

CZ Lacertae – a Blazhko RR Lyrae star with multiperiodic modulation

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Abstract

CZ Lacertae, a fundamental mode RR Lyrae star, was observed during the Konkoly Blazhko Survey at Konkoly Observatory. The observations covered two consecutive seasons and were obtained with a Wright CCD camera attached to the 60 cm automatic telescope at Svábhegy, Budapest. The log of the multicolour ($BVR_C I_C$) observations are summarized in Table 1.

After several nights of observation it was obvious that CZ Lac was a Blazhko star and its modulation was rather complex. Therefore we collected an extended amount of data on this object. Our Konkoly Blazhko Survey provides the most extended multicolour Blazhko observations ever obtained; the data of CZ Lac and MW Lyr (Jurcsik et al. 2008, 2009) are the most numerous. The V light curve of the observations from the two seasons folded with the pulsation period is shown in Fig. 1.

Our data show that this variable is modulated with two different periods. The two modulations have similar amplitudes i.e., none of them is dominant. The multiperiodic behaviour of the modulation is hard to be explained by those theoretical models of the phenomenon that bind the modulation period to the rotation of the star e.g., the oblique magnetic rotator model.

The multiperiodic modulation of RR Lyrae stars is not a completely new phenomenon, as it was suspected earlier e.g., in XZ Cyg (LaCluyzé et al. 2004) or at UZ UMa (Sódor et al. 2006). Also the Blazhko RR Lyrae stars of the MACHO and OGLE surveys (Alcock et al. 2000, Moskalik & Poretti 2003) that have unequally spaced triplet structures in their Fourier spectra are possibly multiperiodically modulated variables. Nonetheless, CZ Lac is the first Blazhko star with multiperiodic modulation where both modulation periods are unambiguously identified. The length of the data set allows to resolve the modulations in both seasons independently. Both modulation frequencies show significant changes between the two seasons, which suggests that multiperiodic modulations may have a greater instability than monoperoiodic ones. In contrast with CZ Lac, MW Lyr with a single Blazhko period shows very stable modulation throughout two seasons of observations (20 Blazhko cycles).

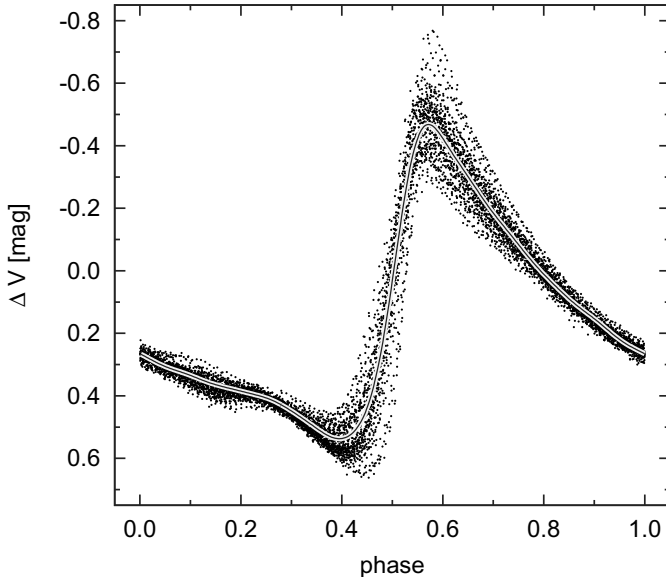
There are complex multiplet structures around the pulsation harmonics (kf_0) in the Fourier spectra. Not only modulation sidelobes ($kf_0 \pm f_{m_1}$ and $kf_0 \pm f_{m_2}$) with the two modulation frequencies (f_{m_1} and f_{m_2}) appear but also sidelobes with their linear combinations ($kf_0 + (f_{m_1} + f_{m_2})$ and $kf_0 \pm (f_{m_1} - f_{m_2})$), and even with a subharmonic of the larger frequency ($kf_0 \pm 0.5f_{m_2}$) can be observed around several pulsation harmonics.

A detailed study on the analysis of the Blazhko behaviour of CZ Lac is in preparation and is planned to be published elsewhere.

Individual Objects: CZ Lac

Table 1: Log of our CCD multicolour $BVR_C I_C$ observations of CZ Lac.

Season	Begin [JD]	Length [d]	No. of data points per band
2004–2005	2 453 266	146	≈ 3650
2005–2006	2 453 648	84	3011–4460

Figure 1: V light curve of CZ Lac, folded with the pulsation period, with the fitted mean curve.

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