A Further Look Into Quenching: Tearing Apart The Main Sequence Into Its Bulge, Disk And Gas Content

Pannella, M.; Schreiber, C.; Elbaz, D.; Ciesla, L.

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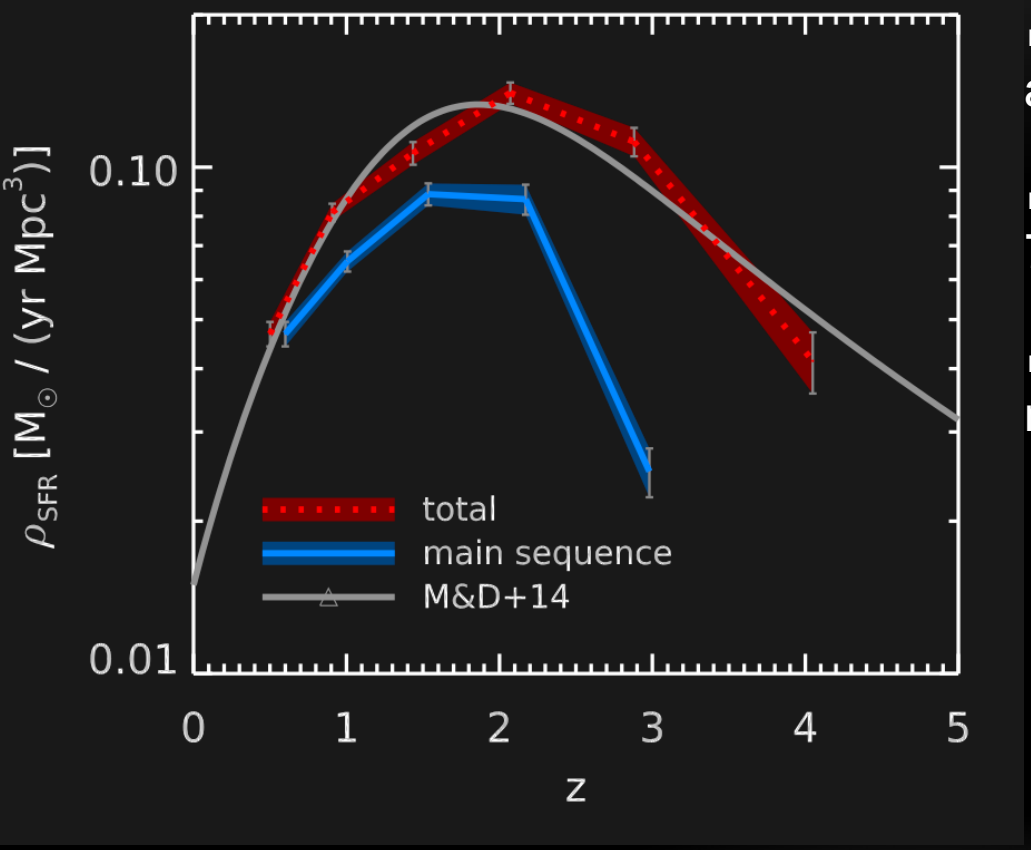
A FURTHER LOOK INTO QUENCHING: TEARING APART THE MAIN SEQUENCE INTO ITS BULGE, DISK AND GAS CONTENT

Maurilio Pannella, Corentin Schreiber, David Elbaz, Laure Ciesla
and the CANDELS+GOODS+Herschel folks

THE MAIN SEQUENCE PROPAGANDA



- Scatter is ~0.3 dex at all stellar masses and all redshifts up to z~4
- Galaxies on the MS produce more than 70% of present day stars
- The Main Sequence is the dominant mode of star formation at least up to z ~4

(Schreiber, MP et al., 2015)

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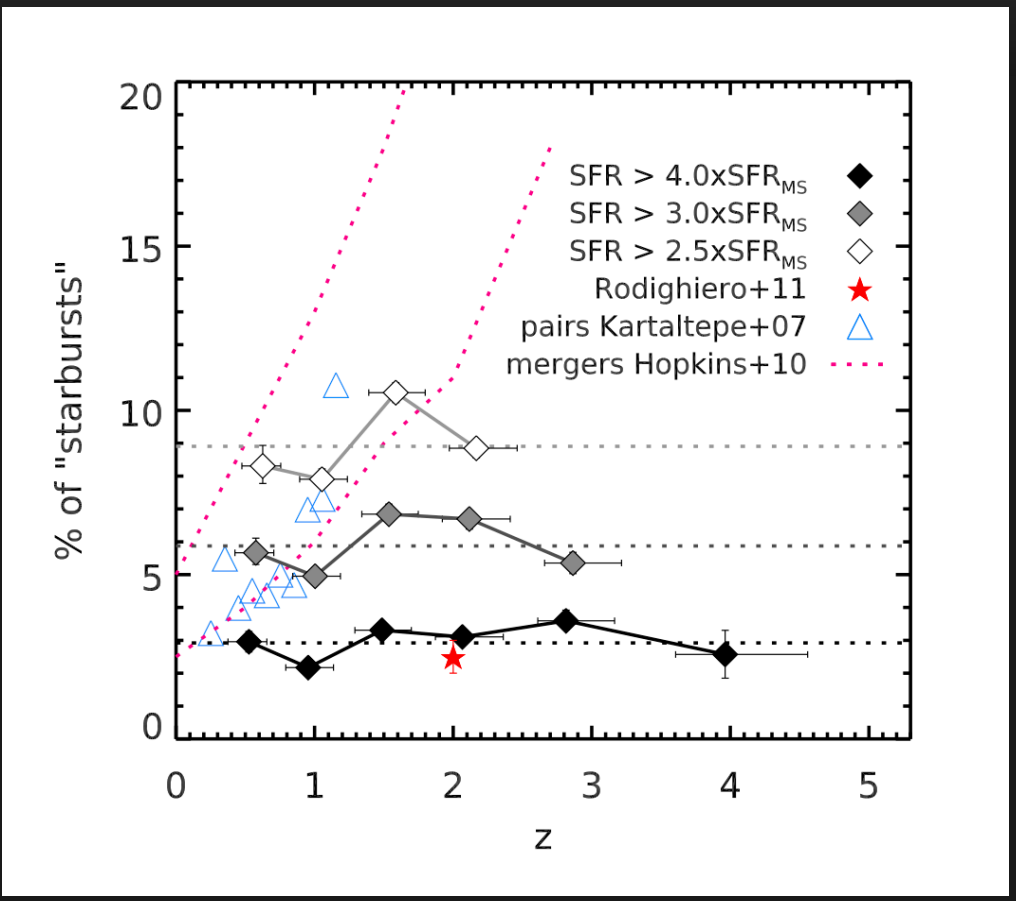

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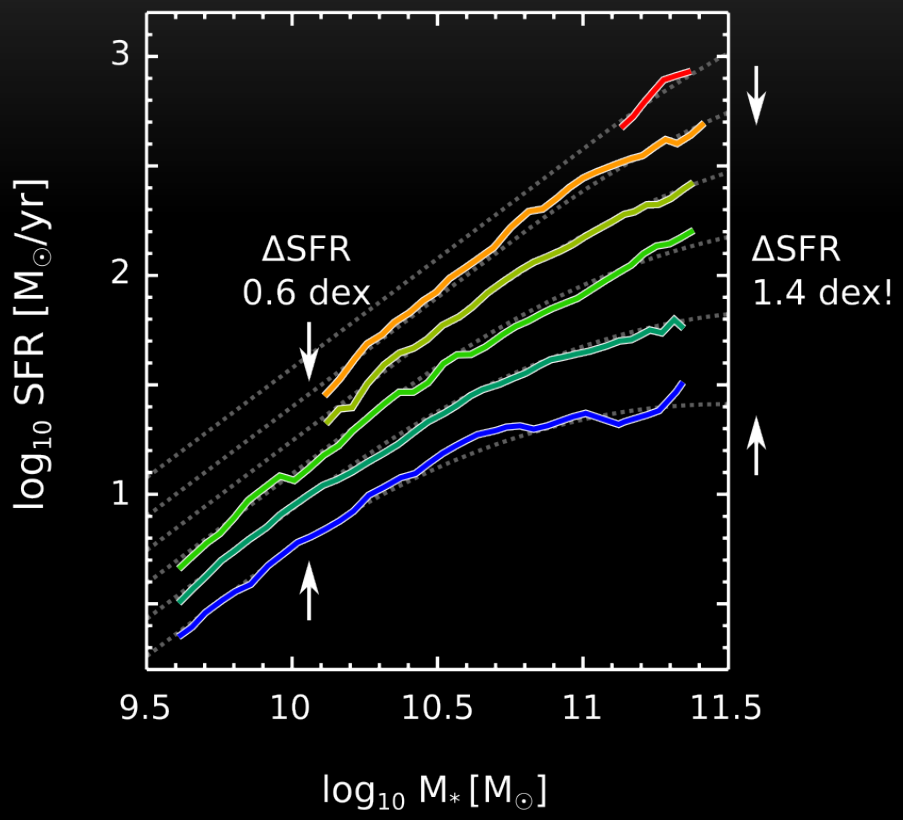
- Galaxies on the MS produce more than 70% of present day stars
- The Main Sequence is the dominant mode of star formation at least up to z ~4
- Starbursts fraction is constant with z
- Account for ~15% of the CSFR

