



Publication Year	2020
Acceptance in OA	2021-09-01T12:10:02Z
Title	A panchromatic spatially resolved analysis of nearby galaxies - I. Sub-kpc-scale main sequence in grand-design spirals
Authors	Enia, A., Rodighiero, G., Morselli, L., CASASOLA, VIVIANA, BIANCHI, SIMONE, Rodriguez-Muñoz, L., Mancini, C., Renzini, A., Popesso, P., Cassata, P., Negrello, M., Franceschini, A.
Publisher's version (DOI)	10.1093/mnras/staa433
Handle	http://hdl.handle.net/20.500.12386/31013
Journal	MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY
Volume	493

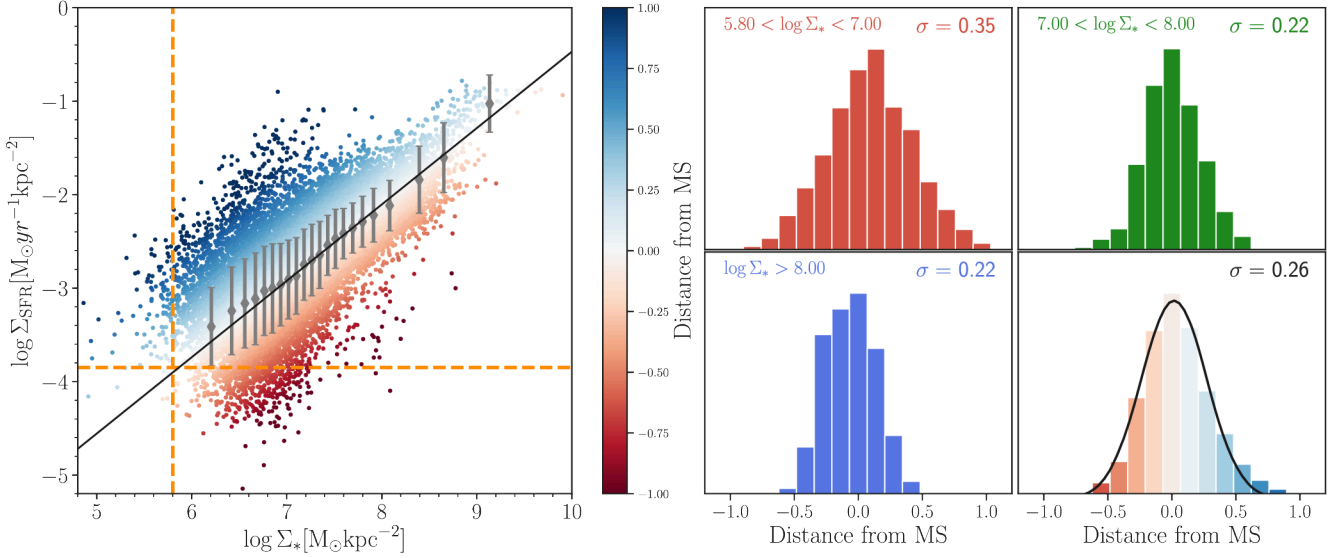


Figure 6. The fitted MS, and its scatter. *Left-hand panel:* 8 arcsec cell results for SFR surface density and stellar mass density, colour coded as a function of their distance from the MS. The orange dashes lines are the sensitivity limits. The MS (black solid line) is obtained as the linear fit of the grey data points. The error bars are the 1σ dispersion in each bin. *Right-hand panel:* distribution of distances from the MS, in three stellar mass bins (red, cyan, and blue, colour coded as in the left-hand panel). The σ values reported in each panel are obtained by fitting the distribution with a Gaussian. The scatter varies between 0.22 for the highest mass bin to 0.35 for the lowest mass bin.

Díaz et al. 2016; González Delgado et al. 2016; Abdurro’uf 2017, 2018; Hall et al. 2018; Cano-Díaz et al. 2019). It is worth noting that several of the literature works implement the orthogonal distance regression (ODR) method to find the location of the MS relation. If we perform an ODR fit on our results, we obtain a slope of 0.88 and an intercept of -9.05 .

