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Ages and metallicities for 50 globular clusters in NGC 1023

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Abstract. We selected a sample of 50 globular clusters in NGC 1023 observed with J-PLUS, with the aim of studying its stellar population content. Using SED fitting techniques, we derived ages and metallicities for these objects with the codes TGASPEX and DynBaS3 and the following stellar population models: Bruzual & Charlot 2003 (BC03), Charlot & Bruzual 2017 (CB17) and Vazdekis (VM). The preliminary results show that the ages of the GC candidates lie between 8 and 9 Gyr and the metallicities lie between $-0.5 \leq [Z/Z_{\odot}] \leq 0.5$.

Resumo. Selecionamos uma amostra de 50 aglomerados globulares da galáxia NGC 1023 observados com o J-PLUS, com o objetivo de estudá-los em termos de suas populações estelares. Utilizando técnicas de ajuste de distribuições espectrais de energia, derivamos idades e metalicidades para esses objetos usando os códigos TGASPEX e DynBaS3 e os seguintes modelos de população estelar: Bruzual & Charlot 2003 (BC03), Charlot & Bruzual 2017 (CB17) e Vazdekis (VM). Os resultados preliminares mostram que as idades dos candidatos a aglomerados globulares situam-se entre 8 e 9 Ganos e as metalicidades situam-se entre $-0.5 \leq [Z/Z_{\odot}] \leq 0.5$.

Keywords. Galaxies: individual: NGC 1023 – Galaxies: star clusters: general – Galaxies: stellar content

1. Introduction

Globular Clusters (GCs) are found in most galaxies and are among the oldest radiant objects in the universe (Larsen 2001; Brodie & Strader 2006). The study of these objects is a powerful way to recover the history of galaxy formation and evolution.

NGC 1023 (SB0) is a nearby galaxy (11.1 Mpc) that hosts a population of GCs. This galaxy has been studied in a significant number of works (Larsen 2001; Forbes et al. 2014).

In order to study the GC population in NGC 1023 according to its stellar population content, here we present preliminary results of ages and metallicities of 50 GC candidates, selected using the pipeline GCFinder (see Brito-Silva et al. in this volume).

2. Data and methodology

We worked with images of NGC 1023 observed by the JAST/T80 telescope (diameter of 80 cm) and T80Cam (pixel scale of 0.55"/pixel) from J-PLUS survey (http://jplus.cefca.es).

We detected and selected a sample of GC candidates using the pipeline GCFinder. We study here only the objects detected in 11 bands (u, J0378, J0410, J0430, g, J0515, r, J0660, i,J0861 and z), and confirmed as GC candidates by the work of Forbes et al. (2014).

We employ here a version of the codes TGASPEX and DynBaS3 adapted to work with J-PLUS and J-PAS filter systems (Magris et al. 2015; Mejìa-Narváez et al. 2017). As preliminary tests of the software, we fitted a sample of galaxies used in the J-PAS Stellar Population Challenges (listed below):

- C1: Galaxy SED simulated from stellar population models, used in Challenge 2011 of the J-PAS/J-PLUS collaboration.
- C2: Galaxy SED simulated from stellar population models, used in Challenge 2015 of the J-PAS/J-PLUS collaboration.
- C3: Galaxy SED simulated from SDSS galaxy spectra, used in Challenge 2017 of the J-PAS/J-PLUS collaboration.
- C3-JPLUS: Galaxy SED simulated from SDSS galaxy spectra, used in Challenge 2017 of the J-PAS/J-PLUS collaboration.

We started our tests of TGASPEX and DynBaS3 by using 3 different stellar population models: Bruzual & Charlot 2003 (BC03) (Bruzual & Charlot 2003), Charlot & Bruzual 2017 (CB17) (Charlot & Bruzual 2017) and Vazdekis (VM) (Vazdekis et al. 2010), and compared results for Av, stellar mass, mass-weighted age, mass-weighted log age, L_V-weighted log age, mass-weighted log Z, and L_V-weighted log Z in different scenarios: reducing the number of filters used, and varying metallicities available in the models.

3. SED fitting of GC candidates

After testing the software, we built the Spectral Energy Distribution (SED) of the 50 brightest GCs detected by GCFinder.

We used again the SED fitting codes TGASPEX and DynBaS3 and the stellar population models BC03 and CB17 to obtain ages and metallicities of our sample of GCs candidates. The results can be seen in Figure 1.

The results show that the ages of the GC candidates lie between 8 and 9 Gyr and metallicities lie between $-0.5 \leq [Z/Z_{\odot}] \leq 0.5$.

We observed that the age-metallicity relation has an expected distribution in DynBaS3 results – i.e. older GCs are more metal-poor than younger GCs –, but the same distribution was not so clearly seen in TGASPEX results.

4. Conclusions and perspectives

In the tests with simulated SEDs, we observed that BC03 and CB17 results are in better agreement with each other than any

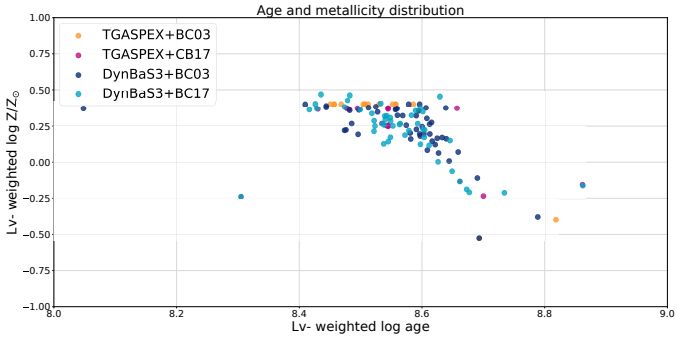

Figure 1. Age and metallicity results.

other model comparison. We also observed that results for C1 and C2 SEDs sets are in better agreement than C3 sets.

Our preliminary results from Dynbas3 show that older GCs are more metal-poor than younger GCs, in agreement with expectations. This gives us confidence that this code is behaving well with the J-PLUS filter system.

We plan to expand this work in the following ways:

1. Review the magnitudes we obtained in this work and compare it with results found in literature.
2. Perform additional studies on TGASPEX results, as well as the differences obtained using different stellar population models.
3. Run Dynbas3 and TGASPEX on the revised data.
4. Obtain more astrophysical parameters from the SEDs of the GCs, such as redenning and stellar masses.
5. Study the GCs in terms of its stellar population content, exploring possible subpopulations of GCs.

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