THE MAIN SEQUENCE BENDING



(Schreiber, MP et al., 2015)

- A varying slope with redshift/mass

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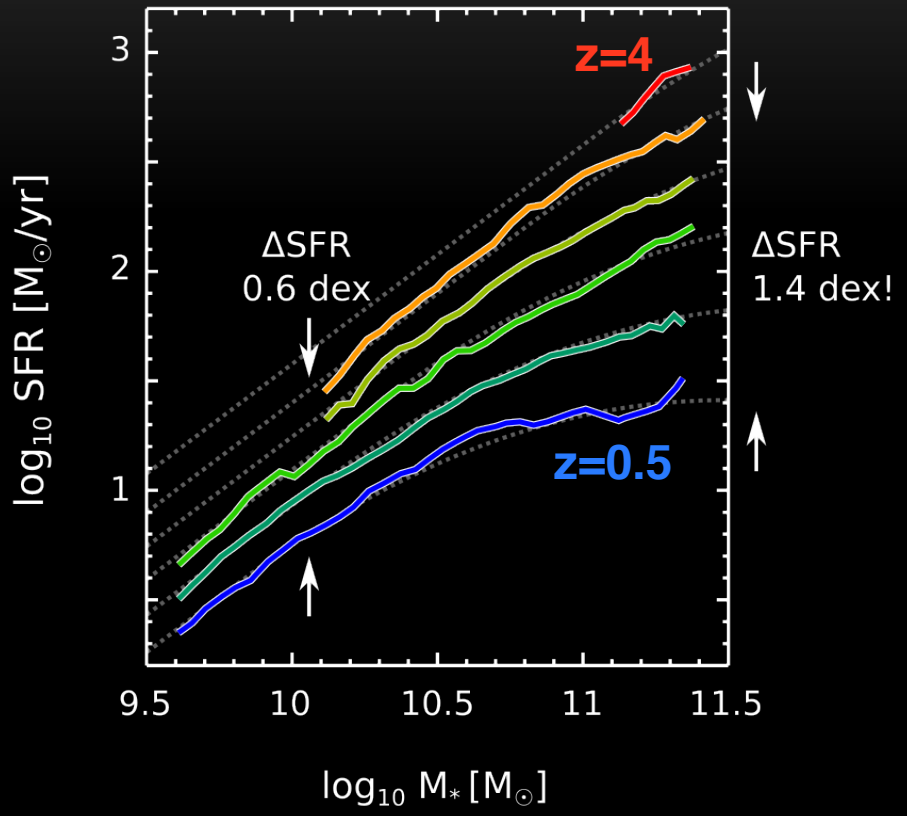

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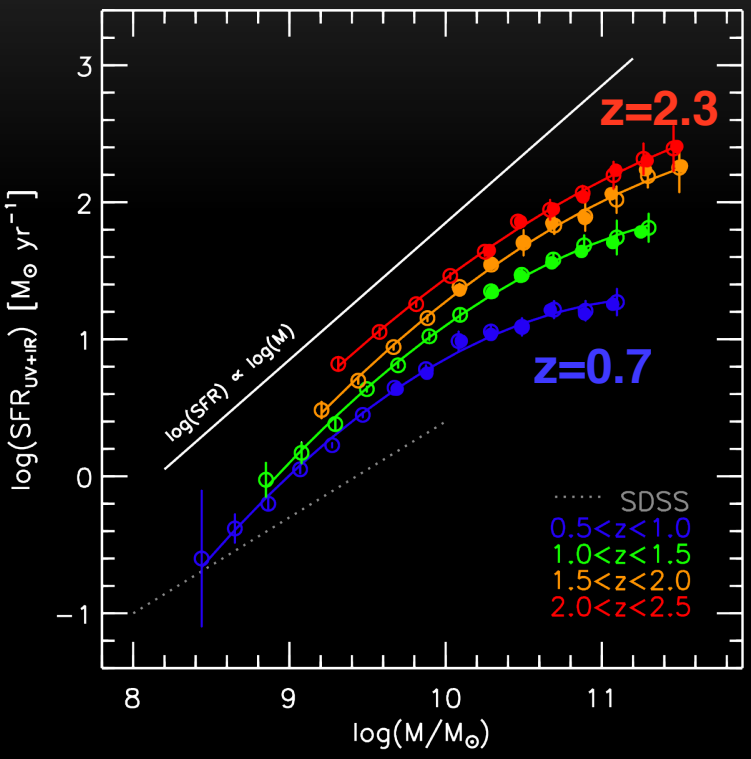

(Whitaker et al., 2014 but see also Karim et al., 2011; Whitaker et al., 2012; Magnelli et al., 2014 and others …)

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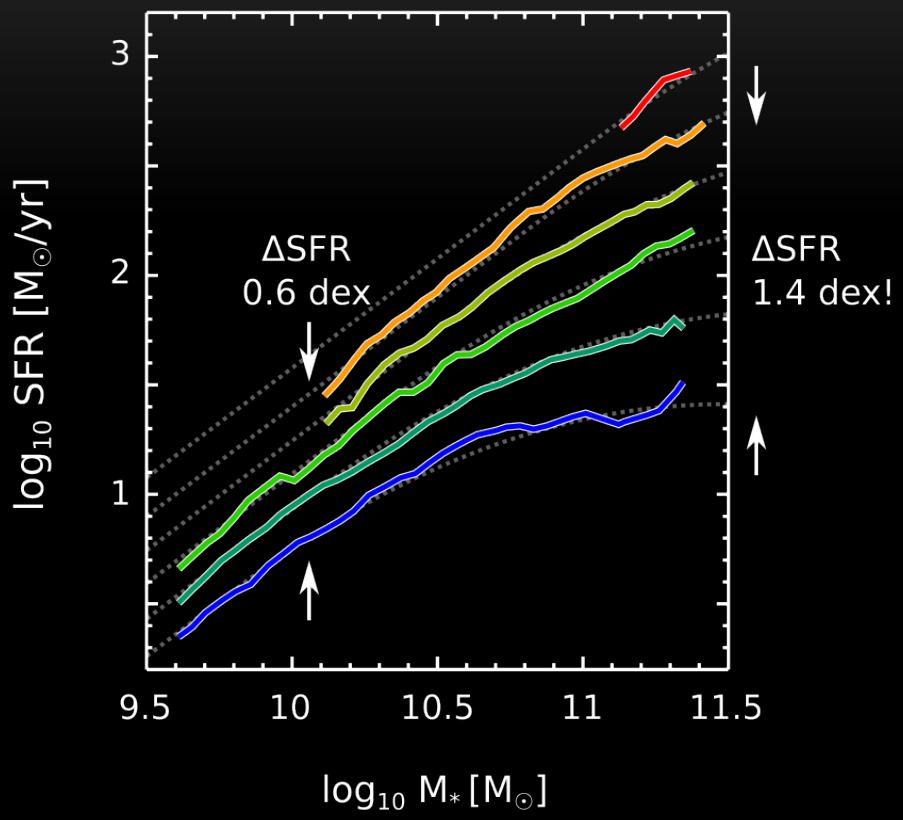

