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THE BRIGHT CEPHEID V411 LACERTAE

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Photometric variability of V411 Lacertae (HD 213233, HIP 110968, SAO 34498) was first detected by the Tycho instrument during the Hipparcos project (Woitas, 1997). Surprisingly enough, variability of such a bright star had escaped the observers' attention before. There are three such bright (between 7-8 mag. in V) Cepheids discovered from the photometric data of this astrometric satellite: CK Cam, V898 Cen, and V411 Lac. While the first two have been observed more or less regularly since then, no more recent observational data are available on V411 Lac. There exist, however, several earlier photometric data obtained between October 1981 and January 1982 whose mean value (averaged from two to four observations) is $V = 9\overset{\mathrm{m}}{.}80$ (Scharlach and Craine, 1983). Because the real value is $7\overset{\mathrm{m}}{.}80$, this figure is either a typographic error or the result of a misidentification (both the $V-R$ and $V-I$ colour indices assigned to SAO 34498 are too red for a Cepheid).

In the discovery paper, Woitas (1997) reported a $2\overset{\mathrm{d}}{.}91$ periodicity. This value was then refined in the Hipparcos Catalogue (ESA, 1997) to be 2.90816 days. In order to have more information (light curve in more than one colour, precise pulsation period and its possible changes), V411 Lacertae was put on the photometric observational program of monitoring bright northern Cepheids in the Konkoly Observatory.

The new photometric observations were obtained with the 50 cm Cassegrain telescope located at Piszkéstető Mountain Station, equipped with a refrigerated photoelectric photometer. The observations were made through UBV filters of Johnson's system. 34 observations were obtained on 31 nights between 1997 and 2004. HD 213159 served as the comparison star whose constancy was regularly checked against the brightness of HD 213243. Moreover, Hipparcos photometry also testifies photometric constancy of this star (HIP 110924). The instrumental magnitude differences have been converted into the standard photometric system using the average transformation coefficients determined for the V magnitude, $B-V$ and $U-B$ colour indices by observing photometric standard stars. The following magnitudes were used for the comparison star, HD 213159: $V = 7\overset{\mathrm{m}}{.}73$, $B-V = 0\overset{\mathrm{m}}{.}0$, and $U-B = -0\overset{\mathrm{m}}{.}34$ (Scharlach and Craine, 1983). The individual observational data are listed in Table 1. The internal accuracy of the photometric data is better than $0\overset{\mathrm{m}}{.}01$ in V and B bands and is about $0\overset{\mathrm{m}}{.}01$ in U. The phased light curve in V band, the $B-V$ and $U-B$ phase curves are shown plotted in Figures 1-3, respectively. The photometric data have been folded on the period value of $2\overset{\mathrm{d}}{.}908269$, obtained from the $O-C$ diagram as discussed below.

Table 1. New photometric observations of V411 Lacertae

JD Hel. 2 400 000+	V [mag]	$B-V$ [mag]	$U-B$ [mag]	JD Hel. 2 400 000+	V [mag]	$B-V$ [mag]	$U-B$ [mag]
50749.2969	7.709	0.697	-	52198.3900	7.826	0.788	0.341
50749.3804	7.720	0.686	-	52199.4228	7.855	0.785	0.321
50750.2973	7.865	0.764	-	52200.3657	7.681	0.708	0.286
50750.3841	7.877	0.794	-	52589.2790	7.831	0.752	0.319
50751.2700	7.836	0.748	-	52618.3074	7.839	0.760	0.324
50751.3396	7.810	0.736	-	52619.2581	7.705	0.702	0.294
50832.2514	7.918	0.769	-	52620.2554	7.806	0.807	0.372
51052.4423	7.810	0.762	-	52673.2423	7.928	0.780	0.365
51758.4083	7.674	0.704	0.289	52901.4175	7.697	0.688	0.313
51759.4032	7.845	0.794	0.358	52902.3468	7.844	0.799	0.362
51838.3429	7.955	0.821	0.363	52903.3790	7.821	0.754	0.315
51839.3167	7.741	0.724	0.287	52904.3444	7.683	0.713	0.299
51840.3195	7.719	0.723	0.318	52906.3452	7.802	0.740	0.314
52194.4521	7.700	0.705	0.285	52948.3702	7.747	0.732	0.336
52195.3596	7.788	0.771	0.332	53266.3669	7.900	0.815	0.387
52197.3657	7.695	0.705	0.291	53286.3753	7.868	0.795	0.370

