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

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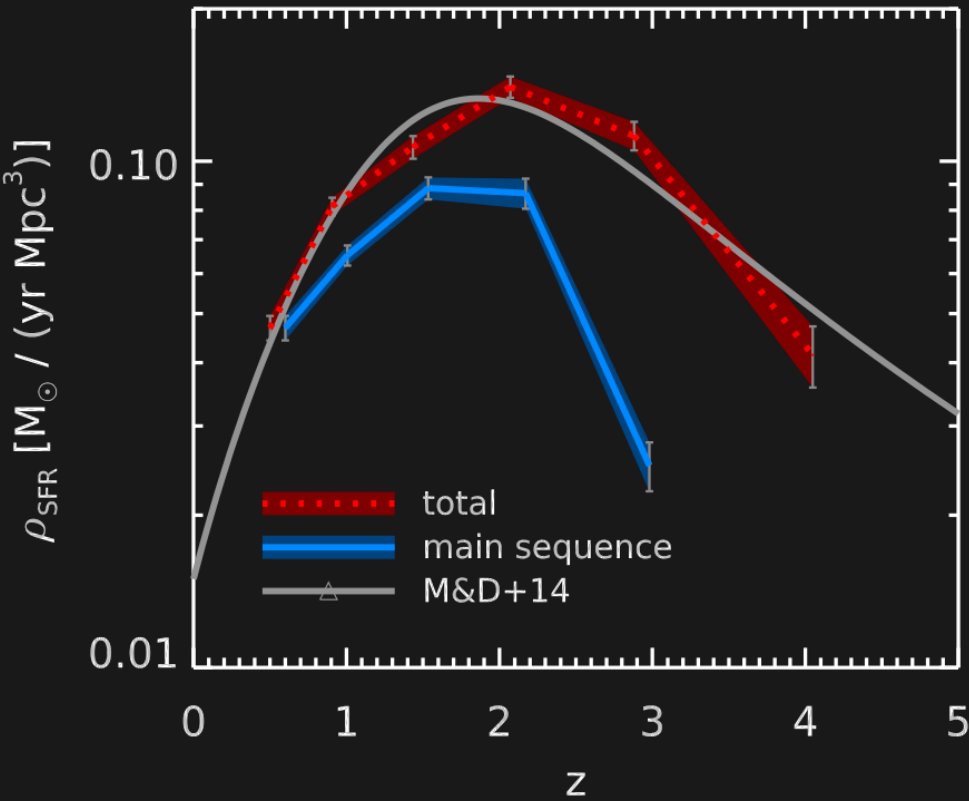
LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
MÜNCHEN



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

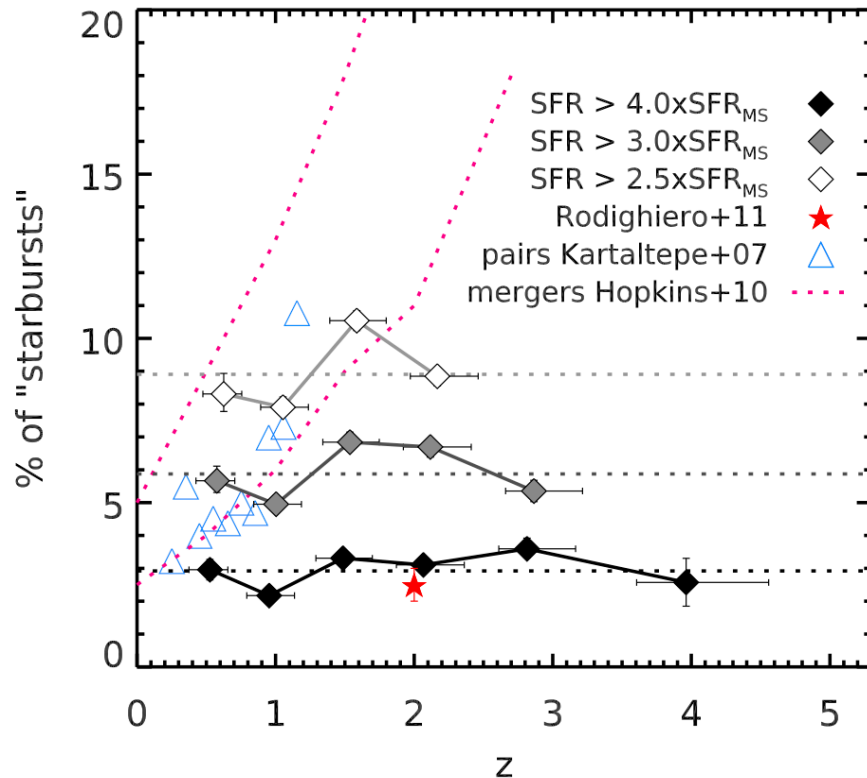
THE MAIN SEQUENCE PROPAGANDA



(Schreiber, MP et al., 2015)

- Scatter is ~ 0.3 dex at all stellar masses and all redshifts up to $z \sim 4$
- 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 $z \sim 4$

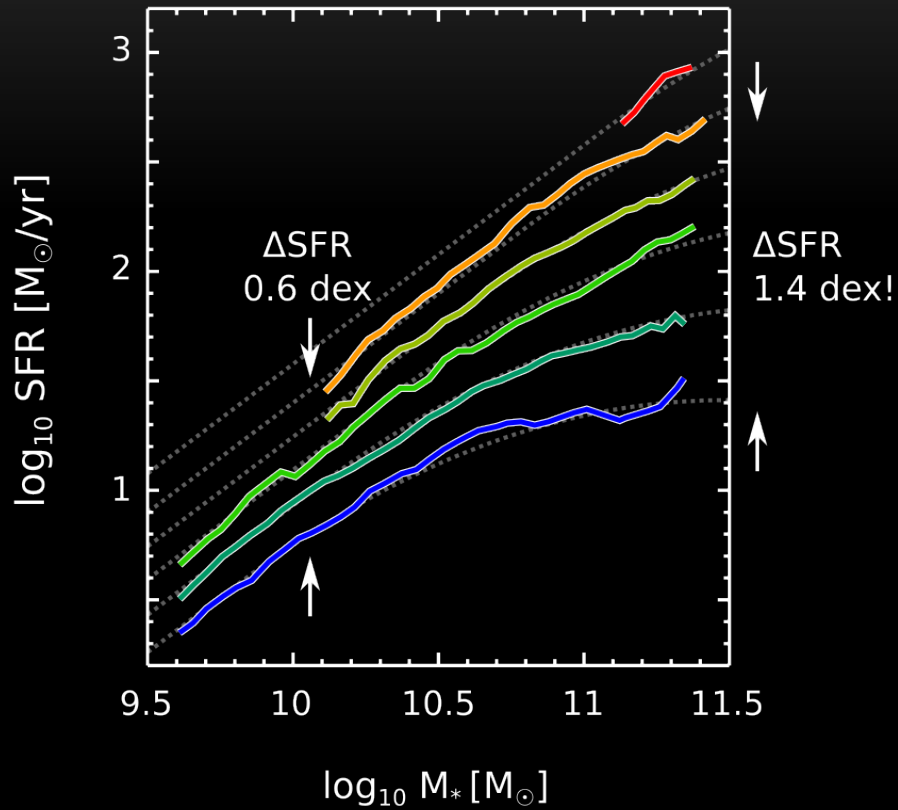
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- Galaxies on the MS produce more than 70% of present day stars
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- Starbursts fraction is constant with z
- Account for $\sim 15\%$ of the CSFR

(Schreiber, MP et al., 2015)

