The sub-galactic and nuclear main sequences for local star-forming galaxies

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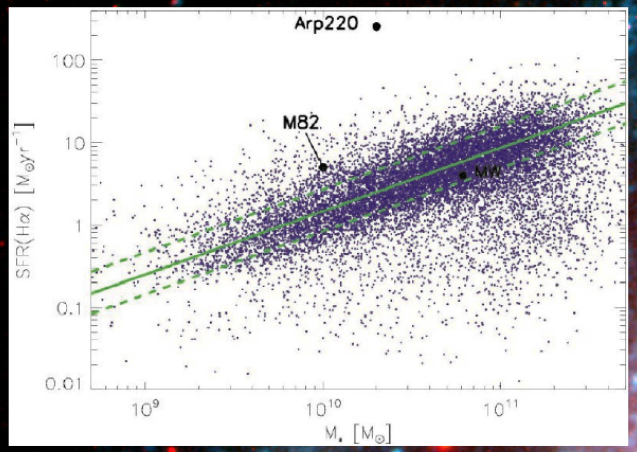
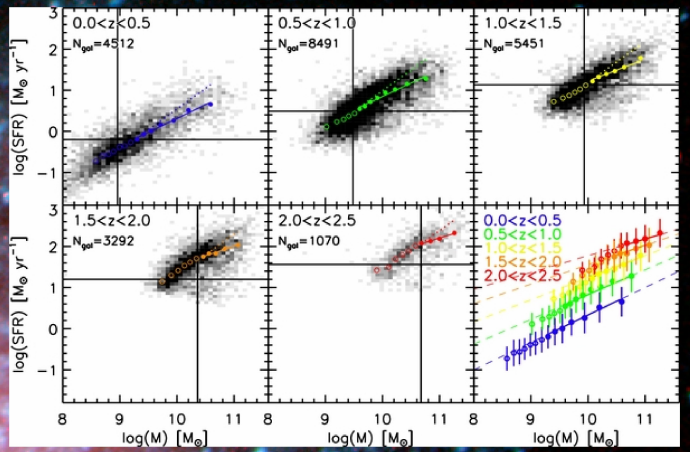
The main sequence of star formation

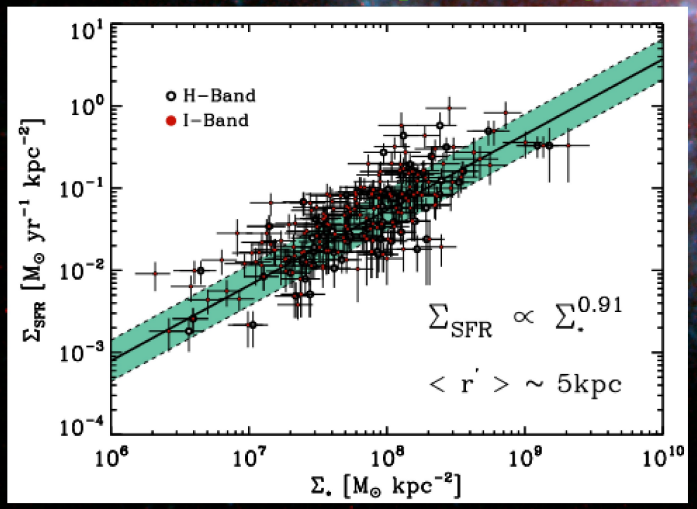


Elbaz et al. (2007)

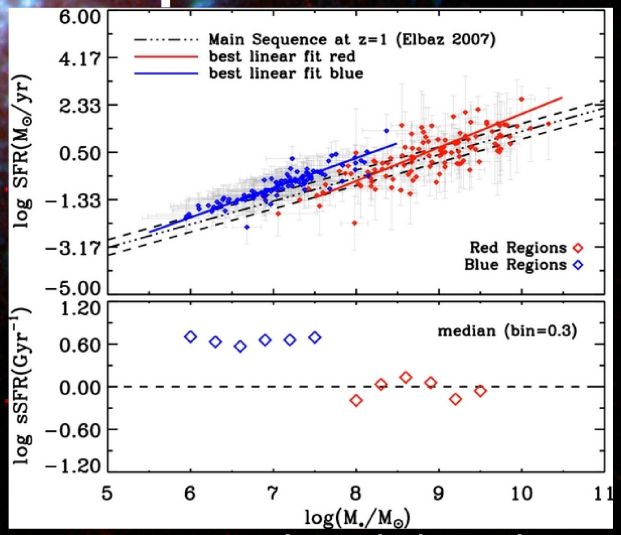


Whitaker et al. (2012)

Spatially-resolved main sequence



Magdis et al. (2016)



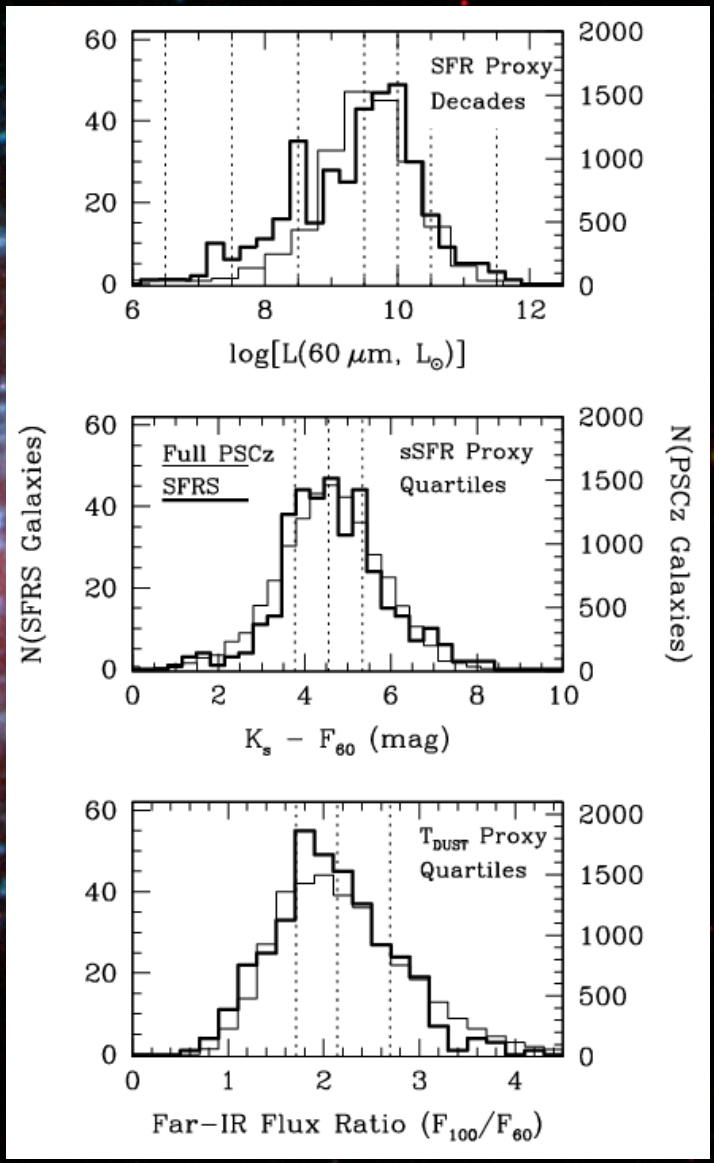
Hemmati et al. (2014)

The SFRS sample

The Star Formation Reference Survey (SFRS)

369 galaxies representative of the 3D-space:

- L(60μm): Star-formation rate (SFR)
- Ks – F60: Specific SFR (sSFR)
- F100/F60: Dust temperature

