Chemical Analysis of the Bulge Globular Cluster NGC6553

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Abstract

The purpose of our research is to perform a detailed analysis of chemical abundances to a sample of stars belonging to the Bulge Globular Cluster NGC 6553, in order to determine chemical patterns that allow us to appreciate the phenomenon of the Multiple Population (MP) in one of the most metal-rich GCs of the galaxy, besides to perform a comparison of abundances with Bulge field stars.

This analysis is being carried out with a sample of spectroscopic data obtained by the FLAMES / GIRAFFE spectrograph mounted on the Kueyen VLT-UT2 telescope of the Paranal Observatory (Chile), photometric data obtained by Variable Variable View in the Milky Way Survey (VVV) and data obtained from Data Release 2 (DR2) of The Gaia Mission.

Introduction

The knowledge that Galactic Globular Clusters (GGCs) are simple stellar populations (SSP) has changed with the discovery of Multiple Populations (MP) in a large number of GCs. Because they present inhomogeneities in the content of light elements such as C, N, O, Na, Mg and Al, which translate into well-defined anticorrelations such as O-Na (Carretta et al., 2009). It is likely that this phenomenon is due to self-contamination of the cluster generated by first-generation evolved stars, allowing the birth of two or more generations of stars (Kraft 1994, Gratton et al 2004, 2012, Piotto 2009, Piotto et al. 2012).

Another discovery was carried out by Fernandez-Trincado et al. (2017), where they observed that there are galaxy field stars with similar abundances to the GC second-generation stars.

This discovery makes us wonder about its origin, since it could be second generation stars that were expelled from the cluster. Therefore, the study of these stars is a fundamental for the abundance studies of the globular clusters and for the galaxy.

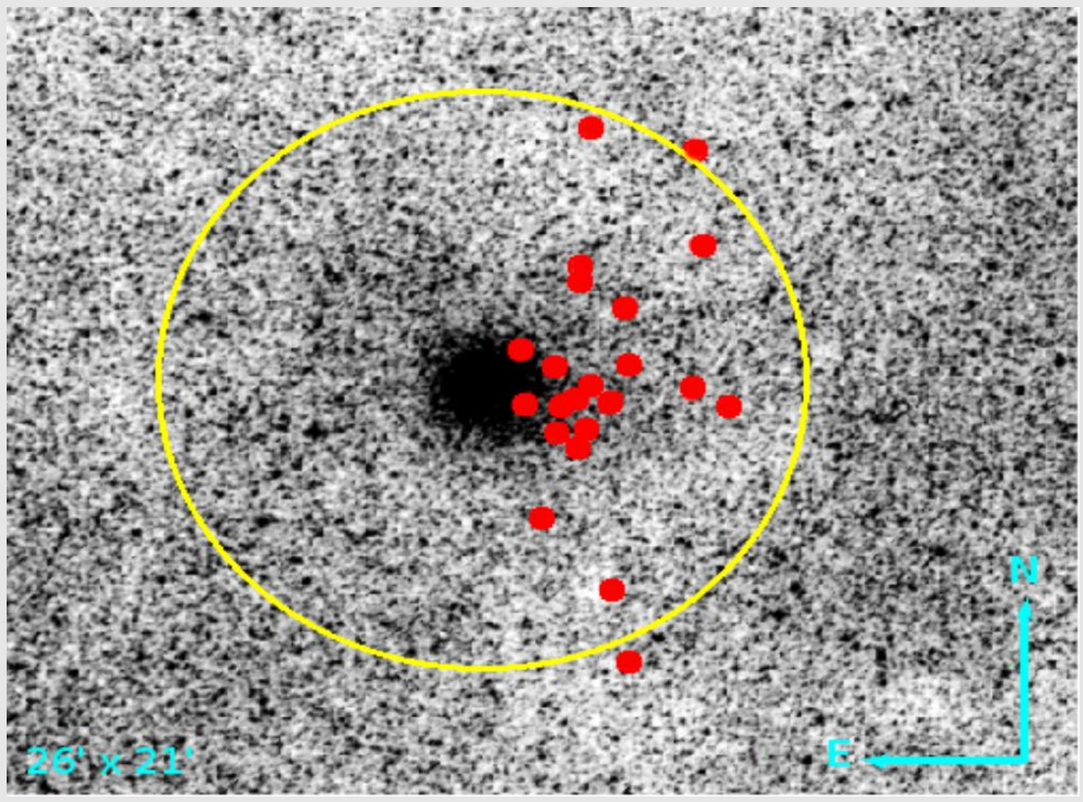

Fig1. Distribution of stars observed in NGC 6553, represented by red circles. The yellow line represents tidal radius (Harris 1996, 2010 edition).

