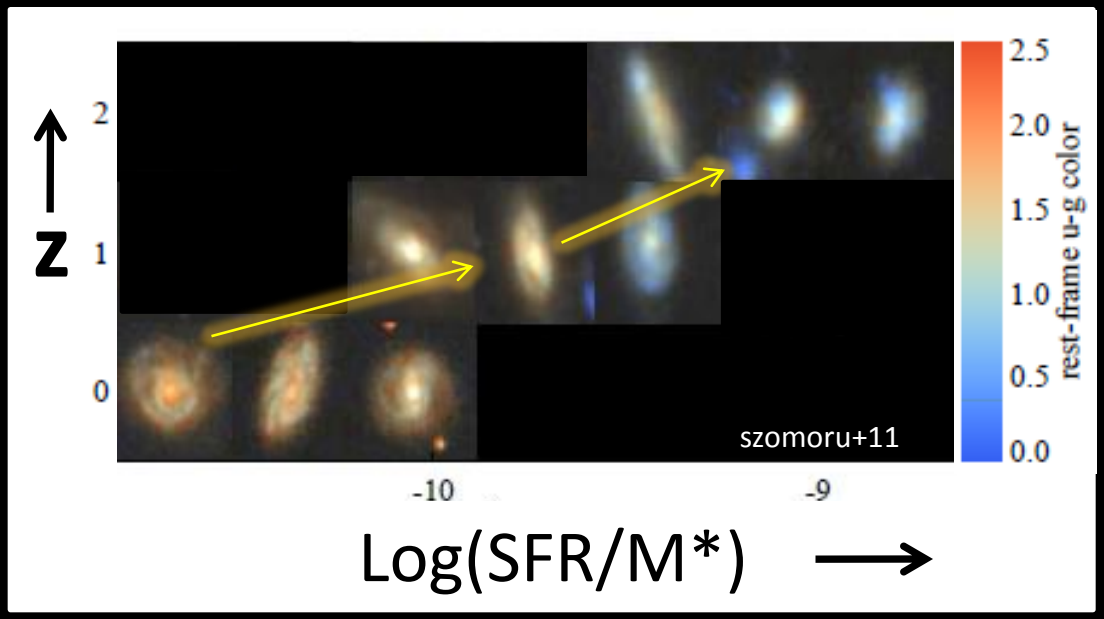
On the last 10 billion years of stellar mass growth in star-forming galaxies



Sam Leitner (University of Chicago)
Advisor: Andrey Kravtsov

Santa Cruz Galaxy Workshop, August 2011

A persistent SFR main sequence

Small scatter in SFR at M_*:

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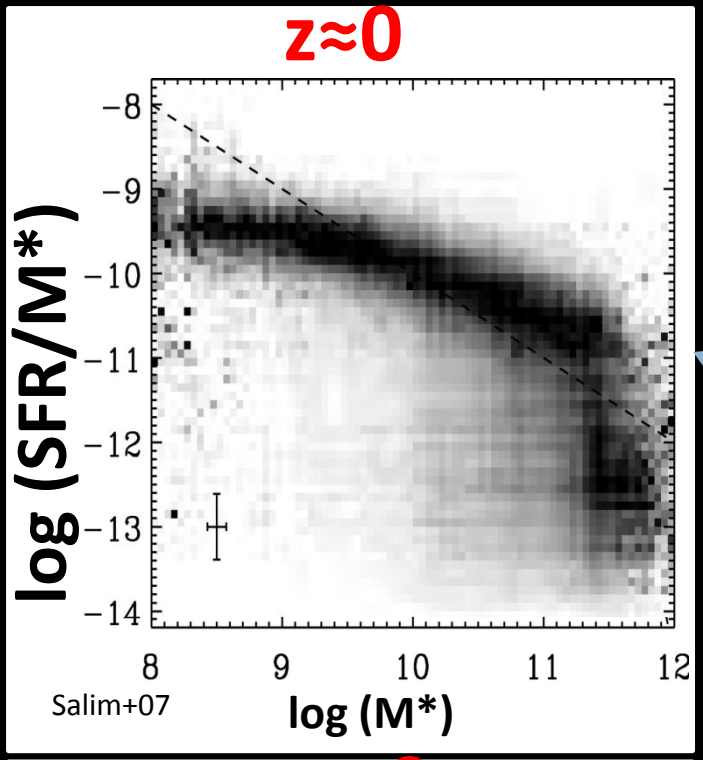
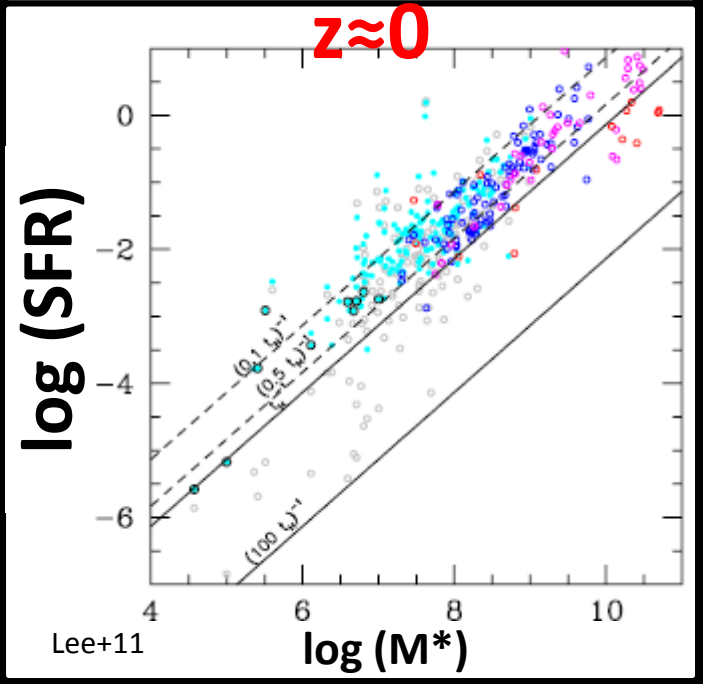
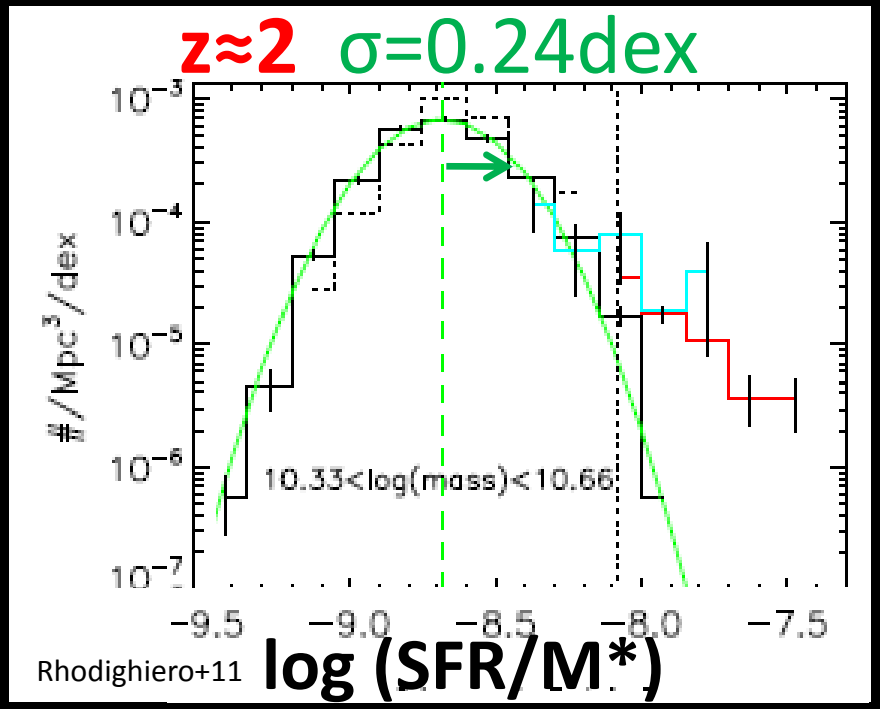
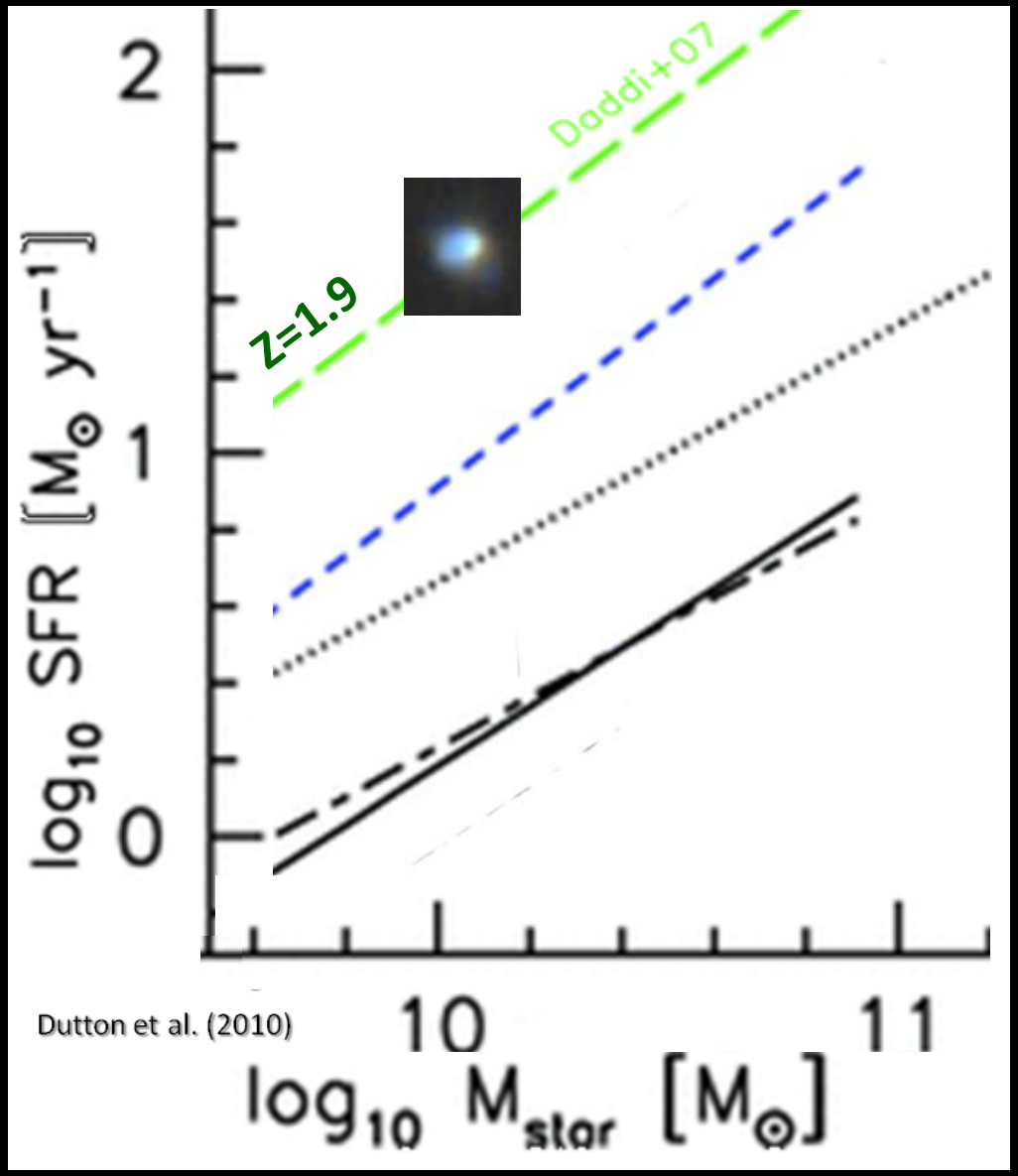


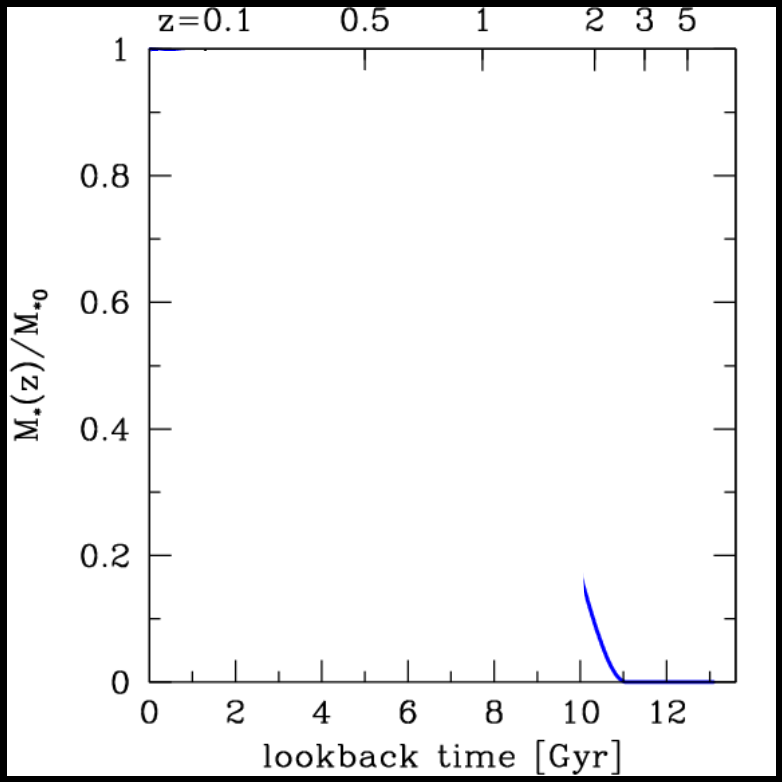




Main Sequence Integration



stellar mass fraction formed



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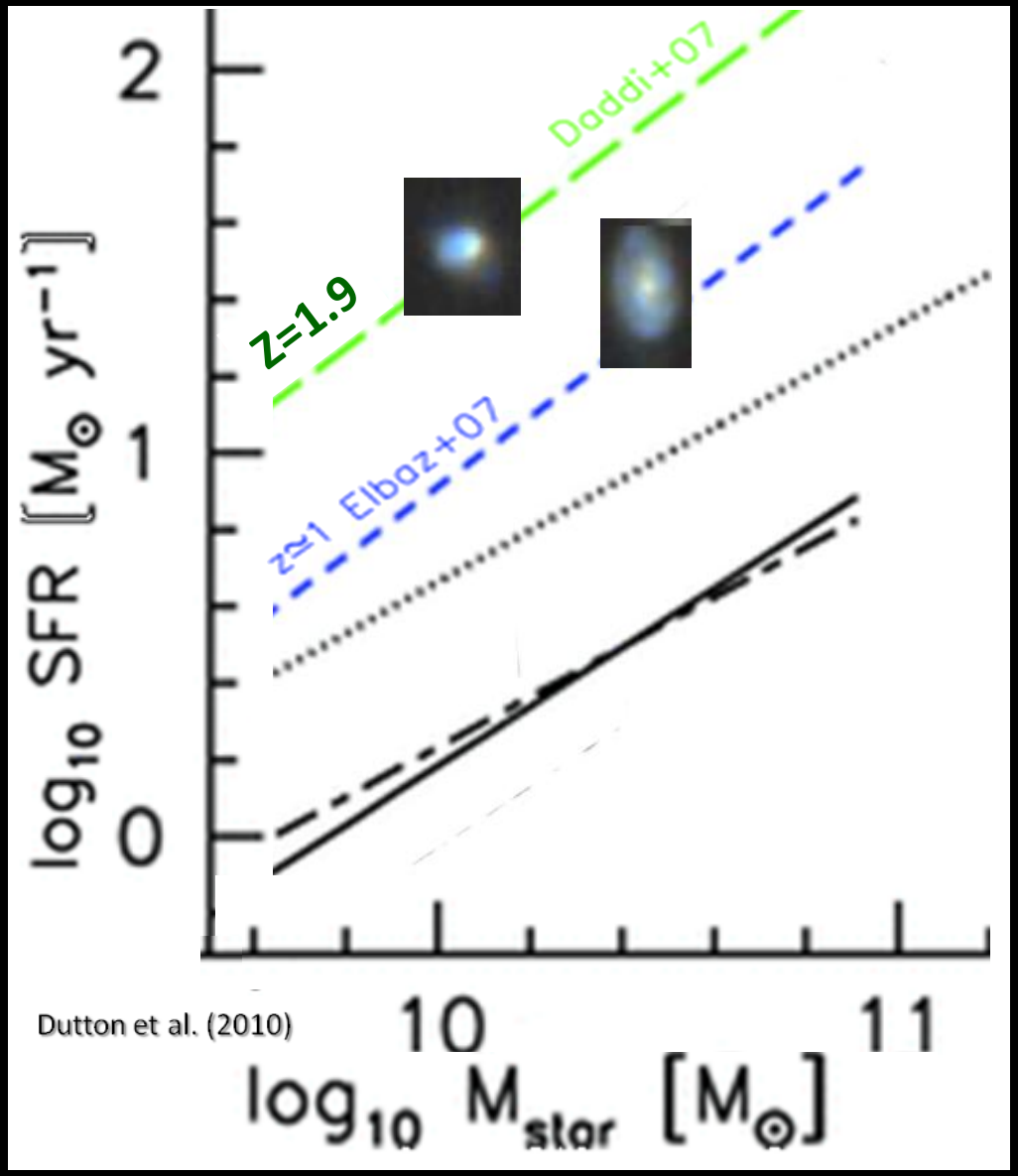