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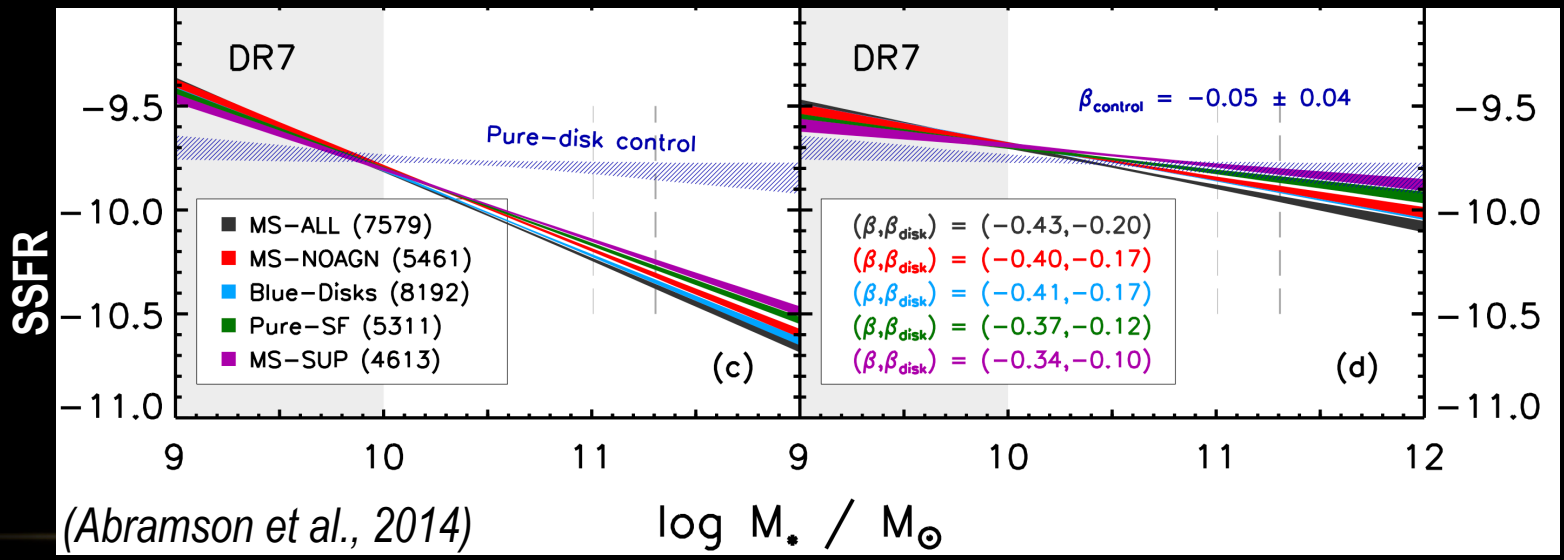

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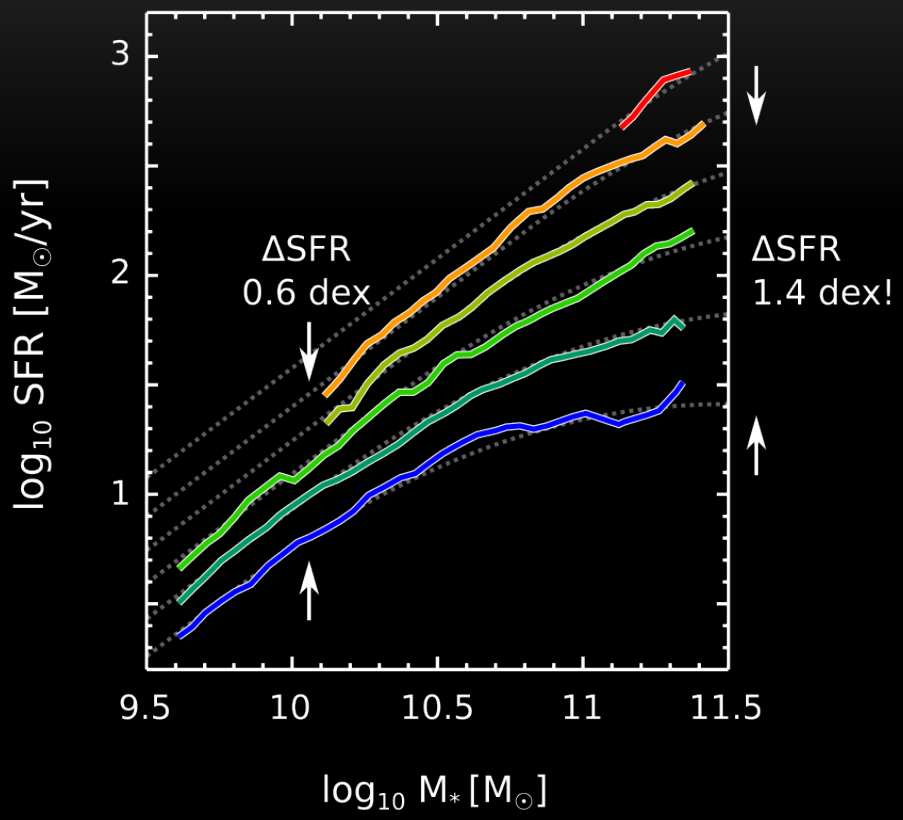

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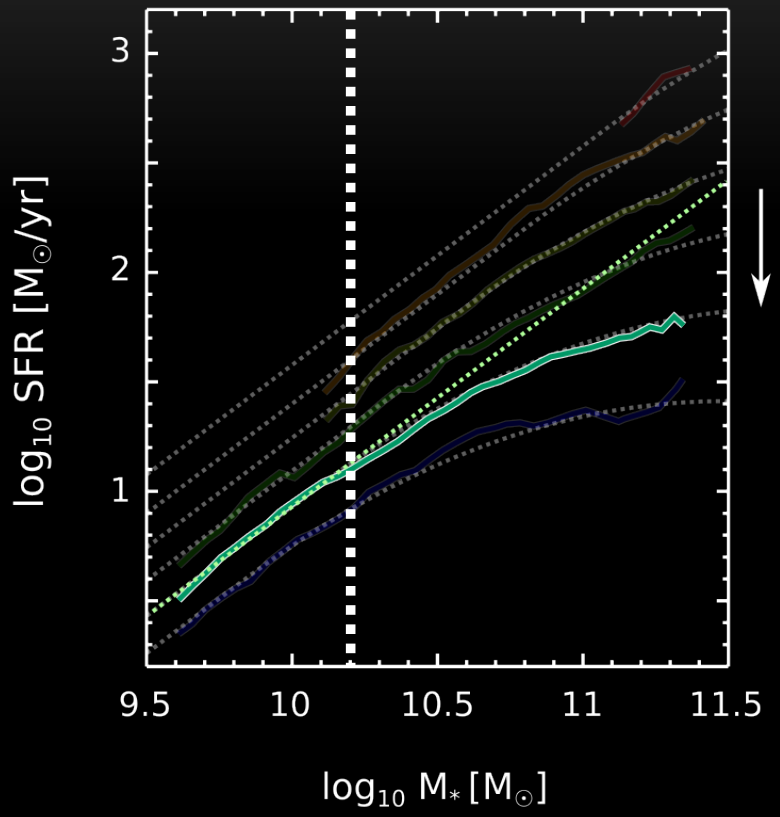
- A varying slope with redshift/mass
- Is there a growing component that increases the stellar mass but not the SFR? Bulges?
- Is the SFR lower because of gas depletion? (Gavazzi et al., 2015)
- Or a decreasing efficiency in converting gas to stars?

