Stellar Populations - Planning for the Next Decade
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Stellar populations of disc galaxies: from the center of the bulge to the edge of the disc

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Abstract. We present extensive photometric and spectroscopic study to give a new insight in the bulge stellar population. Super-solar α/Fe and its constant value along the radial profile, in most of the galaxies, suggest that the star formation in these objects has been fast and occurred at the same time in the whole bulge.

Keywords. galaxies : abundances – galaxies : bulges – galaxies : evolution – galaxies : stellar content – galaxies : formation – galaxies : Kinematics and Dynamics

1. Introduction

Bulge of spiral galaxies, due to their privileged position in the center of galaxies, are very promising to reveal the mechanisms of their formation and evolution. Dynamical and kinematical studies suggested they could have completely different nature through the Hubble sequence. Bulges of early-type spiral galaxies (Sa to Sb) have similar behavior to field elliptical galaxies, while bulges hosted in late type spiral galaxies (Sc onward) host a younger stellar population. Any good theory explaining the galaxy evolution has to be able to reproduce the constraints given by the observation of stellar populations such as age, metallicity and α-enhancement. To this aim we derived metal abundances, age, α-enhancement, and their gradients for a large sample of galaxies, with a morphological type ranging from S0 to Sc. More extended description and details about data, data reduction, and stellar population analysis of this work can be found in Morelli *et al.* 2008.

2. Results and Conclusions

We obtained long-slit spectra at the ESO 3.6-m telescope using EFOSC2 spectrograph in the range between 4700Å and 6700Å. We measured the linestrength of Lick indices in the central regions and their gradients from the center to $r_{\rm db}$, radius where the surface-brightness contributions of the bulge and disc are equal. The value of ages, metallicities, and α/Fe enhancements were derived converting the Lick indices by using the stellar population models by Thomas *et al.* (2003). The youngest bulges have an average age of 2 Gyr (Fig. 2a). They are characterized by ongoing star formation. The stellar population of intermediate-age bulges is 4 to 8 Gyr old. It has solar metallicity (Z/H = 0.0 dex) . The older bulges have a narrow distribution in age around 10 Gyr and high metallicity (Z/H = 0.30 dex). Most of the sample bulges display solar α/Fe enhancements. A few have a central super-solar enhancement (α/Fe = 0.3) (Fig. 2a).

The gradients were set as the difference between the values of age, metallicity and α/Fe enhancement at centre and their values at $r_{\rm db}$. Most of the sample galaxies show

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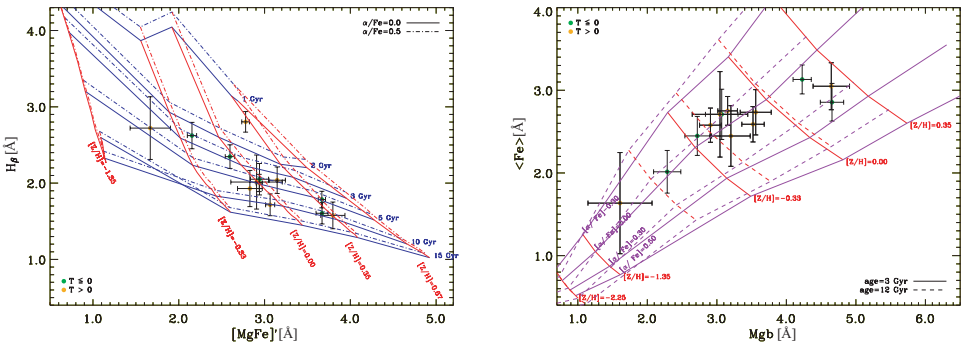

Figure 1. The distribution of the central values of Hβ and [MgFe]$'$ indices (left panel) and $\langle$Fe$\rangle$ and Mg b indices (right panel) averaged over 0.3 $r_{\rm e}$ for the 14 sample galaxies.

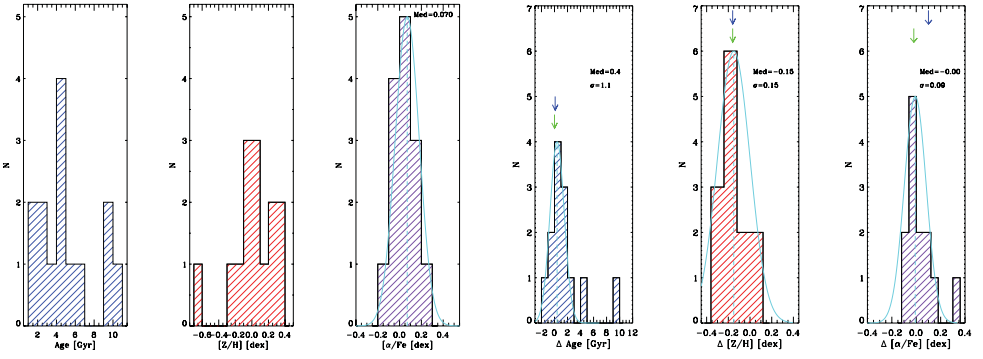

Figure 2. Fig. 2a shows the distribution of the age (left panel), metallicity (central panel) and α/Fe enhancement (right panel) while Fig. 2b show the distribution of the gradients of age (left panel), metallicity (central panel) and α/Fe enhancement (right panel) for the sample galaxies. Dashed line represents the median of the distribution and its values is reported. Solid line represents a Gaussian centered in the median value of distribution. The green and blue arrows show the average gradient found for early-type galaxies and bulges by Mehlert *et al.* 2003 and Jablonka *et al.* 2007.

no gradient in age (median = 0.4), in agreement with the earlier findings Sanchez *et al.* (2006), Jablonka *et al.* (2007) (Fig. 2b). Negative gradients of metallicity were observed in the sample bulges. The number distribution show a clear peak at Δ(Z/H) = − 0.15. No gradient was measured in the α/Fe radial profiles for almost all the galaxies. Only 1 object of 14 are out of 3 σ of distribution showing clear gradient. All these hints suggest that a pure dissipative collapse is not able to explain formation of bulges and that other phenomena like mergers or acquisition events need to be invoked Kobayashi & Arimoto 1999.

References

Jablonka, P., Gorgas, J., & Goudfrooij, P. 2007 *A&A* 474, 763
Kobayashi, C. & Arimoto, N. 1999 *ApJ* 527, 573
Morelli, L., Pompei, E., Pizzella, A. *et al. MNRAS* 389, 341
Mehlert, D., Thomas, D., Saglia, R. P., Bender, R., & Wegner, G 2003 *A&A* 407, 423
Sánchez-Blázquez, P., Gorgas, J., & Cardiel, N. 2006 *A&A* 457, 823
Thomas, D., Maraston, C., & Bender, R. 2003 *MNRAS* 339, 897

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