

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 1717

Konkoly Observatory
Budapest
1979 December 14

ON THE LIGHT VARIATION OF HD 209813 = HK Lac

The light variability of the single line spectroscopic binary HD 209813 was discovered by Blanco and Catalano (1968). On the basis of their 1967 observations they gave the preliminary elements: $2439766.5 + 25^d.98E$ and supposed that the star was probably a cepheid. Each of the amplitudes of the light variations was about $0^m.1$ in U,B and V.

Fernie et al. (1968) questioned this assumption remarking that the characteristics of the light curves as well as the spectral type of the star (K0III, Halliday, 1955) were unusual for a pulsating variable. They thought that the star was an eclipsing binary.

The orbital period of the binary system was given first by Northcott (1947) as 24.431 days and corrected by Gorza and Heard (1971) to 24.4284 days, both mentioning that the CaII H and K lines had emission cores.

In 1968 Blanco and Catalano (1970) reobserved the star and published excellent light curves in their instrumental system close to UBV, with the new elements: $2440100.8 + 25^d.3E$. The orbital period of the system did not fit their photometric observations. They concluded that the shape of the light curve of 1967 differed from that of 1968.

Searching for variability among a few strong CaII emission binaries Herbst (1973) also observed HK Lac in the V band. He determined a mean period of 25.75 days but stated that "the light variation of HD 209813 is somewhat variable in its period".

Hall (1976) classified HK Lac as a member of the "long period group" of RS CVn stars defined by himself.

As one of the members subjected to a survey program seeking BY Dra or possible similar stars, HK Lac was observed at the Konkoly Observatory on 26 nights between 1976-1979 with the 60 cm

telescope. The comparison stars, HD 208728 (C1) and HD 210731 (C2), were the same as used by Blanco and Catalano. All the observations were corrected for atmospheric extinction and transformed to the international UBV system.

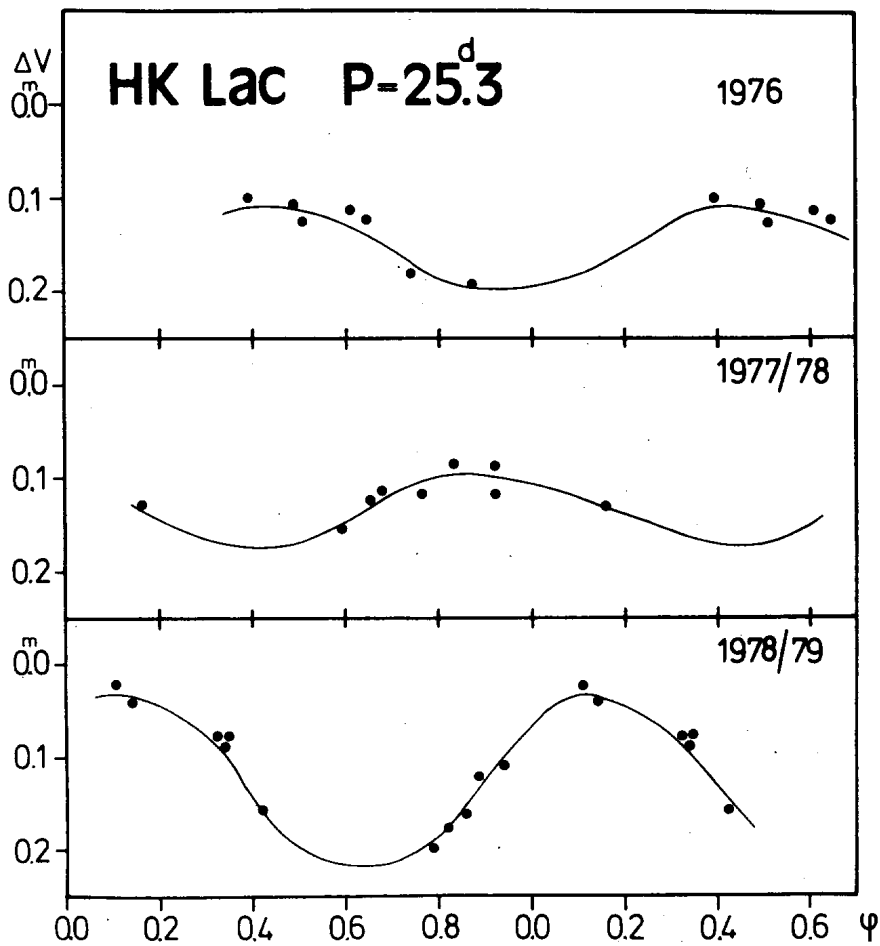


Figure 1 shows the light curves in V colour separately for each observational season. The phases were computed using Blanco and Catalano's (1970) elements.

Table 1
UBV observations of HK Lac

2443000+	ΔV	$\Delta(B-V)$	$\Delta(U-B)$
045.437	+0.100	-0.113	-
048.522	.126	.137	-
073.303	.107	.105	-
076.286	.112	.114	-0.093
077.230	.122	.104	.071
079.217	.180	.143	.079
108.254	.192	.099	.118
368.503	.130	.106	.114
385.525	.086	.142	-
432.316	.115	.132	.121
434.322	.117	.129	.101
438.356	.113	.120	.105
455.286	.152	.138	.121
482.276	.124	.148	.113
514.222	.088	.117	.159
713.473	.199	.103	.098
727.547	.078	.112	.133
739.464	.177	.112	.090
740.412	.162	.103	.136
742.456	.111	.102	.047
747.497	.039	.140	-
766.378	.122	.106	.079
777.461	.077	.125	.104
797.304	.022	.135	-0.112
879.209	.091	.102	-
881.232	+0.157	-0.118	-

The following remarks can be made:

1. The 25.3 day period well represents the observations of each season separately but strong phase-shifts exist between the maxima. With a period of 25.9 days the phases of the maxima can be brought together but in this case the data on the light curves (especially on the 1978/79 light curve) are more scattered. What is more, the 1978/79 observations can best be fitted by the even shorter period of 25.0 days.

2. In 1976 the amplitude was about the same ($0^m.10-0^m.11$) as of 1967/68 and 1970/71 (Blanco and Catalano, 1970; Herbst, 1973); in 1977/78 it decreased to $0^m.07-0^m.08$; finally in 1978/79 it increased to $0^m.20-0^m.22$ (in each colour).

3. For the years 1976-1979 the median brightness of the star became fainter by about $0^m.15-0^m.20$ relative to the 1967-1971 observations.

Table 2

	1967/68	1970/71	1978/79
median brightness in U	-0.32		-0.11
B	-0.18		0.0
V	-0.04	0.0	+0.13

The magnitude differences between the comparison stars (C2-C1) are +0.598 in V, +0.027 in B and -0.742 in U which differ from the Catania observations by about $0^m.06$ which is probably due to the fact that our observations were transformed into the UBV system. Nevertheless, this relatively small discrepancy between the Catania and Budapest observations for the comparison stars shows, that the $0^m.15$ - $0^m.20$ difference between the median brightnesses seems to be real. This fact indicates a long term variability of this star.

4. Each year the variations in (B-V) and (U-B) are less than $0^m.05$ and $0^m.07$, respectively.

It might be interesting to compare the light variations of the two stars HK Lac and the RS CVn binary UX Ari, investigated by Evans and Hall (1974) and Hall (1977). In UX Ari it was observed that the overall brightness of the star decreased by $0^m.1$. Both stars exhibit amplitude variations too, but in contrast to HK Lac, UX Ari shows decreasing amplitude with the decreased overall brightness.

Grateful acknowledgments are due to Mrs. K. Barlai for making some of the observations.

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