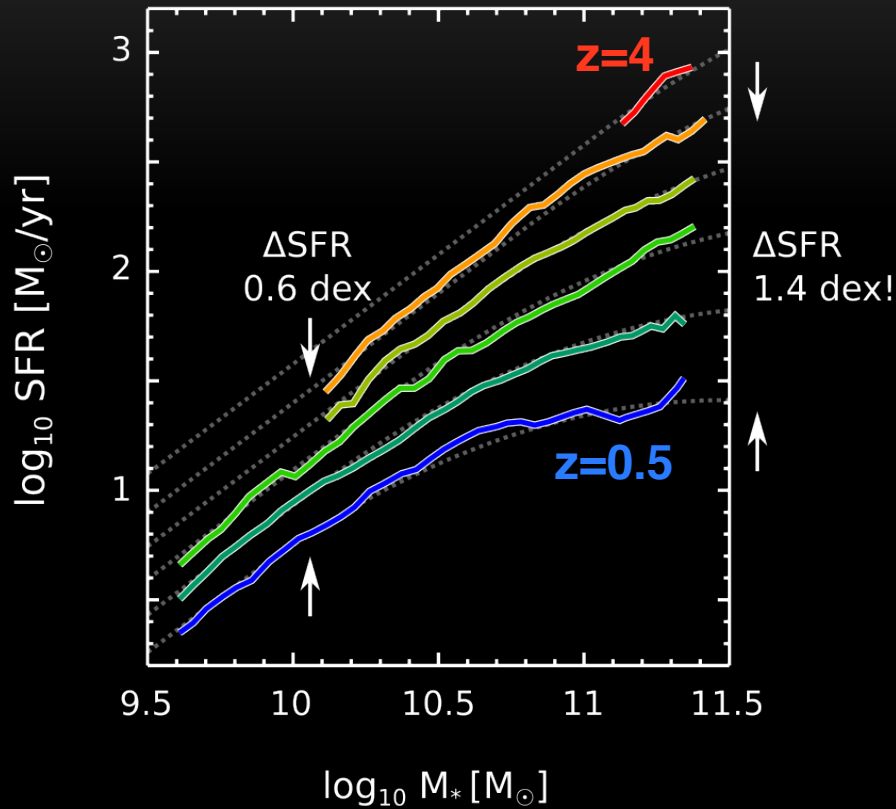
THE MAIN SEQUENCE BENDING



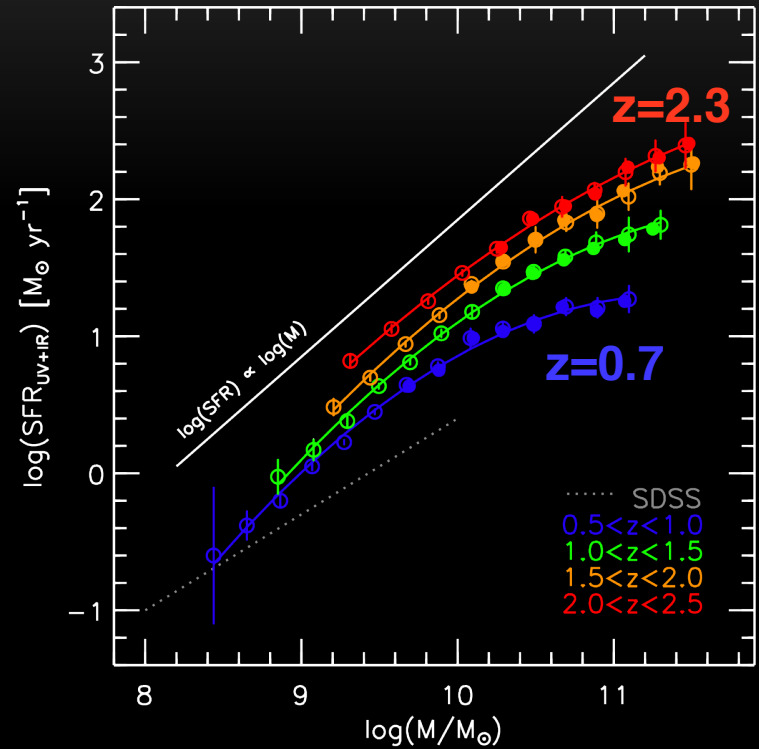
- A varying slope with redshift/mass

(Schreiber, MP et al., 2015)

THE MAIN SEQUENCE BENDING

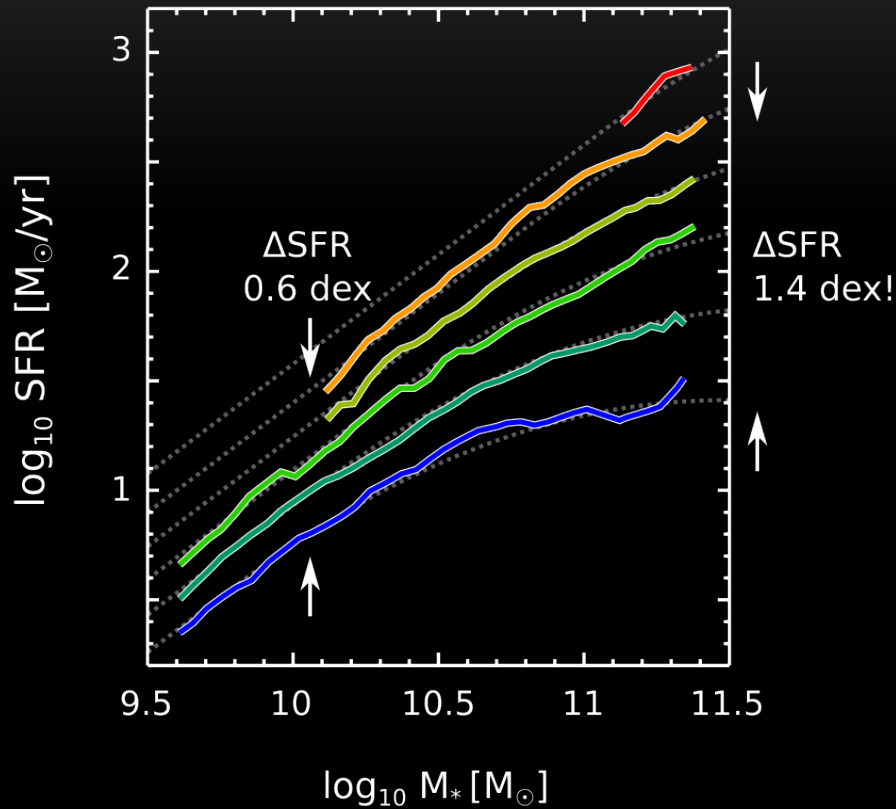


(Schreiber, MP et al., 2015)



