Active OB stars: structure, evolution, mass loss, and critical limits
Proceedings IAU Symposium No. 272, 2010
C. Neiner, G. Wade, G. Meynet & G. Peters, eds.

doi:10.1017/S1743921311010593

Multicolour studies of β Cephei stars in the LMC

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Abstract. Preliminary results of a four-week multi-colour photometric campaign on previously identified β Cephei stars as well as newly-discovered variable stars in two respective LMC fields are presented. Besides the two targeted β Cephei stars, at least six further presumed B variables are detected. The strongest identified periods appear to lie on the longward end of the galactic β Cep instability strip, as predicted by model calculations.

Keywords. stars: early-type, techniques: photometric, stars: variables: other

1. Introduction

Pigulski & Kolaczkowski (2002) announced the first discovery of β Cephei pulsators in the LMC. Theoretical analyses of pulsational stability had previously predicted that early B main-sequence stars with metallicities lower than Z = 0.01 should not pulsate at all (e.g. Pamyatnykh 1999). Following this announcement, and announcements of 92 β Cep candidates in the LMC by Kolaczkowski & Pigulski (2006) - also see Diago *et al.* (2009) - more detailed studies adopting a variety of opacity calculations and metal mixtures indicated that β Cep pulsations could be explained in low-metallicity environments after all (Miglio *et al.* 2007a; Miglio *et al.* 2007b; Zdravkov & Pamyatnykh 2008), but with the longer-period modes favoured over the shorter-period ones. It has thus become very relevant to study the exact nature of the detected β Cep pulsations seen in low-metallicity environments, in order to subject the new models to more precise constraints. As noted by Handler (2008), observations in at least three different photometric filters are advised to ensure effective mode identification. We ran a 4-week UBVRI campaign on two of the LMC β Cep stars considered by Pigulski & Kolaczkowski (2002) to attempt a mode identification analysis, and to search for other pulsating stars in the surrounding fields. We labelled the main targets LMC1 and LMC2 respectively. Pigulski and Kolaczkowski clearly identified 5 regular periodicities in LMC1, and two in LMC2.

2. Observations and Analysis

We observed the two fields surrounding LMC1 and LMC2, respectively, for four weeks spread over December 2009 and January 2010, using the 1.0 m telescope at the Sutherland station of the South African Astronomical Observatory (SAAO). Table 1 displays the strongest provisional pulsation frequencies (and their corresponding amplitudes in B) for a small selection of stars observed in the two chosen fields. We confirm most of the frequencies reported by Pigulski & Kolaczkowski (2002). Three of these four stars only display strong signals below 4 cycles per day, which is on the low end of the β

Table 1. Firmly detected periodicities in four stars in the LMC.

Star ID	Frequency(c/d)	Amplitude (mmag)
LMC1	2.00	42
	3.76	28
	1.70	20
LMC2	3.50	17
LMC1 V2	4.81	4
	7.13	4
	3.09	3
	7.29	2
LMC2 V2	2.96	28
	3.10	17
	3.75	16

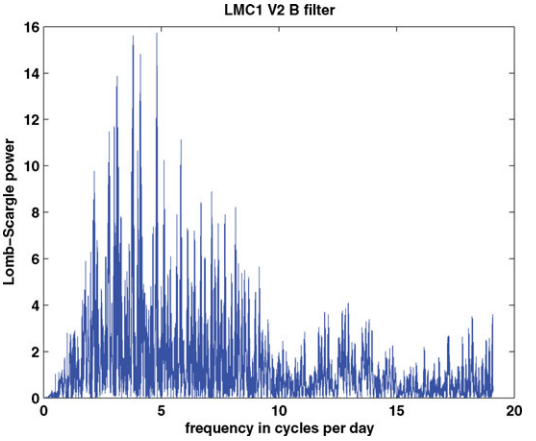

Figure 1. Lomb-Scargle periodogram of one of the newly-discovered B variables, LMC1 V2.

Cep spectrum for stars in our galaxy. This is in agreement with expectations for low-metallicity β Cep stars. The Lomb-Scargle periodogram for one of the newly-discovered B variables (LMC1 V2) is shown in Figure 1.

Acknowledgements

We thank the SAAO for generous amounts of observing time and the NRF for funding. CAE thanks Luis Balona for valuable discussions.

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https://doi.org/10.1017/S1743921311010593 Published online by Cambridge University Press