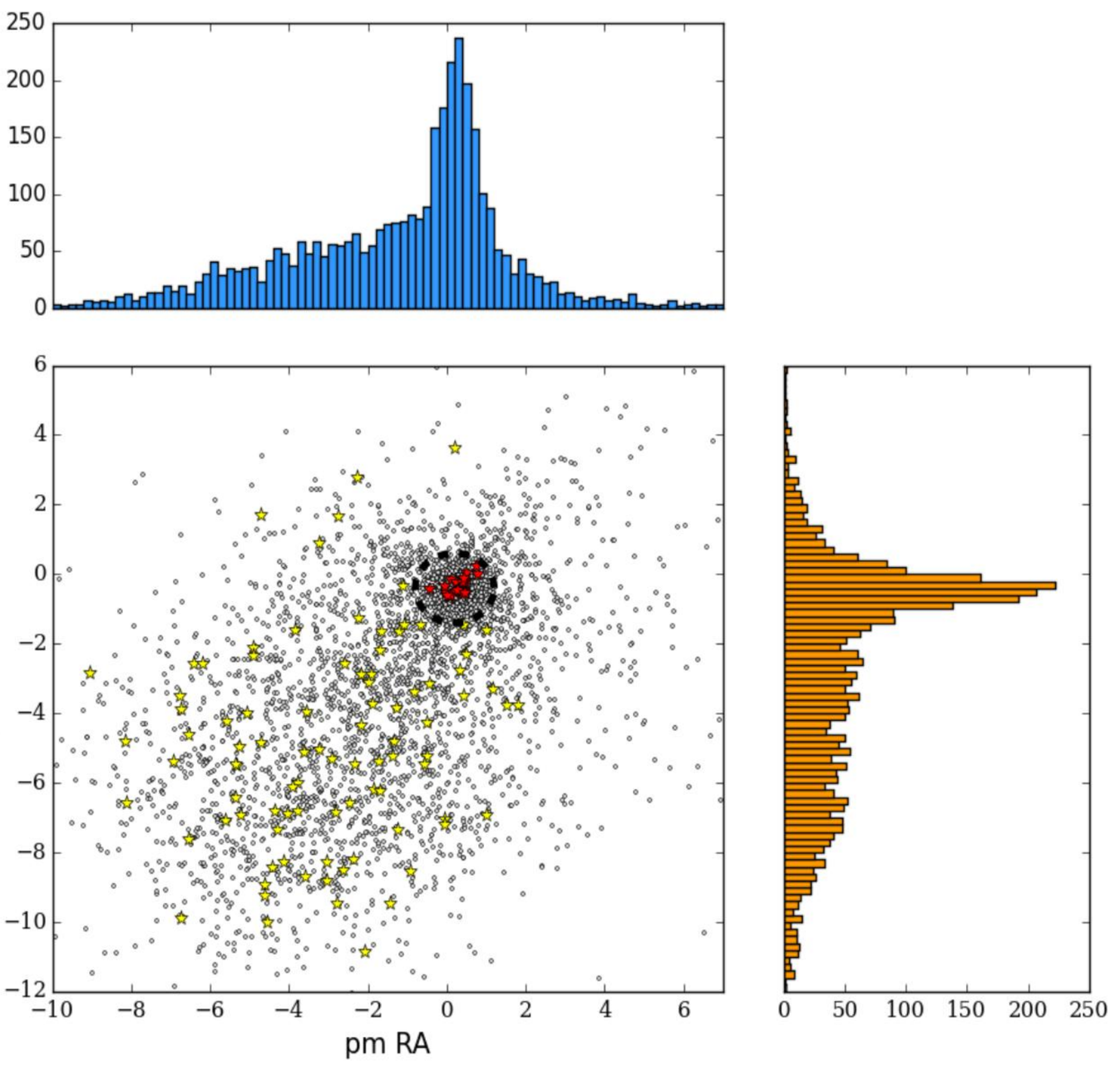

Fig 2. Proper motion diagram for the field stars and the globular cluster NGC 6553. The histograms of 0.2 mas/yr bins in both directions, show the distribution of the stars with maximum points in pmra = 0.19 mas/yr and pmdec = -0.4 mas/yr respectively. In this diagram of proper motion, the cluster is clearly distinguished from the field stars, where the cluster is within the circle of dashed black lines.

The observed stars are symbolized as yellow and red stars, representing both the field and the cluster members stars, respectively.