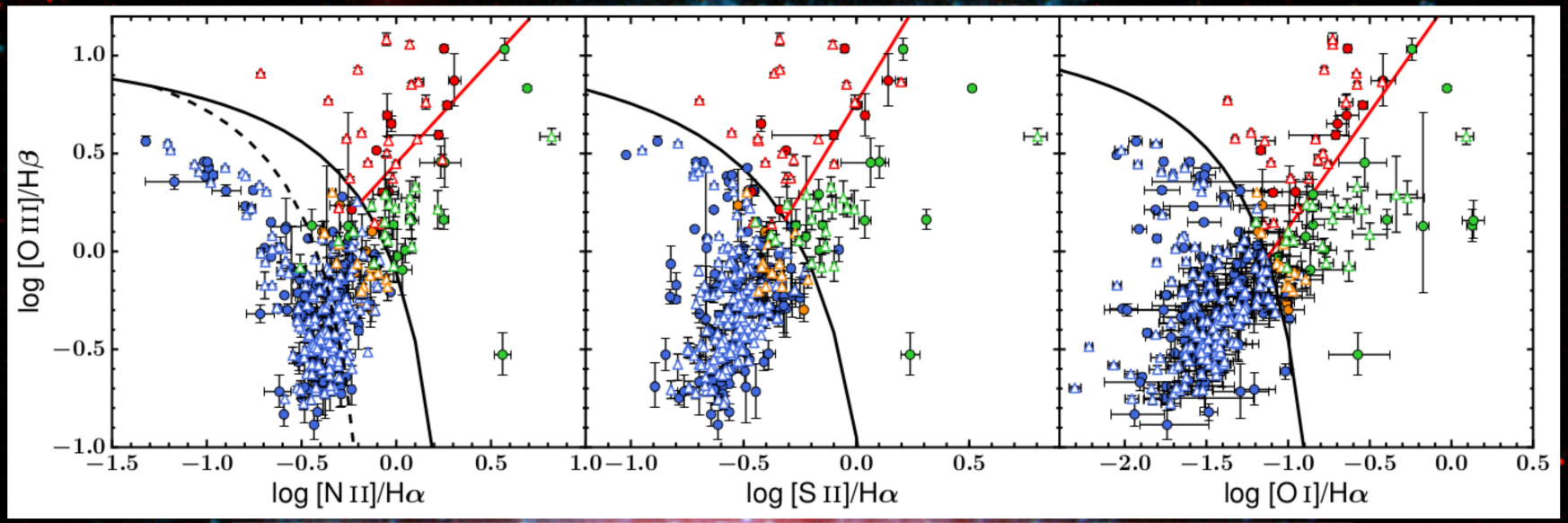


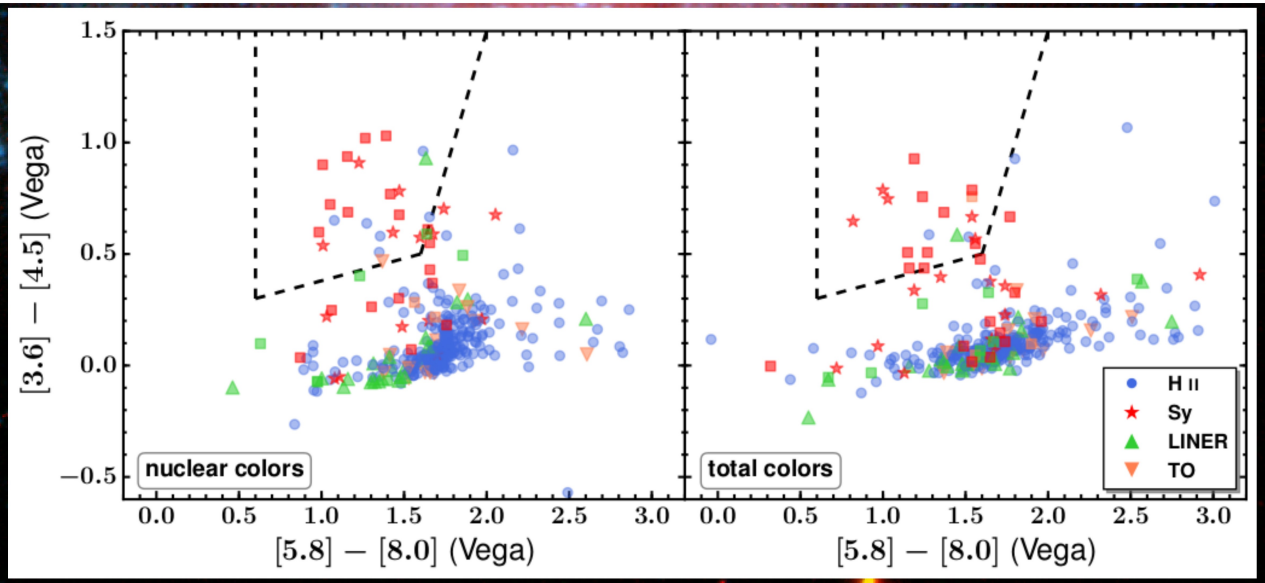
Ashby et al. (2011)

Multi-wavelength data

Bandpass	***Observatory***	***Coverage***
1.4 GHz	VLA/NVSS	100%
12, 25, 60, 100 μm	IRAS	100%
65, 90, 140, 160 μm	AKARI	95%
12, 23 μm	WISE	100%
24 μm	Spitzer / MIPS	70%
3.6, 4.5, 5.8, 8.0 μm	Spitzer / IRAC	100%
JHKs	2MASS	100%
JHK	PAIRITEL / Skinakas	100%
PS1.y	Pan-STARRS	100%
ugriz	SDSS	100%
Optical spectra	SDSS (fiber)	57% (210/369)
Optical spectra	FAST (long-slit)	43% (159/369)
IFU Optical spectra	CALIFA / MaNGA	8% (32/369)
Hα imaging	Skinakas	30% (ongoing)
0.13 – 0.28 μm	GALEX	90%
0.5 – 8.0 kev	Chandra / XMM	30%

