Comparation between different tracers of SFR in the CALIFA sample

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1.Abstract

The Calar Alto Legacy Integral Field Area survey (CALIFA survey) has been designed to be the first survey to provide Integral Field Spectroscopy (IFS) data for a statistical sample of all galaxy types (~600 galaxies) in the local Universe (0.005<z<0.03) covering the optical wavelength range. We compare these data with the ones in the UV range obtained by GALEX (GALaxy Evolution eXplorer) satellite at both far-UV (FUV) and near-UV (NUV) wavelengths.

The main objective of our work will be to provide a robust determination of the star formation rate (SFR) in galaxies as a crucial element to understand galaxy evolution. We will focus on the analysis of this property using different tracers/calibrators: Hα-line emission (from CALIFA), FUV continuum (from GALEX), and infrared luminosities (from Spitzer & WISE), all with spatial resolution.

The CALIFA mother sample includes 937 galaxies throughout the whole colour-magnitude diagram, from the red sequence through the green valley to the blue cloud. Using GALEX observations we will be also able to describe the UV properties of the sample as a total of 578 and 630 galaxies have been observed in the FUV and NUV GALEX bands, respectively.

2.UV properties of the CALIFA sample: characterization

The plots at the top show several UV properties for the galaxies that have already been observed. The ones at the bottom show all galaxies in the CALIFA mother sample that have UV images available.

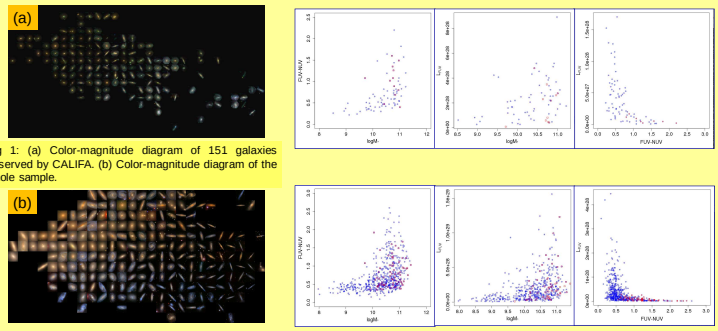
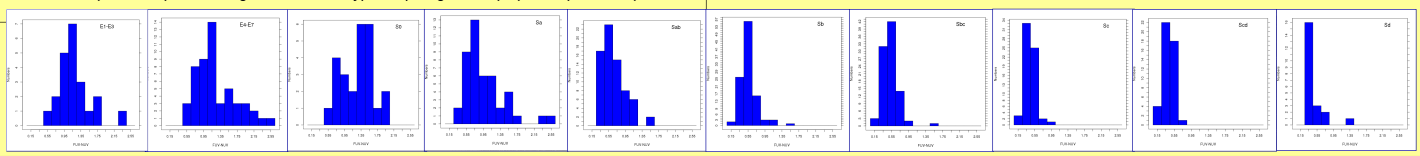


Fig 1: (a) Color-magnitude diagram of 151 galaxies observed by CALIFA. (b) Color-magnitude diagram of the whole sample.

3. UV properties: UV color & morphological type.

We have characterized the sample taking into account the morphological type of the galaxies.The following plots show how the FUV-NUV color changes with galaxy type. Early-type galaxies (E1-E2-E3) have a color centered at (FUV-NUV) ~ 1.15 mag vhile the latest type of spiral galaxies (Sd) show (FUV-NUV) ~ 0.35



4. Analysis and Results

FUV continuum

The dust will heavily obscure the UV emission, so it is important to correct for the UV extinction. We assumed the relation between the extinction and the FUV-NUV color given by Muñoz-Mateos et al. (2009ab)

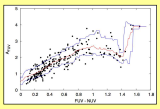


Fig 2 Relation between A_{FUV} vs. (FUV-NUV) , Given by Muñoz-Mateos et al. (2009ab)

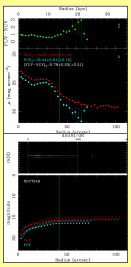


Fig 3: (a). Surface photometry. (b) Growth curves and asymptotic magnitudes

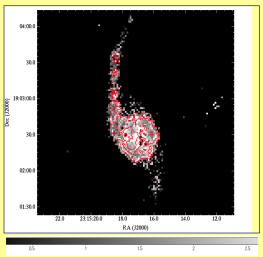


Fig 4: UV continuum attenuation map for NGC7549 galaxy. A_{FUV} is given in magnitudes and its values oscilate between $0<A_{FUV}<3$ mag. The red outlines indicate the values for the SFR_{FUV} corrected ($\log_{10}(SFR_{FUV})$=-3.5,-3.0,-2.5.)

