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Frequency Analysis of a Subset of Fundamental Mode RR Lyrae Stars from the MACHO Project Large Magellanic Cloud Database

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Abstract. We present the preliminary results of a frequency analysis of 1457 fundamental mode RR Lyrae (RR0) stars in the Large Magellanic Cloud (LMC) from MACHO Project photometry. We find the same classes of pulsational behavior as were found in our earlier survey of first overtone RR Lyrae (RR1) stars. Variables whose prewhitened power spectra contain one or two peaks close to the main frequency component in the original power spectra are commonly known as Blazhko-type variables. The present analysis shows the overall frequency of Blazhko-type stars in the total RR0 population analysed to date to be $\approx 10\%$. This is lower than the often cited Galactic field/globular rate of 20-30% (Szeidl, 1988).

The incidence rate of Blazhko-type variability in the LMC appears to be about *three times* higher in RR0 stars than in RR1 stars. This puts important constraints on possible models of the Blazhko effect.

1. Introduction

The lightcurve modulation of some RR Lyrae stars, discovered by Blazhko (1907), has still not been adequately explained almost a century later. One factor limiting progress has been the inability to fairly sample a large population of RR Lyrae variables over the appropriate timescales of months and years. We report an analysis of 1457 LMC RR0 stars from the MACHO Project photometry database. This work is similar in nature to that reported by Alcock et al. (2000) for RR1 stars.

2. Results and Conclusions

We report the following results:

- Discovery of 54 variables with a symmetric frequency doublet around the main frequency component of the fundamental pulsation - type RR0–BL.
- Discovery of 95 variables with a single frequency component close to that of the fundamental mode - type RR0–ν1.
- Both BL and ν1 behavior are more common in RR0 stars than in RR1 stars, by a factor of 2.7.
- 80% of the RR0–ν1 stars have a modulation component which has a larger frequency than the fundamental mode.
- For 68% of the RR0–BL stars the modulation component with the larger frequency also has larger amplitude.

Asymmetric modulation amplitudes and the existence of RR0–ν1 stars, which apparently lack symmetric modulation components, pose serious problems for existing proposed models for the Blazhko effect. We expect the fully analysed RR0 sample of 6500 variables will contain 650 Blazhko-type stars.

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