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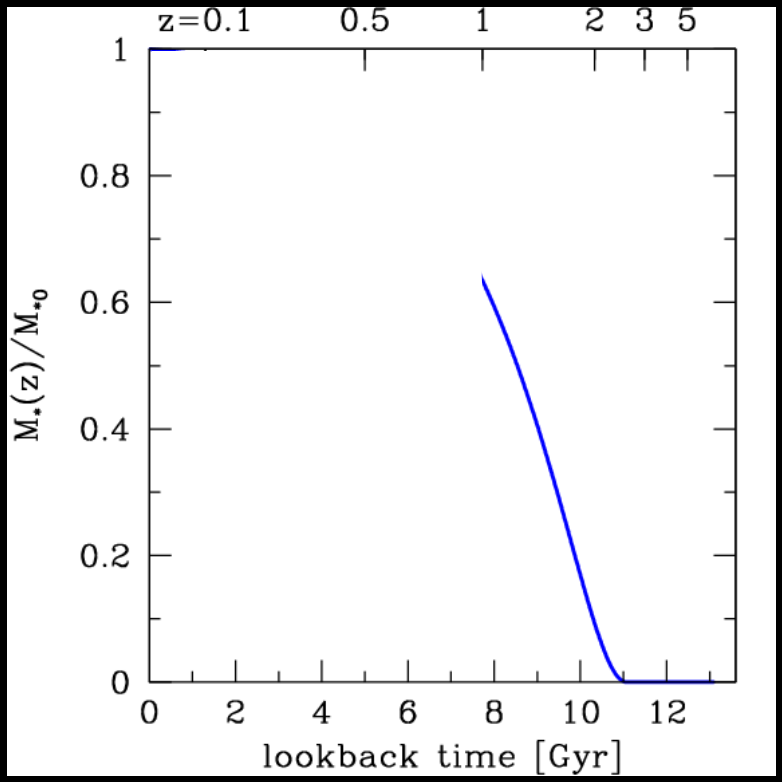

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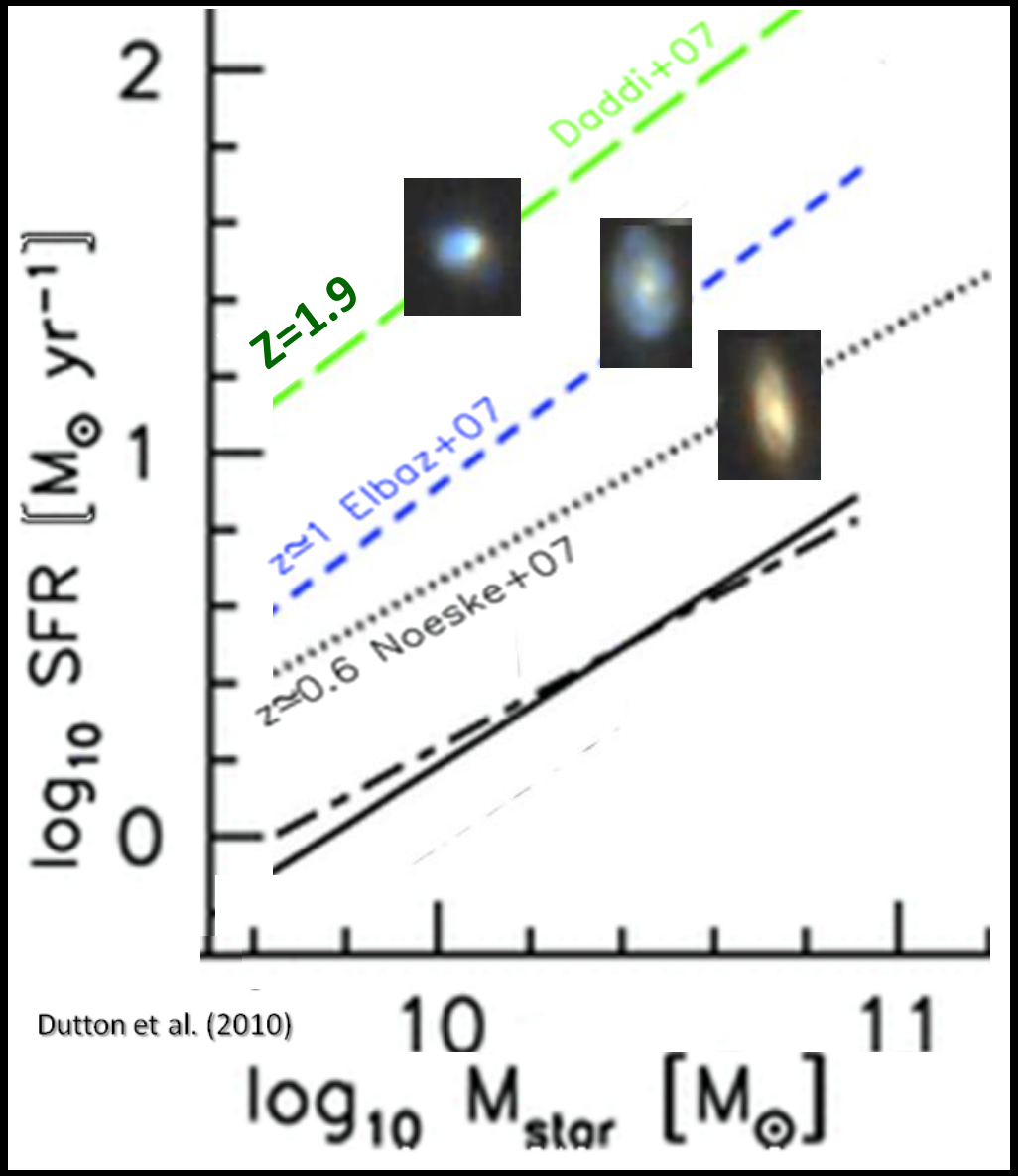

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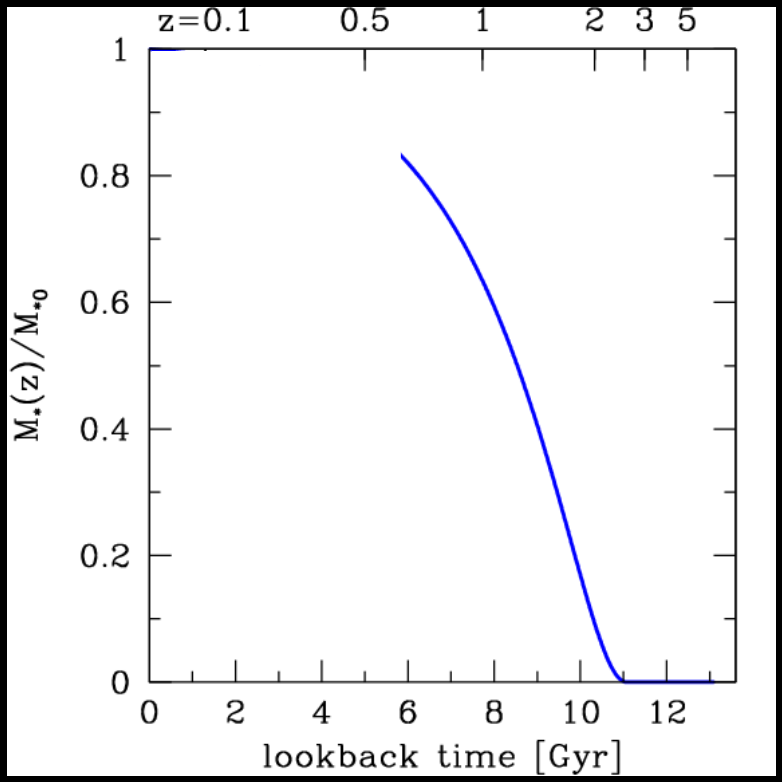

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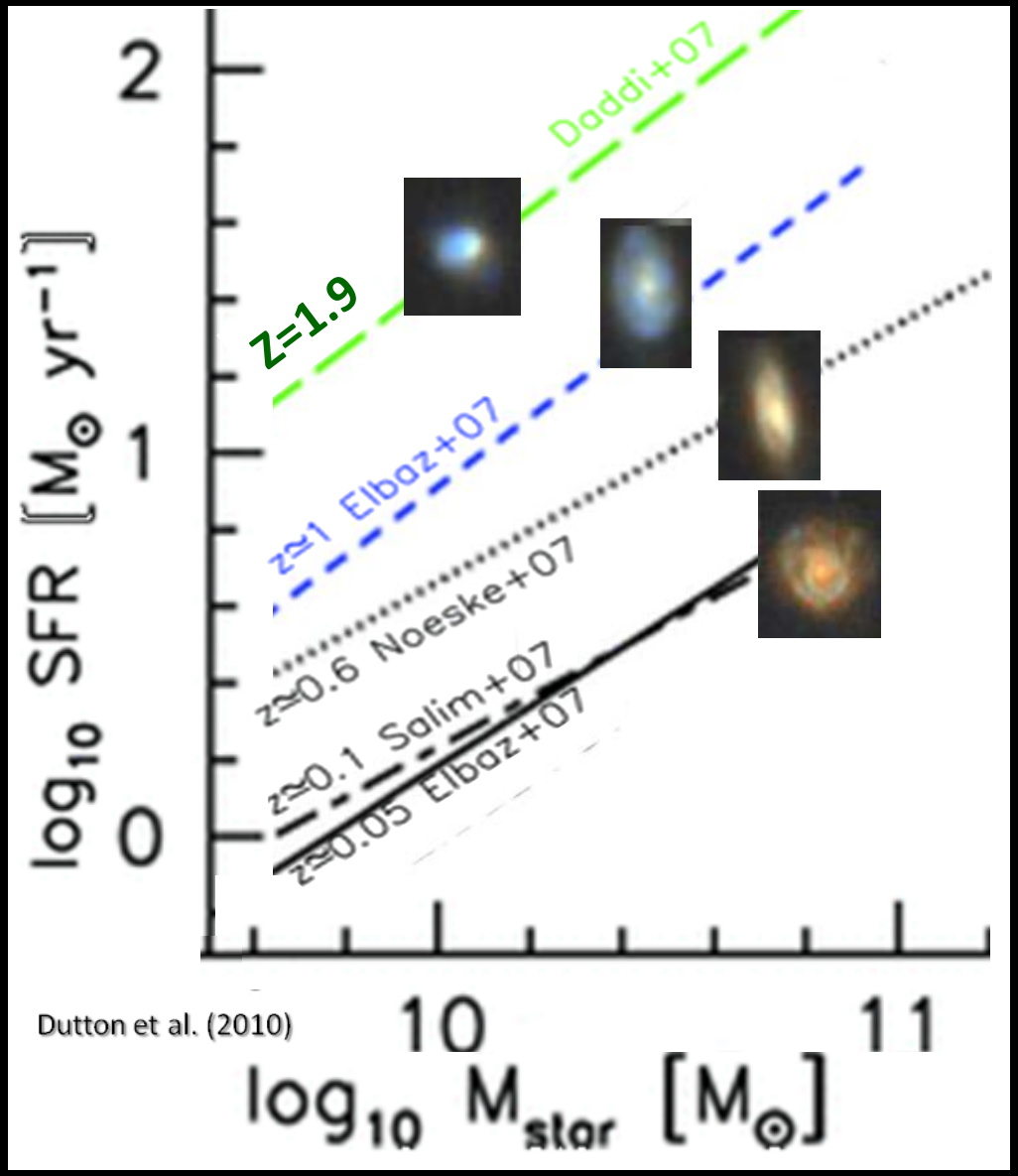

Dutton et al. (2010)

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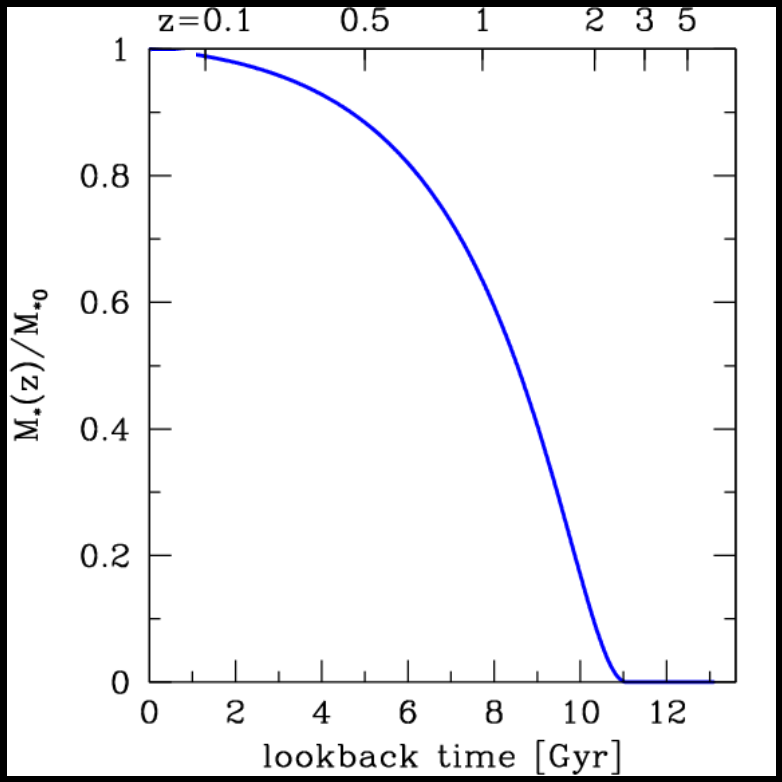