Activity classification of the SFRS sample

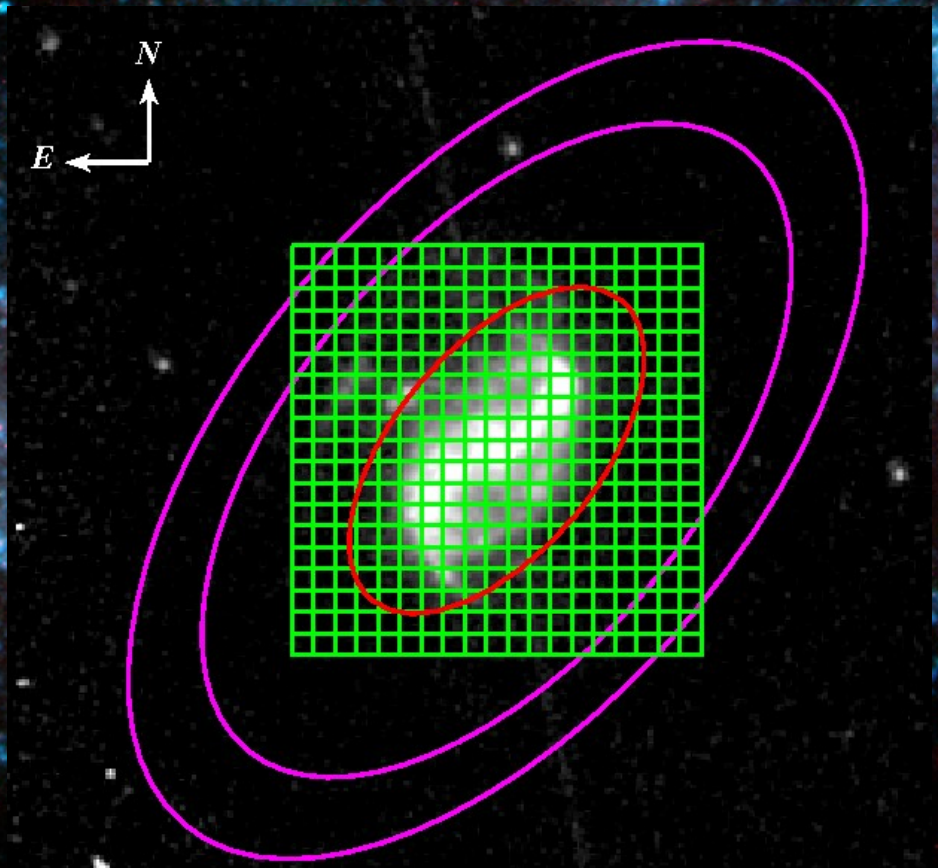




Maragkoudakis et al. 2017, submitted to MNRAS

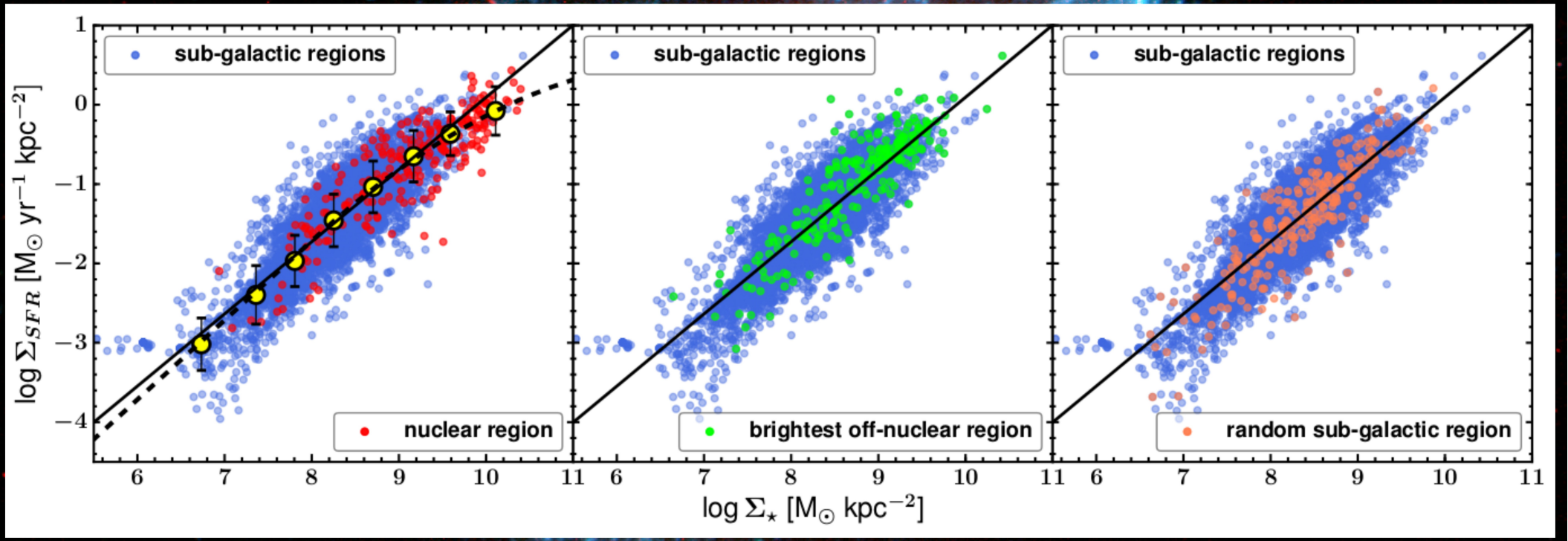
Matched aperture photometry

- IRAC 3.6μm
- IRAC 8.0μm



(Maragkoudakis et al. 2017)

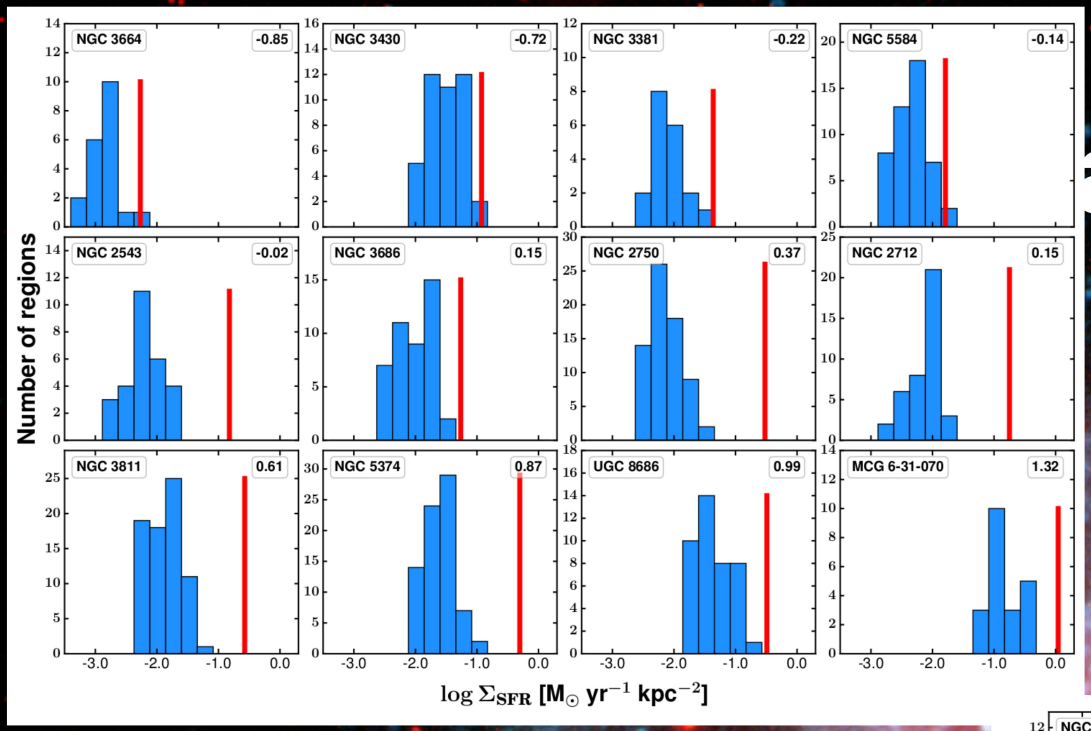
The sub-galactic main sequence (SGMS)

