

NN Cephei and PP Lacertae

NN Cephei and PP Lacertae, catalogued as RR? in the Second Supplement to the Third Edition of the General Catalogue of Variable Stars (1974), are in fact two eclipsing binaries.

NN Cep = HD 217 796

NN Cep, spectrum A5 and magnitude V=8.2 according to the HD, was added in March 1976 to the GEOS observing programme. From 20 May to 6 August 1976, R. Rolland followed continuously this star, performing 751 visual estimations with binoculars (aperture 50 mm). The most used comparison star was HD 217 966, spectral type B7 V (1) and magnitude V=8.21 (2).

The resulting light-curves have revealed the eclipsing binary character of NN Cep, previously known as a spectroscopic binary. NN Cep is probably a Beta Lyrae system with a period of 2.058 days. The light-curves for each night show a slight daily drift, confirming that a multiple or sub-multiple of the period has a value of about one day (The period is " 0.5 or 1 " day according to the GCVS 1974). This daily drift has such a value that the minima, of amplitude about 0.3 mag, occur again at the same hour approximately every 36 days.

The best observed minima obtained by Rolland are listed below. Reductions were made using the tracing paper method.

JD	24 42 919 , 49	Minimum	II	O - C =	+ 0.05 d
	922 , 51		I		- 0.02
	991 . 49		II		+ 0.02
	994 , 56		I		+ 0.00

The O - C values refer to this calculated ephemeris :

$$\text{Min I} = \text{JD hel } 24\,42\,959.57 \pm 7 + 2.058 \text{ E} \pm 2$$

The observed minimum of the night of 23 - 24 May 1976 is shown on figure 1 as an example. Dots represent individual estimates. Figure 2 shows the mean light curve obtained using the 2.058 day-period. Each dot represents the mean of " n " individual estimates (see the value of n in the following table). The means are calculated on separate intervals of 0.02 , 0.04 or 0.06 period, using the 751 estimates of Rolland.

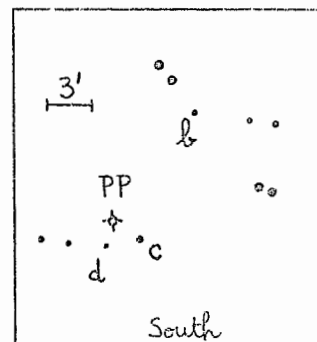
Mean phase	Number n of estimates	Mean visual magnitude	Mean phase	Number n of estimates	Mean visual magnitude
0.004	17	8.583	0.524	34	8.488
0.024	17	8.511	0.544	29	8.419
0.044	16	8.440	0.564	39	8.362
0.064	15	8.363	0.584	30	8.374
0.094	39	8.342	0.604	30	8.299
0.134	39	8.321	0.624	31	8.316
0.174	31	8.335	0.654	31	8.298
0.214	11	8.289	0.704	17	8.295
0.254	22	8.269	0.754	11	8.302
0.294	31	8.298	0.794	23	8.284
0.334	22	8.354	0.834	13	8.314
0.384	12	8.353	0.894	27	8.315
0.434	15	8.336	0.924	21	8.322
0.464	16	8.451	0.944	29	8.404
0.484	16	8.495	0.964	26	8.489
0.504	23	8.559	0.984	18	8.547

The secondary minimum appears almost as deep as the primary one. The form of the light curve does not formally exclude the EA type. Notice that the 1.029 day-period (half-period) was eliminated considering the misshape of the corresponding mean light curve.

Observations of other GEOS observers (A. Figer, P. Guiraudou, J.F. Le Borgne, Ph. Ralincourt, A. Royer) have confirmed the 2.058 day-period and the eclipsing nature of NN Cep. But the minima are generally estimated a little deeper (about 0.4 mag).