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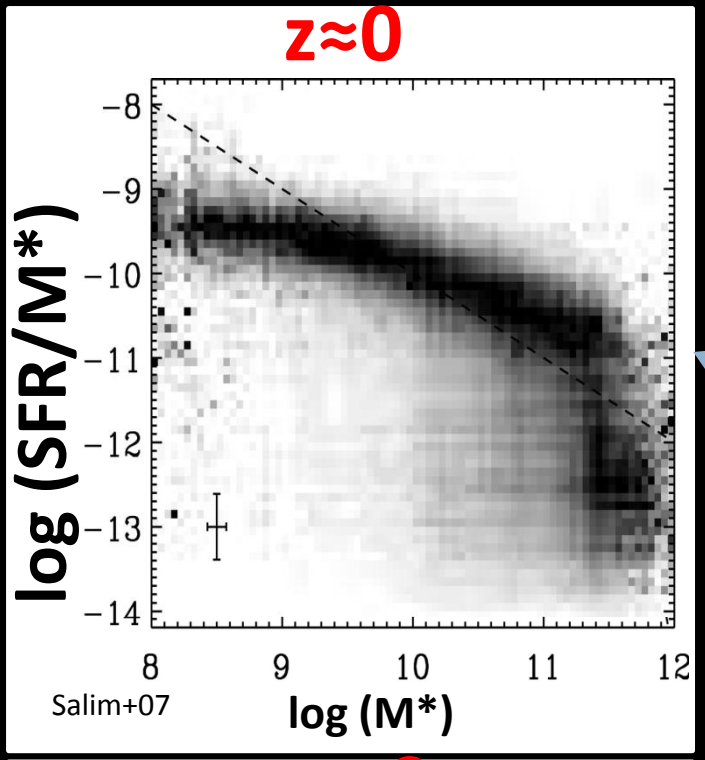

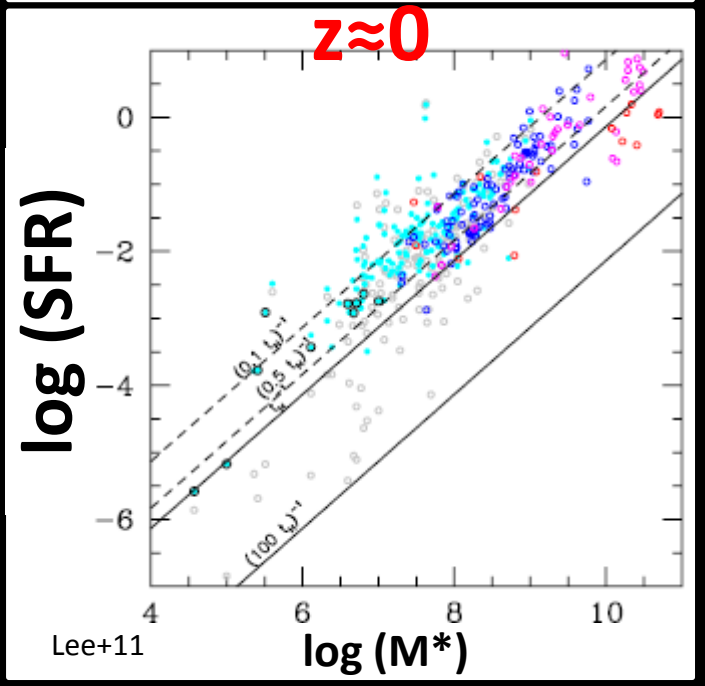

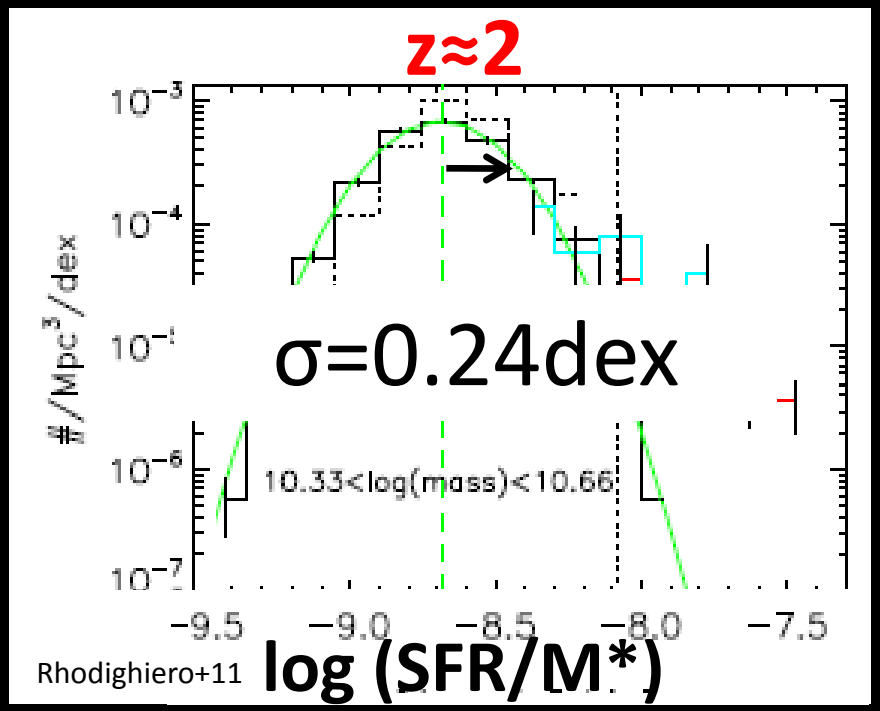

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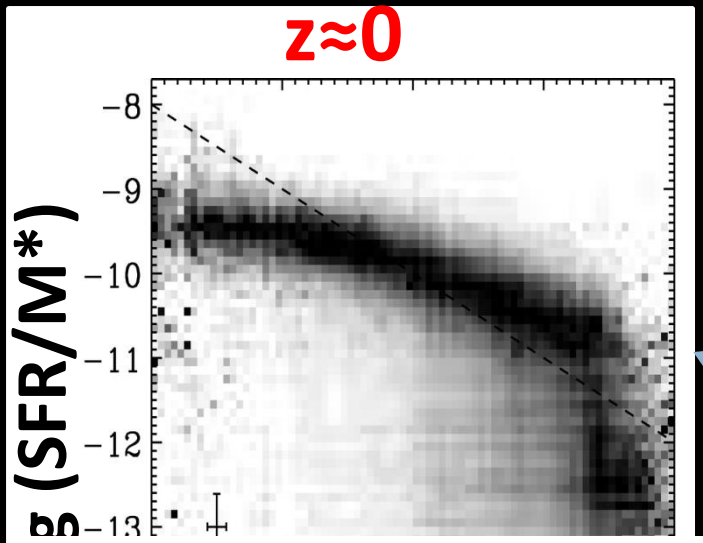
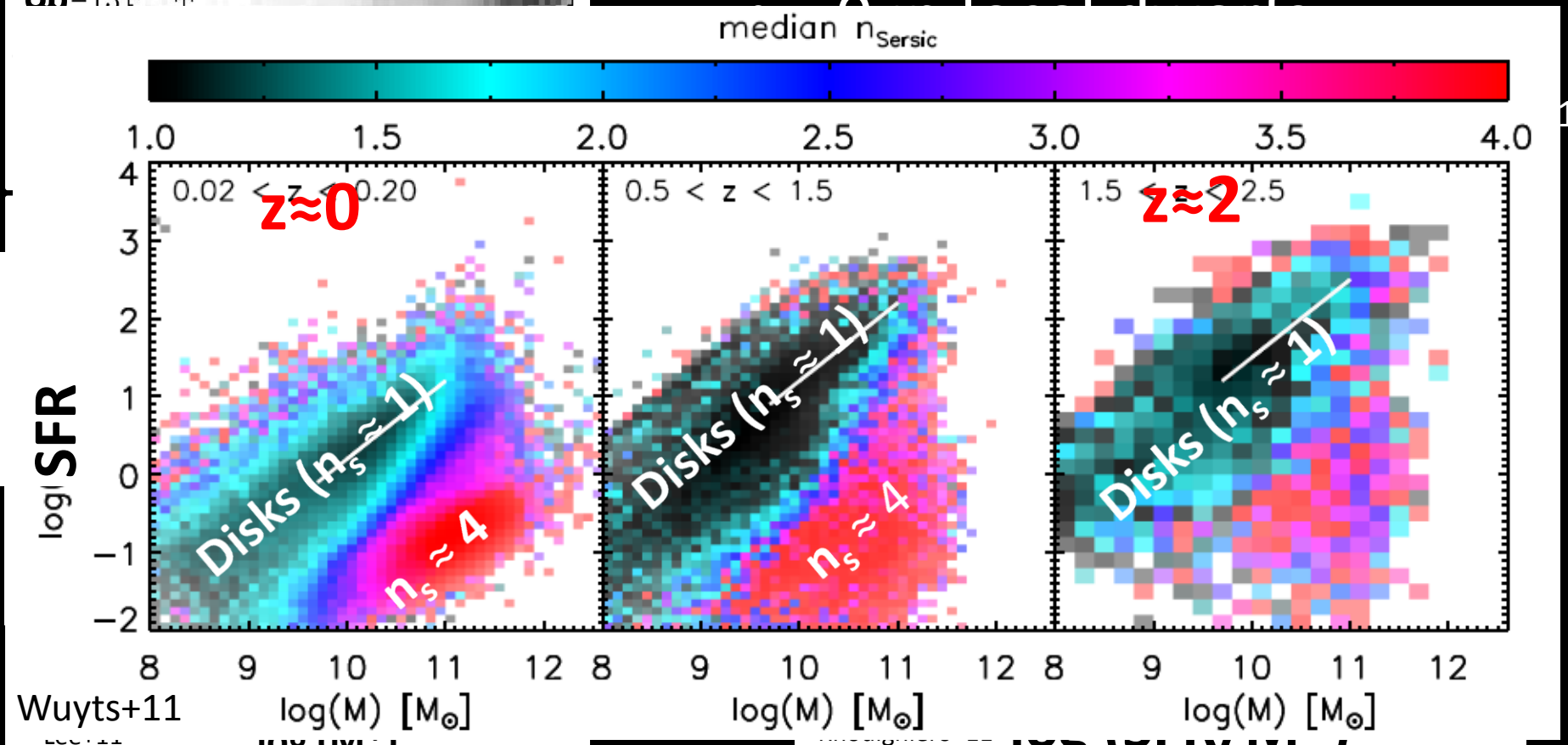
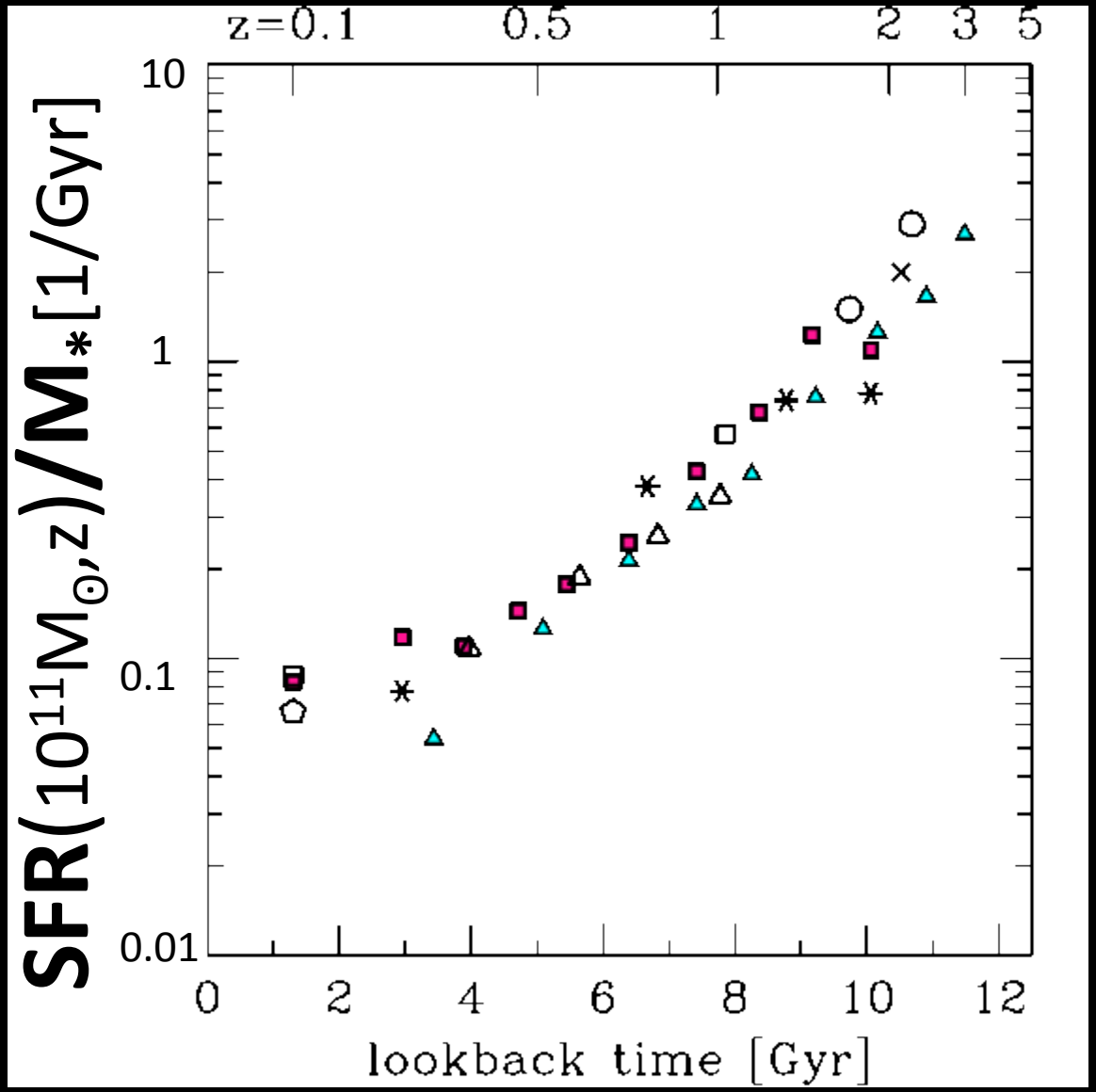