BULGES, DISKS AND GAS ON THE MAIN SEQUENCE



(Schreiber et al., 2016)

Sample:

CANDELS fields

$0.7 < z < 1.3$
$H < 22.5$ (Log $M_\star > 10.2$)

Spitzer/Herschel detections
($SFR = SFR_{IR} + SFR_{UV}$)

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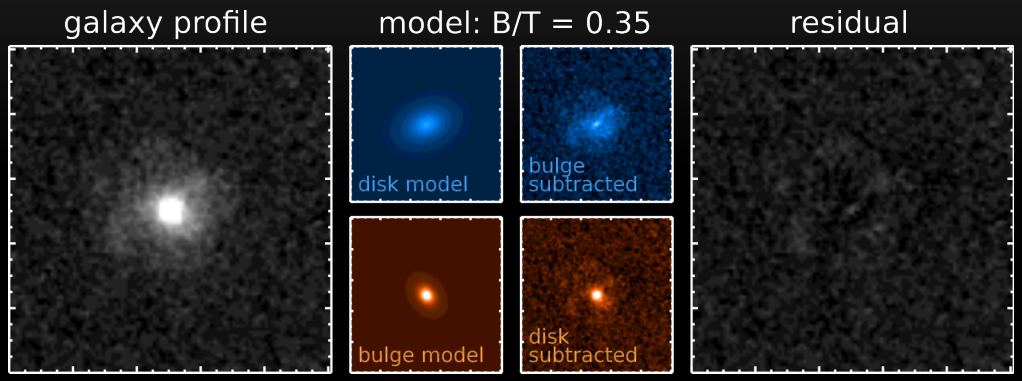

(Schreiber et al., 2016)

- GIM2D bulge+disk model

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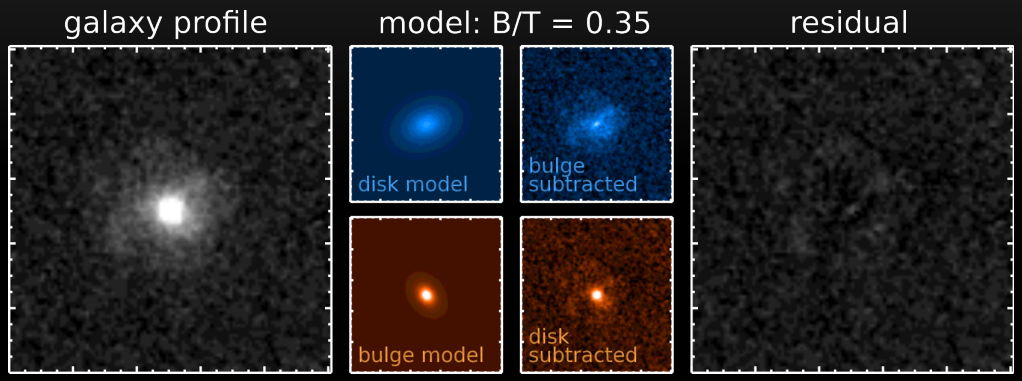

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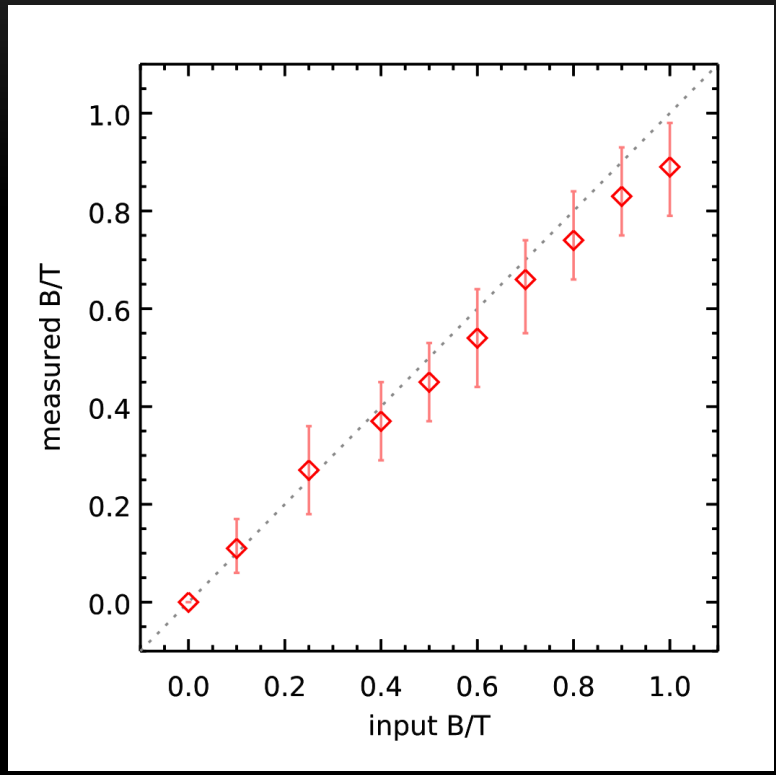
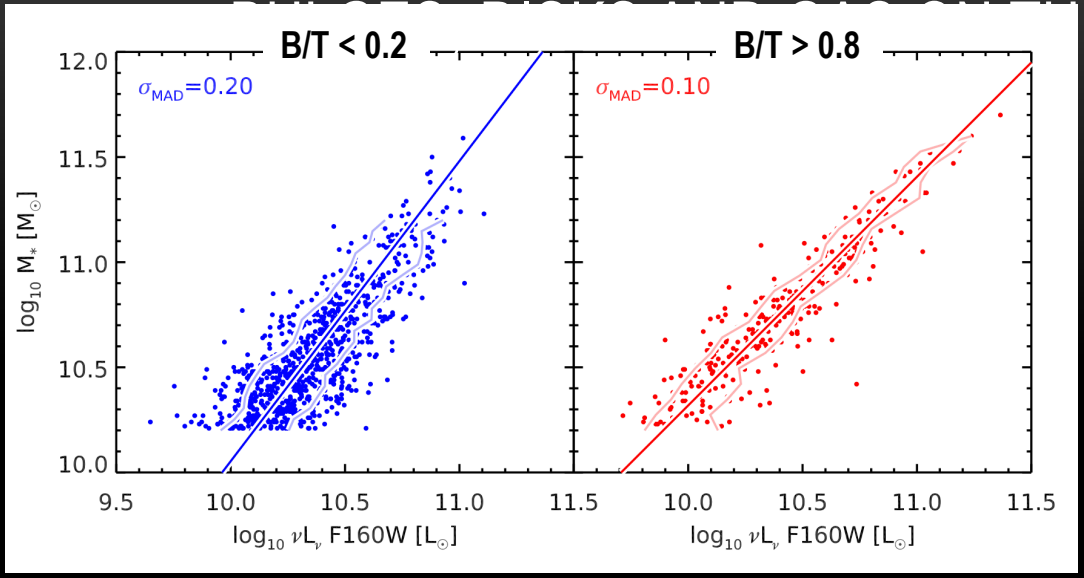


E MAIN SEQUENCE



(Schreiber et al., 2016)

- GIM2D bulge+disk model
- Tested with simulations
- Corrected for ≠ mass-to-light ratios of bulge and disk

$B/T = (M_\star - M_{disk})/M_\star$

$B/T < 0.2 \leftrightarrow$ pure disk

$B/T > 0.8 \leftrightarrow$ pure bulge

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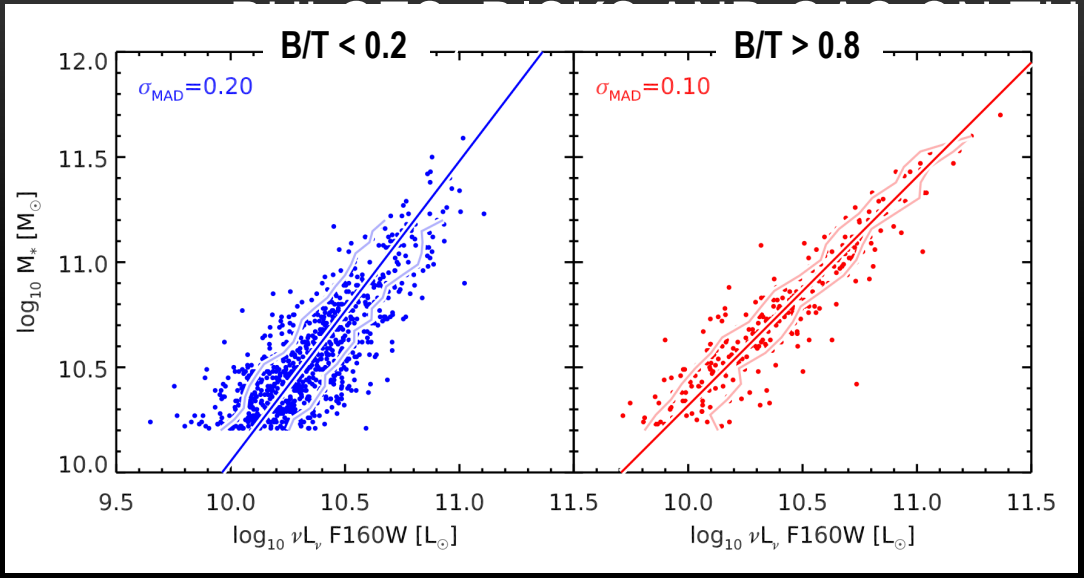

