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Characterizing Hα emitters in the Fornax galaxy cluster with S-PLUS

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The Fornax cluster is a remarkable environment to investigate emission line galaxies in high density environments. The narrow band filter J0660 of the Southern Photometric Local Universe Survey (S-PLUS), used as an input of our own code P.E.L.E. (Pixel-to-pixel Emission Line Estimate), allow us to create Hα+[NII] emission maps for the Fornax galaxy members. From these maps, we are able to characterize the Hα+[NII] emitters in relation to their morphology, spatial distribution within the cluster and their location in the phase-space diagram.

P.E.L.E. (Lopes et al., in prep.) is a python script that uses the combination of three images (r, J0660 and i in the case of S-PLUS) to build pixel maps highlighting Hα+[NII] emission. This software follows an automatic procedure that downloads the images from the splus.cloud database, performs their photometric calibration and a point-spread function correction, masks the stars based on an independent run of SEP (Source Extraction and Photometry, Barbary 2016) and applies the Three Filter Method (e.g. Vilella-Rojo et al. (2015)) resulting in an Hα+[NII] map. The methodology was validated by the comparison with the derived Hα maps from Iodice et al., 2019 (hereafter I19) based on VLT/MUSE data (Smith Castelli et al., submitted). It is found that P.E.L.E is able to recover all emission signal down to 10^{-17} erg s^{-1} cm^{-2} per pixel in the 13 objects discussed by I19.

From 213 spectroscopic confirmed members of Fornax, 79 emitters were identified. After a visual inspection, 28 galaxies were classified as spirals (S), 21 as ellipticals or lenticulars (Early-type), and 30 as irregulars or with a disturbed, peculiar shape (Irr). Figure 1 shows that all Early-type emitters are located inside an area of 3 virial radii ($R_{\rm vir}$) of the cluster (Fornax $R_{\rm vir} \sim 0.7$ Mpc ~ 2 deg), while the late-type sources extend outwards. Moreover, a number of emitters can be seen inside the Fornax A subgroup ($R_{\rm vir} \sim 0.35$ Mpc ~ 1 deg) but only one of them displays an Early-type morphology. Alternatively, an analysis of the projected phase-space diagram reveals that the majority of Irr emitters within 3 $R_{\rm vir}$ are recent infallers, i.e., they fell into the cluster less than 1 Gyr ago. Such results agree with the scenario in which recent infallers still preserve disturbed morphologies.

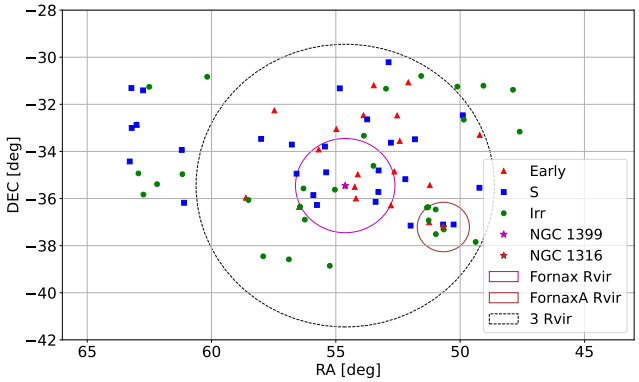

Figure 1. Spatial distribution of 79 Hα+[NII] emitters detected by P.E.L.E. and color coded according to their morphologies (spirals: S; early-type galaxies: Early; irregular/disturbed/peculiar objects: Irr). The magenta and brown solid lines represent the virial radius of Fornax and Fornax A, respectively.

In order to further explore the morphological characteristics of the selected objects, a study using Morfometryka (Ferrari et al., 2015) is under development.

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The goal is to improve our current classification by using different morphometrical parameters, such as sersic index, asymmetry and concentration, among others, in the 12 filters of S-PLUS. In addition, we expect that the combination of our Hα+[NII] maps with data in other wavelengths (e.g. HI) provides some clues about the physical processes the galaxies are currently undergoing in Fornax.

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