Observations: normalization of SFR-M_*



Salim et al. 2007;
Noeske et al. 2007b;
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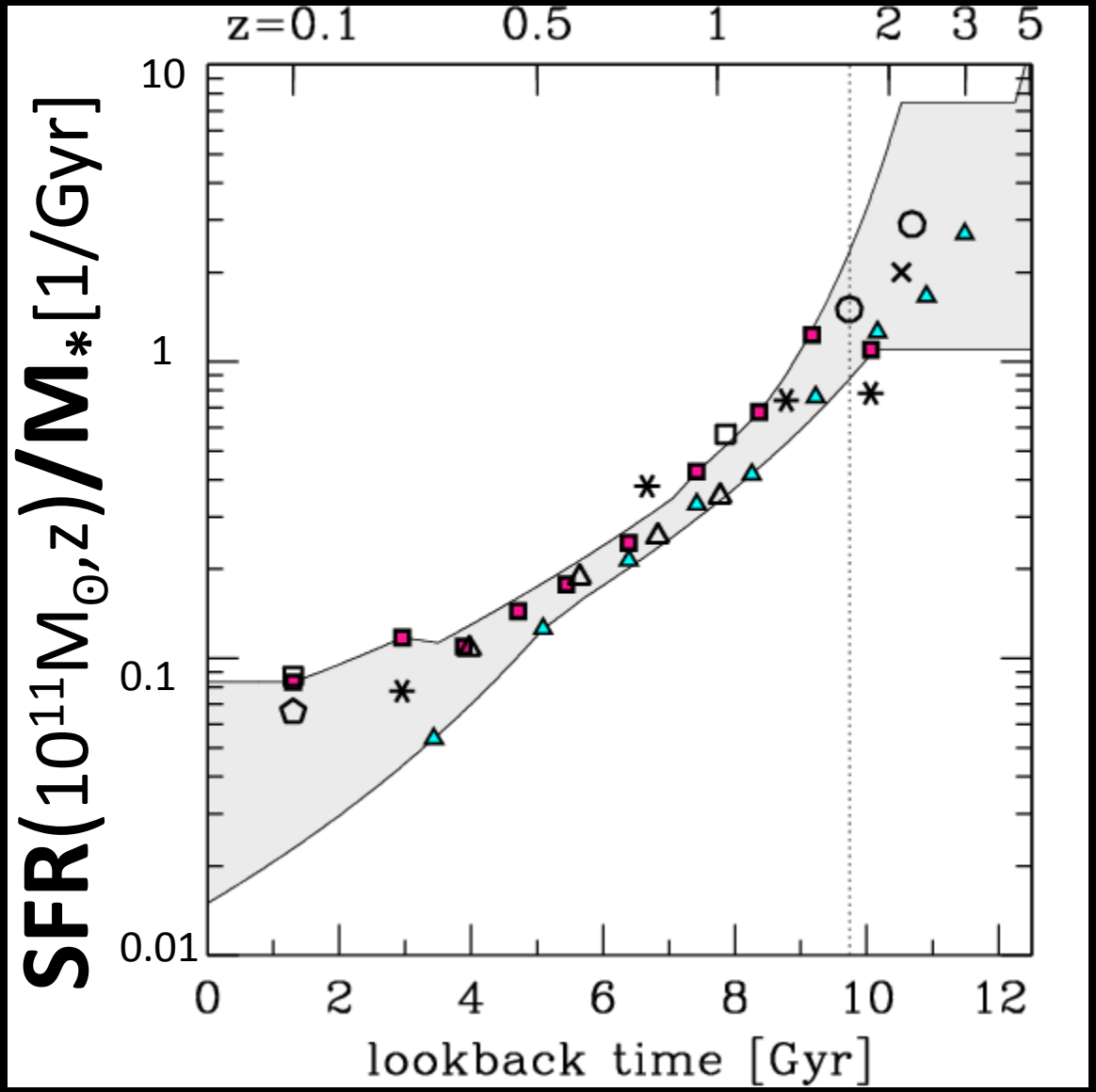

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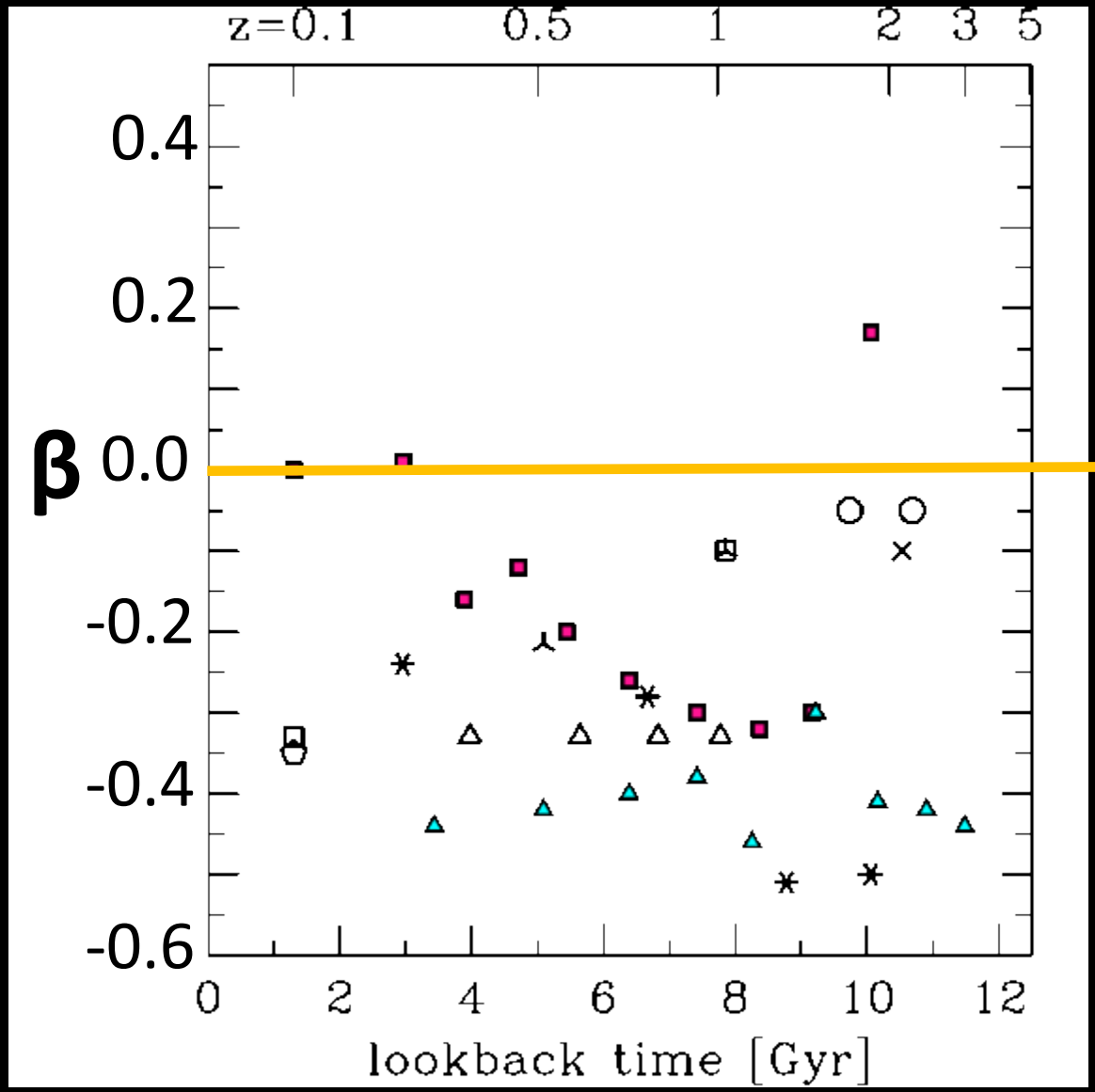

smaller galaxies grow faster (implies downsizing)

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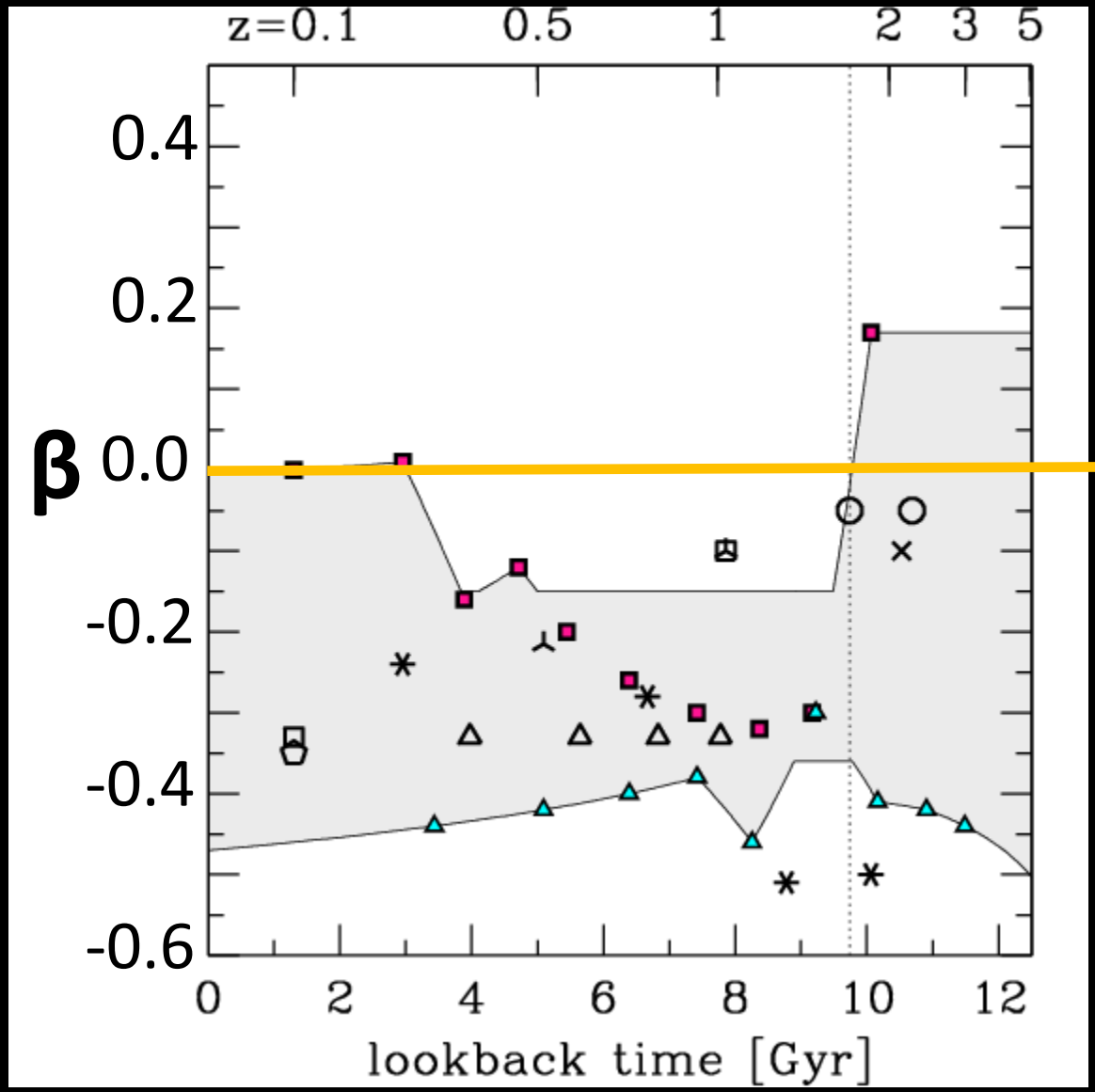

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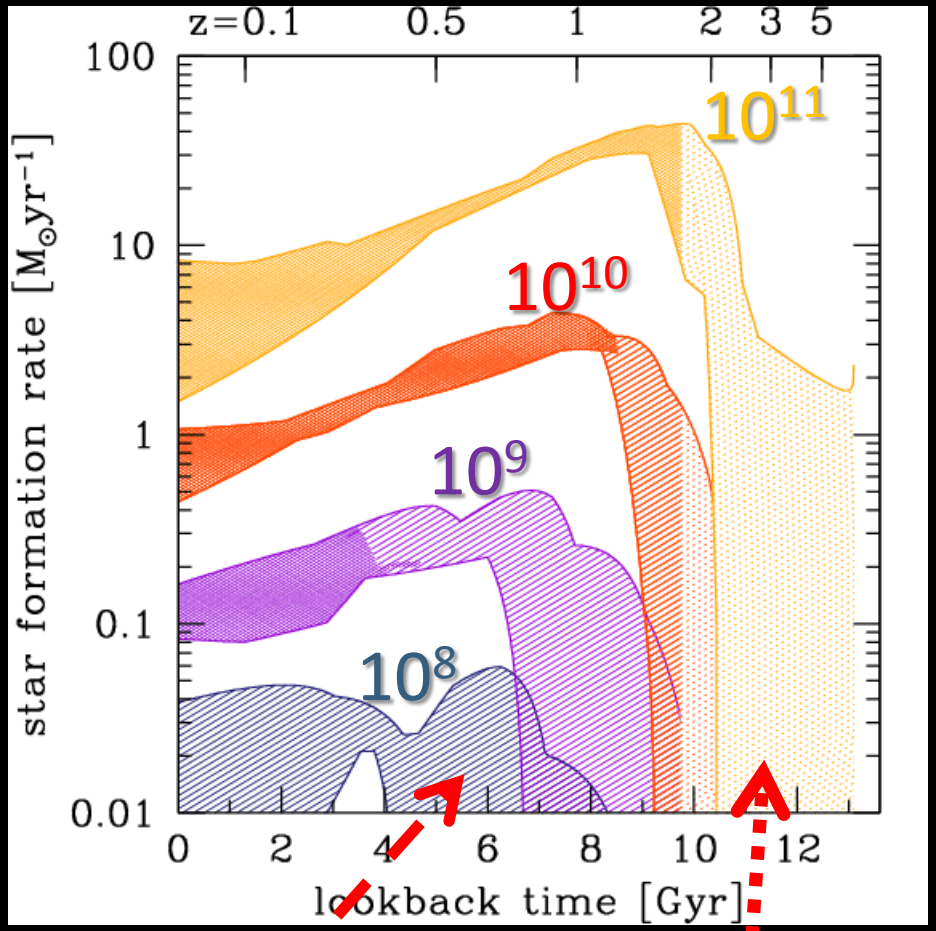
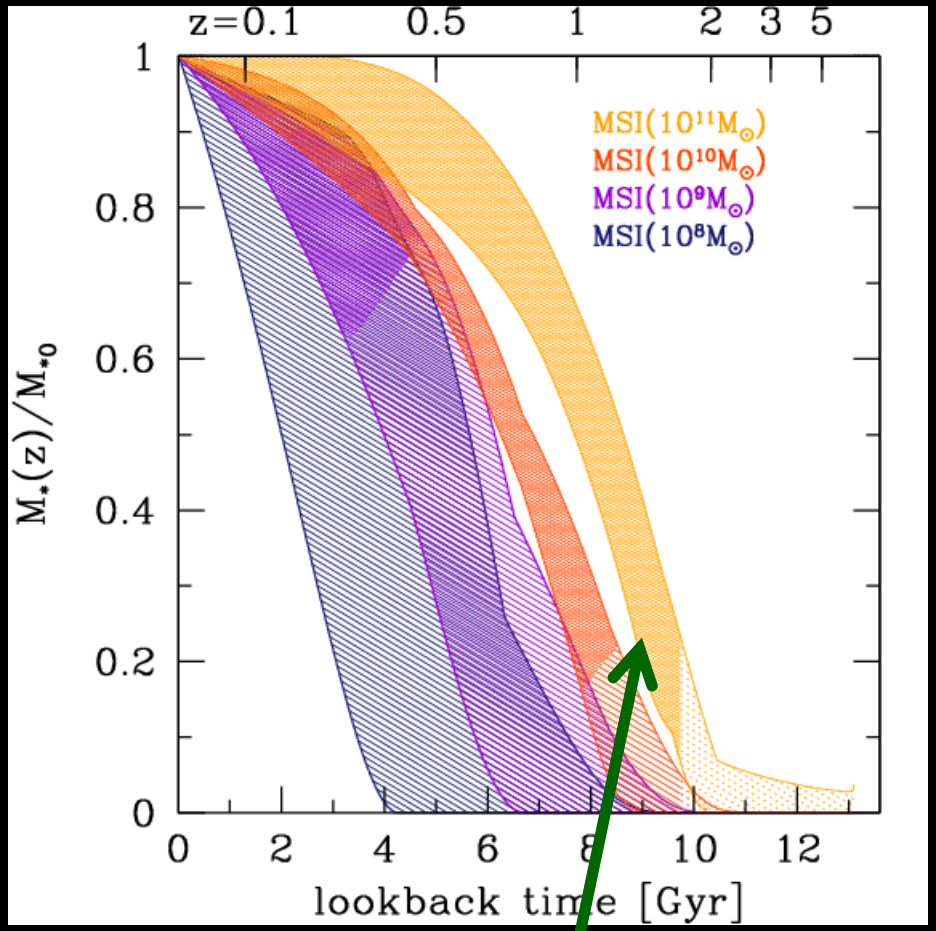
Typical stellar mass growth from main sequence integration

