HP Lyrae – the sudden period decrease

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Abstract Based on about 400 blue sensitive plates of the Sonneberg Sky Patrol (SSP) of the years 1960 to 1981, a sudden period change of about -2 days was found to happen in 1962/63. New elements of this beta Lyrae type variables are given.

Objects HP Lyr

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In 1960 the author of the present paper classified HP Lyrae as an eclipsing binary of beta Lyrae type with primary and secondary minima of similar depth (Wenzel 1960). This had been done because of the early spectral type A6 and the surprisingly good constancy of the period (140.75 days) during the years 1931 to 1960, which both could hardly be expected of a pulsating variable.

Further observations were secured not before the eightees (predominantly by amateur observers), at it soon turned out that the period now was remarkably shorter (138.77 days) - see for instance the summary by Meyer (2002). This fact as well as multi-colour and spectroscopic observations led Graczyk et al. (2002) to the conclusion that the object might well be an RV Tauri pulsating variable with extremely early spectral type.

In order to clarify the course of the period change I checked the star on about 400 blue sensitive plates of the Sonneberg Sky Patrol (SSP) of the years 1960 to 1981, using the comparison stars and the magnitude sequence of Wenzel (1960). Light-curves were constructed for the years 1960 to 1968, and the moments of minima in table 1 could be derived. Additional moments of faint single observations ($\leq$ 11.0 m) are given in table 2 for the years following.

The new complete O-C diagram for the years 1931 to 2002, computed with the elements of Wenzel (1960)

$$\text{(I)} \quad C_W = 242\,6920 + 140.75 * E_W$$

is shown in figure 1. Meaning of the symbols:

■ times of minima derived from the light-curve (SSP)

· faint single observations (SSP and others)

+ dates of Meyer

In figure 1 the parabolic curve and the inclined straight line (G) correspond to the elements discussed by Graczyk et al. for the years after 1980 (misprint in their paper: the quadratic term of formula 2 must bear the plus sign). The period of their linear elements 3 (138.66 days) and the supposed beginning of its efficacy ($E_W = 128$) are practically identical with those of Meyer.

Conclusions:

1. The period change of about -2 days happened between the epochs $E_W = 78$ and 81, i.e. 1962 / 1963. The light-curve during these cycles shows no conspicuous pecularities.

2. Hence the elements valid from 192 onward are

$$\text{(II)} C_{II} = 243\,7888 + 138.66 * (E_W - 78).$$

3. Meyer's initial minimum corresponds to the epoch $E_W = 128$, the initial minimum $244\,4893$ of Graczyk et al. to $E_W = 128.5$. Therefore the latter authors' minima $245\,1062$ (misprint in their text) and $245\,1341$ are primary minima according to our epoch counting ($E_W = 173$ and 174) and lie at phase (II) 0.0.

Fig. 2 shows the mean light-curve for the time interval $243\,7888$ to $244\,0002$, deduced from estimates (an accuracy higher than 0.1 mag was not aimed for) on SSP plates by using the elements II (■ night means, · lesser weight).

References

Graczyk, D., et al. 2002, Acta Astron. 52, 293
Meyer, R. 2002, BAV Rundbrief 51, 33
Wenzel, W. 1960, MVS 499