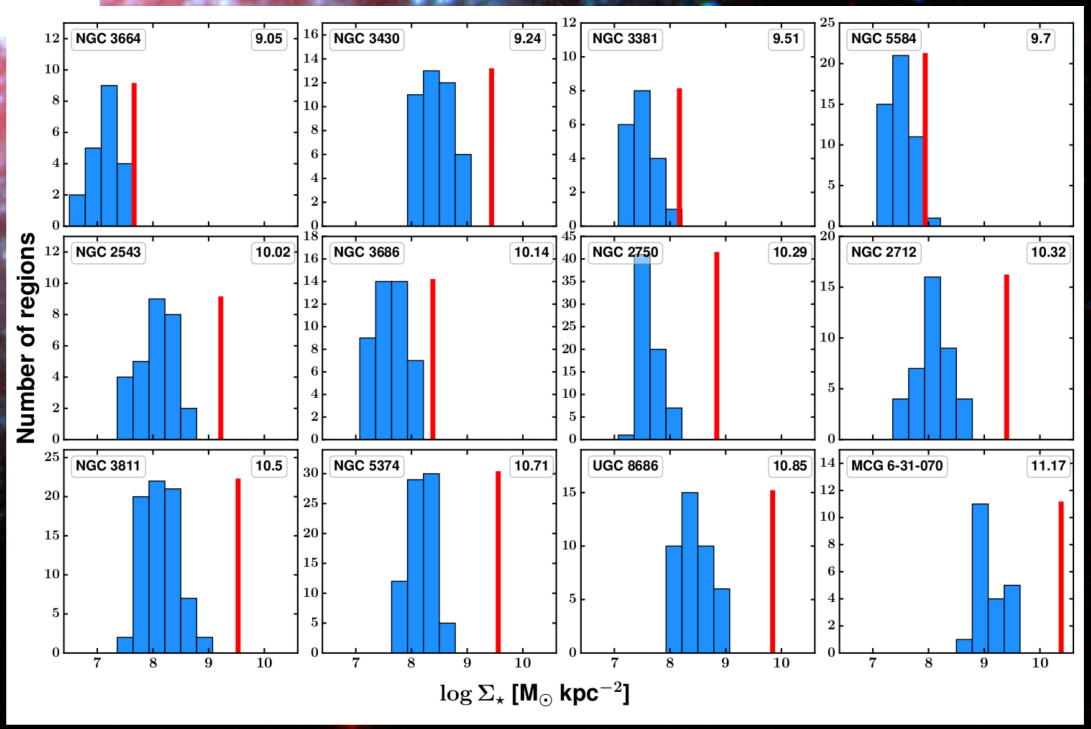


- $\alpha_{SGMS} = 0.91$
- $\sigma_{SGMS} = 0.31$

(Maragkoudakis et al. 2017)

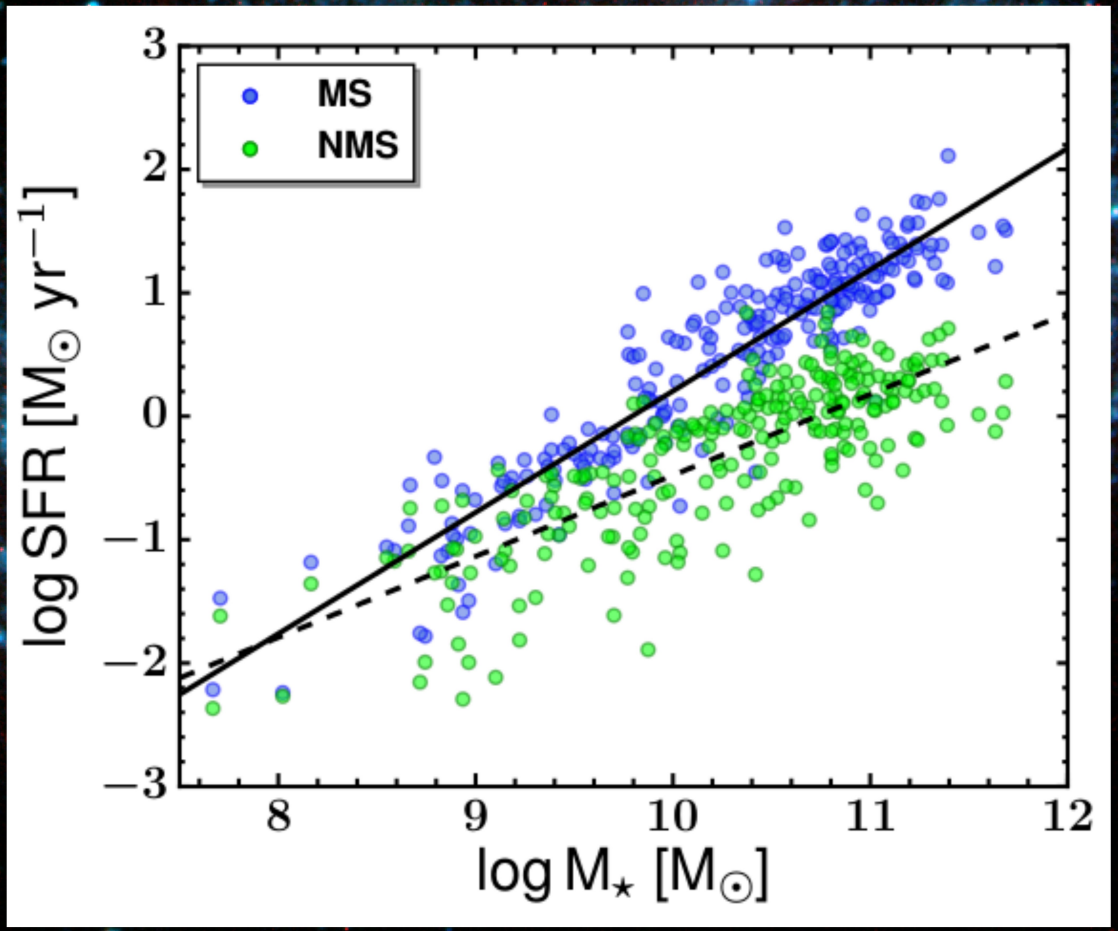
ar region


NGC 3664 -0.85
NGC 3430 -0.72
NGC 3381 -0.22
NGC 5584 -0.14
NGC 2543 -0.02
NGC 3686 0.15
NGC 2750 0.37
NGC 2712 0.15
NGC 3811 0.61
NGC 5374 0.87
UGC 8686 0.99
MCG 6-31-070 1.32
Number of regions
log Σ_{SFR} [$M_\odot$ yr^{-1} kpc^{-2}]


NGC 3664 9.05
NGC 3430 9.24
NGC 3381 9.51
NGC 5584 9.7
NGC 2543 10.02
NGC 3686 10.14
NGC 2750 10.29
NGC 2712 10.32
NGC 3811 10.5
NGC 5374 10.71
UGC 8686 10.85
MCG 6-31-070 11.17
Number of regions
log $\Sigma_\star$ [$M_\odot$ kpc^{-2}]

The Total and Nuclear main sequence

- α_{MS} = 0.98
- σ_{MS} = 0.32



- α_{NMS} = 0.66
- σ_{NMS} = 0.39

(Maragkoudakis et al. 2017)