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

THE MAIN SEQUENCE BENDING

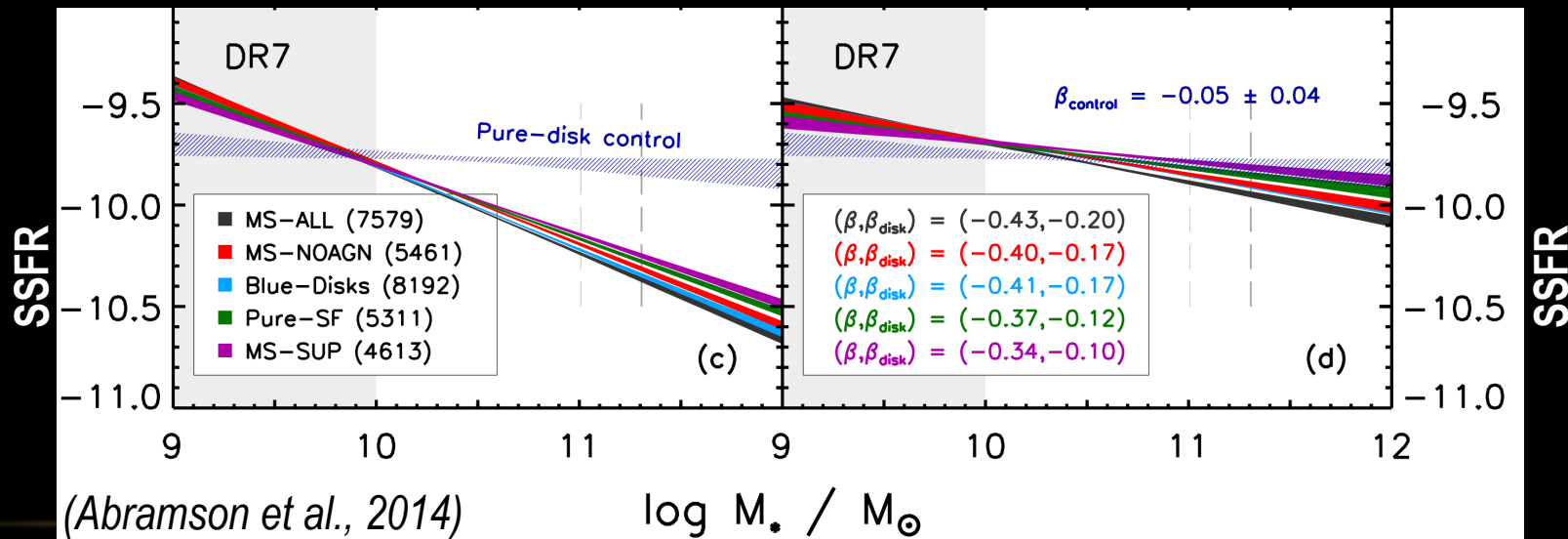


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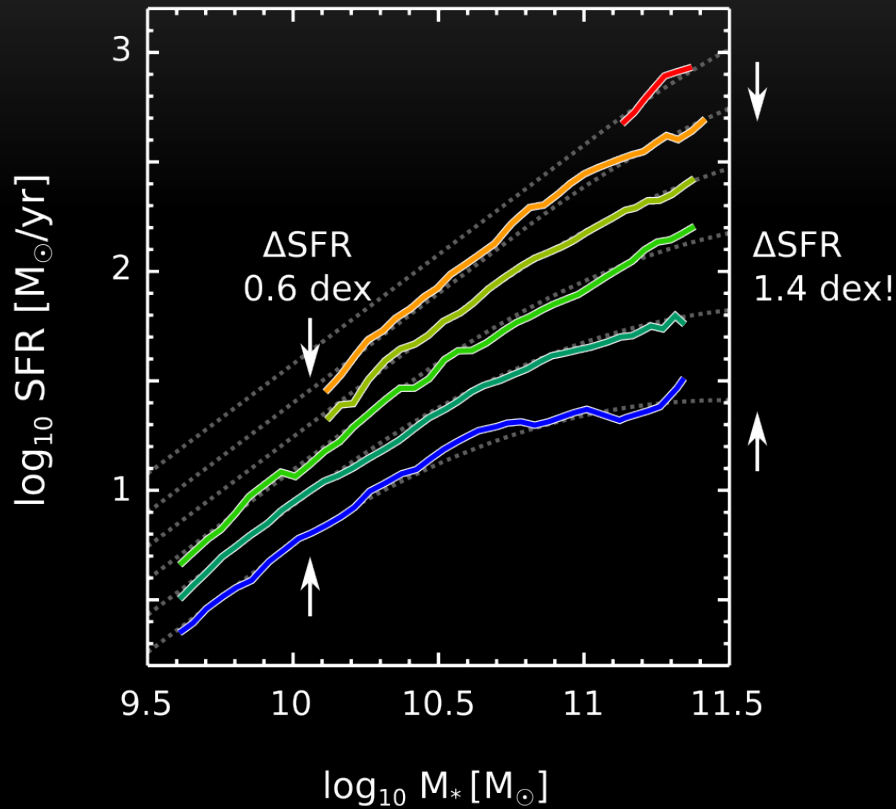
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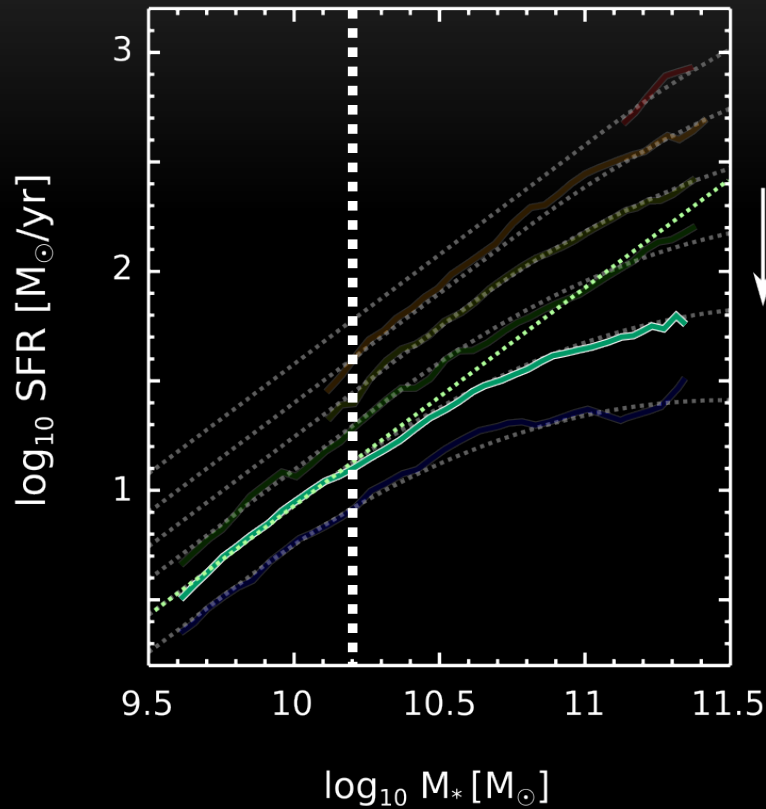
THE MAIN SEQUENCE BENDING



(Schreiber, MP et al., 2015)

- A varying slope with redshift/mass
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- 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:

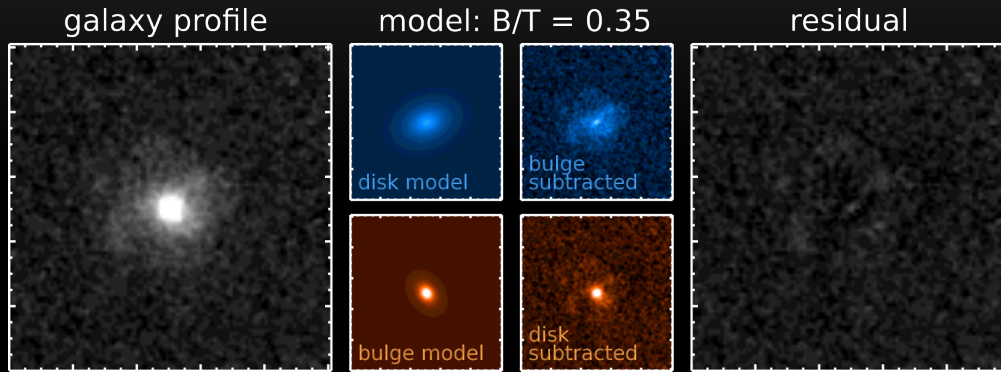
CANDELS fields

$0.7 < z < 1.3$

$H < 22.5$ ($\text{Log } M_{\star} > 10.2$)

Spitzer/Herschel detections
($\text{SFR} = \text{SFR}_{\text{IR}} + \text{SFR}_{\text{UV}}$)

