Self-consistent photometric and spectroscopic Star Formation Histories in Dwarf Galaxies

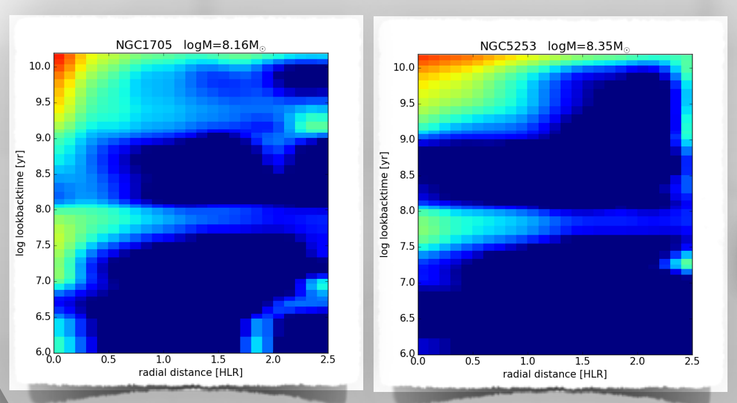
R. García-Benito, E. Pérez, E. Pérez-Montero, R. González Delgado, J. M. Vílchez

Abstract

This project aims to unify the spectroscopic and stellar photometric views by performing a comprehensive study of a sample of the nearest Blue Compact Dwarf Galaxies (BCDs). We plan to derive Star Formation Histories (SFH) both by means of Color-Magnitude Diagrams (CMDs) from extant Hubble Space Telescope (HST) optical imaging and with spectral fitting methods techniques using **MUSE**, allowing us to obtain state-of-the-art 2D stellar properties and abundances of the gas in BCDs.

SFH

Star Formation History 2D maps derived from the fossil record analysis for NGC1705 (left) and NGC5253 (right). Vertical axis represents log(lookbacktime) and horizontal axis radial distance to the center in Half Light Radius (HLR) units.



The star formation histories will be compared with their corresponding CMDs results derived from the HST data.

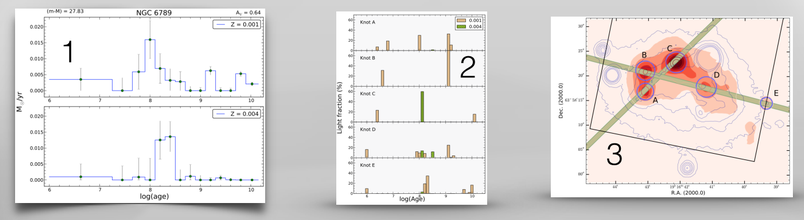
Future Work

We plan to derive all stellar and gas 2D properties to perform a comprehensive analysis of this sample of BCDs. We will also derive the stellar classification of the most relevant stars both using spectral and photometric data.

This work will forward our understanding of the nature and properties of local BCD, and also provide a detailed test for the two most mature techniques to derive star formation histories, namely, through CMD photometry and spectral fitting.

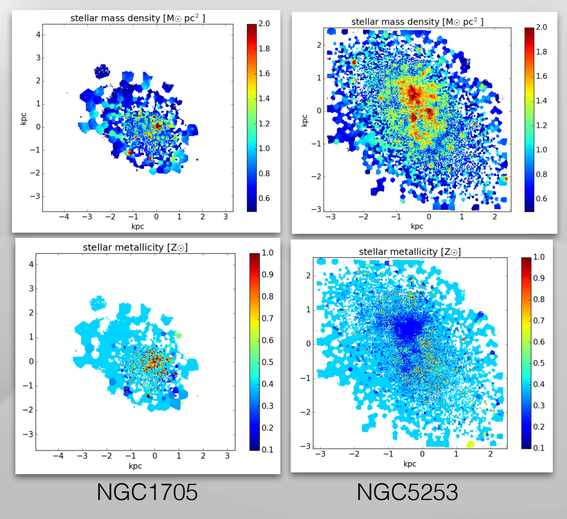
Pilot Project

Very few attempts have been made to combine both spectroscopic and photometric techniques for galaxy evolution studies, in particular for BCDs. The SFH can be analyzed, both by means of deep CMDs and by stellar population spectral synthesis, that should provide a consistent view of the SFH and other stellar properties.



In García-Benito & Pérez-Montero (2012, MNRAS, 423, 406), we used optical HST data to derive the SFH of the BCD NGC 6789 by means of the CMD (1) and by fitting the optical spectrum (2) of the five brightest knots observed using long-slit spectroscopy (3). The combination of several observational and model techniques lead to a better and self-consistent study of BCDs.

Stellar Properties

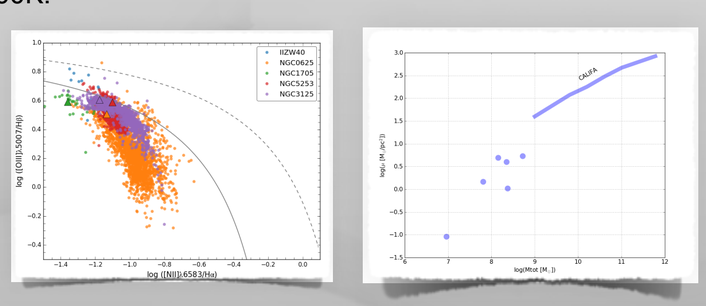


NGC1705 NGC5253

Stellar mass density (top) and stellar metallicity (bottom) for NGC 1705 (left) and NGC 5253 (right). Stellar properties derived from spectral synthesis techniques using STARLIGHT code and Charlot and Bruzual (2007) models (see González-Delgado et al. 2015)

Physical Properties

Thanks to the MUSE wavelength coverage, we can derive the physical conditions of the gas. In average, for all the galaxies (except ESO154-023, because low S/N), the extinction (from Hα/Hβ) is $A_V \sim 0.3$ mag, the density 100 cm^{-3} (from [SII] λ6716/λ6731) and the average [SIII] electron temperature (from λ6312/λ9069) ~ 10000K.



BPT diagram (left) for the spaxels with S/N > 3 for each involved line. Total mass vs mass surface density (right) derived from the stellar population analysis together with the low end curve for CALIFA.

Sample

We observed 6 nearby (< 10Mpc) BCDs galaxies with MUSE (P.I. R. García-Benito, Cycle 94A) that have already HST counterpart in at least three broad band filters.

7400 Å 6550 Å 5000 Å

RGB broad band (800 Å) composite image of the MUSE data cubes