$\alpha_{SGMS(l)} = 1.09$

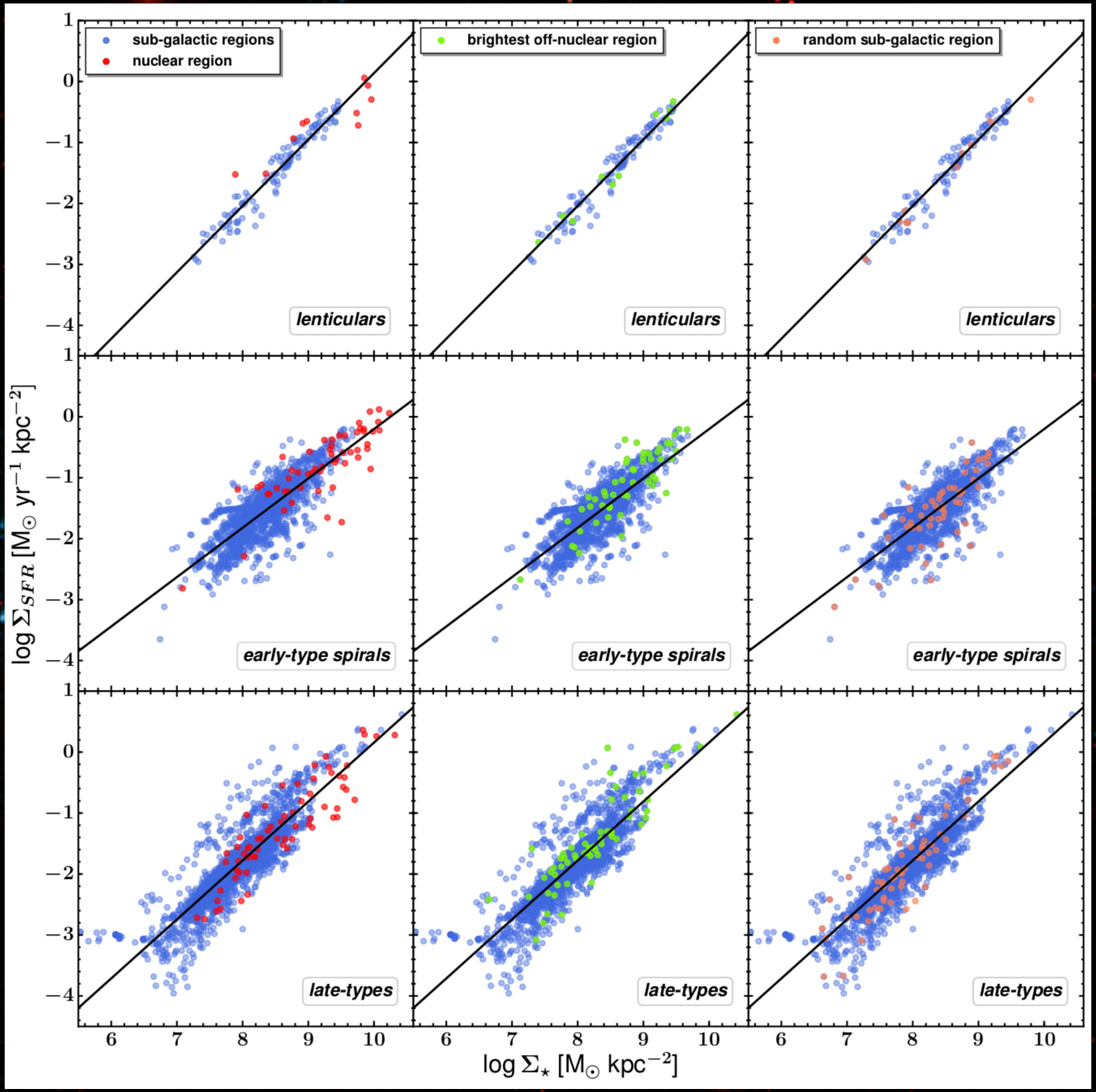
$\sigma_{SGMS(l)} = 0.18$

$\alpha_{SGMS(er)} = 0.81$

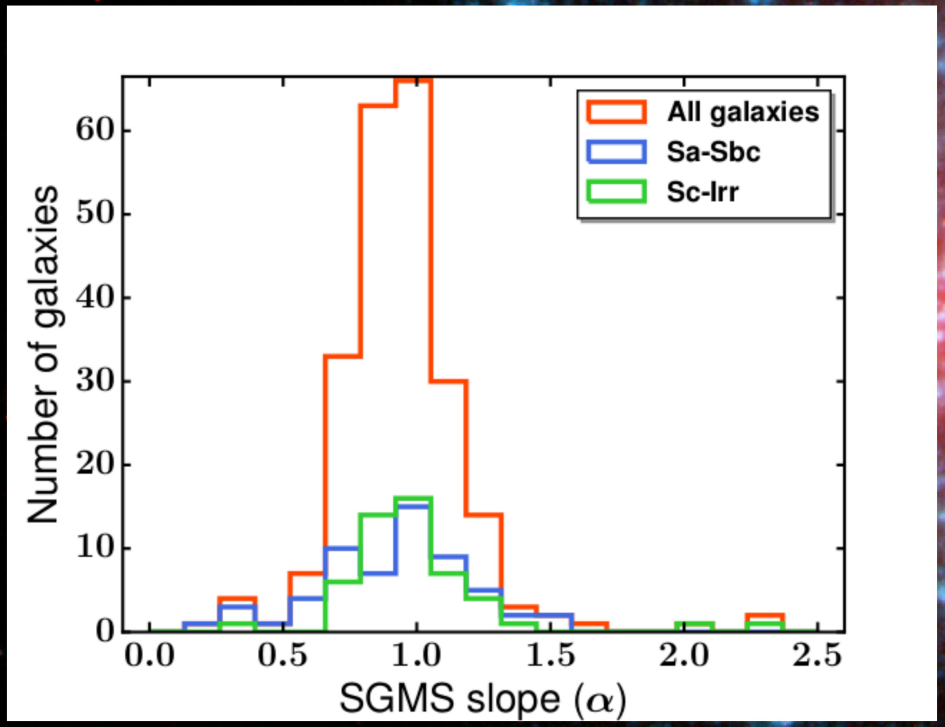
$\sigma_{SGMS(er)} = 0.30$

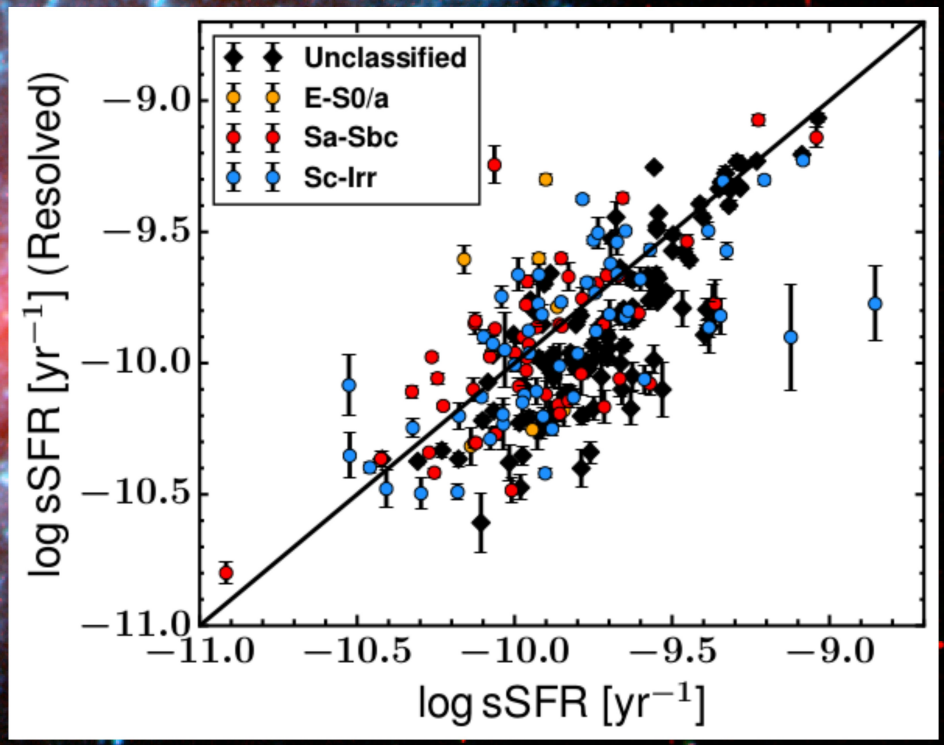
$\alpha_{SGMS(la)} = 0.97$

$\sigma_{SGMS(la)} = 0.30$



Individual galaxy SGMS





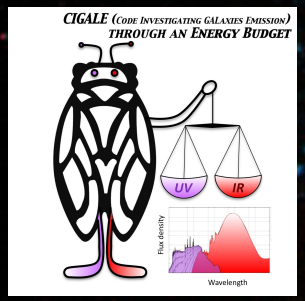
$$\Sigma_{SFR} = \alpha \Sigma_{*} + \beta$$