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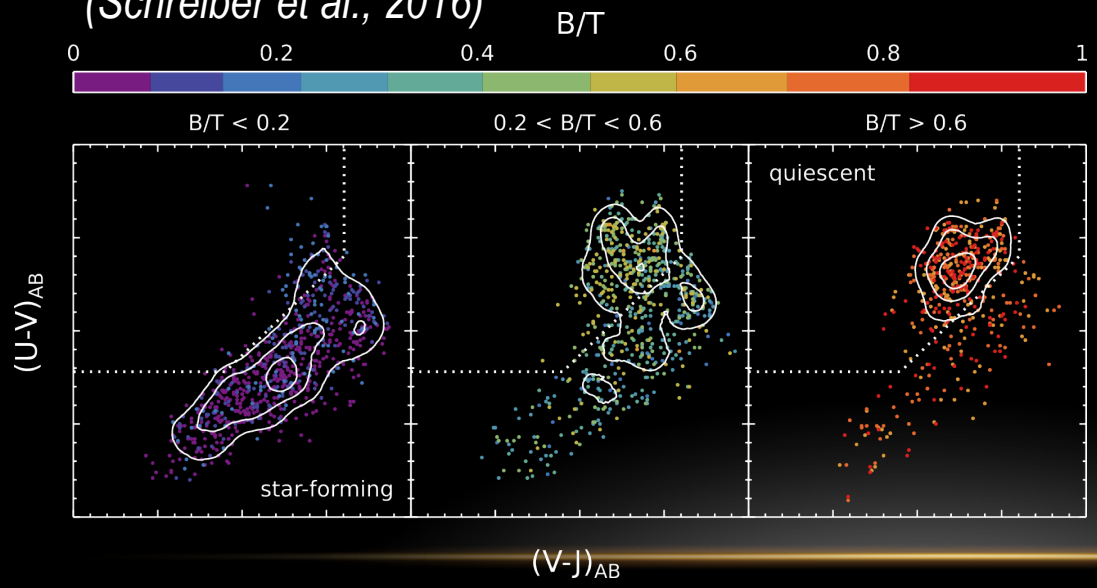

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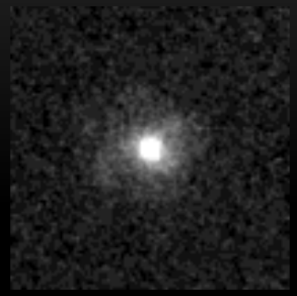
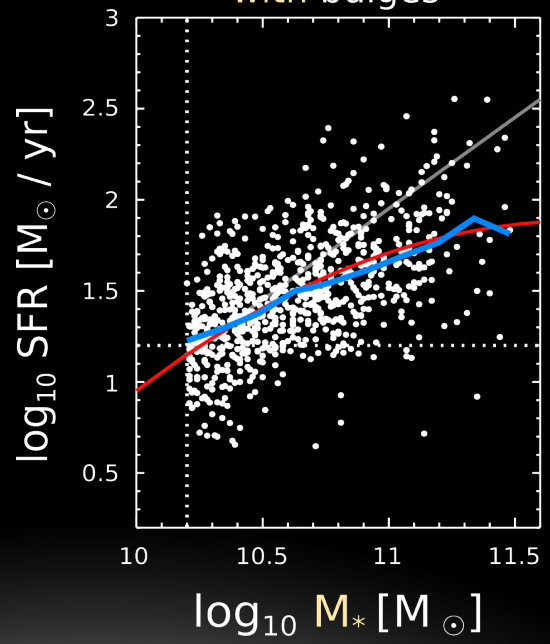


with bulges



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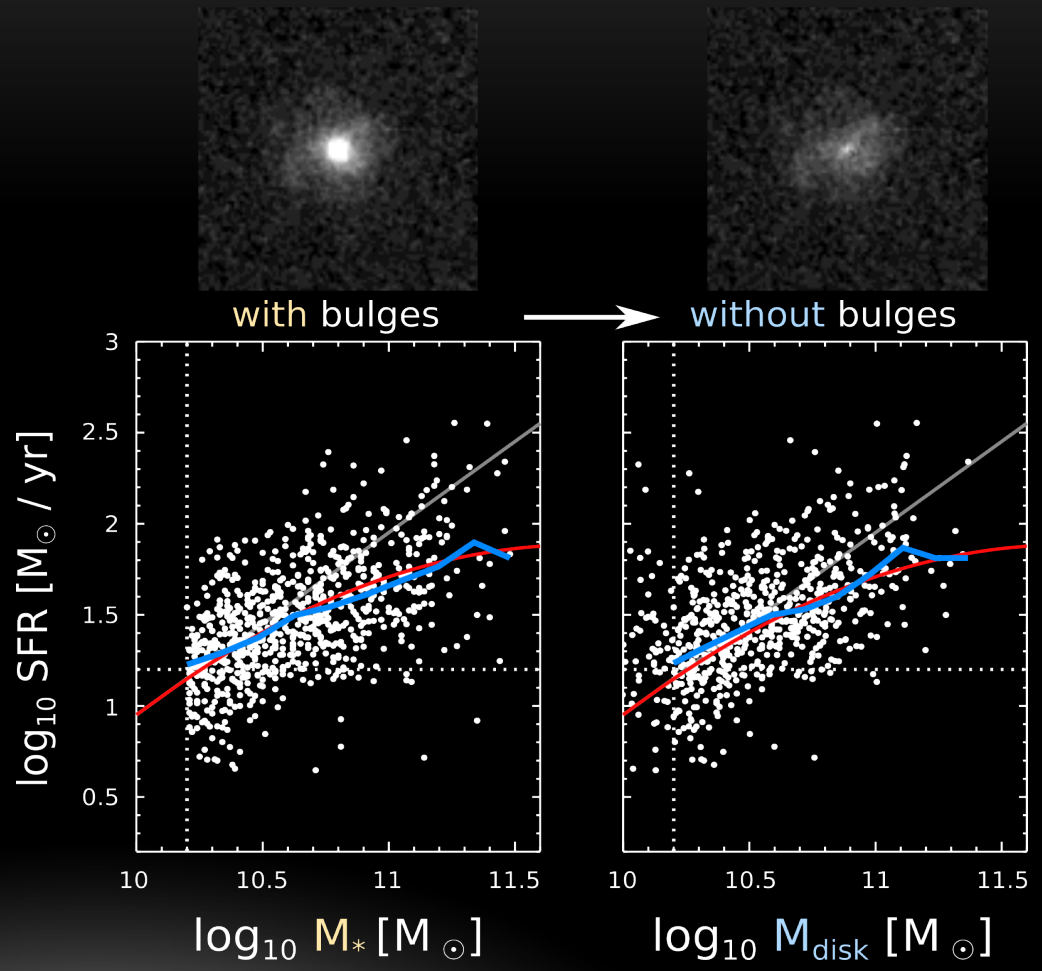
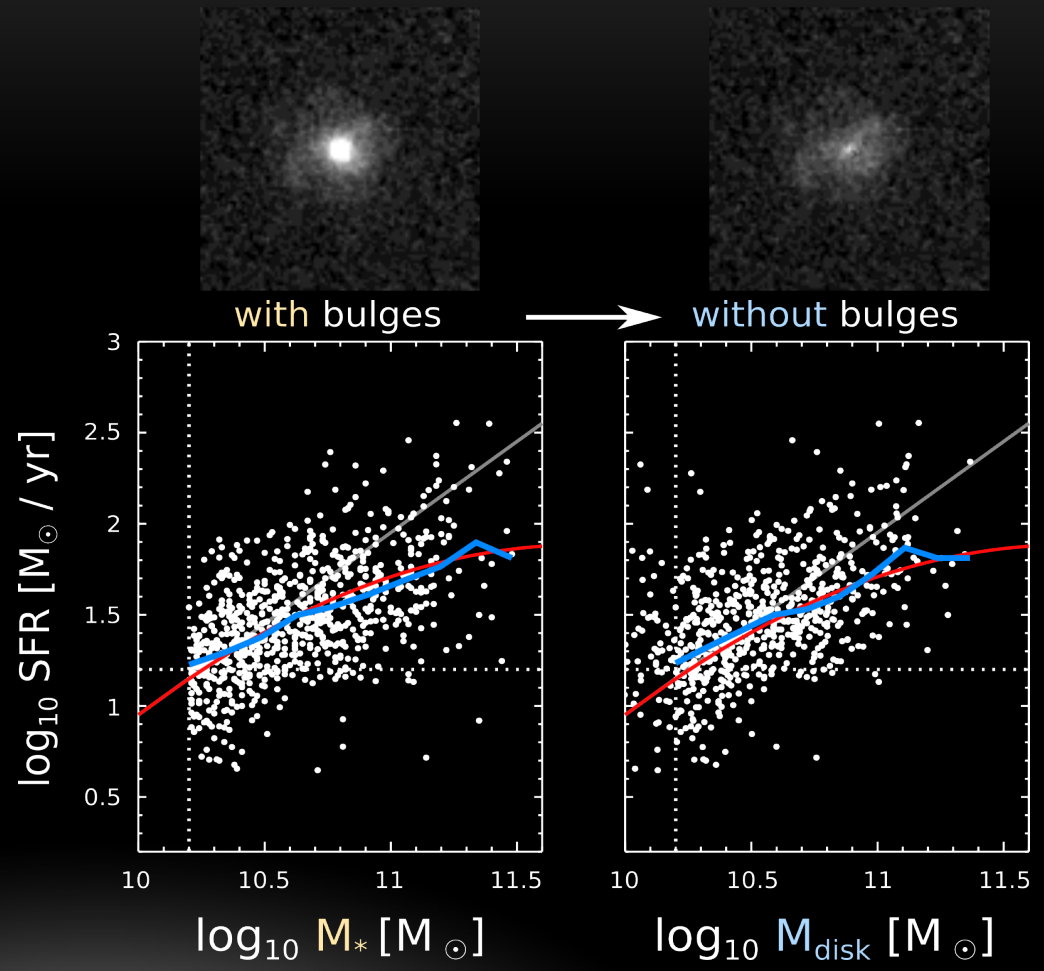