Figures

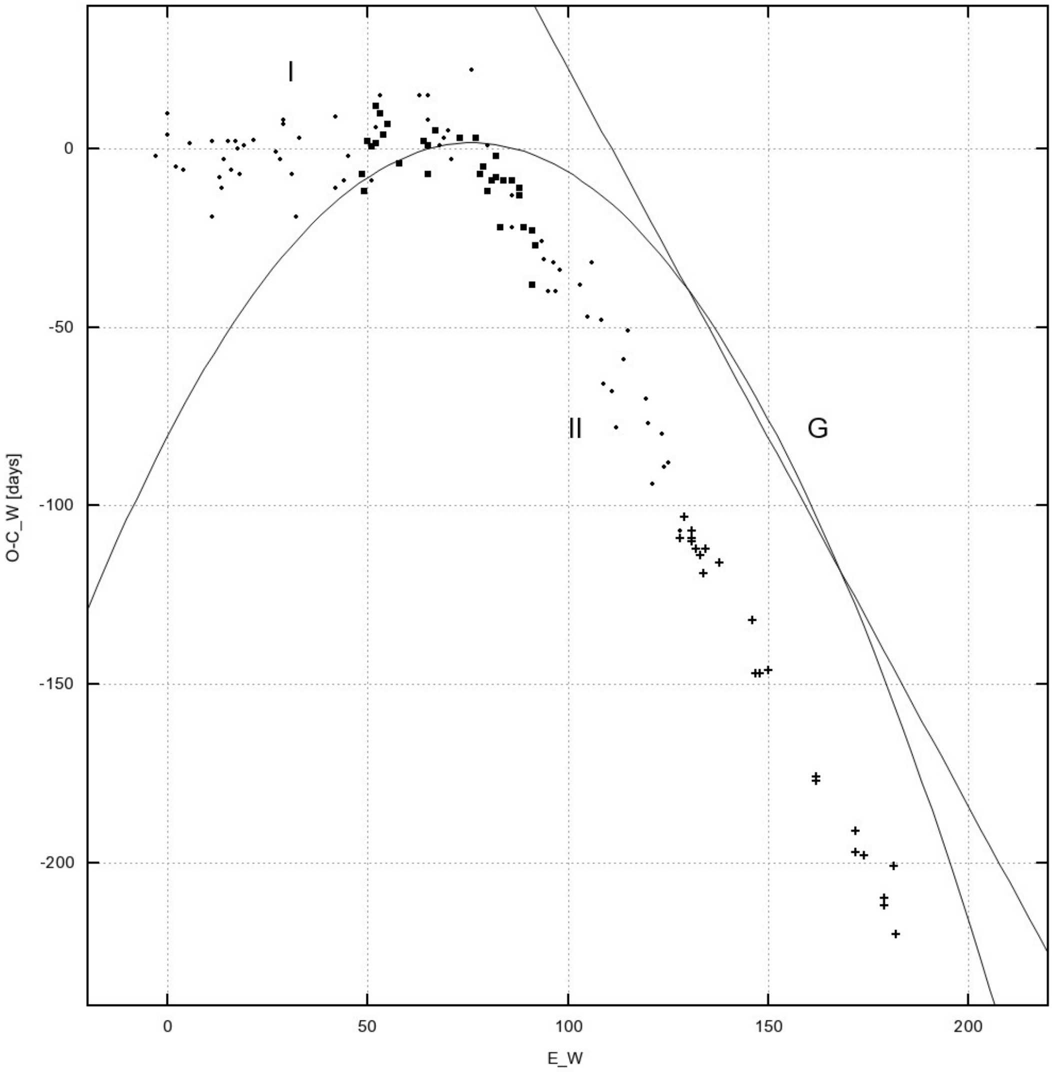

Figure 1: O-C curve of HP Lyrae.

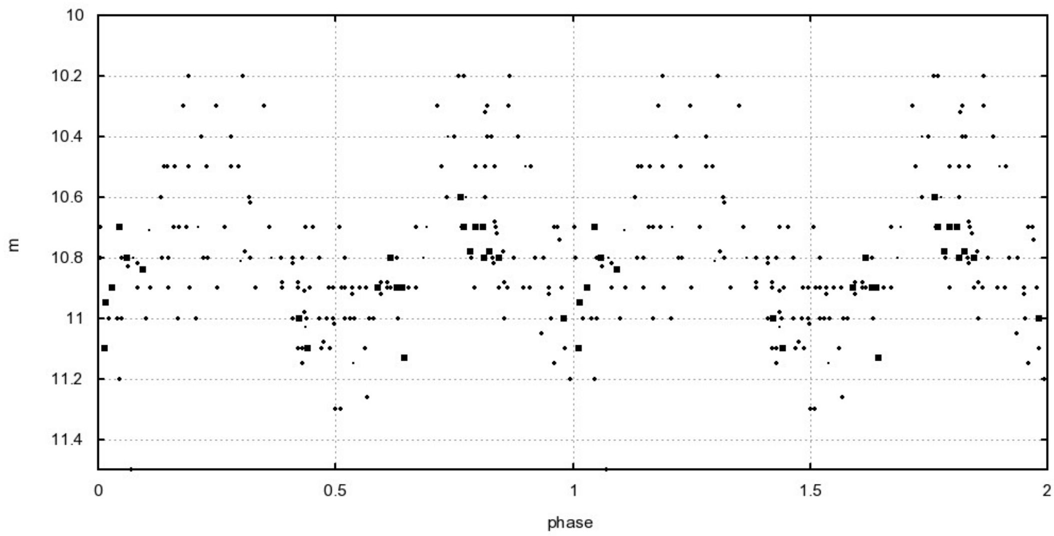

Figure 2: Mean light-curve of HP Lyrae.

Data

Table 1. Moments of minima for the years 1960 to 1968 (O – Julian Day of observation; E_W – epoch number of eq. (I); $(O - C_W)$ in days – according to eq. (I)).

JD		E_W	$O - C_W$	
243 7187		73.0	$+3$	
243 7559	:	75.5	$+22$	:
243 7892		78.0	$+4$	
243 7952		78.5	-7	
243 8095		79.5	-5	
243 8171	:	80.0	$+1$	:
243 8228		80.5	-12	
243 8302		81.0	-9	
243 8373		81.5	-8	
243 8450		82.0	-2	
243 8513		82.5	-9	
243 8574		83.0	-22	
243 8851	:	85.0	-22	:
243 8935		85.5	-9	
243 9001	:	86.0	-13	:
243 9285		88.0	-11	
243 9353		88.5	-13	
243 9415		89.0	-22	
243 9610		90.5	-38	
243 9695		91.0	-23	
243 9762		91.5	-27	

Table 2. Moments of faint single observations after 1968 (O – Julian Day of observation; E_W – epoch number of eq. (I); $(O - C_W)$ in days – according to eq. (I)).

JD	E_W	$O - C_W$
243 9975	93.0	-25
244 0039	93.5	-31
244 0171	94.5	-40
244 0452	96.5	-40
244 0531	97.0	-32
244 0740	98.5	-34
244 1369	103.0	-38
244 1571	104.5	-47
244 1798	106.0	-32
244 2186	109.0	-66
244 2274	109.5	-48
244 2395	110.5	-68
244 2596	112.0	-78
244 2897	114.0	-59
244 3045	115.0	-51
244 3660	119.5	-70
244 3723	120.0	-77
244 3776	120.5	-94
244 4142	123.0	-80
244 4344	124.5	-89
244 4486	125.5	-88
244 4749	127.5	-107