Table 2. $O-C$ residuals for V411 Lacertae

Normal Max JD $_\odot$ 2 400 000+	E	$O-C$ [day]	Band	Source
47995.0192	−210	+0.0181	H_P	Hipparcos
48256.7478	−120	+0.0026	H_P	Hipparcos
48605.7357	0	−0.0018	H_P	Hipparcos
48969.2470	125	−0.0241	H_P	Hipparcos
50798.5727	754	+0.0004	V	present paper
52031.6791	1178	+0.0007	V	present paper
52860.5396	1463	+0.0046	V	present paper

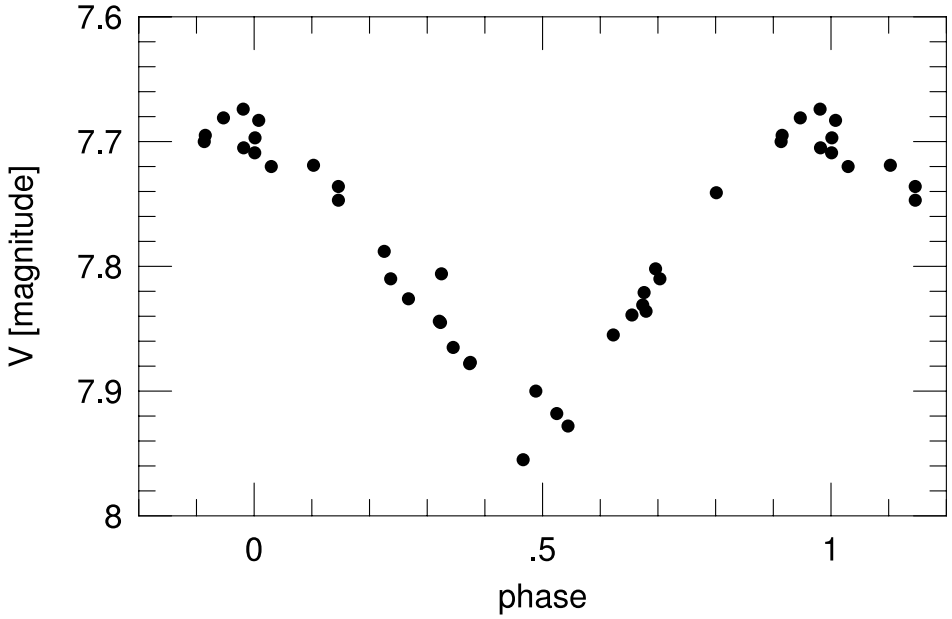

Figure 1. The V light curve of V411 Lacertae

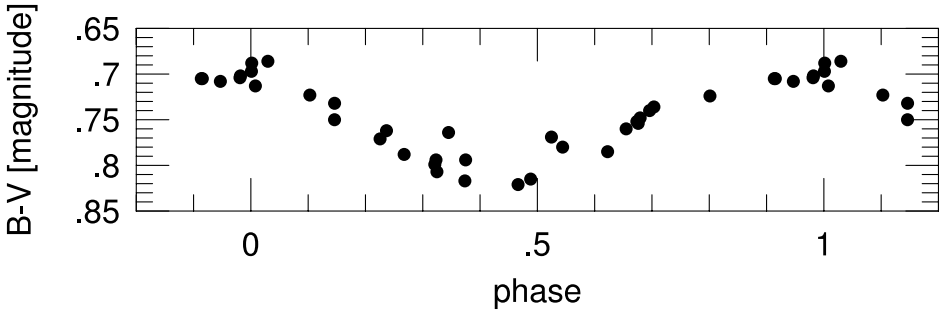

Figure 2. The $B - V$ colour index curve of V411 Lacertae

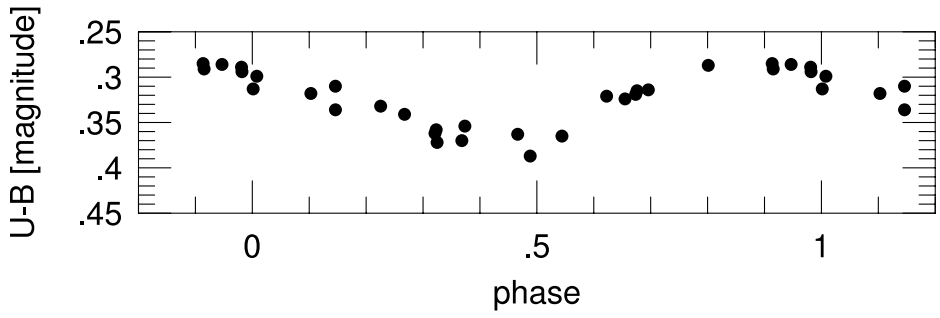

Figure 3. The $U - B$ colour index curve of V411 Lacertae

Availability of the Hipparcos photometric data covering about three years as well as our new data distributed in almost a decade, allow the construction of an $O-C$ diagram. The seasonal normal maxima were determined using the well covered Hipparcos normal light curve. The $O-C$ residuals obtained are listed in Table 2 with respect to the ephemeris:

$$C = 2448605.7375 + 2\overset{\mathrm{d}}{.}908269 \times E.$$
$$\pm.0064 \quad \pm.000008$$

The value of the period appearing in this ephemeris was obtained from the least squares fit to the $O-C$ residuals (using equal weights). The new value of the pulsation period is somewhat longer and more precise than that deduced from the Hipparcos data alone.

