown as a fitting parabola.

Table 1. O−C residuals for four different ephemerides of GW Cep, without any second order term.

	GCVS	H82	L92	RB94
Epoch (JD−2 400 000)	38383.711	38651.545	38651.5445	38651.550
Period [days]	0.31885	0.31884945	0.318851065	0.31883082
$< O-C >_{MW65}$ [days]	0.0022	0.0019	0.0030	−0.0097
$O-C_{H82}$ [days]	−0.0095	0.0000	−0.0276	0.0004
$O-C_{L92}$ [days]	0.0483	0.0653	0.0156	0.0007
$O-C_{AH95}$ [days]	−0.0186	0.0002	−0.0547	−0.0032
$\sum(O-C)^2$ [days$^2 \times 10^{-6}$]	2771	4263	4011	105.7

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