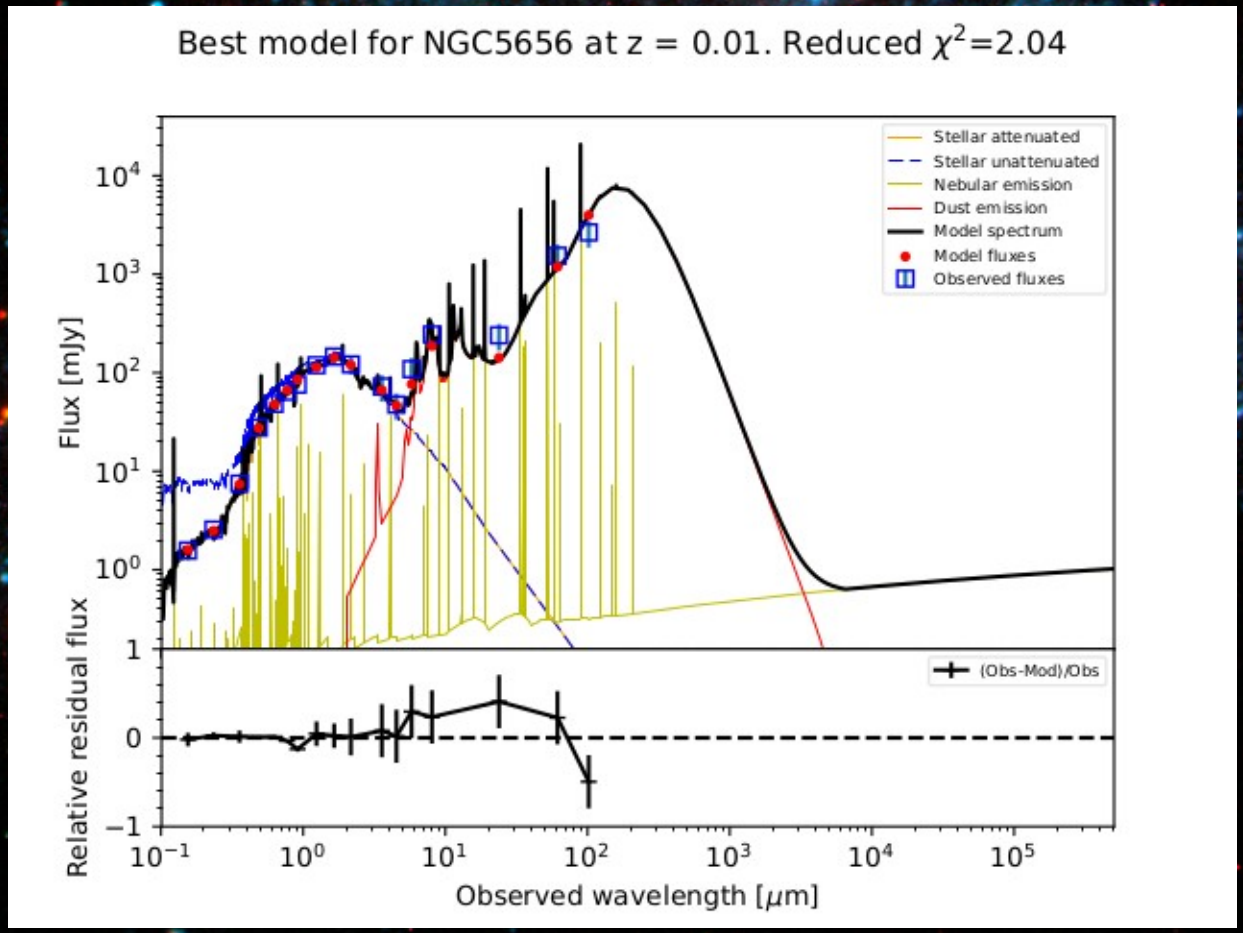
(Maragkoudakis et al. 2017)

Summary of the SGMS study

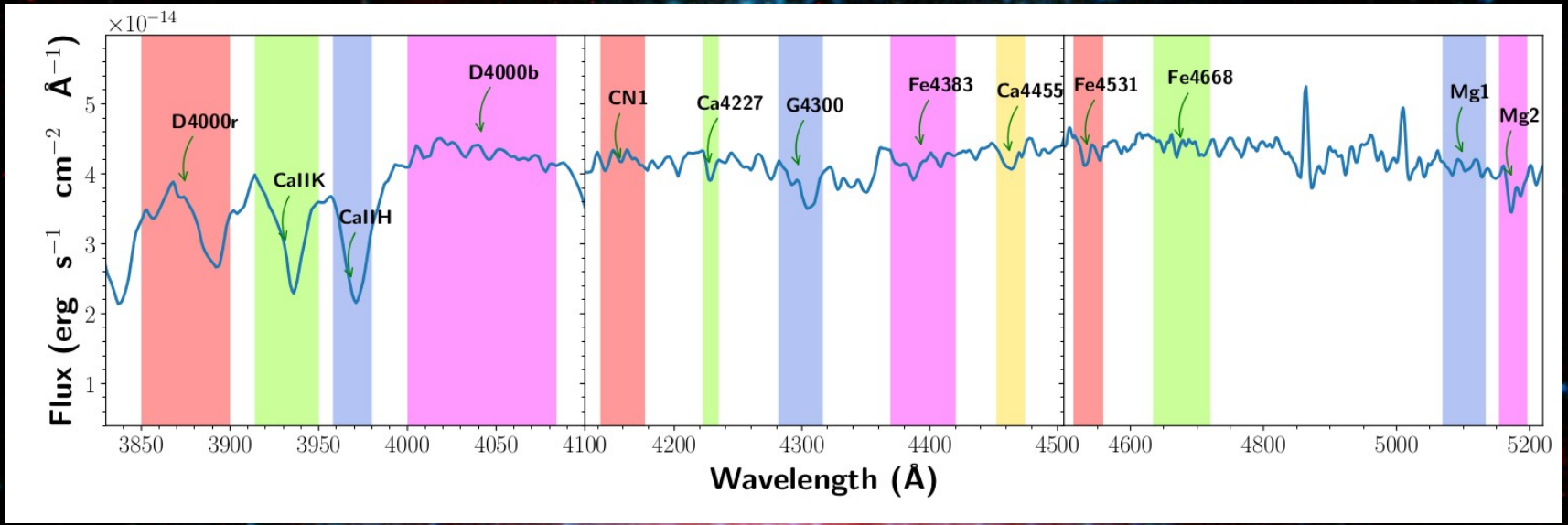
1. The SGMS holds down to ~1 kpc scales with a slope of α=0.91 and a dispersion of 0.31 dex.
2. The SGMS slope depends on galaxy morphology, with late-type galaxies (Sc – Irr) having α=0.97 and early-type spirals (Sa –Sbc) having α=0.81.
3. The SGMS constructed from sub-regions of individual galaxies has on average the same characteristics as the composite SGMS.
4. For nearly all galaxies, both SFR and stellar mass peak in the nucleus.
5. The nuclear SFR also correlates with total stellar mass.

