Variability in the Galactic globular cluster M15
Science Verification Phase T80Cam/JAST80@OAJ

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Introduction

In the framework of the Science Verification Phase of T80Cam of the 83cm Javalambre Auxiliary Survey Telescope (JAST80) located at the Observatorio Astrofísico de Javalambre (OAJ), Teruel, Spain, a program was proposed to study the variability of RR Lyrae stars, as well as other variable sources, belonging to the Galactic globular cluster M15. The observations were carried out on different epochs (almost a dozen different nights along a ~ 4 months period) using the complete set of 12 filters, centered at the optical spectral range, that are being devoted to the exectuion of the ongoing Javalambre Photometric Local Universe Survey (J-PLUS). Preliminarily results are presented here.
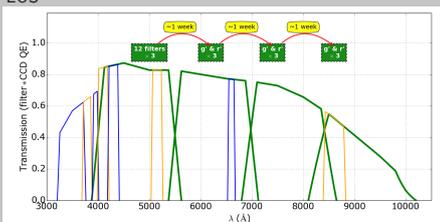
Getting ready for J-PAS & J-PLUS

The Javalambre-Physics of the Accelerating Universe Astrophysical Survey (J-PAS) and the Javalambre-Photometric Local Universe Survey (J-PLUS) (see Benítez et al. 2014) are focused on Cosmology and Galaxy Evolution. But the halo of Milky Way is on the field of view too: more than 15000 RR Lyraes are expected to be found.

▶ J-PAS
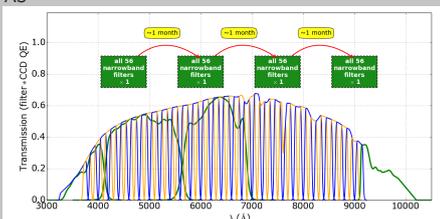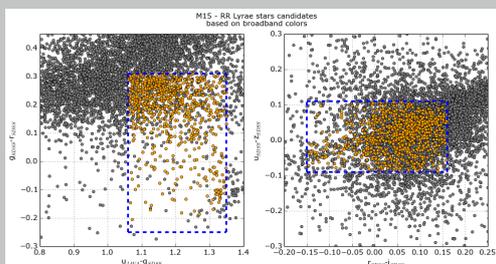

▶ J-PLUS

Spectral domain: seeking candidates

Figure : The color cuts applied to the broadband filters were previously defined using Catalina Sky Surveys data on thousands of RR Lyraes and getting the colors from SDSS. Orange dots are M15 RR Lyrae stars candidates based on color only.
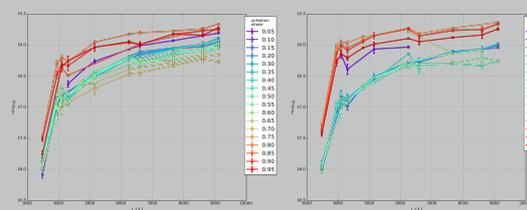

Figure : Spectral energy distributions (SEDs) of the two RR Lyrae (RR0) stars, whose light-curves are shown on the right, along the pulsation phase. One of the main goals of this work is to improve the candidates identification by using the whole spectral information available from the 12 filters. Here maximum brightness is at phase=0.80.

The importance of RR Lyrae stars

- Standard candles. Not so bright as Cepheids, but still bright enough to be detected up to nearby galaxies: $<M_V> \simeq 0.7 - 0.8$.
- Period - Metallicity - Luminosity relations
  - Distance indicators.
  - Metallicity indicators.
  - Interstellar extinction indicators.
- Tracers of the old population of the galaxy and the nearby galaxies $\Rightarrow$ implications on Galaxy formation.
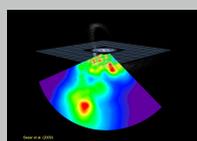

Figure : Overdensities detected using RR Lyrae stars detected within the SDSS Stripe 82 (Sesar et al. 2010).

Galactic Globular Cluster M15

M15 is a well known, very metal-poor GGC belonging to the Oosterhoff's Type II. More than a hundred variable stars (many of them RR Lyrae stars) are present in the cluster. This makes M15 a good target for testing techniques of identification and characterization of variables.

Figure : Coadded multiband fullframe image of the Galactic globular cluster M15 (at the center of the image) taken with T80Cam/JAST80@OAJ. The complete area of the FoV convers $\simeq 2\square°$ with a resolution of $0.556\,\mathrm{arcsec/pix}$.

Time domain: Determination of RR Lyraes' temporal parameters
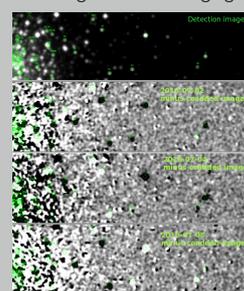
▶ Testing difference imaging.

Figure : DI applied to M15. The 3 bottom images: single epoch image minus coadded reference image. The top figure is the sum of the absolute value of many of the these difference images; thus highlighting variable sources.
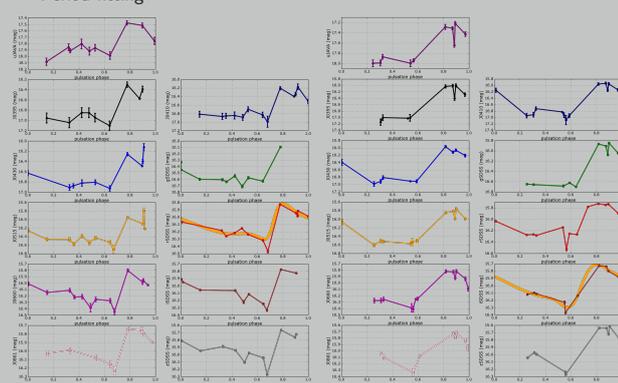
○ Period fitting

Figure : Light curves of two RR Lyrae stars as they look like at the different J-PLUS bands. The period was determined from the band data showing the best-fitting template (thick orange line) taken from Sesar et al. 2010, and it was afterwards applied to the other bands to fold the time series.

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