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# Pulsational behaviour of the SX Phe variable BL Cam

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**Abstract.** The pulsational behaviour of the field high-amplitude SX Phe variable BL Cam is investigated here on the basis of new photometric data collected during the last few years at different sites together with a revision of all the available photometric data sets in the literature. Our results confirm the existence of multiperiodicity in this star previously found by other authors. In addition to the main frequency $f_0$=25.5769 c/d and its harmonics $2f_0$ and $3f_0$, with stable amplitude, a secondary frequency $f_1$ exists in the region 31-32 c/d with variable amplitude. Microvariability takes also place in this star, in the region close to $f_0$, with some additional secondary peaks shown as significant together with some frequency combinations of these modes with $f_0$.Concerning $f_1$, it is shown that there is a possibility of the existence of two independent peaks (around 31.6 c/d and 32.6 c/d), nonradial and with variable amplitudes.

**Key words.** Stars: variables: SX Phe – Stars: individual: BL Cam – Stars: oscillations – Techniques: photometric

## 1. Introduction

BL Cam is one of the very few field SX Phe-type pulsators known to date (Rodríguez &

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**Table 1.** Results of Fourier analysis applied to the 1999 data set of Zhou et al. (2001). The sigma of the residuals is 13.7 mmag.

| Frequency ($cd^{-1}$) | ΔV (mmag) | S/N |
|---|---|---|
| | ±0.5 | |
| $f_0$=25.5769 | 145.7 | 132.5 |
| $2f_0$ | 30.4 | 30.4 |
| $3f_0$ | 4.4 | 6.3 |
| $f_2$=25.2469 | 7.6 | 6.9 |
| $f_1$=31.6759 | 7.0 | 7.0 |
| $f_3$=50.8312 ($\sim f_0+f_2$) | 4.1 | 4.6 |
| $f_4$=32.5456 | 5.6 | 5.6 |
| $f_5$=25.9122 | 5.1 | 4.6 |
| $f_6$=33.1129 | 4.8 | 4.8 |
| $f_7$=25.6653 | 4.7 | 4.3 |

Breger 2001), although a large number of this kind of variables have been discovered in globular clusters during the last few years (Rodríguez & López-González 2000). The field SX Phe variables show low metallicities and spatial motions typical of Population II contrary to the Population I characteristics presented by the $\delta$ Sct-type pulsators located in the same region of the H-R diagram. The majority of the field SX Phe variables display large visual peak-to-peak amplitudes, larger than $\sim 0.^m3$.

BL Cam presents the second shortest period (P=$0.^d0391$) among the field SX Phe variables (the shortest one corresponds to PL43=CS22966-043 with $0.^d0374$) and the shortest one among the high-amplitude objects of this type. Moreover, this star presents the most extreme case of metal deficiency ([Me/H]=−2.4, McNamara 1997) among these objects. Thus, the investigation of the pulsational properties of this variable is of great interest.

## 2. Observations and results

The observations were carried out 1996 and from 2003 to 2005. In all cases, CCD photometry was used, but from different observatories, telescopes and filters. In total, about 105 hours of useful data were adquired on 28 nights. In order to compare amplitudes obtained in different filters, all of them have been related to equivalent amplitudes in the Johnson's V filter by means of suitable transformations.

Frequency analysis was carried out on each of the new data sets presented in this work and those available in the literature which we considered as reliable enough for this purpose. No significant changes are found in the amplitude of the main periodicity $f_0$=25.5769 $cd^{-1}$. If any, they are very small and probably produced by the existence of secondary peaks close to $f_0$ which are nor discerned in short data sets.

On the other hand, our results confirm the existence of a secondary peak $f_1$ in the region around 31.6 or 32.6 $cd^{-1}$ and variable amplitude. This peak is present in all analysed data sets with resolution enough. The difference could be due to the 1 $cd^{-1}$ alias problem intrinsic of data sets collected from only one observatory. However, the analysis of the 1999 data set of Zhou et al. (2001) (probably the best data set in the literature) shows two independent peaks around 31.68 $cd^{-1}$ and 32.54 $cd^{-1}$ (Table 1). In addition to $f_0$ and $f_1$, several peaks of nonradial nature and variable amplitude are detected close to $f_0$. Thus microvariability seems to be present in this star similar to that previously found in some other high-amplitude $\delta$ Sct and SX Phe-type variables (SX Phe itself, DY Peg, AI Vel, RV Ari or RY Lep (Rodríguez et al. 2003) and references therein).

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