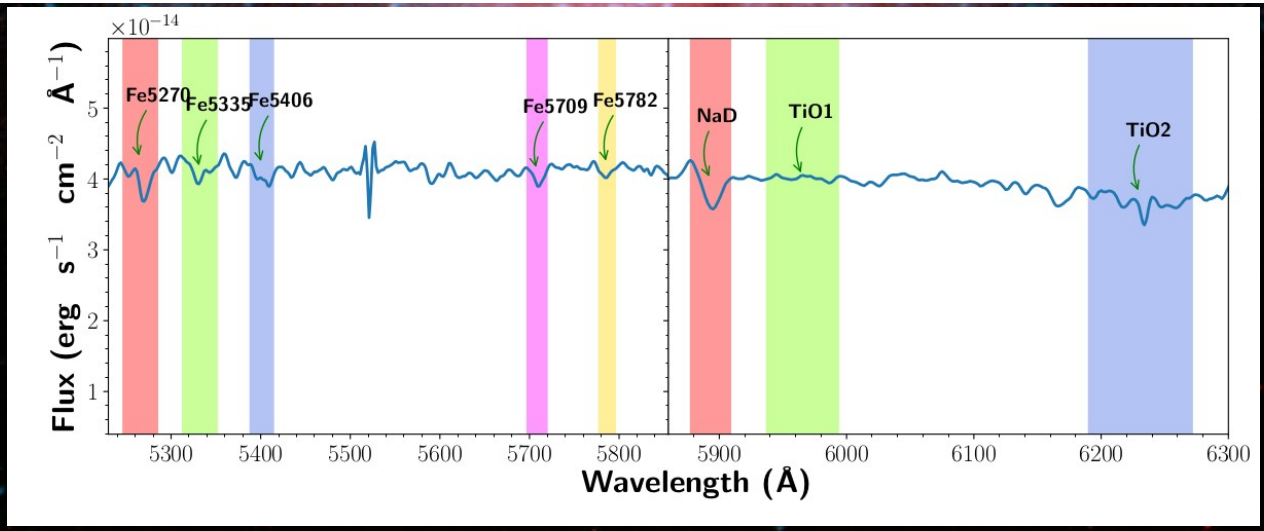
The Spectro-Photometric SED fiting





The Spectro-Photometric SED fiting





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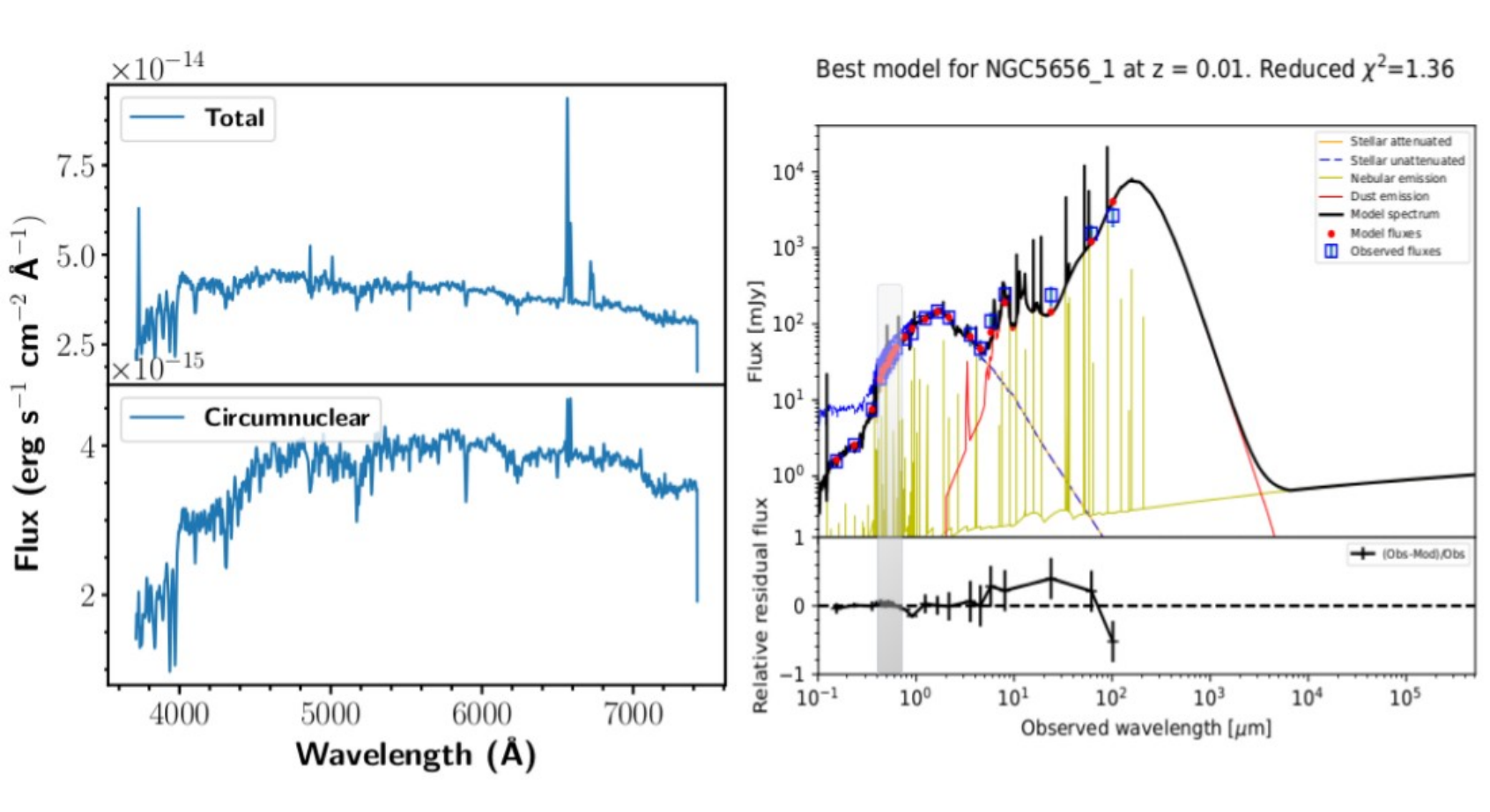
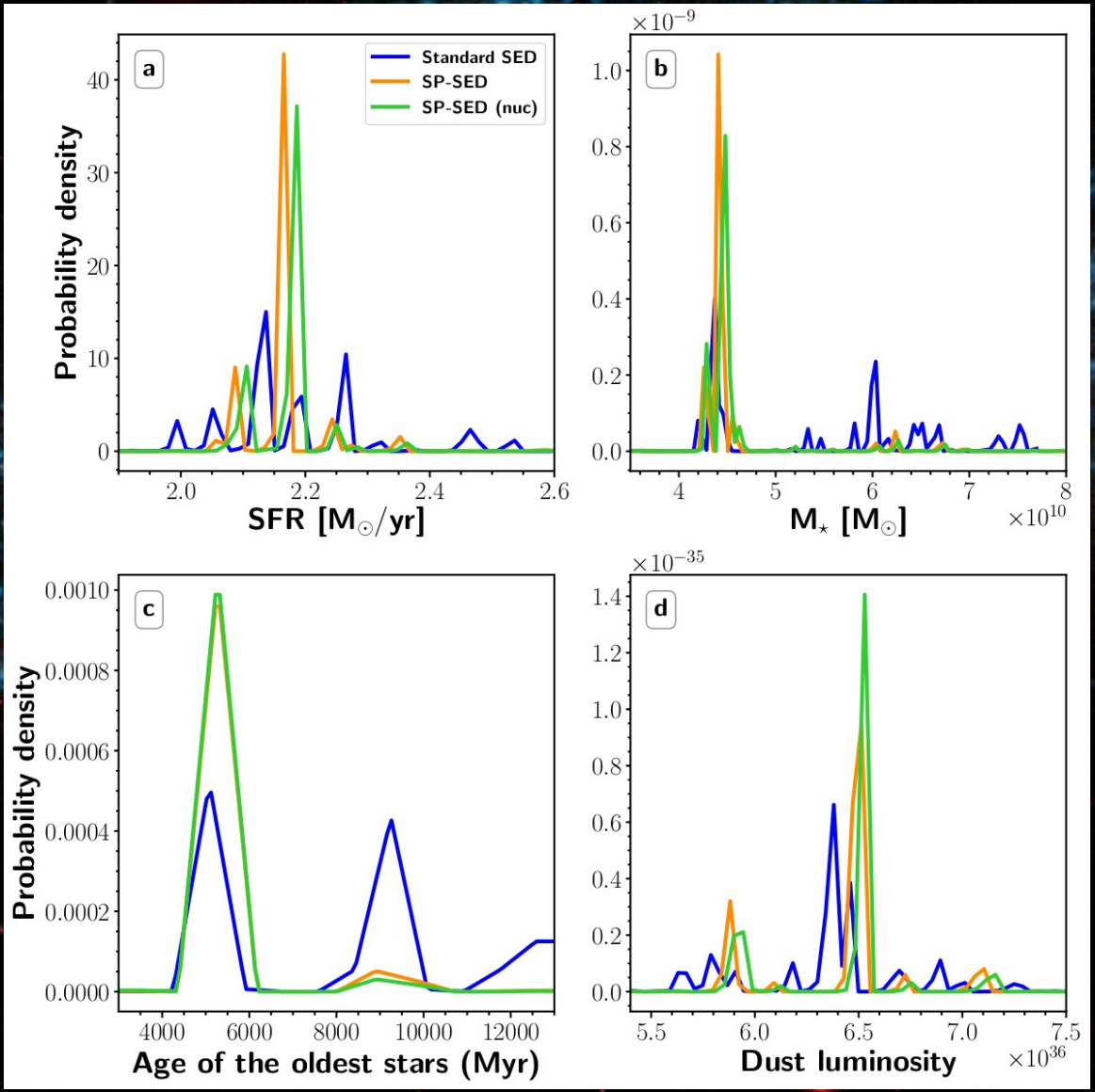
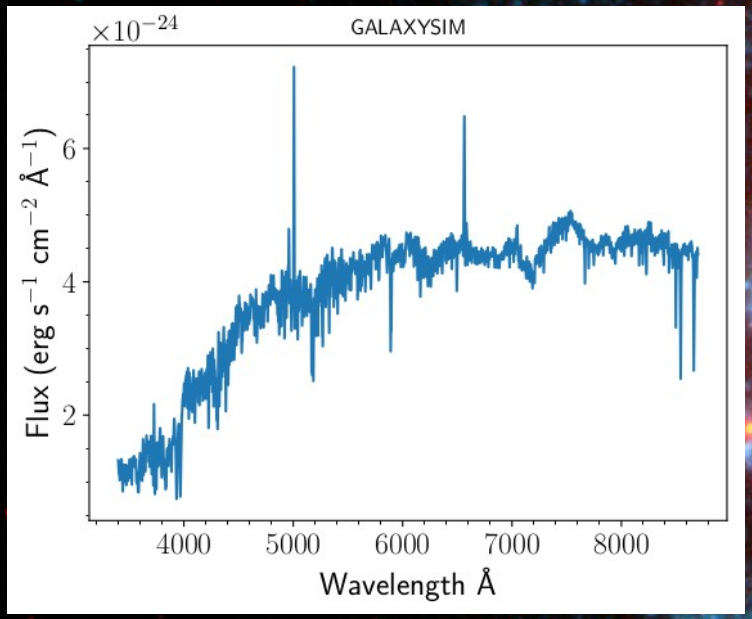