BULGES, DISKS AND GAS ON THE MAIN SEQUENCE

→ “bending” still present with disks only

→ bulges are not the answer



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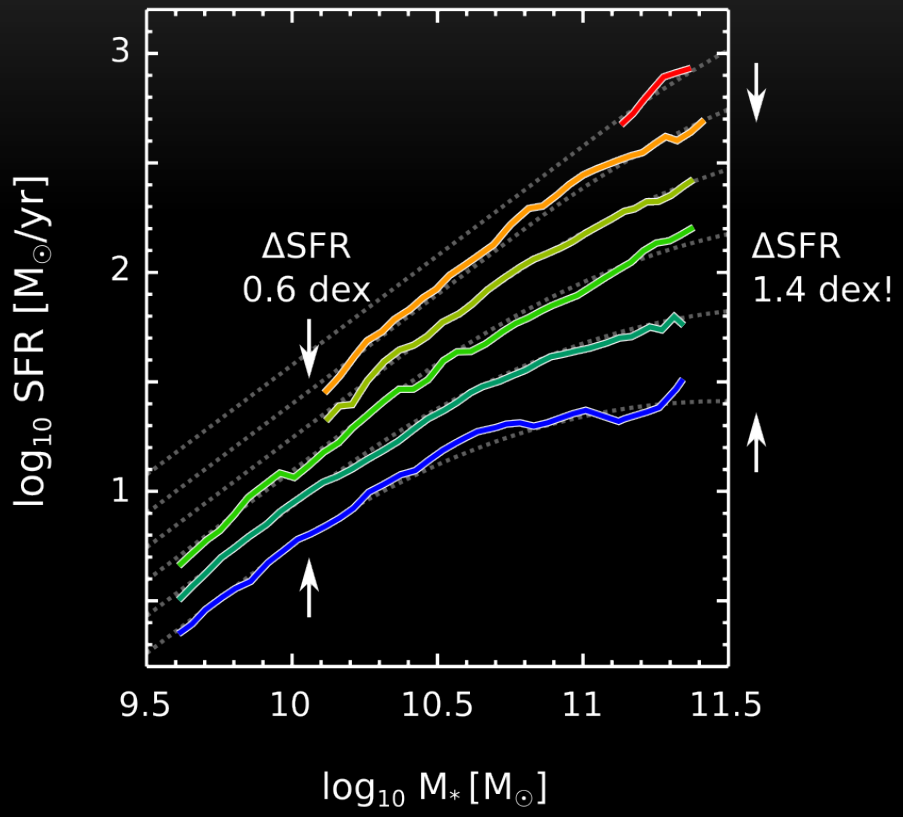

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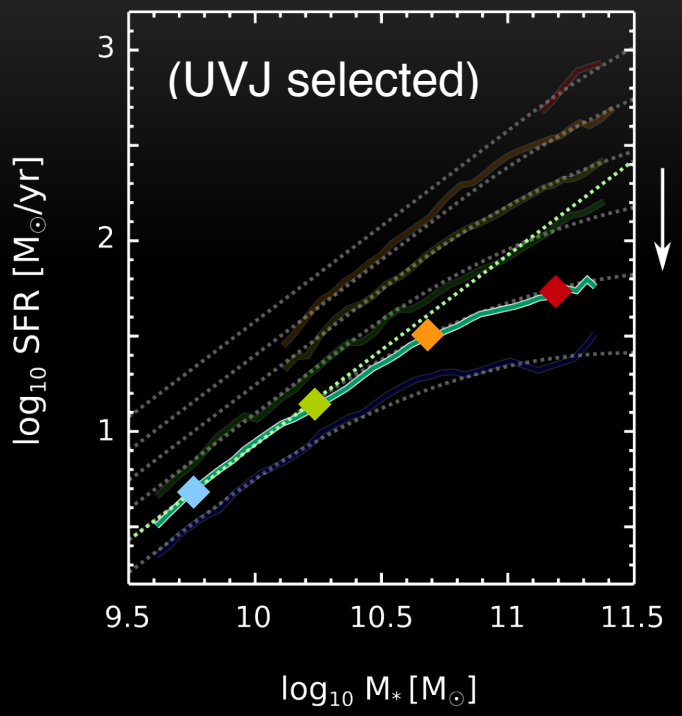

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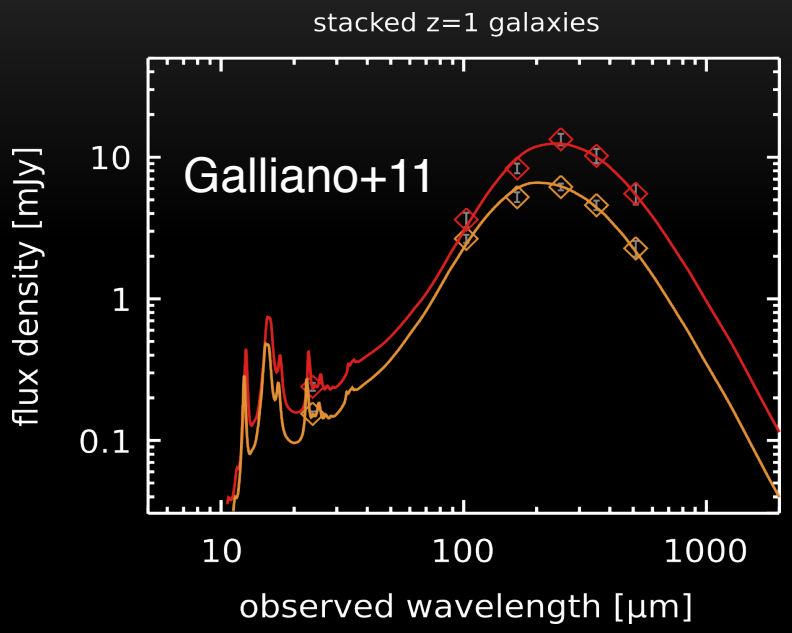