The right-hand panels of Fig. 6 are dedicated to the distribution scatter σ . We investigate if the scatter of the spatially resolved MS varies as a function of mass by dividing our sample in three mass bins, $5.8 \leq \log \Sigma_* [M_\odot \text{ yr}^{-1}] < 7.0$ (red histogram), $7.0 \leq \log \Sigma_* [M_\odot \text{ yr}^{-1}] < 8.0$ (green histogram), and $\log \Sigma_* > 8.0 M_\odot$ (blue histogram). The total scatter of the full sample (coloured histogram) is $\sigma = 0.26$. There are hints of a decreasing scatter with increasing stellar mass, from 0.35 to 0.23. Once again, these values fall within the typical ranges of 0.15–0.35 reported in the literature for the spatially resolved MS (Conselice et al. 2016; Magdis et al. 2016; Maragkoudakis et al. 2017; Hall et al. 2018). The importance of the scatter and the way it relates with the gas properties is explored in Morselli et al. (in prep).

Finally, we check that the results are consistent on different spatial scales. In Fig. 7 we compare the surface densities obtained for 8 arcsec (scales varying from 0.2 to 0.8 kpc) and 1.5 kpc cells. The black solid line is the MS fit to 8 arcsec data (though the fit to 1.5 kpc data leads to the same values well within the uncertainties), and orange lines the sensitivity thresholds. Both distributions follow the same relation, and occupy the same region of the plane, being clear how the retrieved surface density properties on bigger scales reflect the average surface density properties in enclosed smaller scales. The main differences, always in regions below the sensitivity thresholds, arise for galaxy regions where χ^2 criterion for 8 arcsec cells is not reached, as expected since 1.5 kpc cells have an intrinsically higher SNR for the SED points. The fact that the two realizations in different physical scales (sometimes even of an order of magnitude, i.e. NGC 5457) are almost overlapping tells us that the star formation laws still hold on physical scales lower than ~ 500 pc.

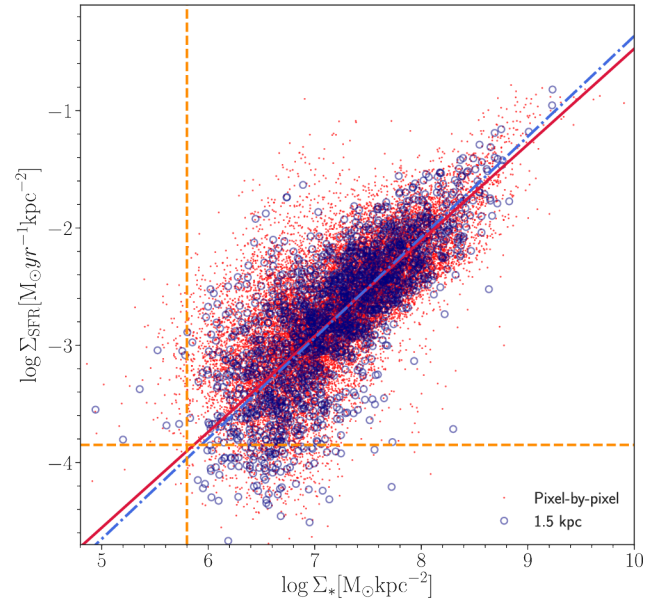


Figure 7. $\Sigma_* - \Sigma_{\text{SFR}}$ results for 8 arcsec (red points) and 1.5 kpc (blue circles) cells. The dashed lines are the sensitivity thresholds. It is clear how the results coming from the higher 1.5 kpc physical scale are the mean of the properties coming from the single cells inside them. Both data sets lead to the same linear relations (red line and blue dashed line, respectively), well within the uncertainties.

4.2 Comparison with other resolved star-forming MSs

In recent years, as already mentioned in the introduction, several works have analysed the spatially resolved MS of SFGs, thanks to the increased availability of IFS data. Surveys like MaNGA, CALIFA, and SAMI made it possible to obtain the SFR from the $H\alpha$ luminosity, and to correct it for dust absorption through the Balmer decrement. The lack of information on the IR emission,