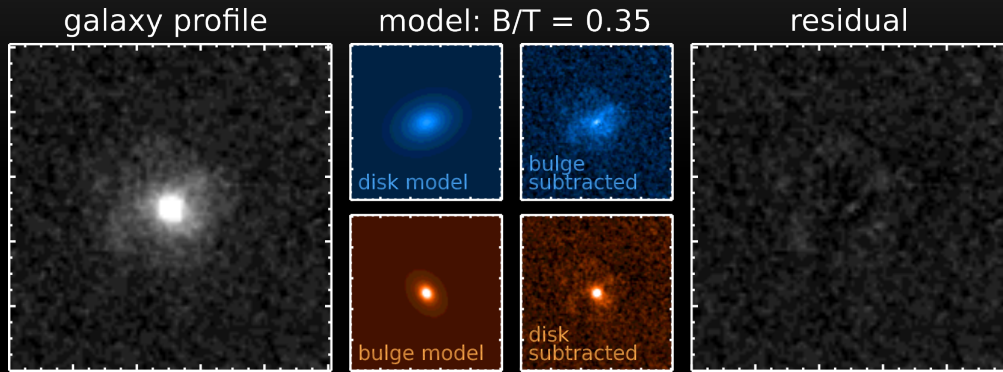
BULGES, DISKS AND GAS ON THE MAIN SEQUENCE



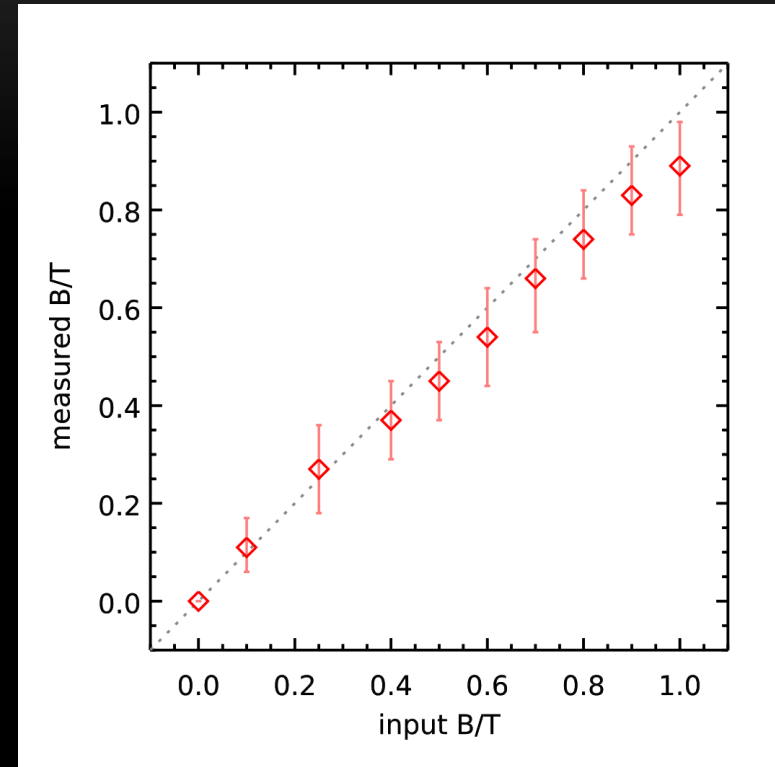
(Schreiber et al., 2016)

- GIM2D bulge+disk model

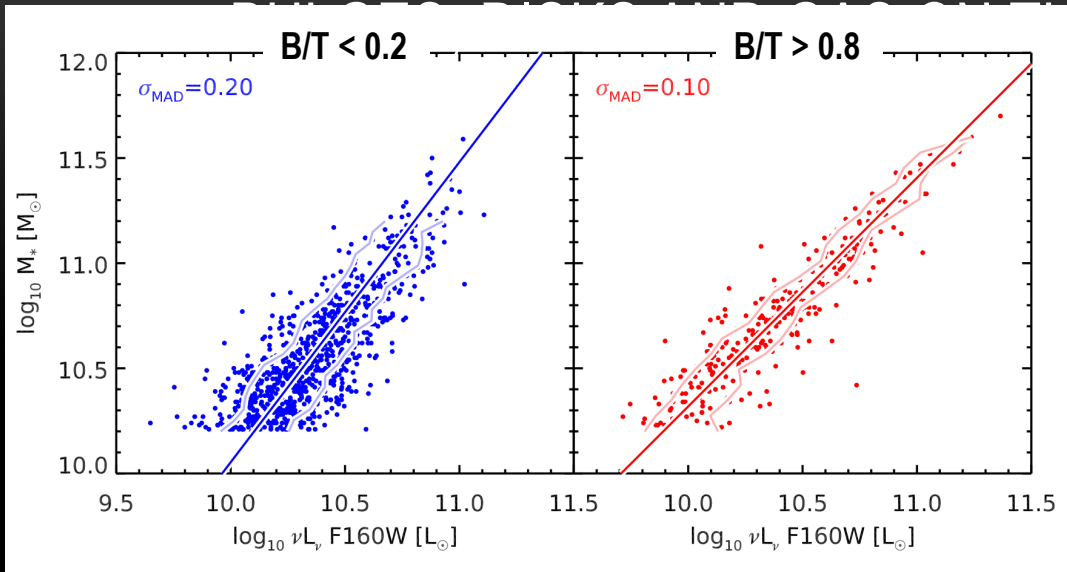
BULGES, DISKS AND GAS ON THE MAIN SEQUENCE



(Schreiber et al., 2016)



E MAIN SEQUENCE



(Schreiber et al., 2016)

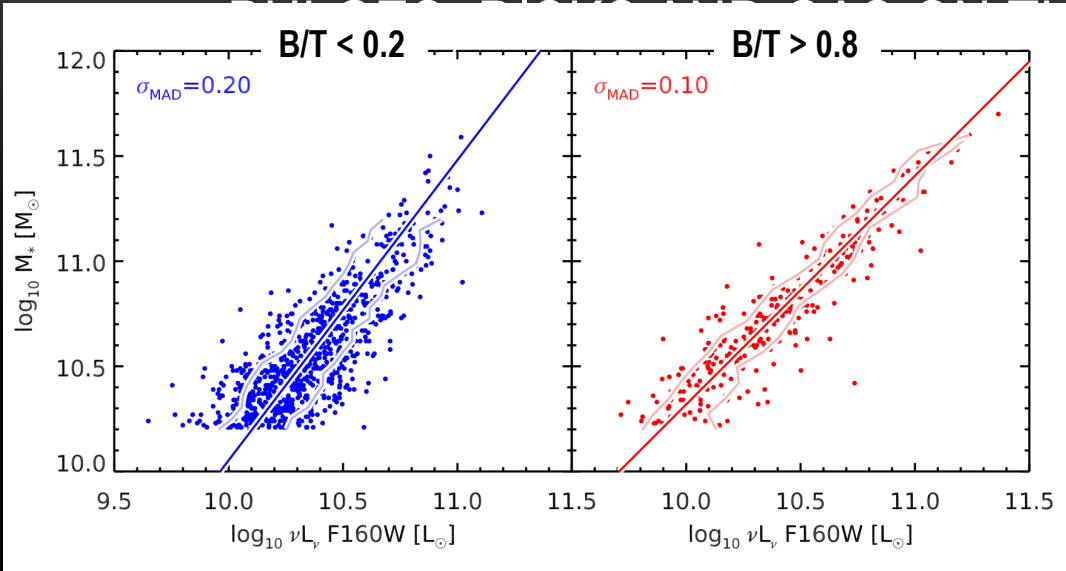
- GIM2D bulge+disk model
- Tested with simulations
- Corrected for \neq mass-to-light ratios of bulge and disk