star formation histories



stellar mass growth



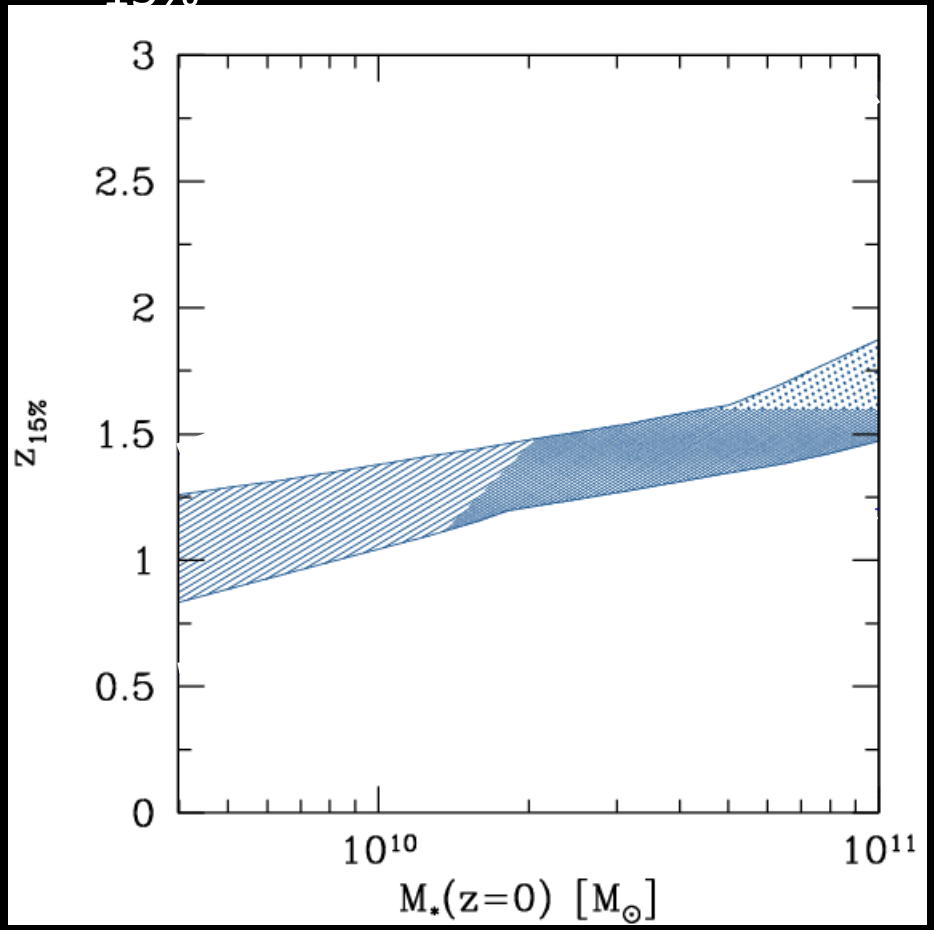
Extrapolated data

Unreliable($\rho_{SFR} \neq \Delta\rho_*$)

Robust early growth

Quantifying the late formation of star forming galaxies

$z_{15\%}$: $M(z)=0.15M_*(z=0)$



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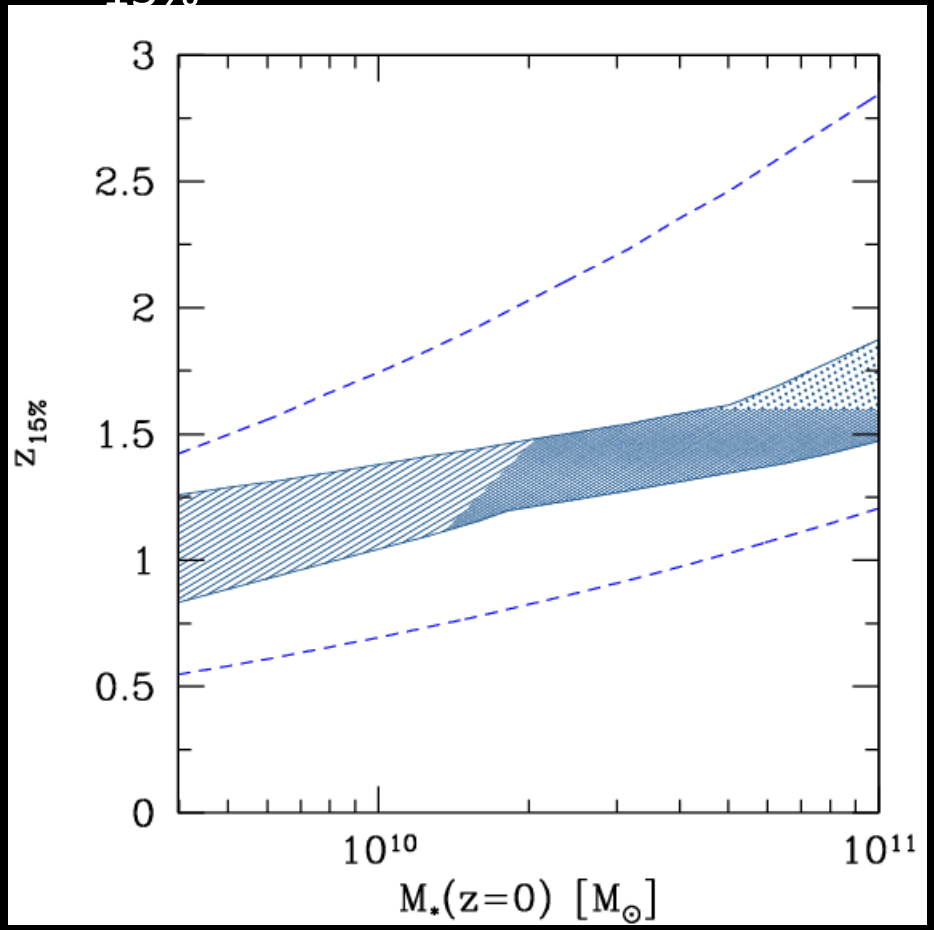

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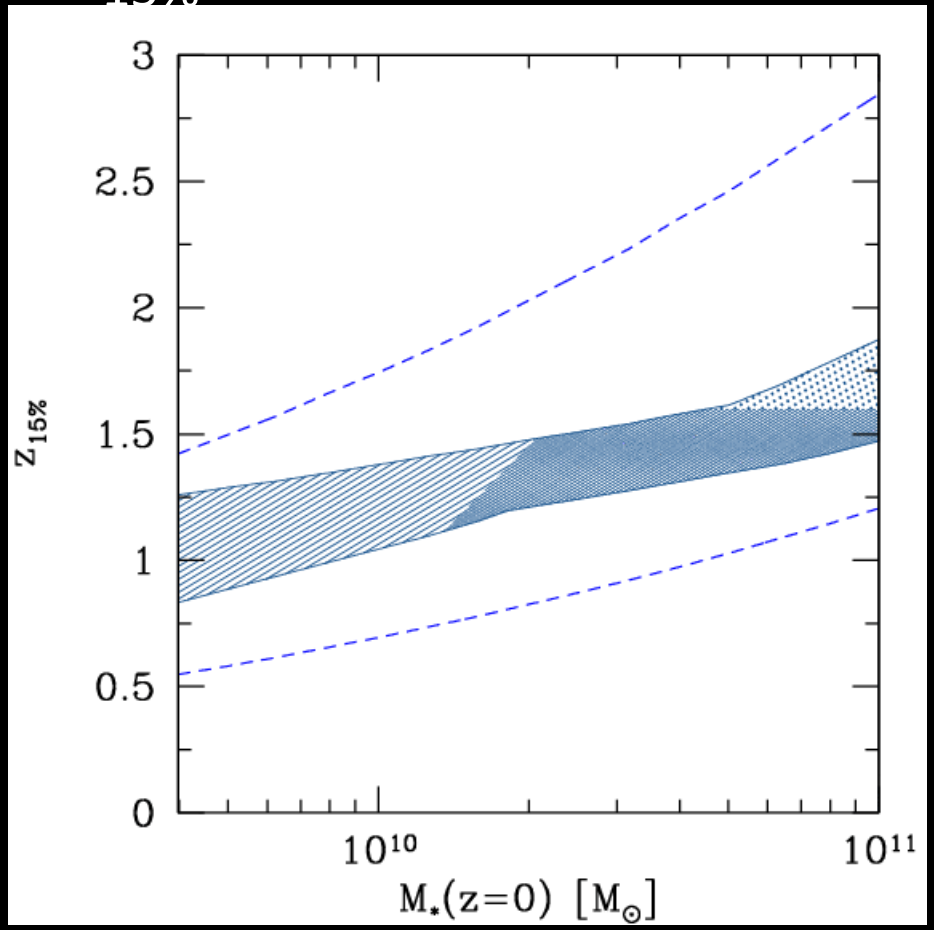
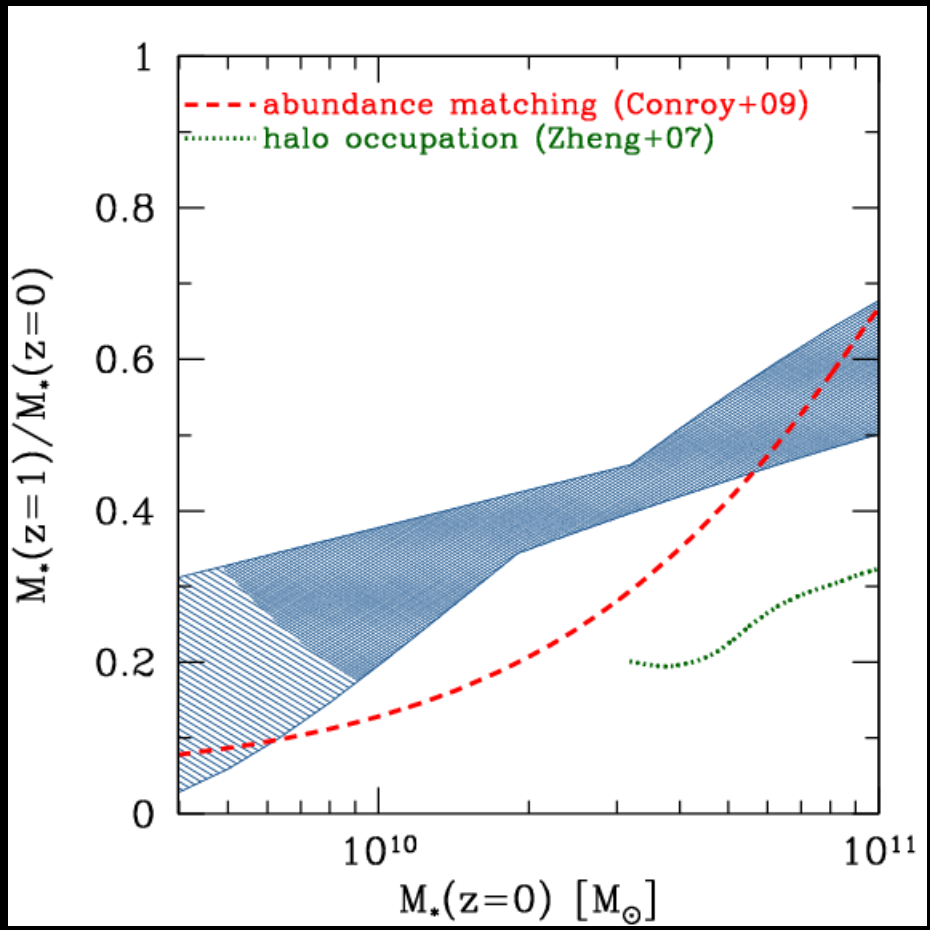