PP Lac = CSV 8787

PP Lac was added in August 1976 to the GEOS observing programme. The comparison stars were chosen close to the variable and their visual magnitudes were attributed on the basis of means of estimates made by several GEOS observers. The errors, owing to this inaccurate procedure, could affect the magnitude values of PP Lac and the range of its variations, but neither the shape of the light curve nor the times of minima and maxima. From 29 August to 17 October, A. Figer made 228 visual estimates of PP Lac on 9 nights with a 10 inch-reflector. Figer's sequence, calculated using a least-squares fit on the GEOS sequence, is: b = 12.02 c = 12.45 d = 12.92 .



Comparison stars

The 9 individual light curves obtained by Figer allow us to support the hypothesis of the eclipsing nature of PP Lac and to assume that the apparent period, very close to 0.2 day, is in fact the half-period.

Two mean light curves, using the two periods 0.20055 and 0.4011 day, were drawn out. Since the first one (0.2 day-period) is different from the mean light curve of any type of RR-variable (in reference to light curves visually obtained by the same observer on a lot of RR-variable), we conclude that PP Lac is a new EW-variable.

Times of the best observed minima, obtained using the tracing paper method, are listed below:

JD hel	24 43 023 . 391	0 - C = + 0.005 d
	040 . 434	+ 0.001
	040 . 625	- 0.008
	050 . 442	- 0.018
	068 . 320	+ 0.011
	068 . 516	+ 0.007
	069 . 312	+ 0.000

The 0 - C values refer to either one of these calculated ephemeris:

Min I =	JD hel	24 43 050 . 46	+	0.4011 E
		±2		±4
Min I =	JD hel	24 43 050 . 66	+	0.4011 E
		±2		±4

The precision of the mean light curve (see fig 4) does not permit to discriminate the primary minimum from the secondary one.

Figure 3 shows a complete half-period, observed in the night of 16 - 17 October.

Notice that the minima (without distinction between I and II) repeat every night almost at the same time for several days, which explains Miller's remark (3) that the " period is about 0.5 d " .

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- (1) GARRISON, R.F. (1970), A.J., 75, 1001
- (2) BLAAUW, A. and al (1960), Ap.J., 130, 69
- (3) MILLER, W.J. and al, Ric. Astr. 8, No 12, 1971