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

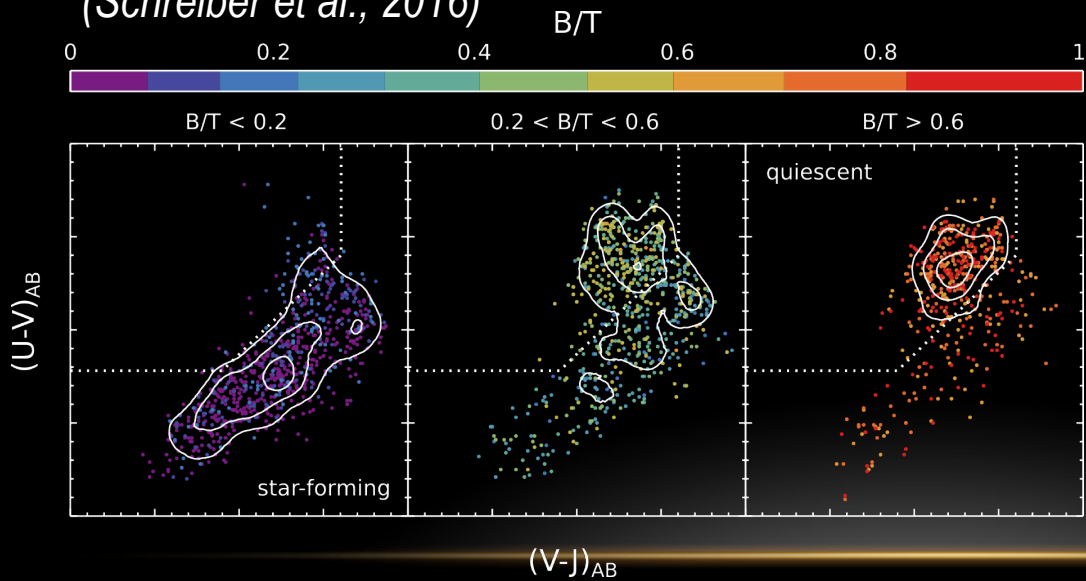
B/T < 0.2 \leftrightarrow pure disk

B/T > 0.8 \leftrightarrow pure bulge

E MAIN SEQUENCE



(Schreiber et al., 2016)



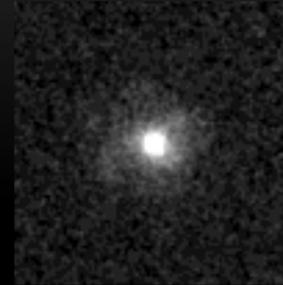
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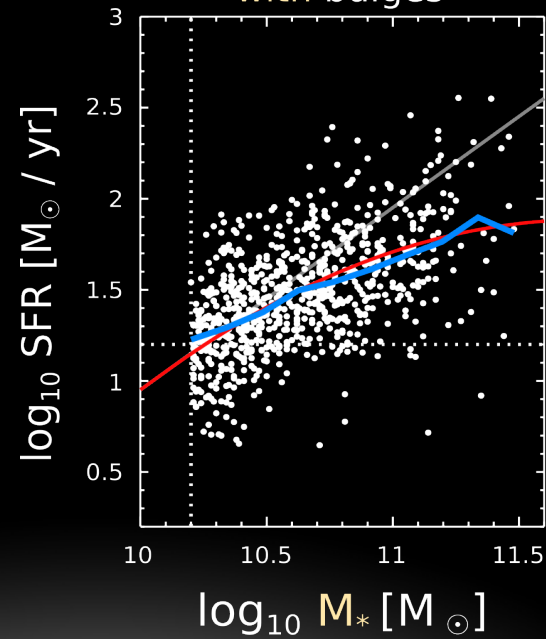
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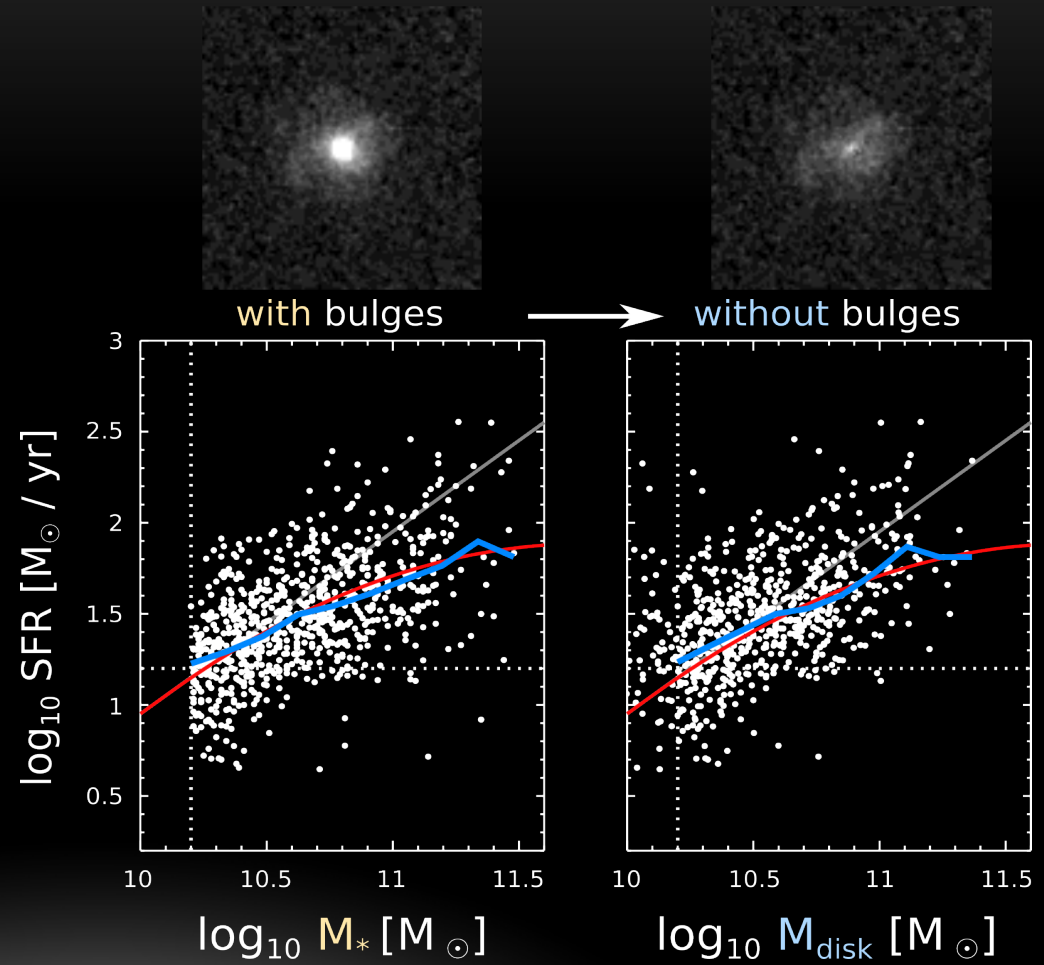
BULGES, DISKS AND GAS ON THE MAIN SEQUENCE



