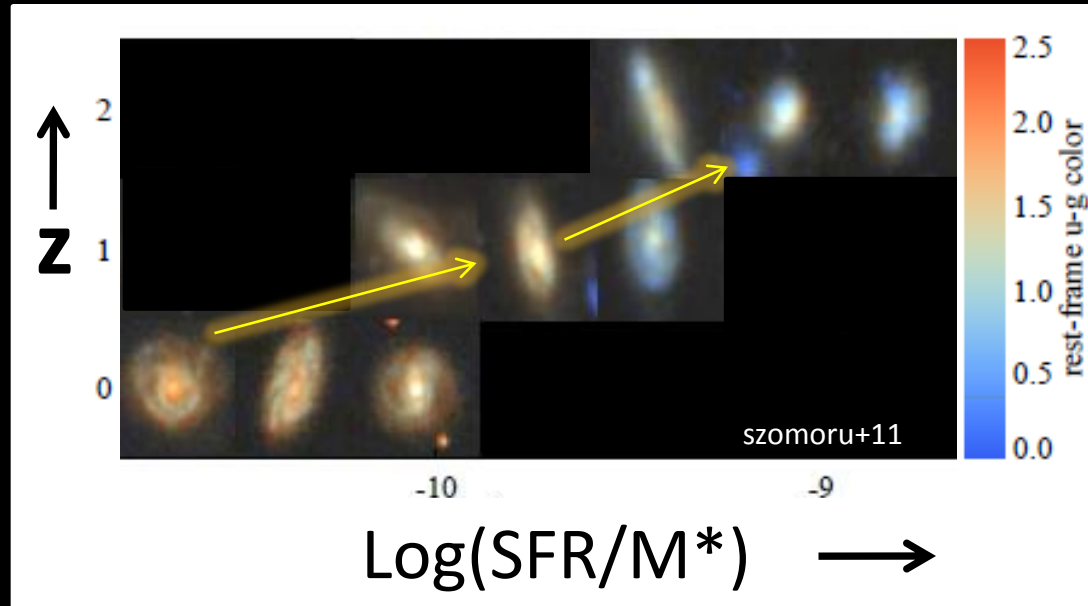


On the last 10 billion years of stellar mass growth in star-forming galaxies



Sam Leitner (University of Chicago)

