

RR Lyrae stars in M4

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Abstract

A large CCD photometry observing campaign in search of p mode oscillations in K giants (see Frandsen et al. 2007) has produced very high quality time series data for the RR Lyrae stars and other variables in the globular cluster M4. New variables have been found and the known RR Lyrae stars have been better characterized.

Non-radial modes in globular cluster RR Lyrae stars

Until now only ten RR Lyrae stars with non-radial modes detected from the Fourier analysis were known in globular clusters (Clement and Rowe 2000, Kopacki et al. 2003). All of them are of the RRc type, which is not surprising since these stars have shorter pulsation and modulation periods and are much easier to discover. Recently, however, Benkő et al. (2006) determined through Fourier analysis modulation periods for 13 RRab stars in M3.

Non-radial modes in pulsators in M4

Using our data we performed a frequency analysis of the observed RR Lyrae stars. We find non-radial modes both in RRc and RRab variables. As expected, these modes appear to be components of a doublet or triplet structure. It should be noted that the equidistant triplet structure in the power spectrum may result from modulation of the purely radial mode only. In RRab stars we detect strong interaction between radial and non-radial pulsations evidenced by the occurrence of many combination frequencies.

Interestingly, all Blazhko RRc stars in our sample are located in the colour – magnitude diagram (see Fig. 1) at the blue edge of the instability strip only. In the period – amplitude diagram, given in Fig. 2, these stars also occupy a distinctive position being the stars with the shortest periods and lowest amplitudes among all RR Lyrae stars in M4.

References

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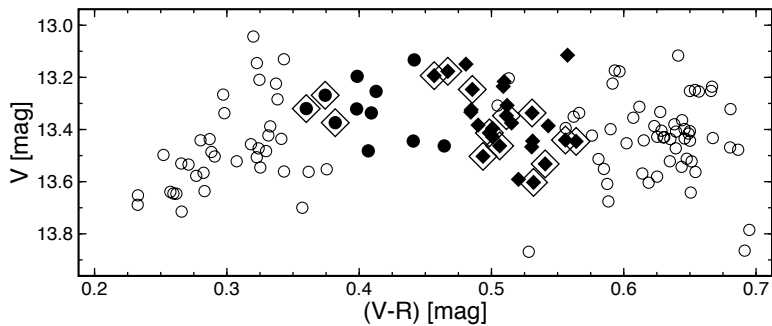


Figure 1: Horizontal branch of M4 in the V vs. $(V - R)$ colour-magnitude diagram. RRab stars are represented by filled diamonds, RRc stars with filled circles. Variables exhibiting the Blazhko effect are indicated with open diamond symbols.

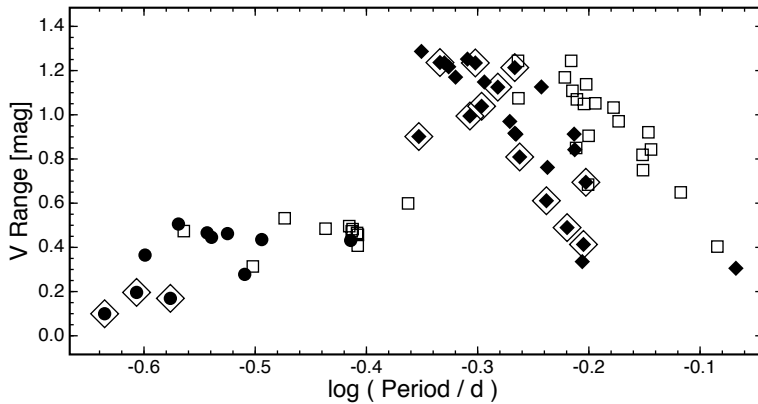


Figure 2: V range of variability as a function of period for RR Lyrae stars in M4. The meaning of symbols is the same as in Fig. 1. For comparison, the RR Lyrae stars of M53 are shown with squares.