with bulges

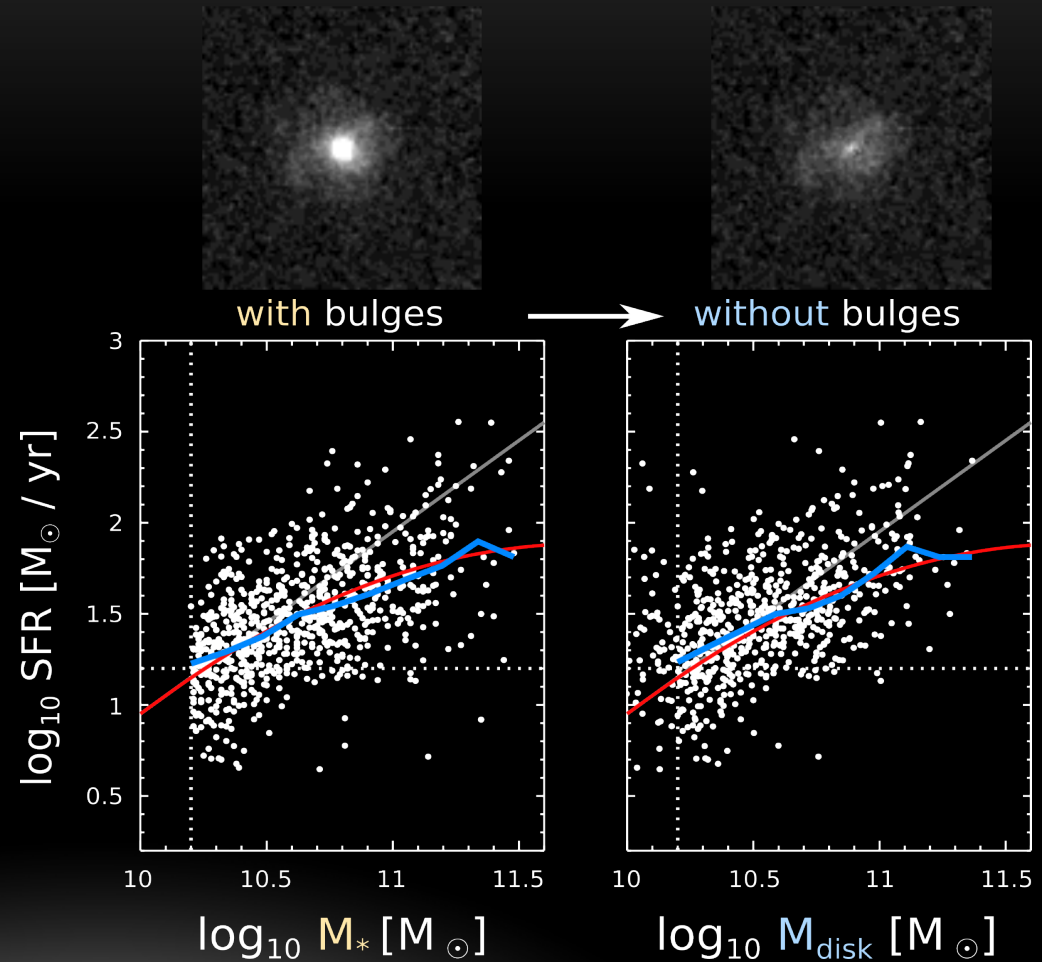


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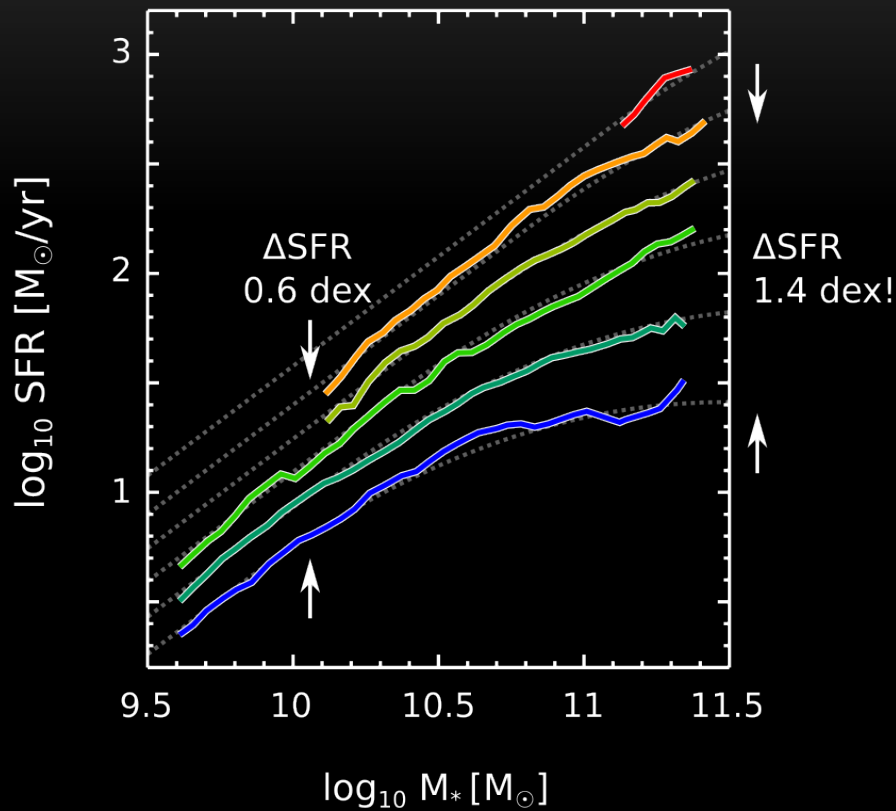


BULGES, DISKS AND GAS ON THE MAIN SEQUENCE

- “bending” still present with disks only
- bulges are not the answer



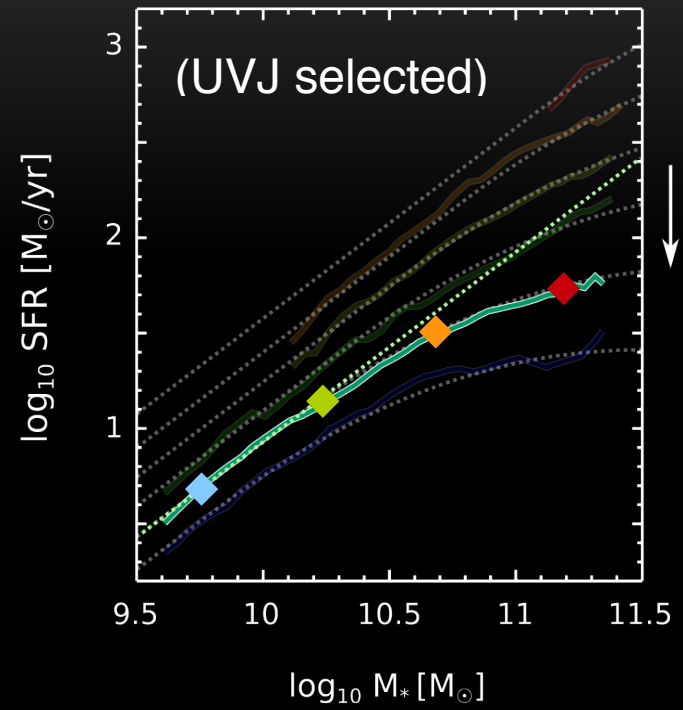
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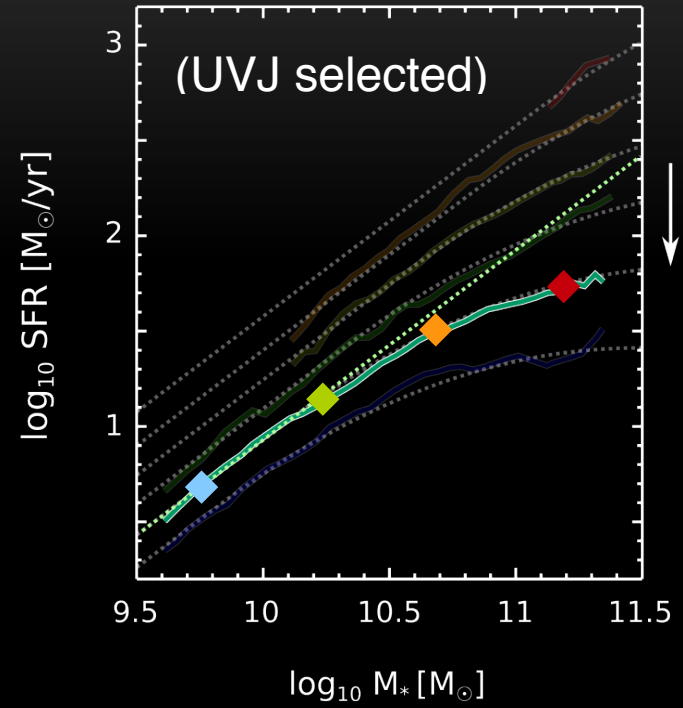
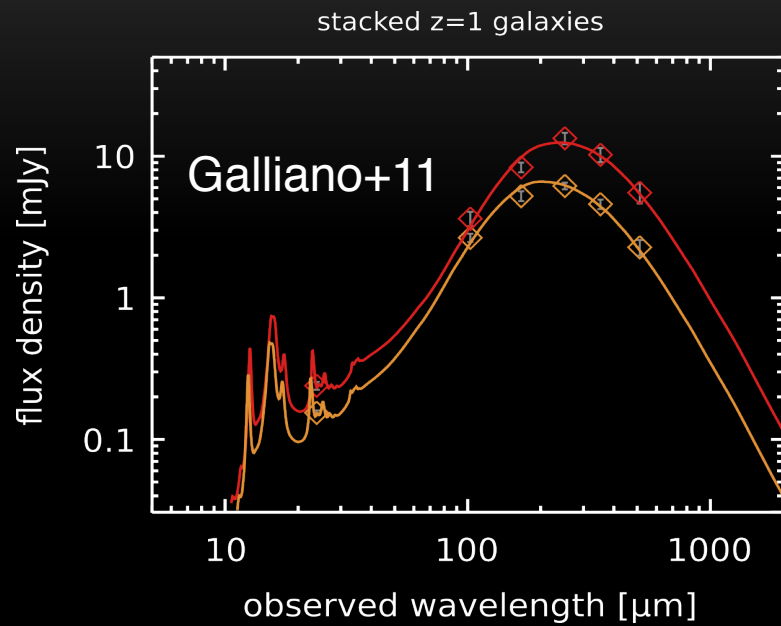
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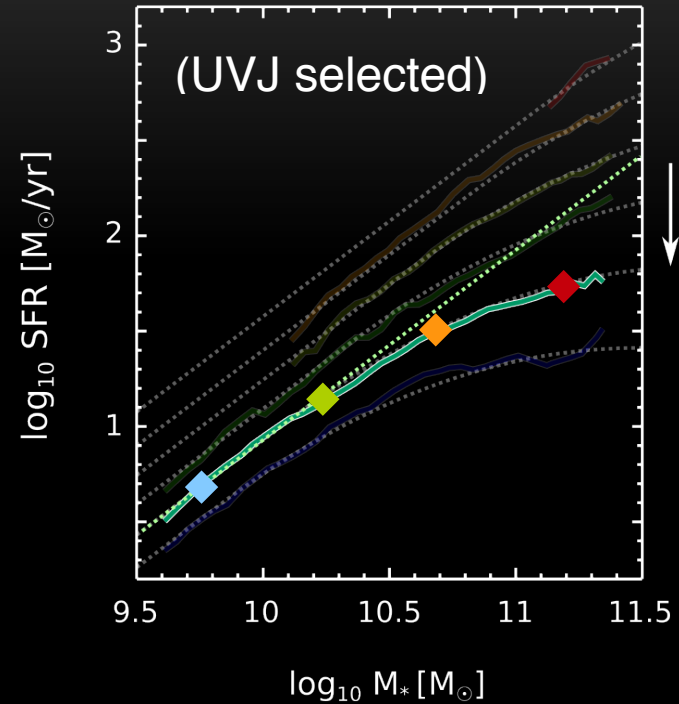
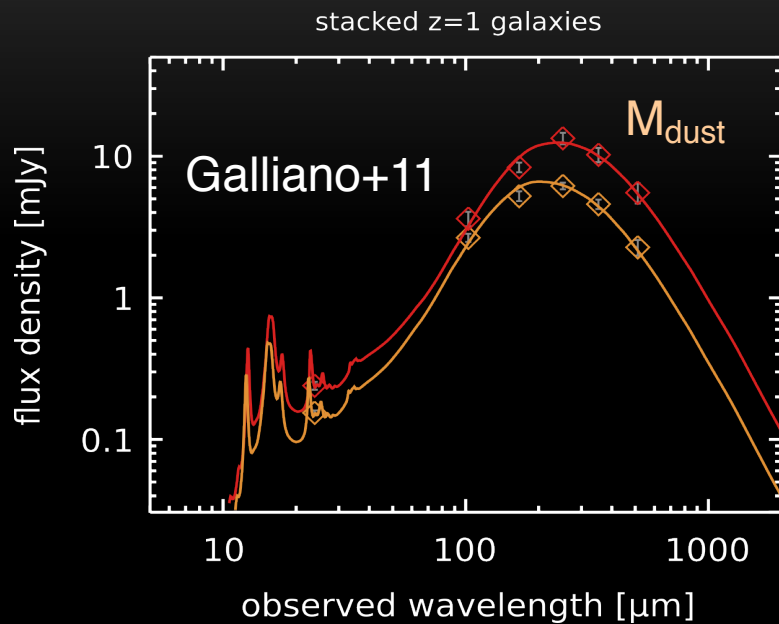
BULGES, DISKS AND GAS ON THE MAIN SEQUENCE