Future observations of V411 Lac are important, since as is seen in Fig. 1, the light curve shows some excessive scatter which cannot be explained by observational uncertainties. The pulsation period of V411 Lac is well within the range where double-mode pulsation occurs among Galactic Cepheids. Therefore, observers having an access to small photometric telescopes in the northern hemisphere are urged to monitor closely V411 Lacertae already in this observing season.

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References:

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Woitas, J., 1997, *IBVS*, No. 4444

ERRATA FOR IBVS 5425, 5431, 5455, 5458, 5489, 5500, 5532, 5586, 5700

Geert Hoogeveen reported the following errors in various IBVS issues:

IBVS No.	item	printed	correct
5425	identifier (BD -4°2739)	1RXS J0950391.1-053029	1RXS J095039.1-053029
5431	RA (BD +20°2890)	$13^{\mathrm{h}}53^{\mathrm{m}}53\overset{\mathrm{s}}{.}848$	$13^{\mathrm{h}}53^{\mathrm{m}}13\overset{\mathrm{s}}{.}848$
5455	Decl. (GSC 4709-1250)	-00 18 05.4	-01 18 05.4
5458	identifier (FASTT 1195)	GSC 0449-0455	GSC 0449-0456
5458	Epoch column header	2400000	2450000
5489	identifier	GSC 7758-1126	GSC 7758-1162
5500	identifier (# 5)	GSC 3328-0163	GSC 6328-0163
5532	identifier (NSV 14532)	HD 214505	HD 220345
5586	identifier (NSV 20599)	HIP 80022	HIP 80222
5586	identifier (NSV 1916)	GSC 8959-0532	GSC 1859-0532
5700	identifier (# 44)	GSC 4207-1658	GSC 4433-1658