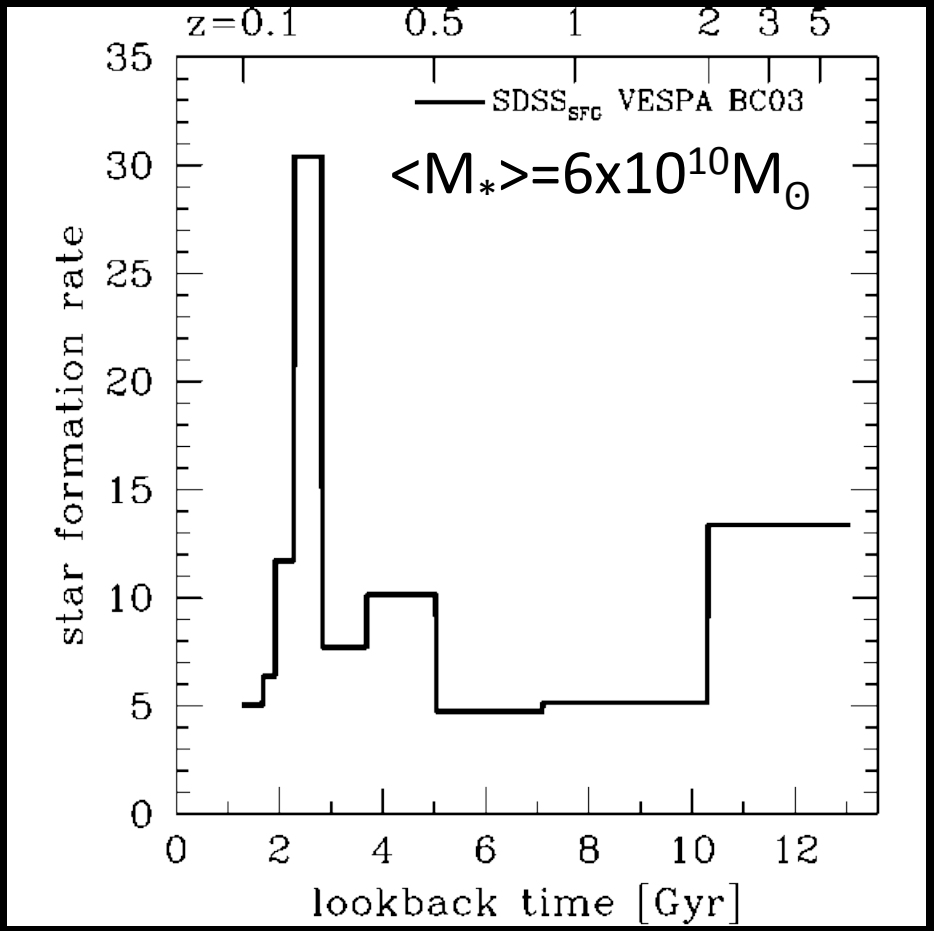
stellar mass at z=1



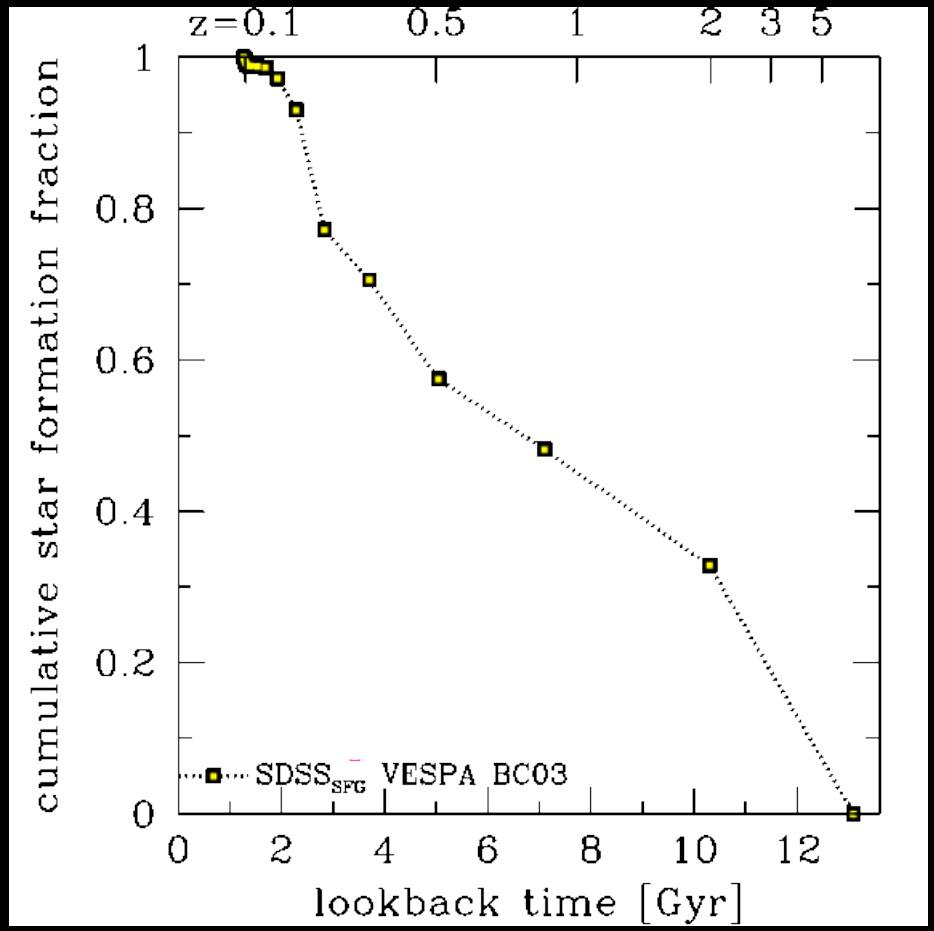
Stellar mass growth from spectra

Averaged SED-based SFHs of ~50,000 SDSS star-forming galaxies of $10^{10.5}$-$10^{11}M_{\odot}$ from the VESPA Database

star formation histories

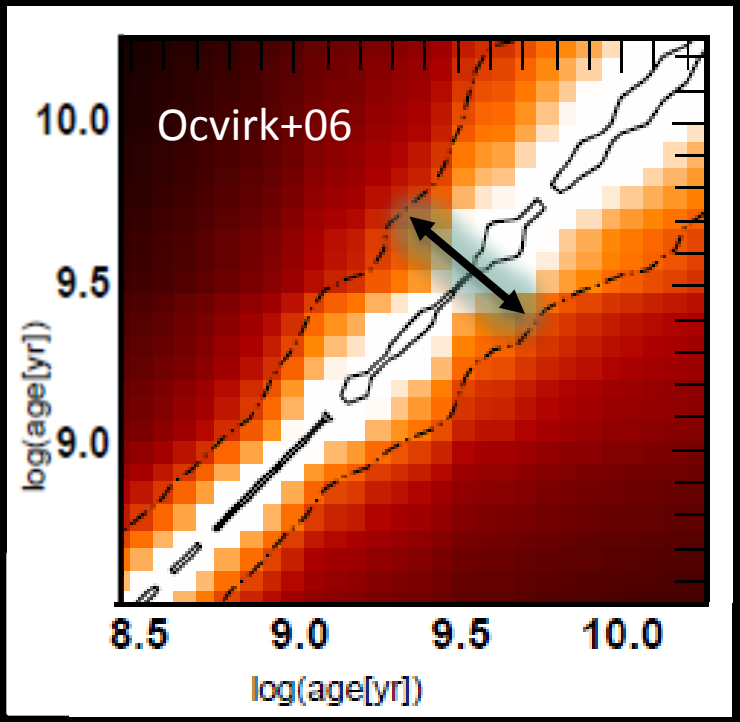


stellar mass growth



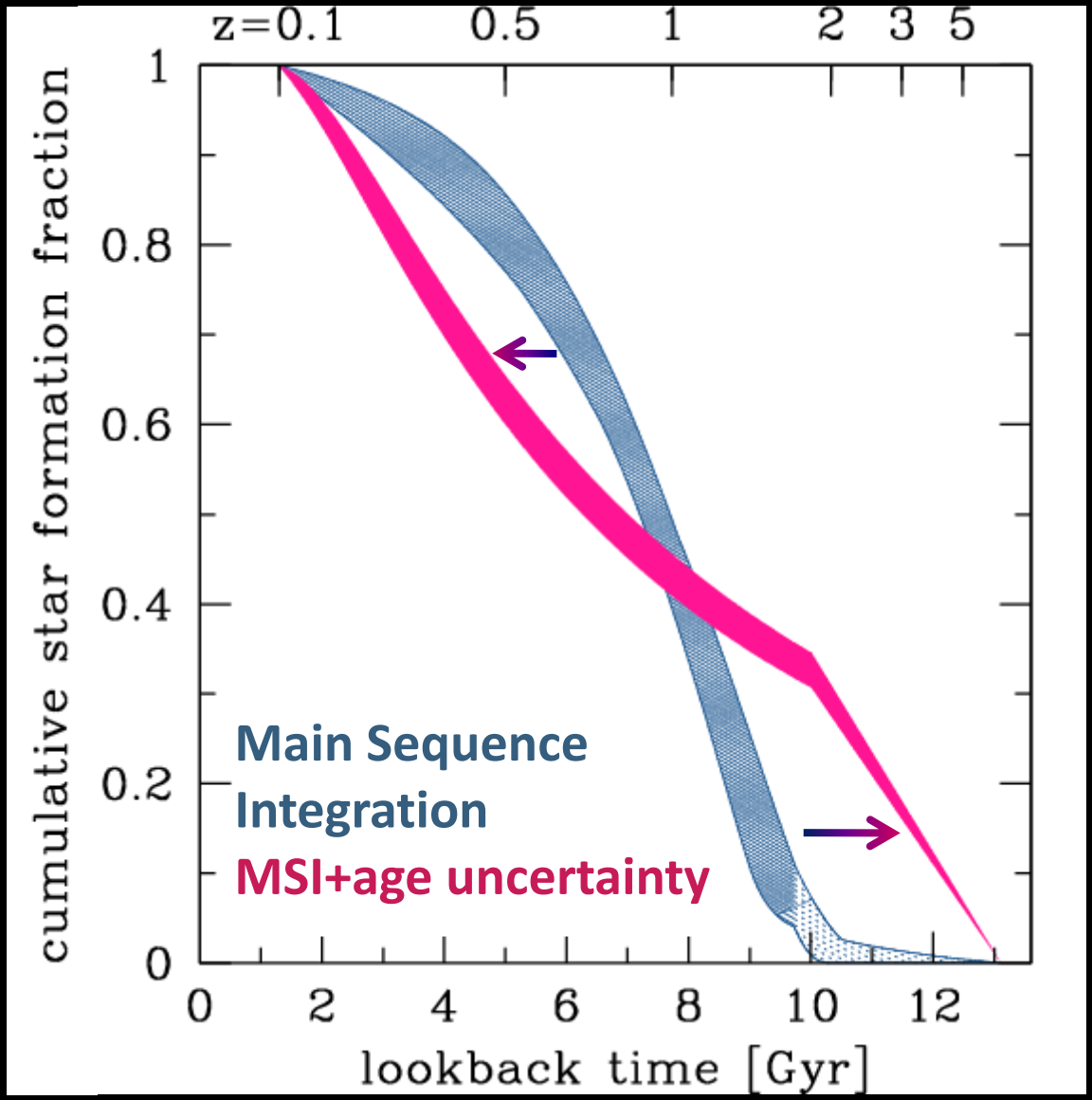
Mimicking age uncertainty

SSPs with typical SDSS signal-to noise are not distinguished over <0.5dex:

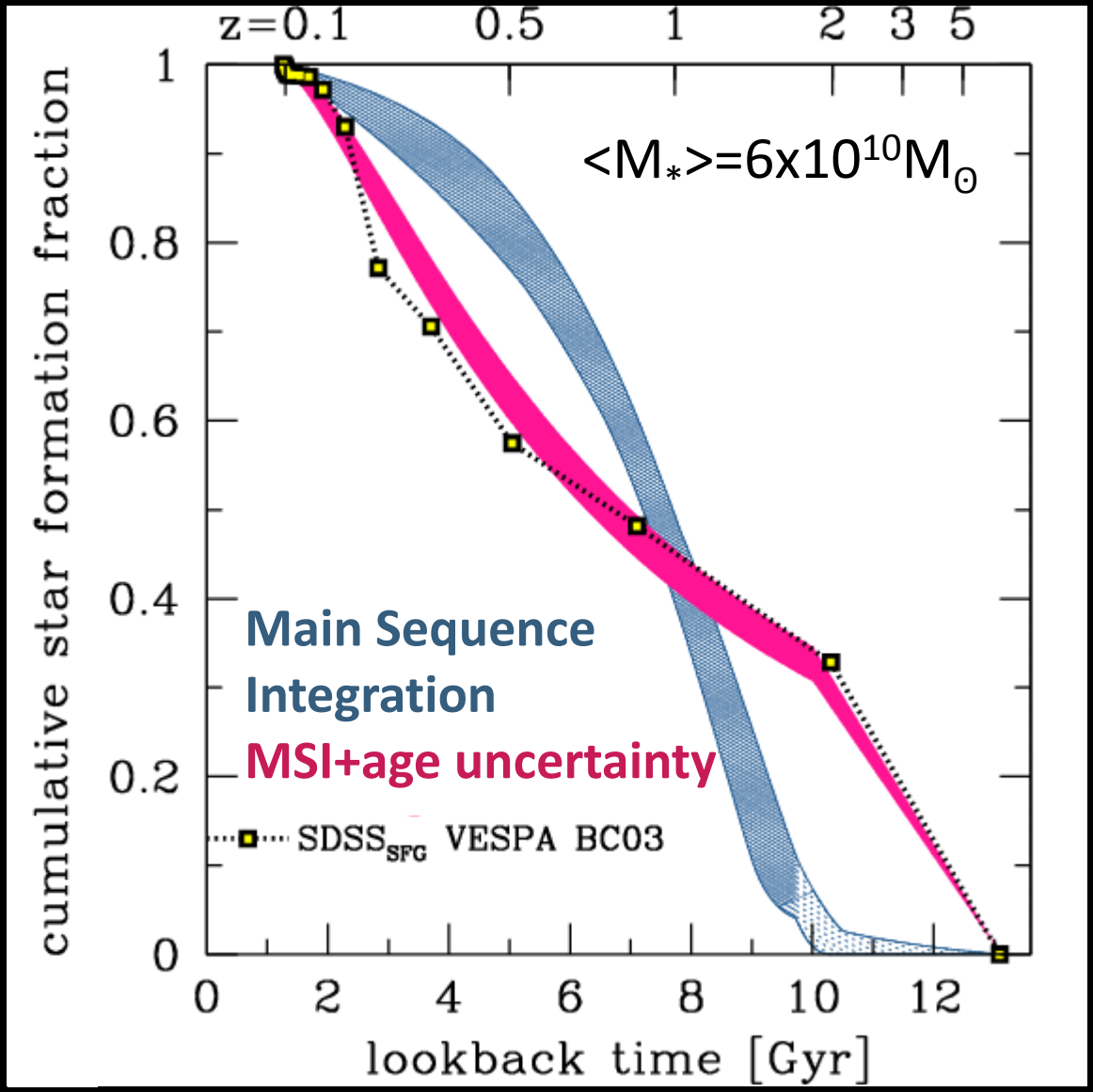


Tests show little bias, but resolution~1dex for non-SSPs with unknown metallicity

->Smooth by σ=0.5dex in log-age



Main sequence integration and SEDs



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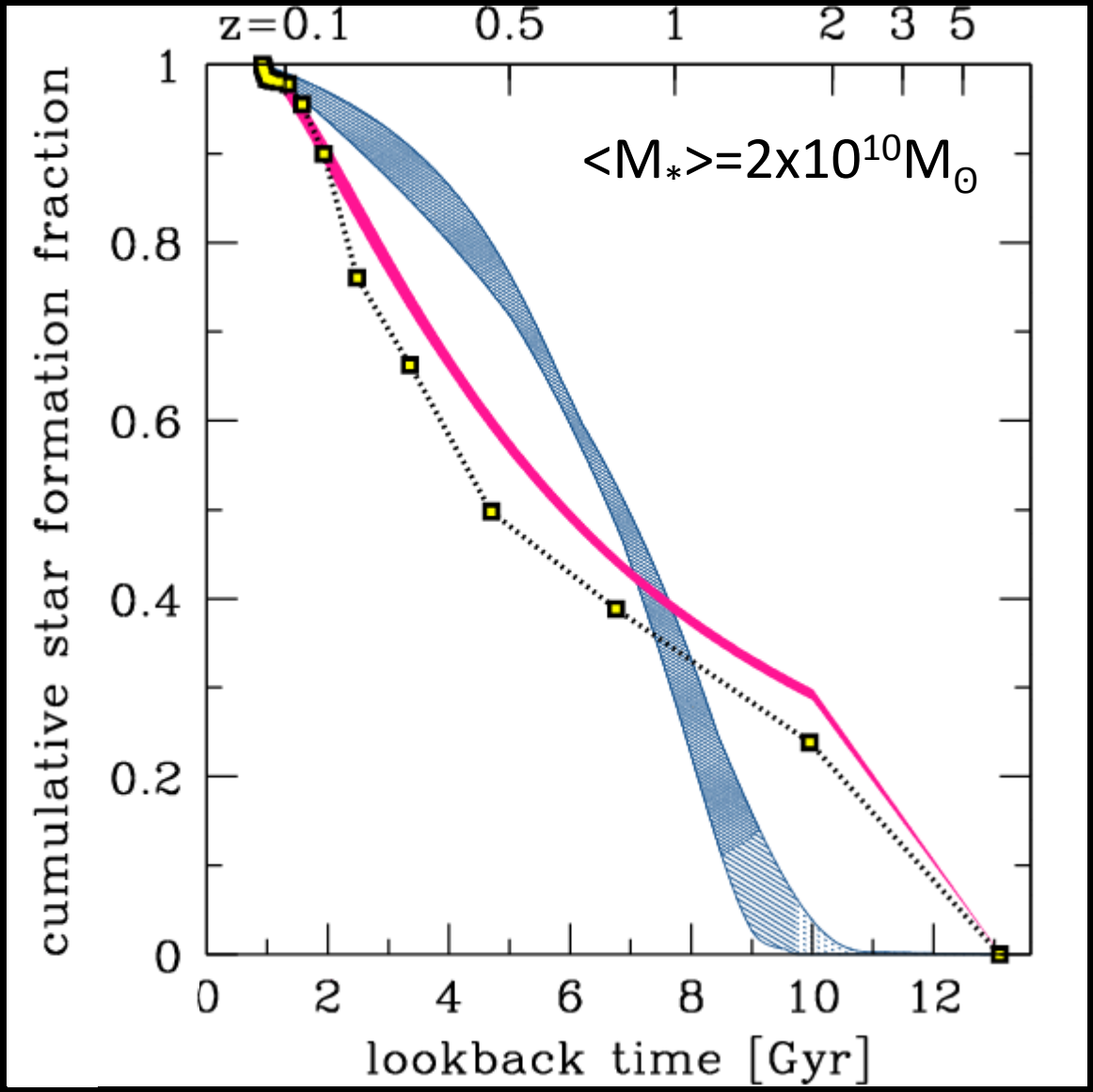