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BULGES, DISKS AND GAS ON THE MAIN SEQUENCE



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

Franco & Cox 86

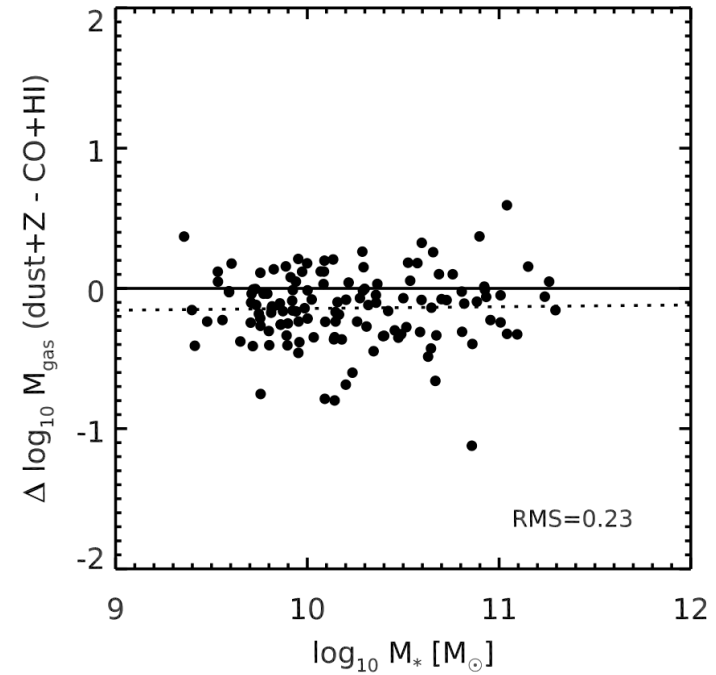
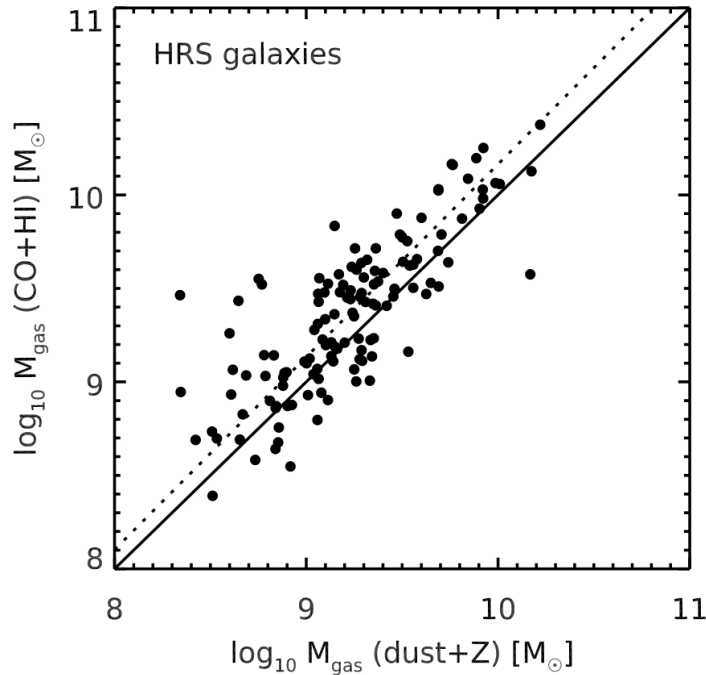
Z: metallicity
FMR, Manucci+10