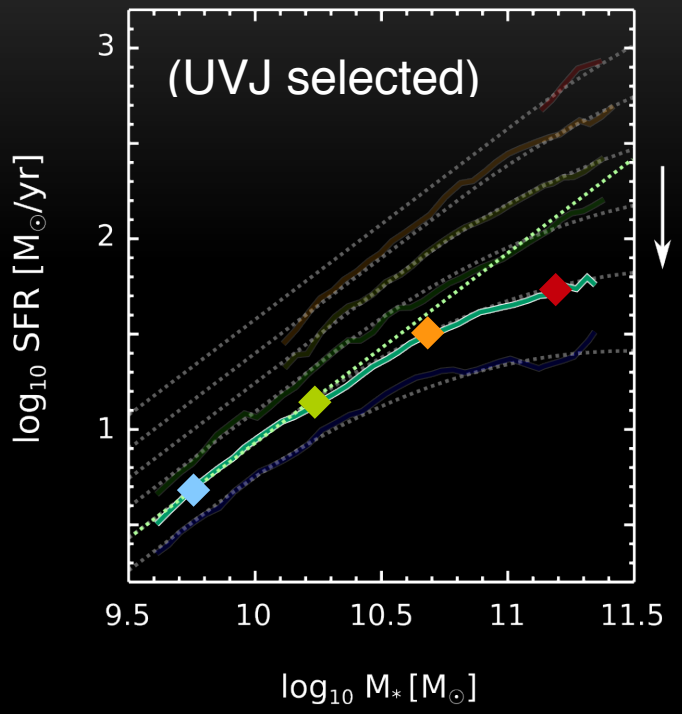

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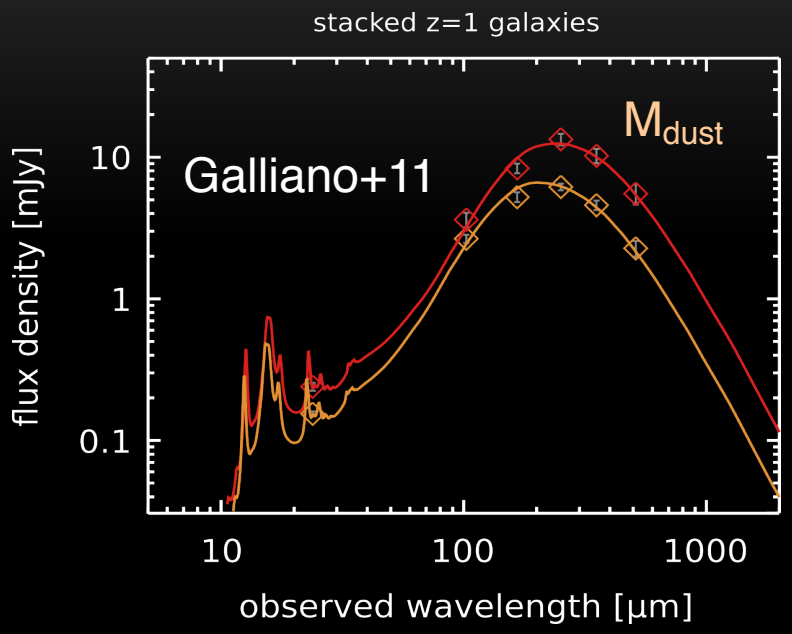

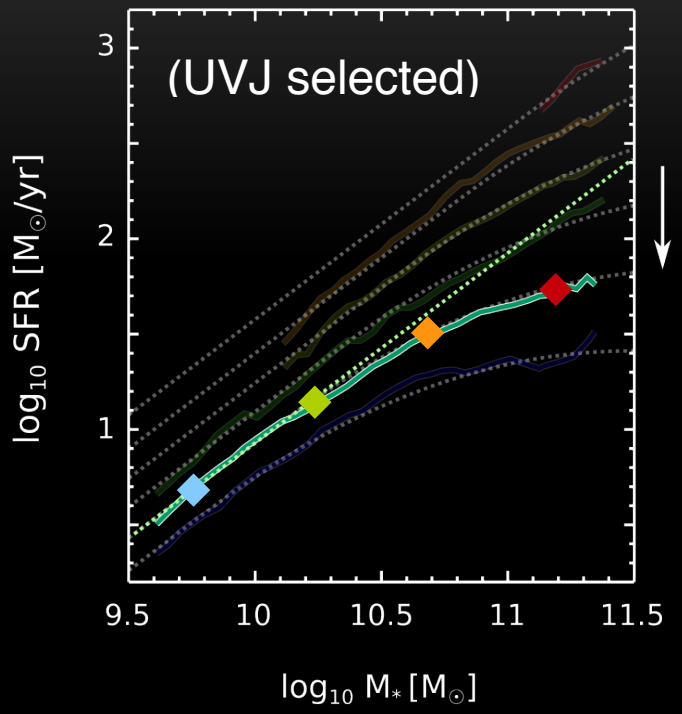

$$M_{gas} = (1/Z) \times (1-f)/f \times M_{dust}$$

Franco & Cox 86

Z: metallicity
FMR, Manucci+10

f: % of metals in dust
Leroy+08, Magdis+12

Assuming:

- single dust grain composition
- M* - SFR - Z relation
- fixed value of f

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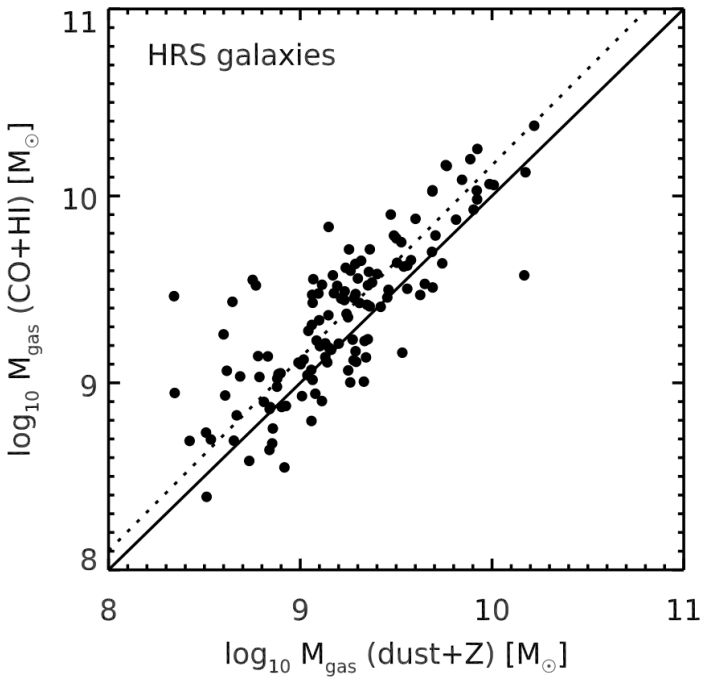