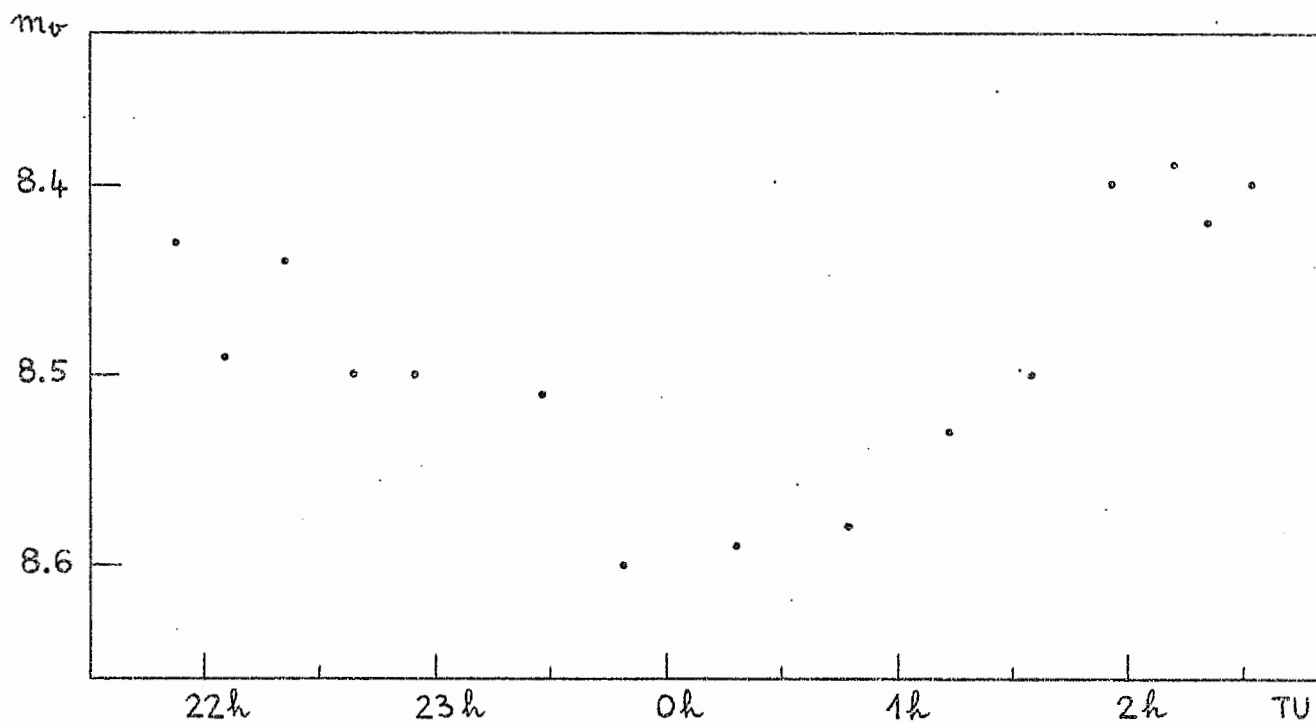


Figure 1 - NN Cep : Minimum occurring on the night of 23 - 24 May 76