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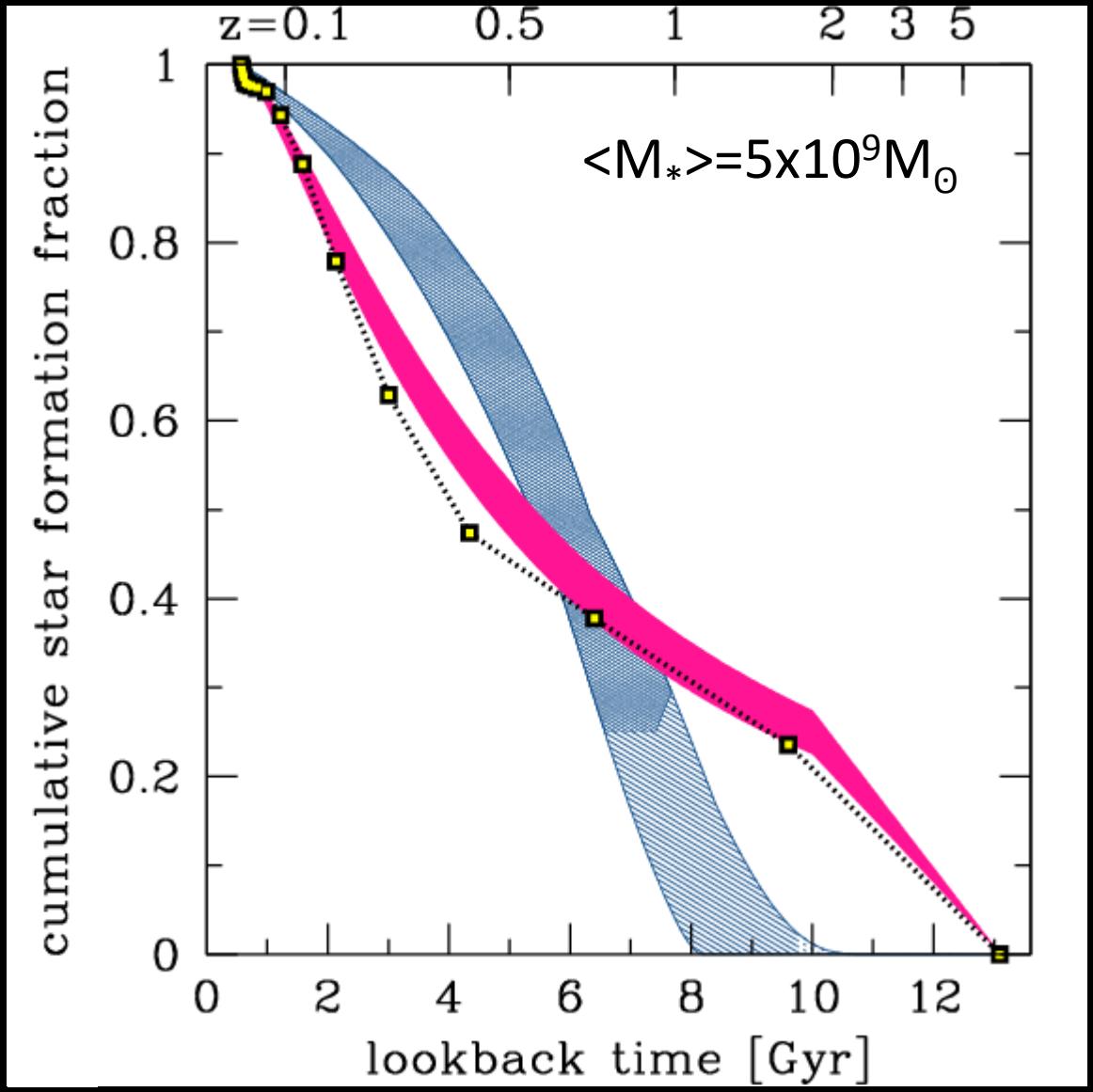

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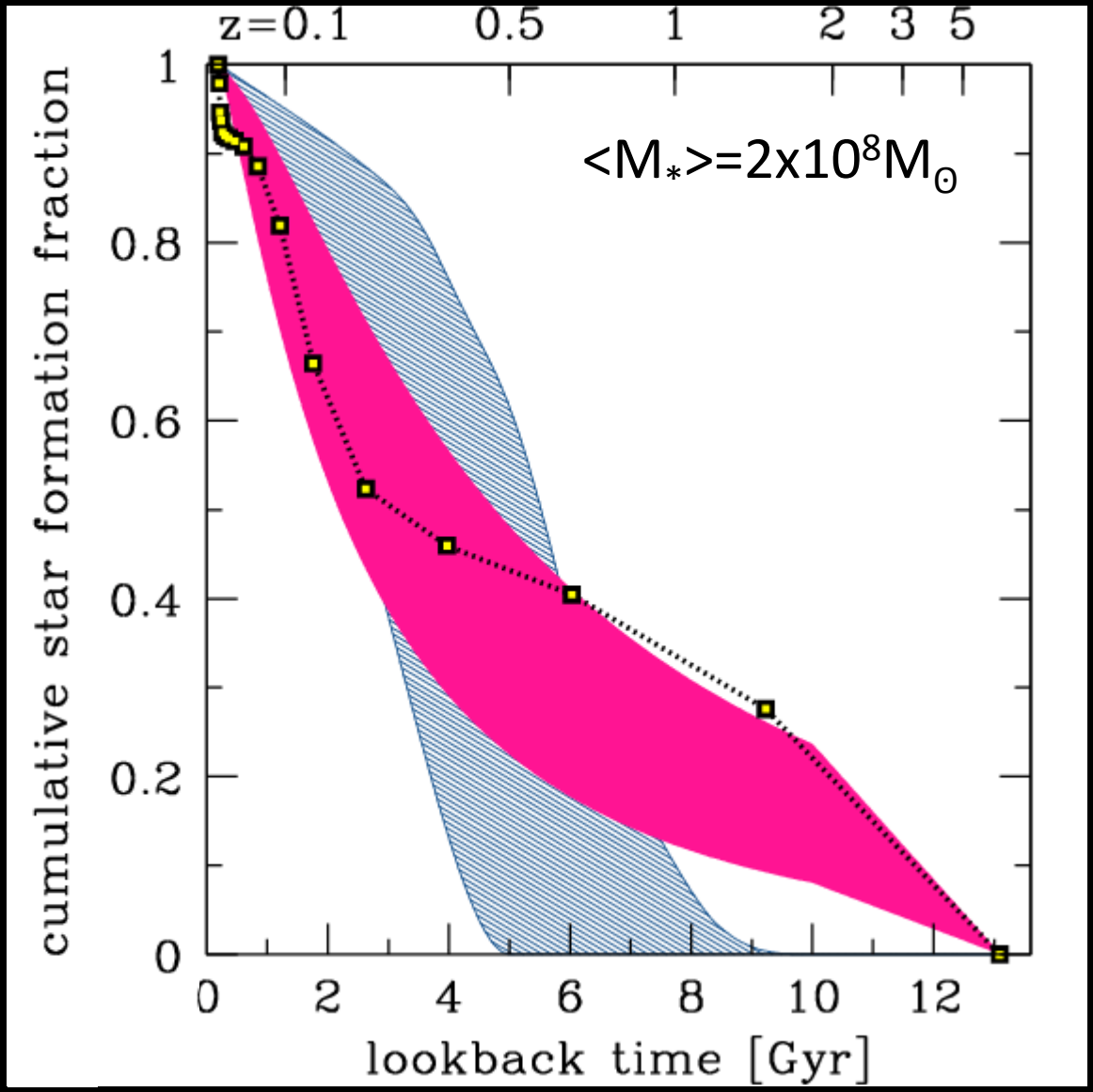
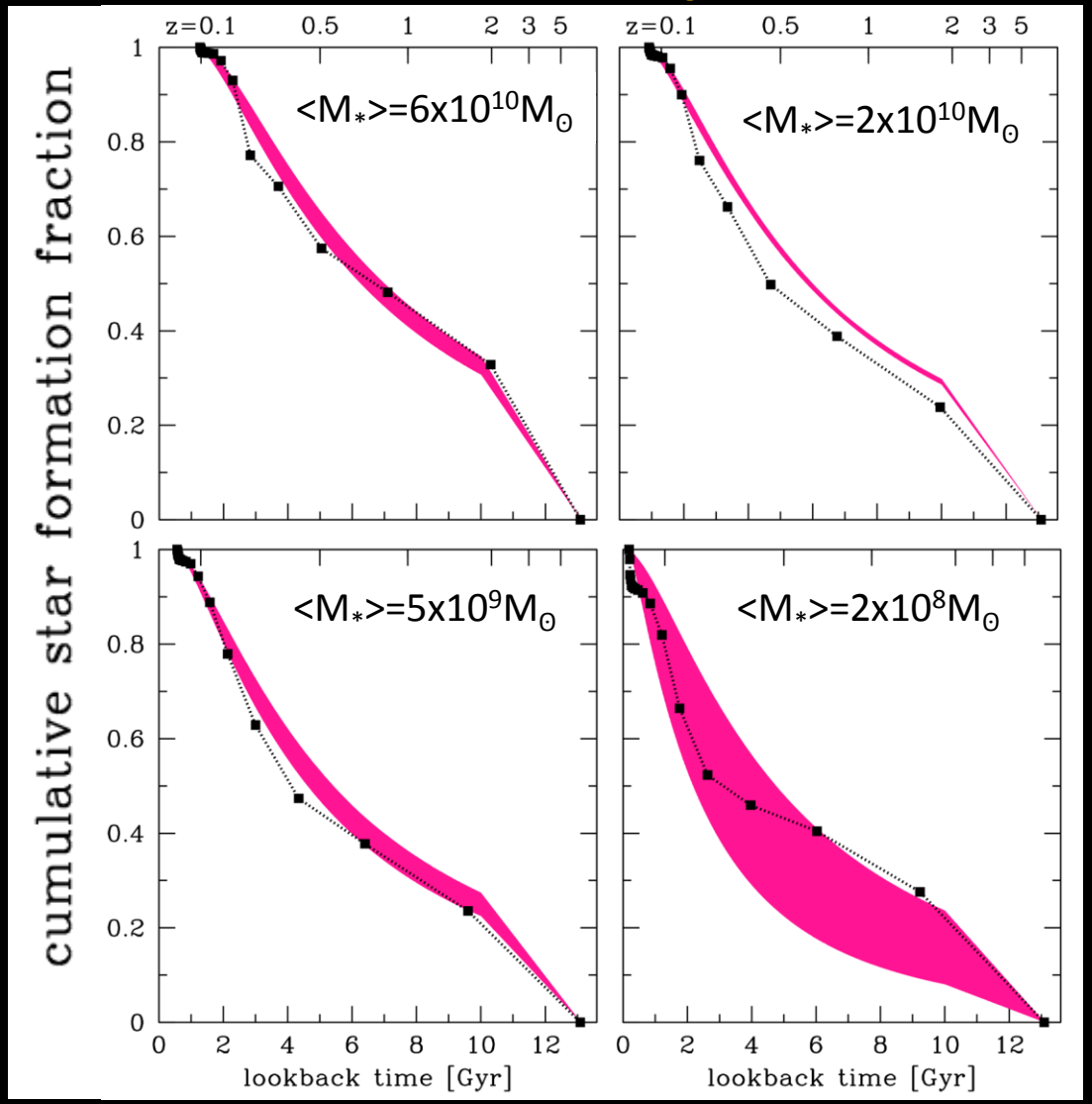
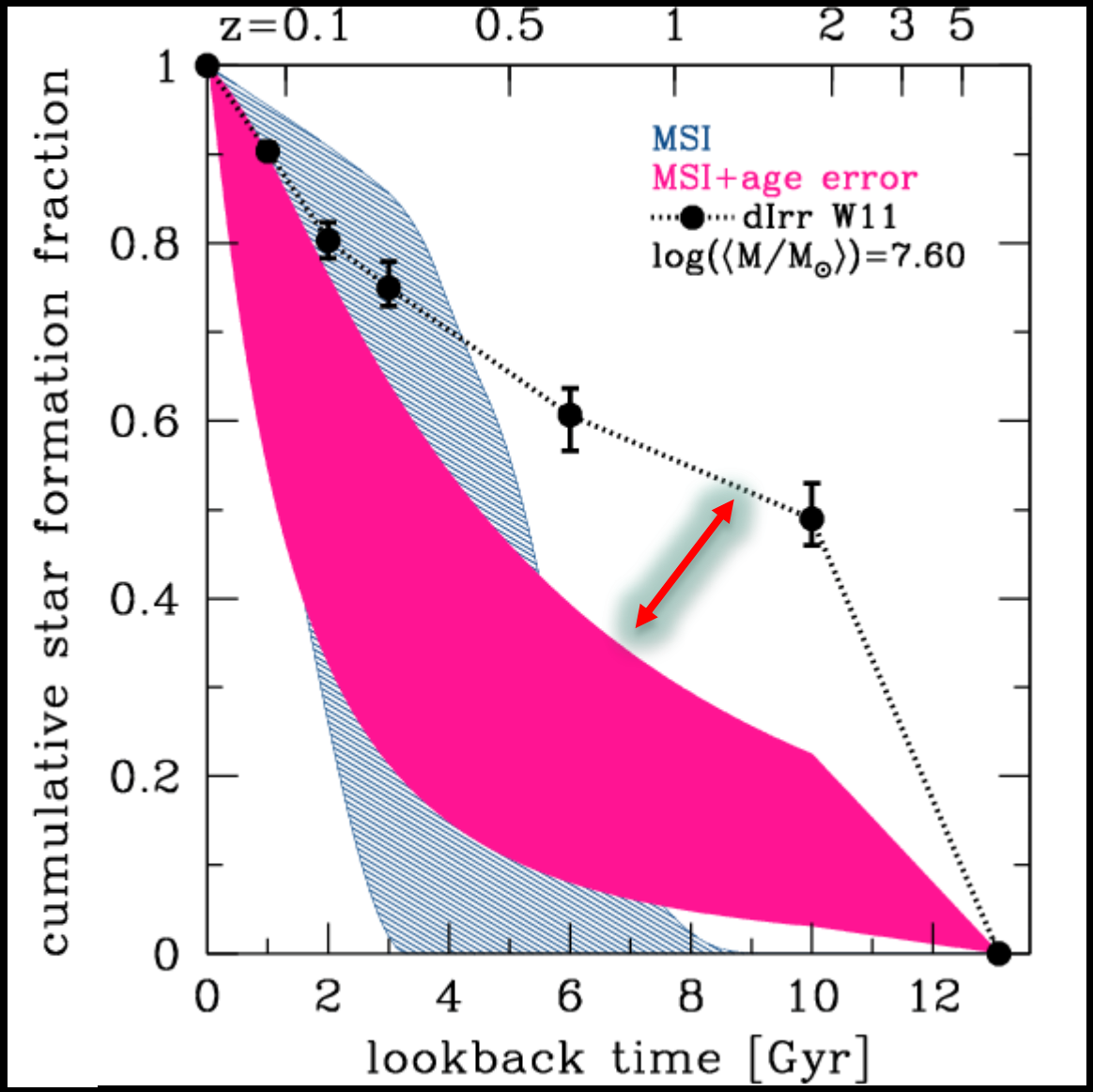