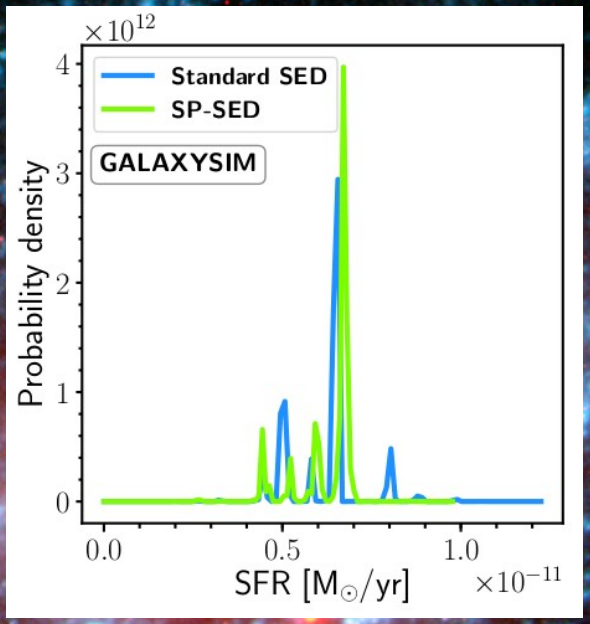
The Spectro-Photometric SED fiting

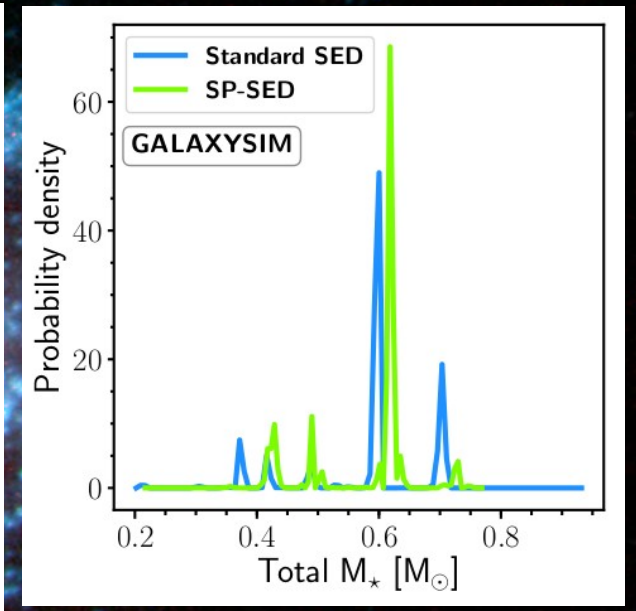


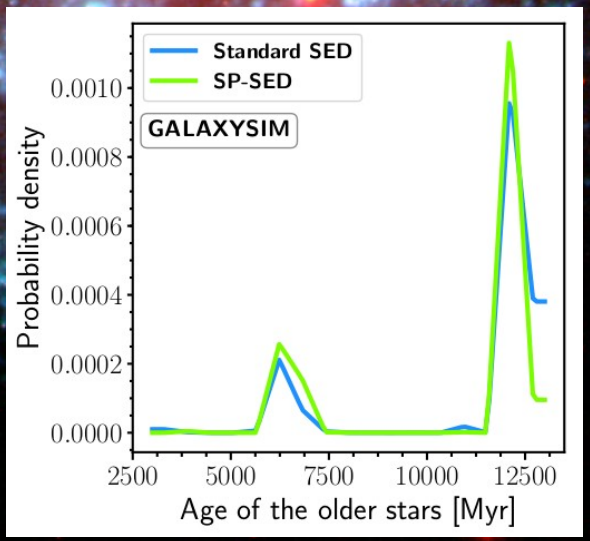
The Spectro-Photometric SED fiting

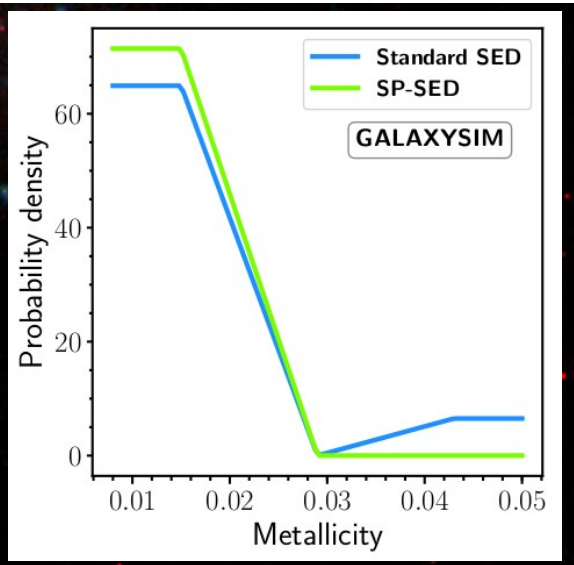
Creating and fitting mock galaxy SED with CIGALE











The Spectro-Photometric SED fiting

Next Steps

- Use galaxy simulations (GADGET-3 / SUNRISE codes) to calibrate SED fitting results.
- Sensitivity check of S-P SED on different spectral features.
- Inclusion of IR spectra.
- Compare results between different SED modeling codes (CIGALE / MAGPHYS).