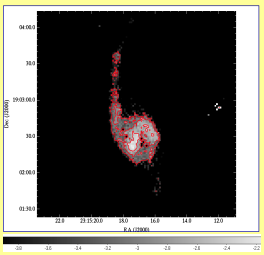


Fig 5: SFR_{FUV} corrected map for NGC7549 galaxy. The values represent $\log_{10}(SFR_{FUV})$ in units of $M_\odot/yr/pixel^2$. The red outlines are the same as in the previous picture. We can appreciate a large amount of SFR at the south-east of the central bar

Hα-line emission

The dust attenuation of the Hα emission line along the line of sight throug a galaxy can be derived from the Balmer decrement, assuming an extiction law (Cardelli et al. 1989) and comparing the theoretical vs. Observed $F_{H\alpha}/F_{H\beta}$ ratio.

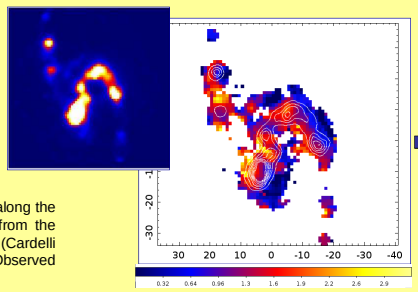


Fig 6: Attenuation $(A)_{H\alpha}$ map for NGC7549

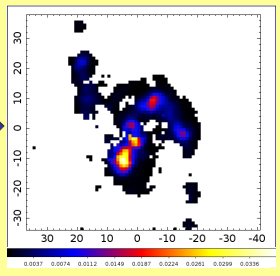


Fig 7:SFR corrected $(SFR)_{H\alpha}$ map for NGC7549

IR (22 μm)

Only PSF photometry done at this stage (good enough for 22 μm)

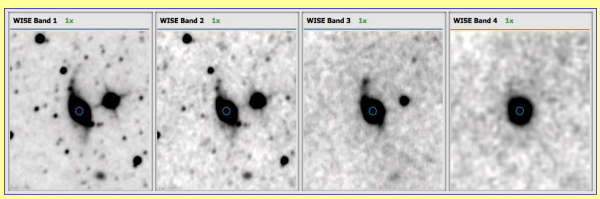
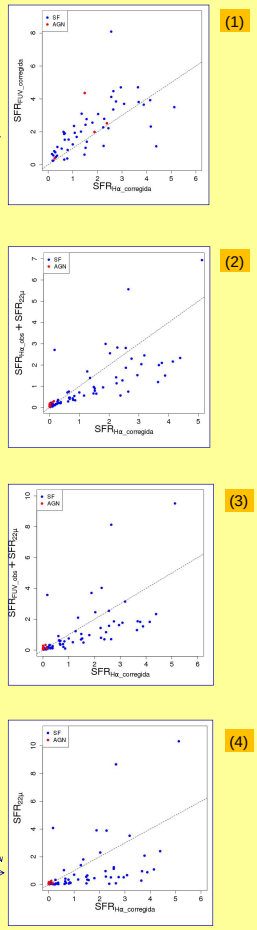


Fig 8: (a) WISE band 1 (3.4 μm), (b) WISE band 2 (4.6 μm), (c) WISE band 3 (12 μm), (d) WISE band 4 (22 μm). All the magnitudes measured with profile-fitting photometry

SFR comparison

(1) Y (4) : single-band
(2) y (3) : hybrids



5. Conclusions

(1) Good correlation overall (highly deviant points to be studied one-by-one → in 2D)
(2), (3) Reasonably good match overall, we can recover part of the SF that we couldn´t observe with only 22μm
(4) Significant un-obscured SF