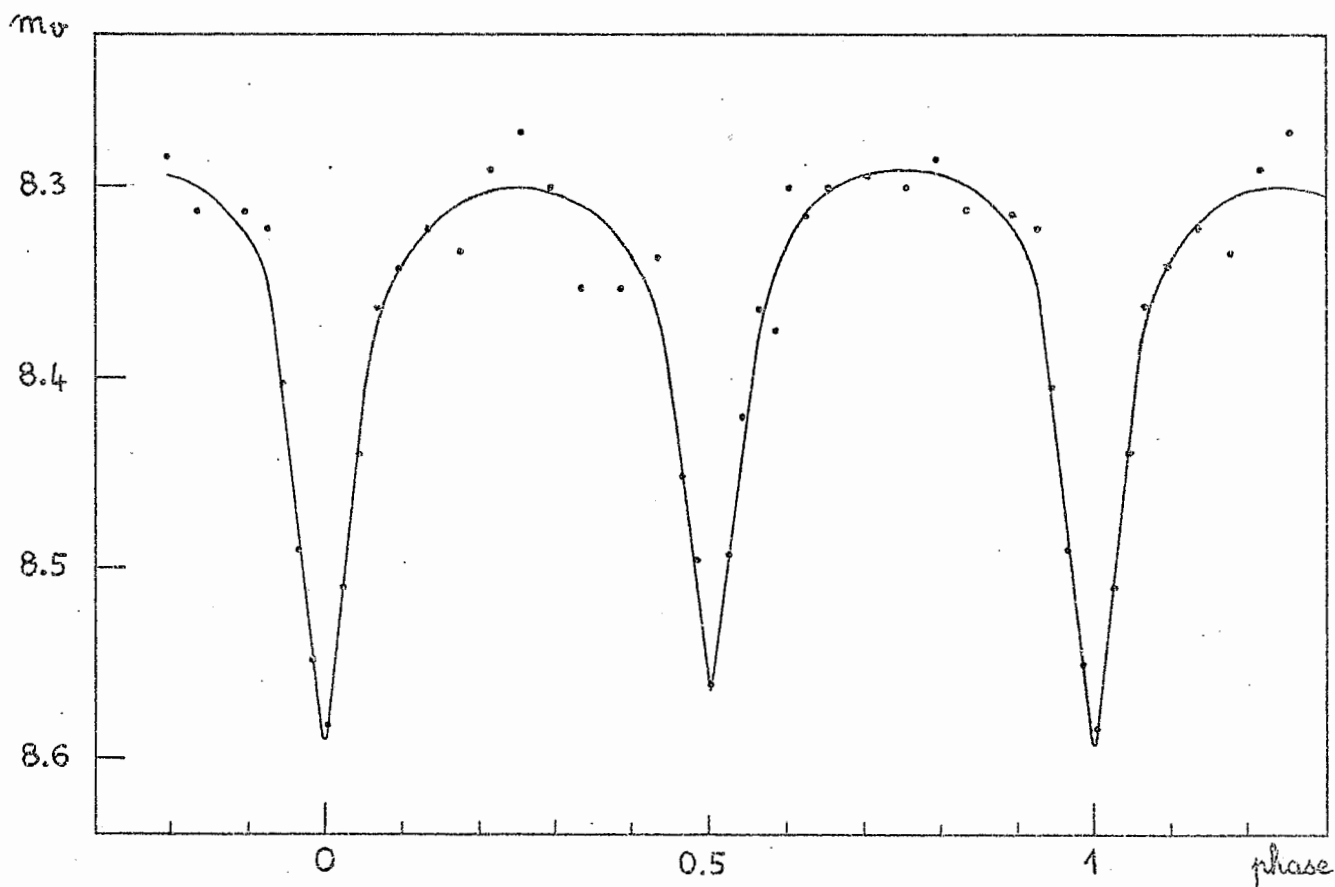


Figure 2 - NN Cep : Mean light curve

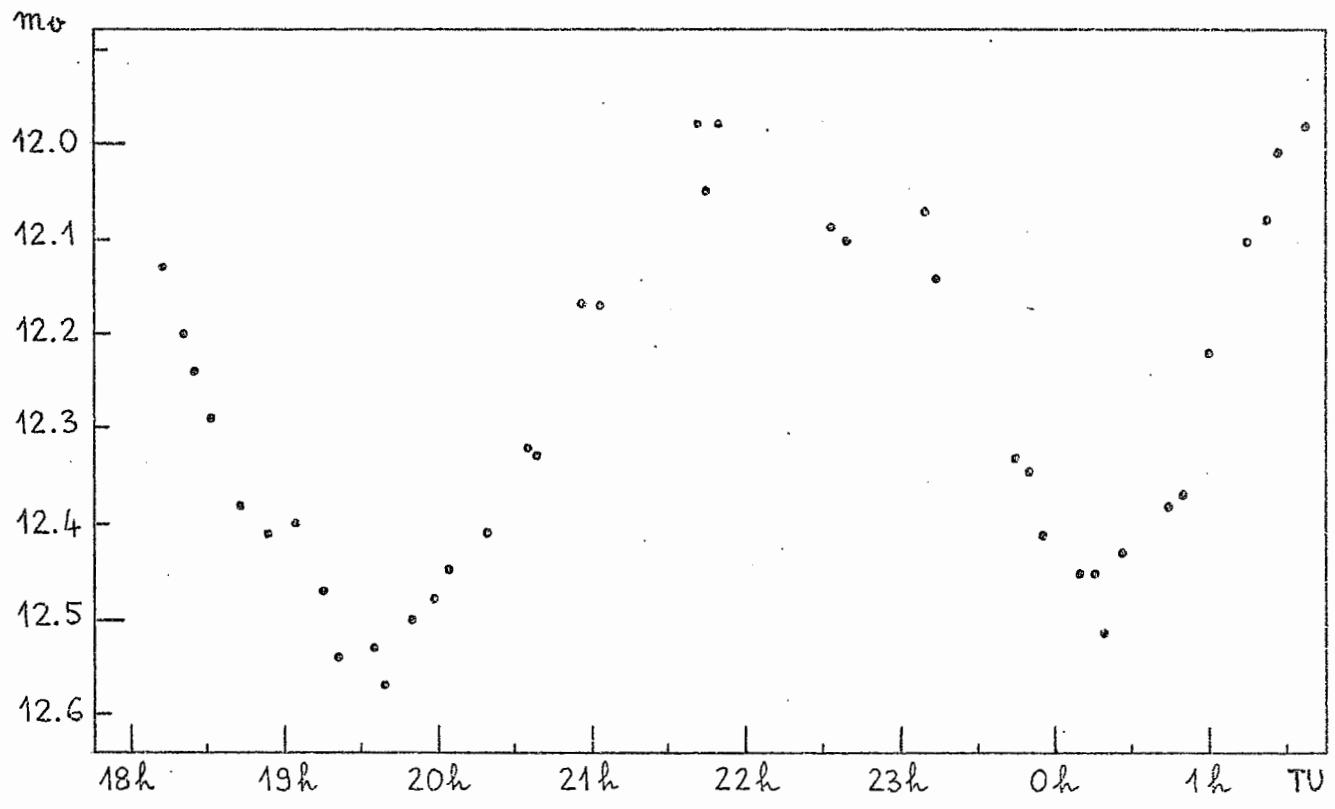