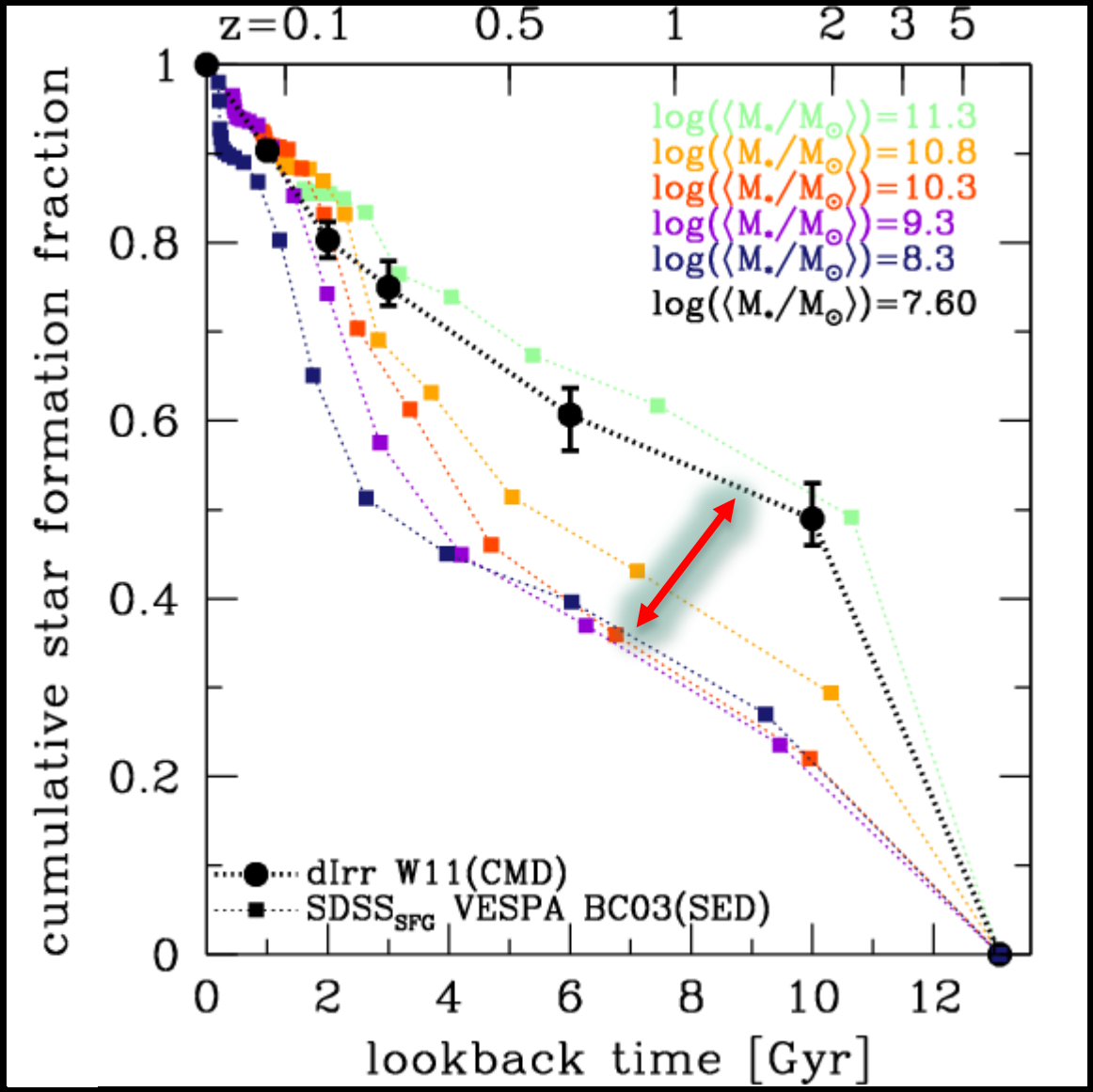
Consistency between SEDs and the main sequence



A transition at low masses?



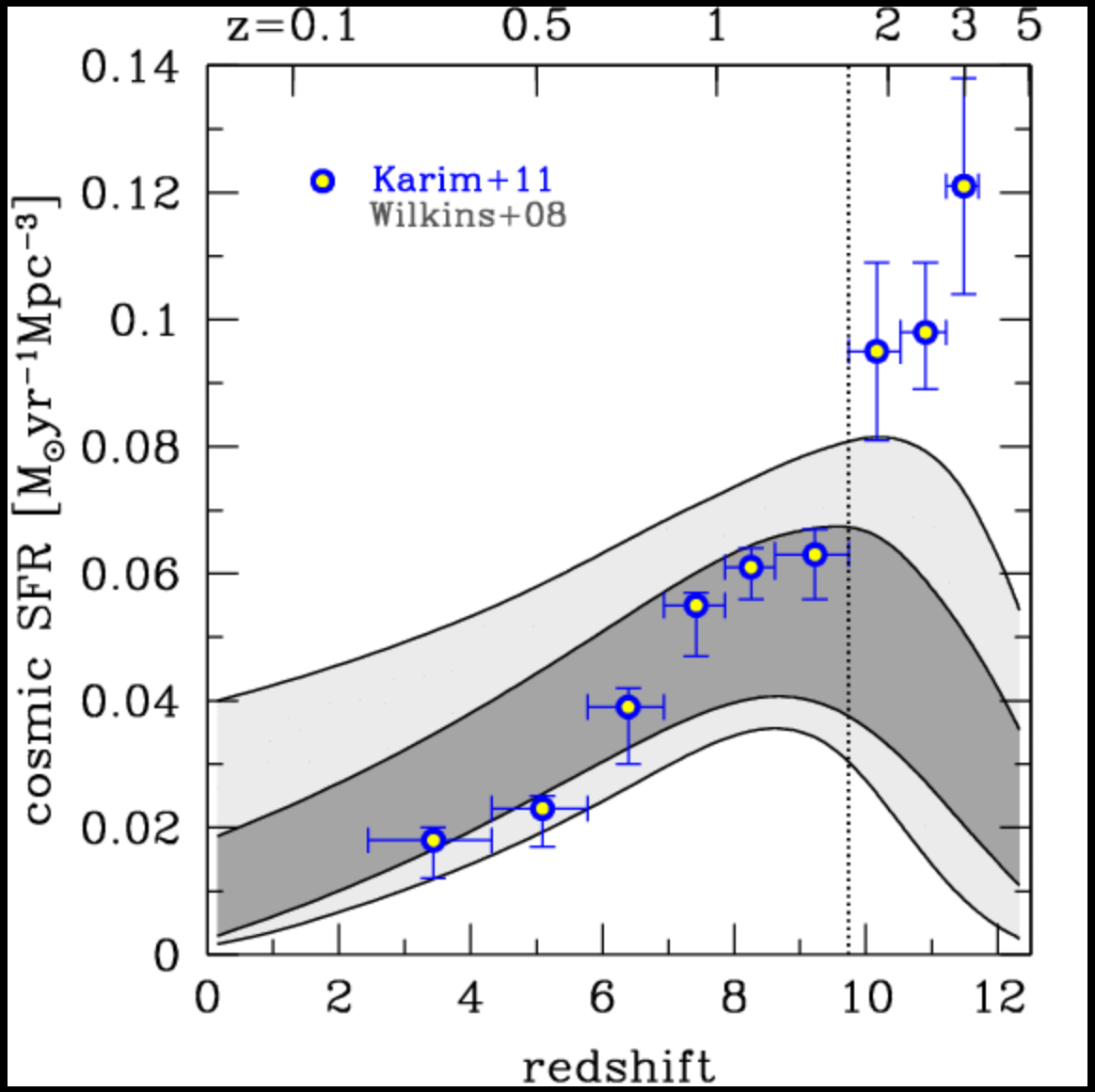
A transition at low masses?
An SED/CMD discrepancy?



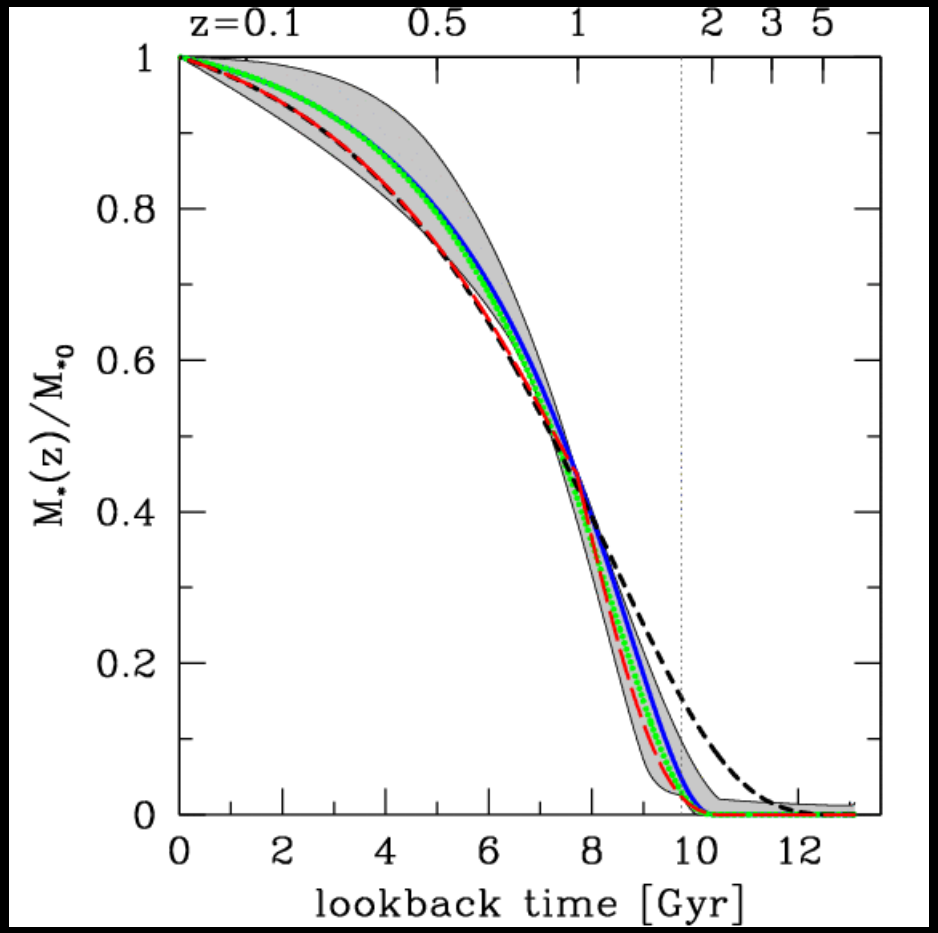
Summary and Conclusions

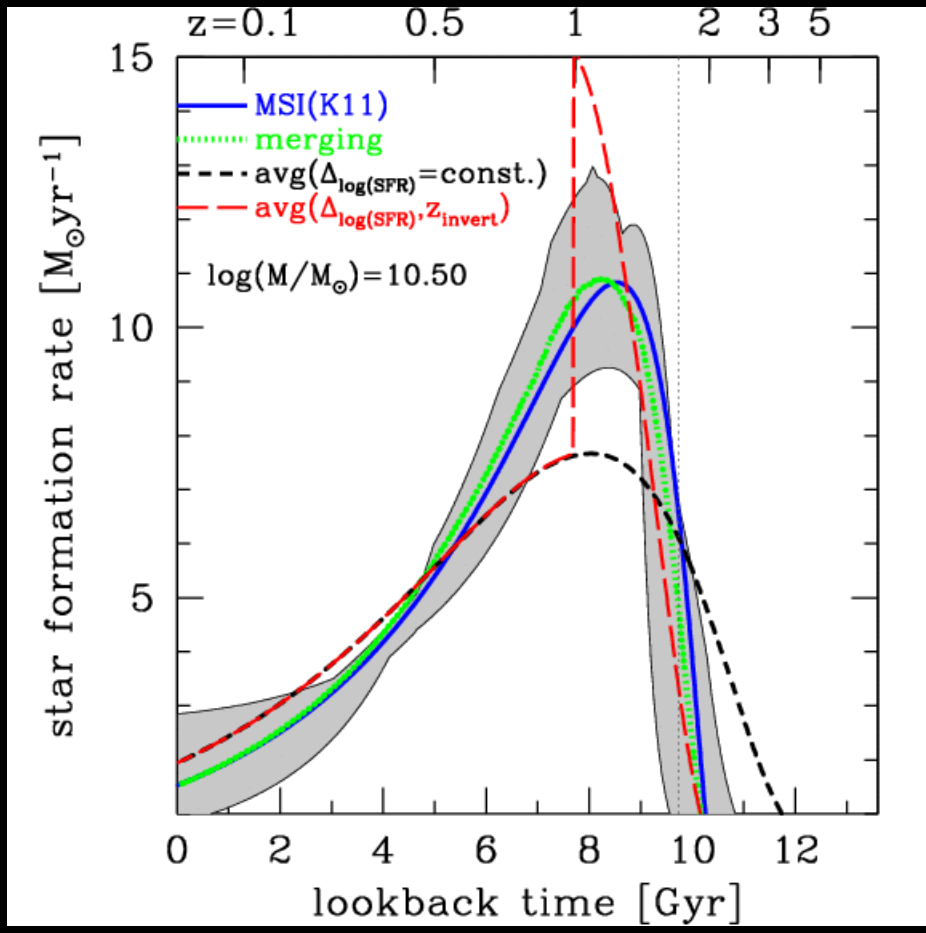
- The main sequence of star formation can be integrated to calculate stellar mass growth in star forming galaxies back to **10-20%** of current stellar masses.
- Less than 15% of stellar mass (median bulge mass) is in place in star forming galaxies of about $M_*=1\text{-}5x10^{10}$ SFGs at $z>2$.
- SED-based star formation histories are consistent with SFR-M_* and its evolution after accounting for age uncertainties.
- Local CMD-analyzed dwarfs formed early(?) compared to SED and main sequence extrapolations.
- Details: merging, $\rho_{SFR} \neq \Delta\rho_*$, effect of scatter in SFR-M_*, other high S/N SED- and CMD-based disk observations.

arXiv:1108.0938


z=0.1
0.5
1
2
3
5
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
cosmic SFR [M$_\odot$yr^{-1}Mpc^{-3}]
Karim+11
Wilkins+08
0
2
4
6
8
10
12
redshift

Merging and Scatter





The effect of age resolution on mass growth in SED-based SFHs