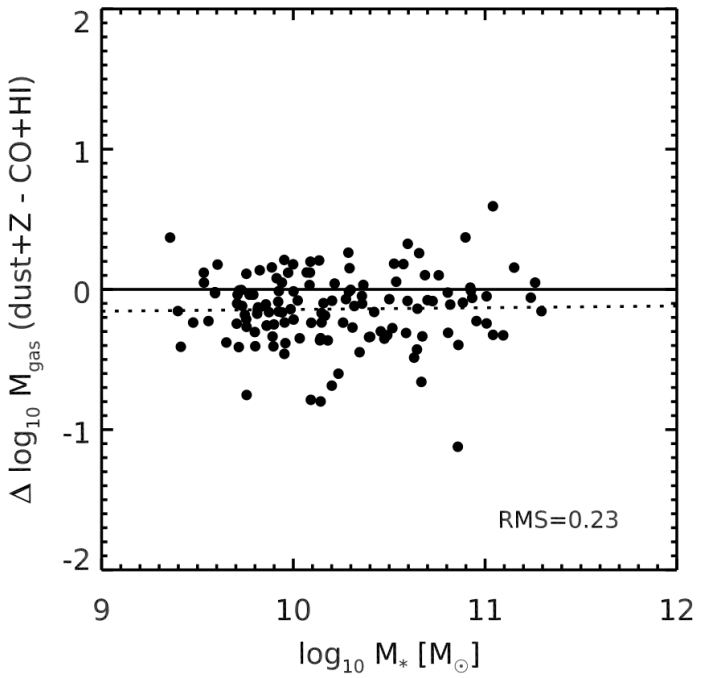

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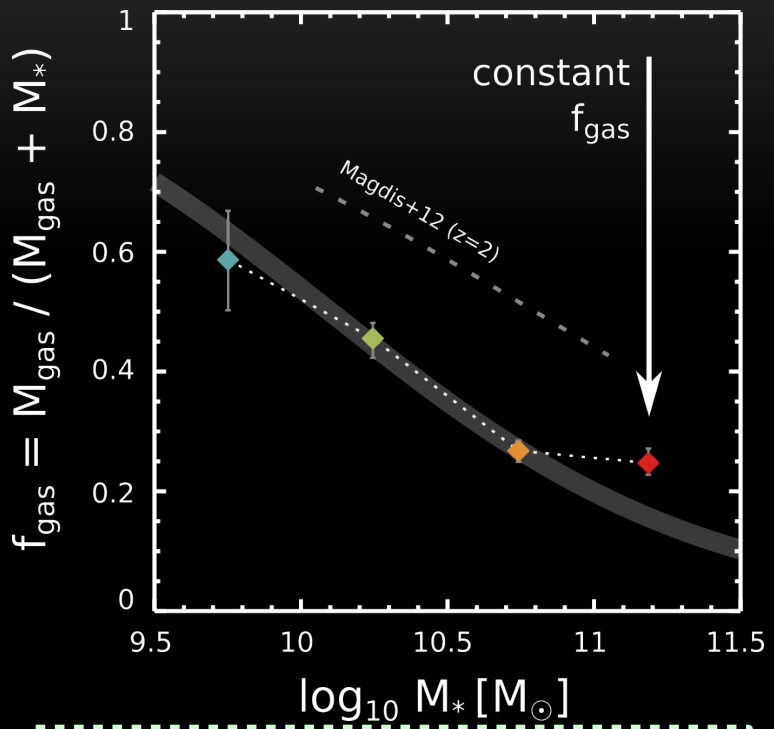

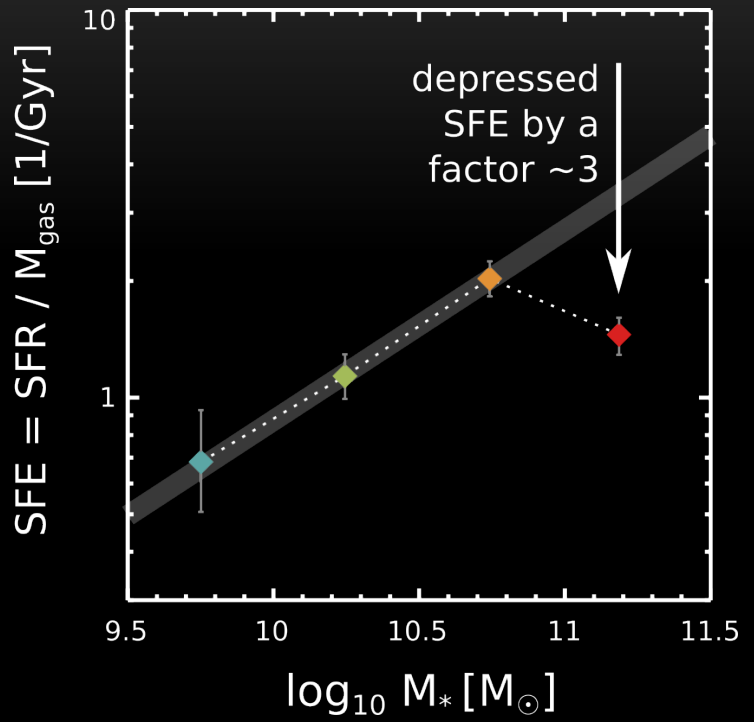

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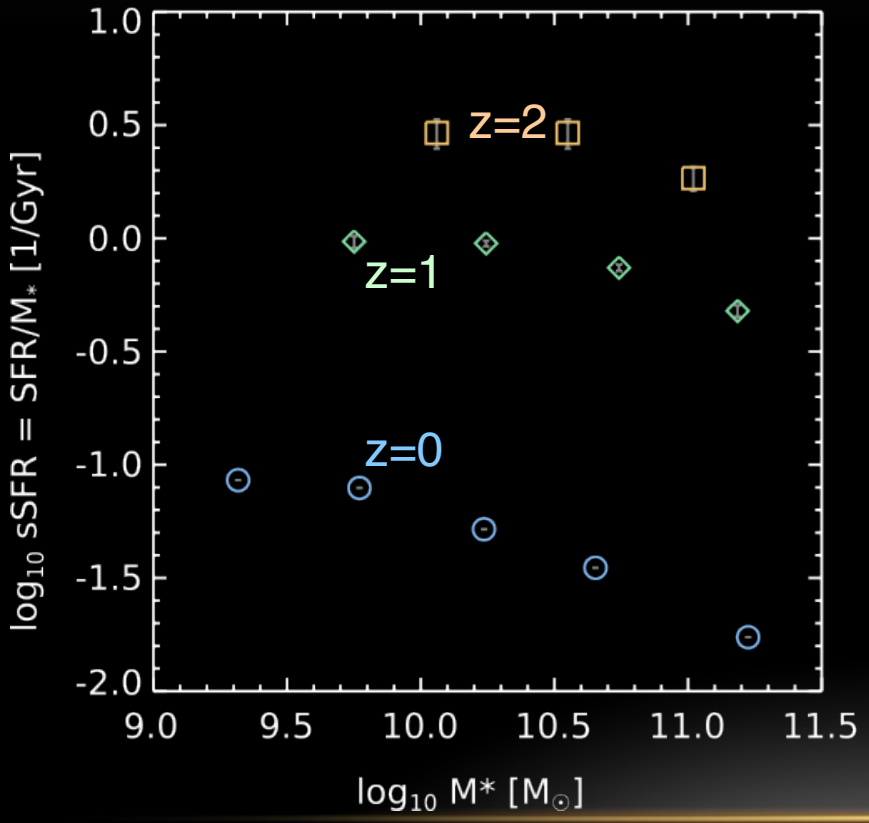
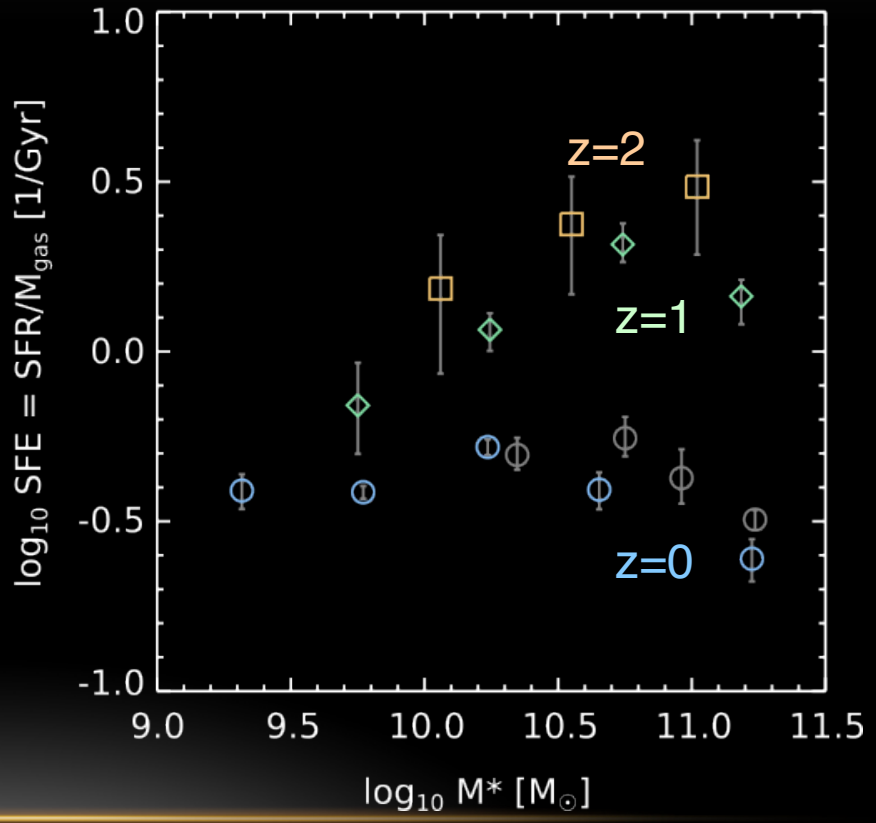
BULGES, DISKS AND GAS ON THE MAIN SEQUENCE

- Magdis+12 (z=2)
- this work (CANDELS z=1)
- this work (HRS z=0)
- Saintonge+11 (z=0)

***slow downfall* of SFE in massive galaxies!**





... TAKE ME HOME ...

- the Main Sequence has a varying slope
- flattens at high stellar mass and low redshift
- not linked to bulge growth or gas deficit
- due to a downfall of star formation efficiency