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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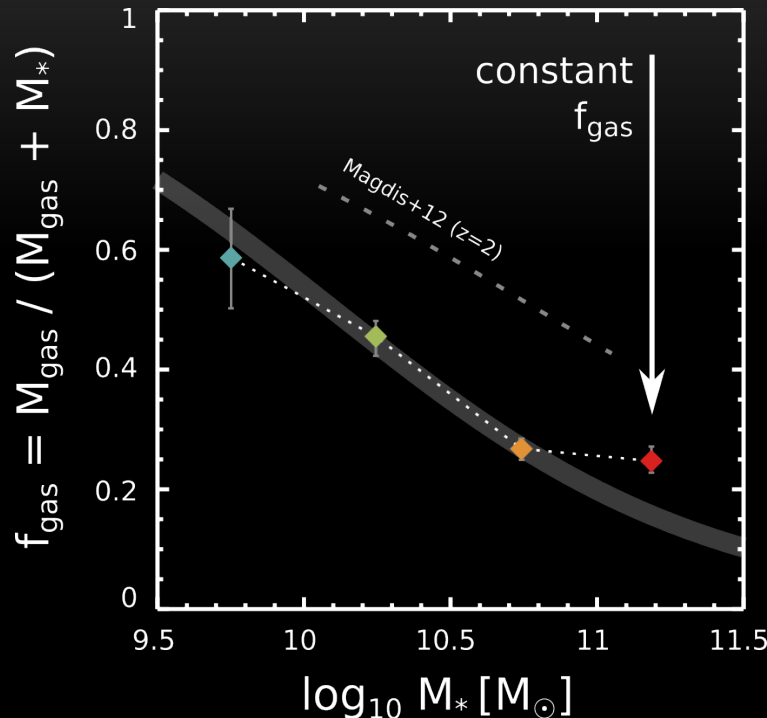
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Cross-checked with H_I+CO at z=0

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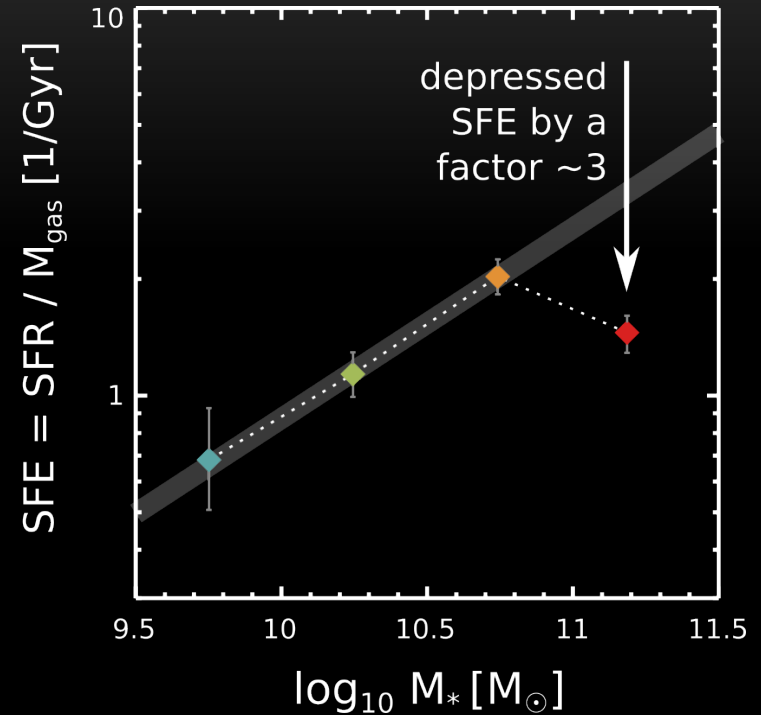


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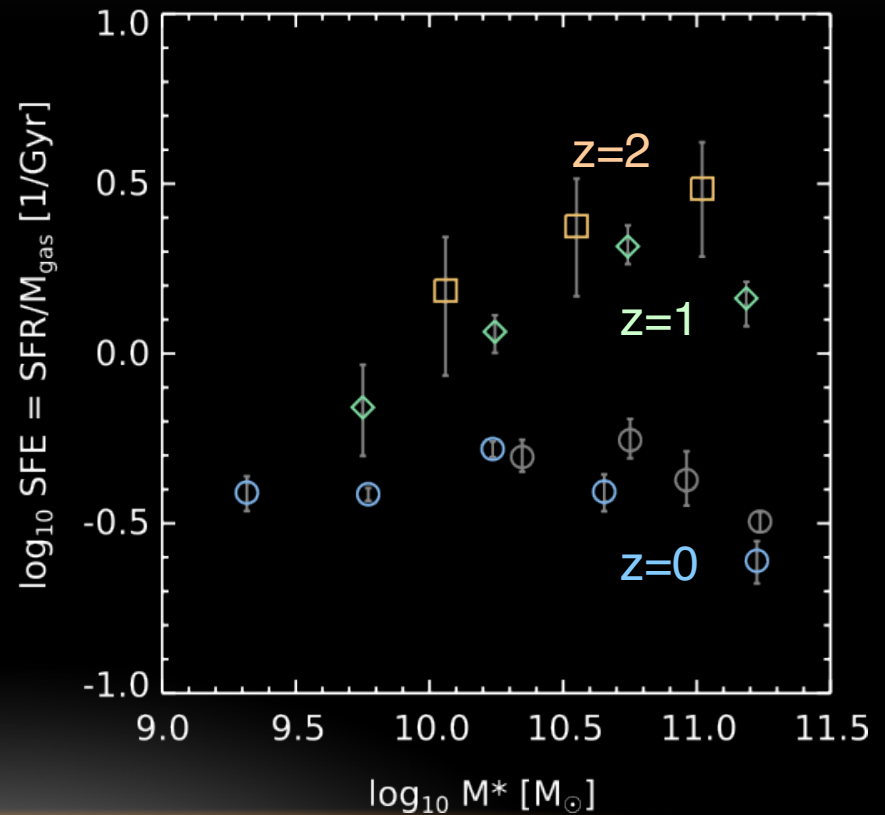
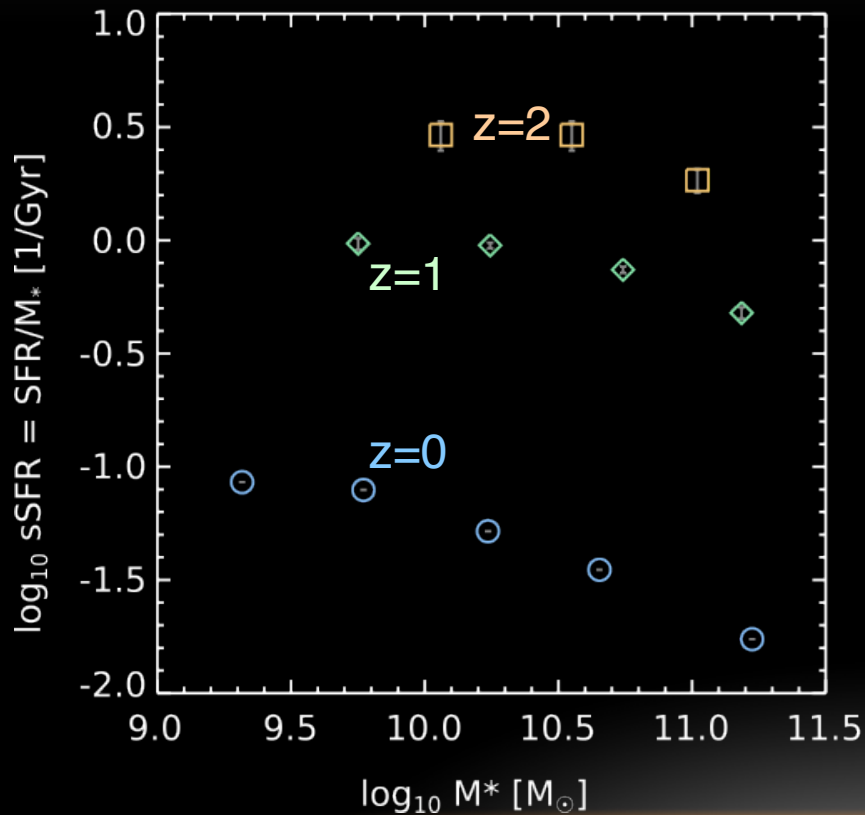
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BULGES, DISKS AND GAS ON THE MAIN SEQUENCE

- 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