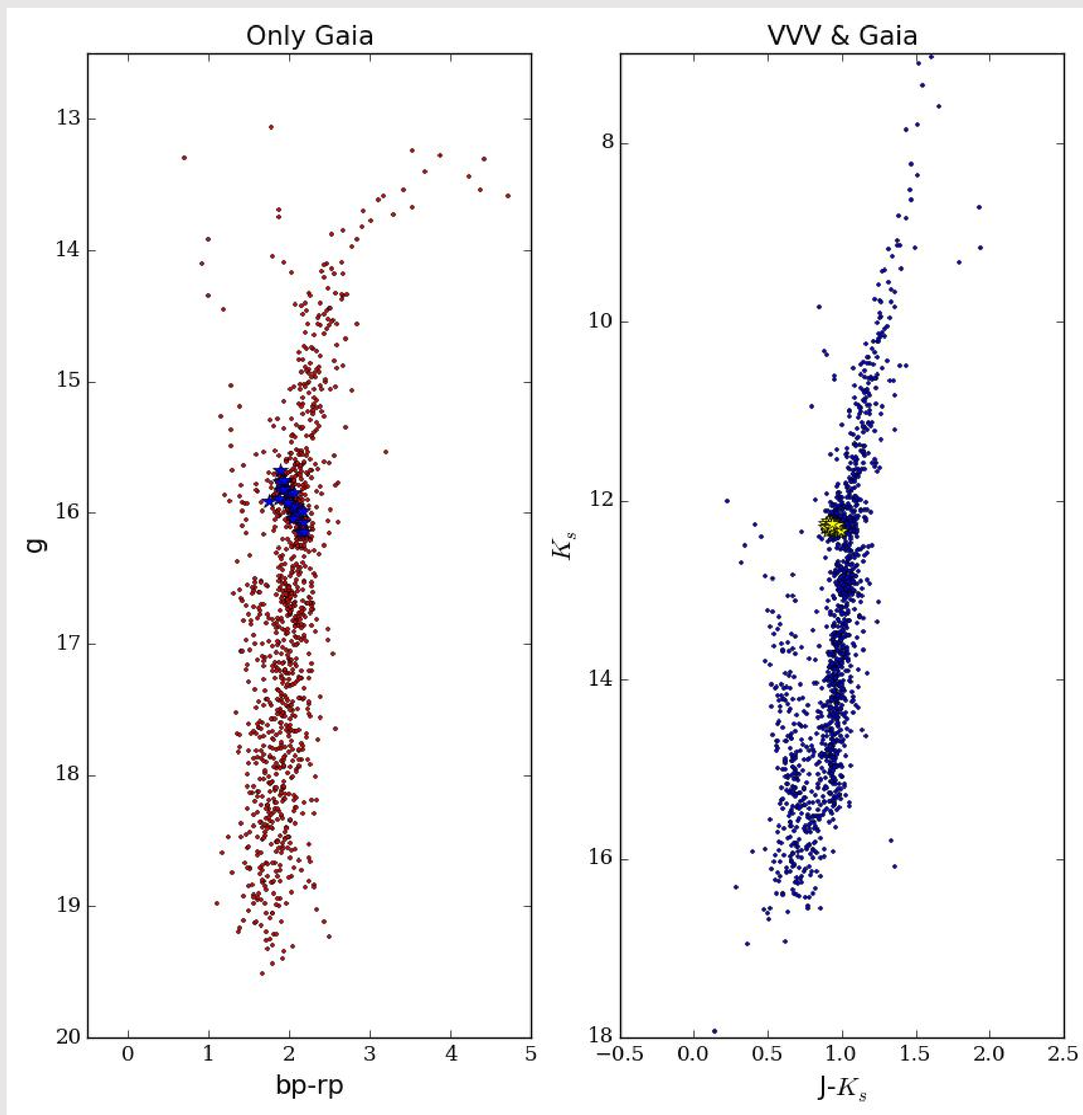

Fig 3. Left: Color-Magnitude Diagram of the NGC 6553 cluster obtained by the photometry of Data Release 2 of Gaia, where the observed stars are represented as filled blue dots. Right: Color-magnitude diagram of the NGC 6553 cluster obtained by VVV photometry, but in this case, corrected by proper motion thanks to Gaia's DR2. Observed stars are represented by yellow dots.

Results

We have obtained, through the combined analysis of radial velocity and proper motion, that of the 116 stars in the sample, 22 belong to the globular cluster, where all are HB stars and 87 are field stars, as we see in the Fig.2.

We also observe that this cluster presents a small extension of its HB (as we see in the Fig 3.), where the extension of the HB in a GC is proportional to the amount of He variation due to self-contamination (D'Antona et al., 2002). In this sense, the stars with He-normal will be located in the redder part of the HB, while the He-rich stars will be located in the bluer part of the HB, as demonstrated in Marino et al. (2011) and Gratton et al. (2011, 2012, 2013).

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