Figure 3 - PP Lac : Light curve in the night of 16-17 October 1976

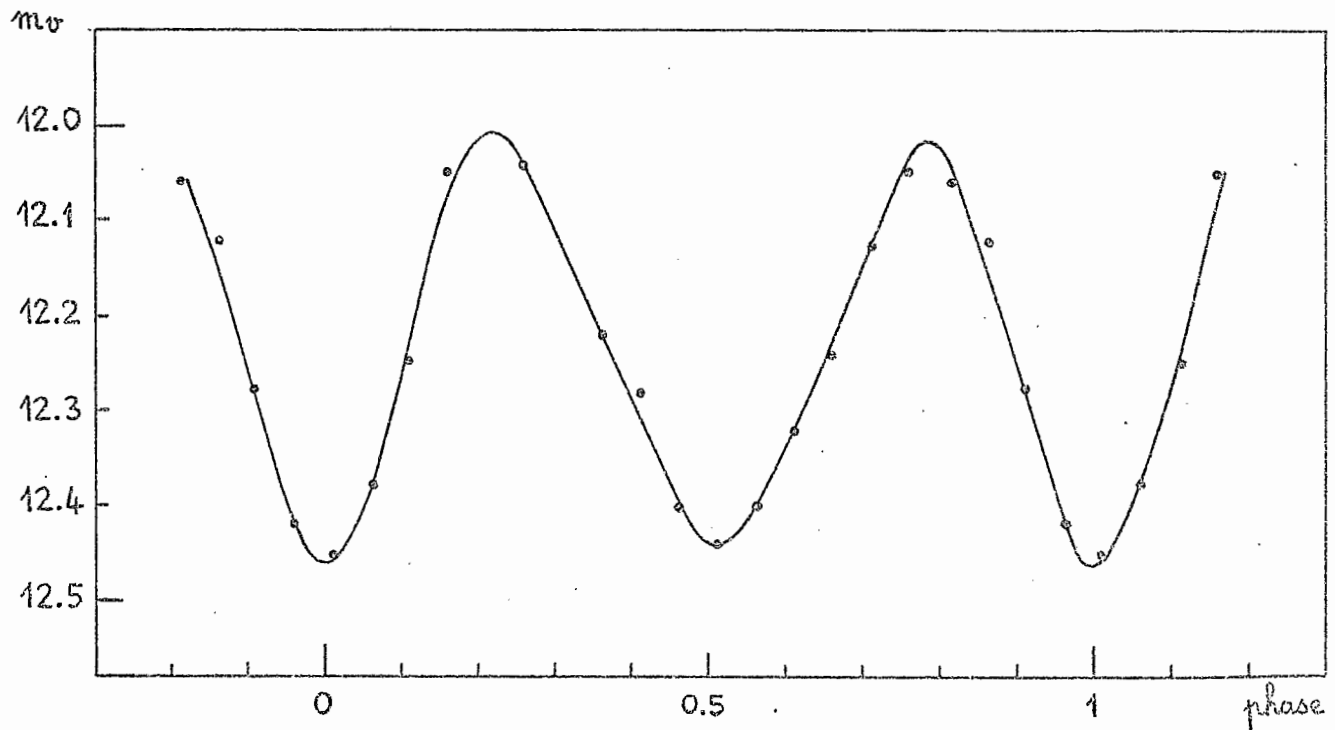


Figure 4 - PP Lac : Mean light curve