Preliminary results for RR Lyrae stars and Classical Cepheids from the Vista Magellanic Cloud (VMC) survey

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Abstract The Vista Magellanic Cloud (VMC, PI M.R. Cioni) survey is collecting $K_S$-band time series photometry of the system formed by the two Magellanic Clouds (MC) and the “bridge” that connects them. These data are used to build $K_S$-band light curves of the MC RR Lyrae stars and Classical Cepheids and determine absolute distances and the 3D geometry of the whole system using the $K$-band period luminosity ($PLK_S$), the period–luminosity–color ($PLC$) and the Wesenhiet relations applicable to these types of variables. As an example of the survey potential we present results from the VMC observations of two fields centered respectively on the South Ecliptic Pole and the 30 Doradus star forming region of the Large Magellanic Cloud. The VMC $K_S$-band light curves of the RR Lyrae stars in these two regions have very good photometric quality with typical errors for the individual data points in the range of $\sim$0.02 to 0.05 mag. The Cepheids have excellent light curves (typical errors of $\sim$0.01 mag). The average $K_S$ magnitudes derived for both types of variables were used to derive $PLK_S$ relations that are in general good agreement within the errors with the literature data, and show a smaller scatter than previous studies.

Keywords Stars: variables: Cepheids · Stars: variables: RR Lyrae · Galaxies: individual: LMC · Galaxies: distances and redshifts

1 Introduction

The VISTA near-infrared $YJK_S$ survey of the Magellanic system (VMC; Cioni et al. 2011) is an ESO public survey that is obtaining deep near infrared imaging in the $Y$, $J$ and $K_S$ filters of a wide area across the Magellanic system, using the VIRCAM camera (Dalton et al. 2006) of the ESO VISTA telescope (Emerson et al. 2006).

The main science goals of the survey are the determination of the spatially-resolved star-formation history (SFH) and the definition of the three-dimensional (3D) structure of the whole Magellanic system. The VMC observations are devised to reach $K_S \sim 20.3$ mag, thus allowing us to measure sources encompassing most phases of stellar evolution: from the main-sequence, to subgiants, upper and lower red giant branch (RGB) stars, red clump stars, RR Lyrae and...