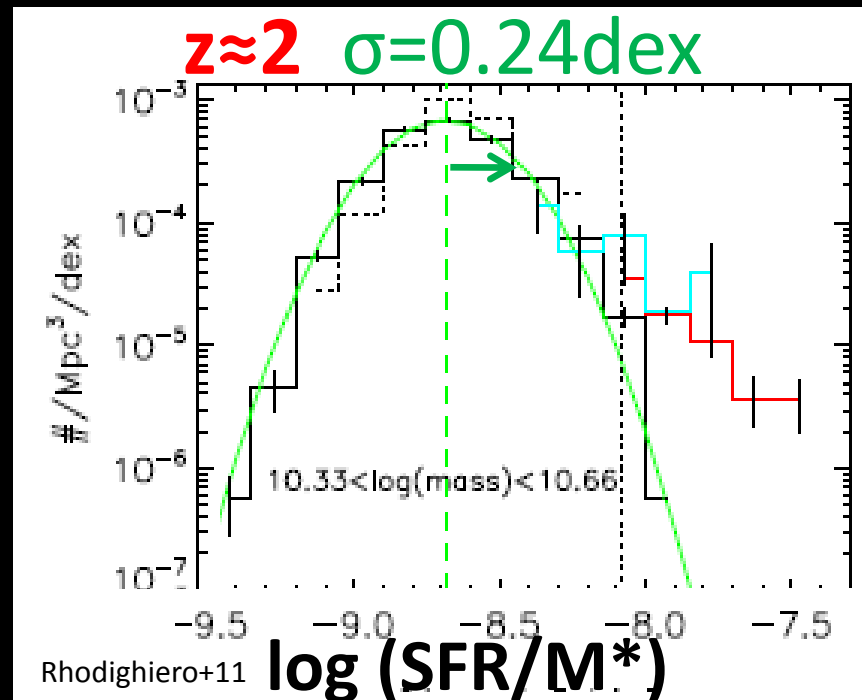
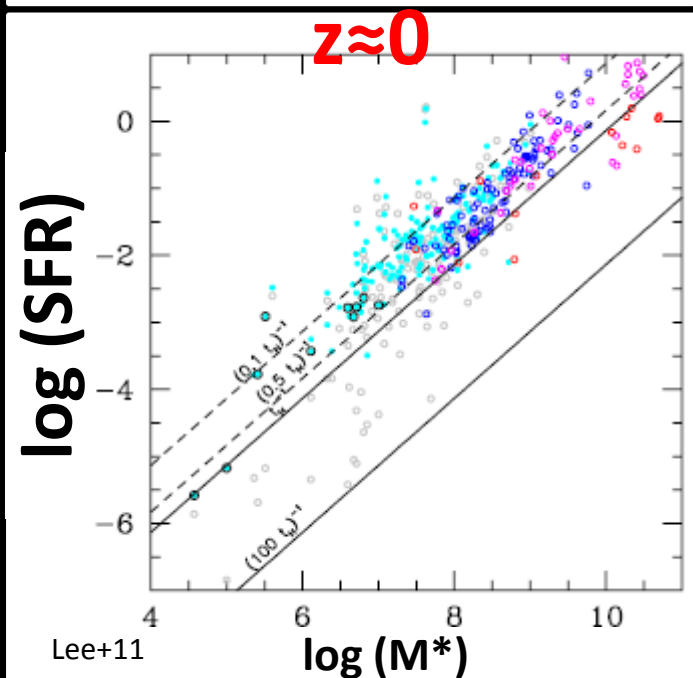
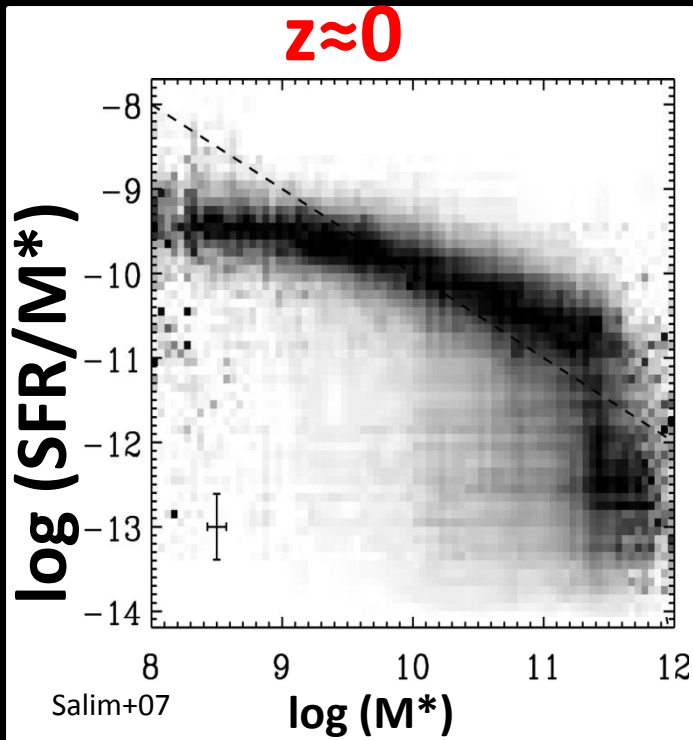
Advisor: Andrey Kravtsov

Santa Cruz Galaxy Workshop, August 2011

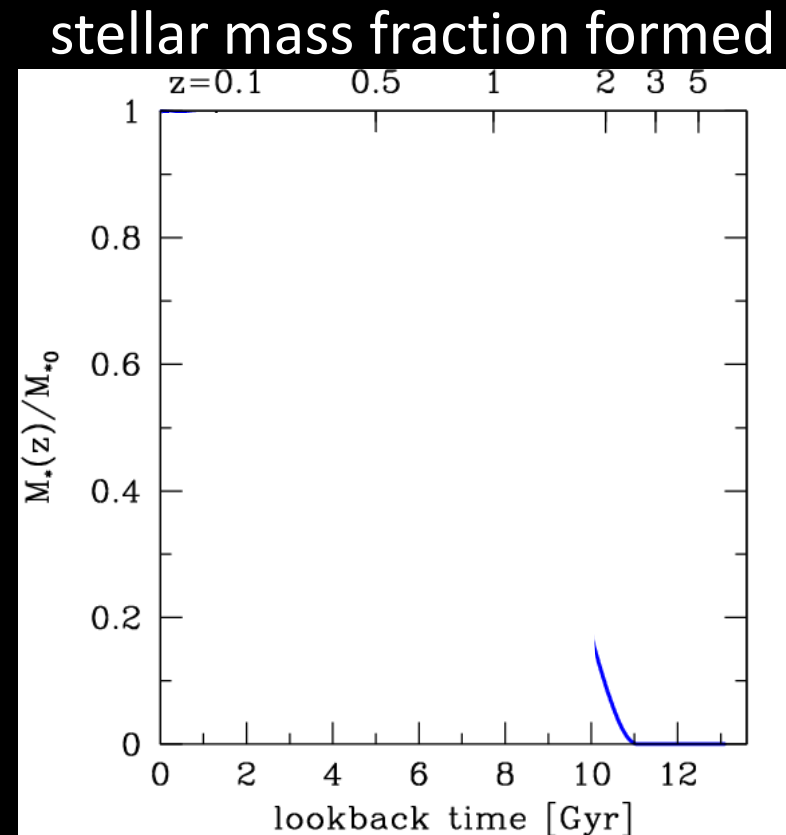
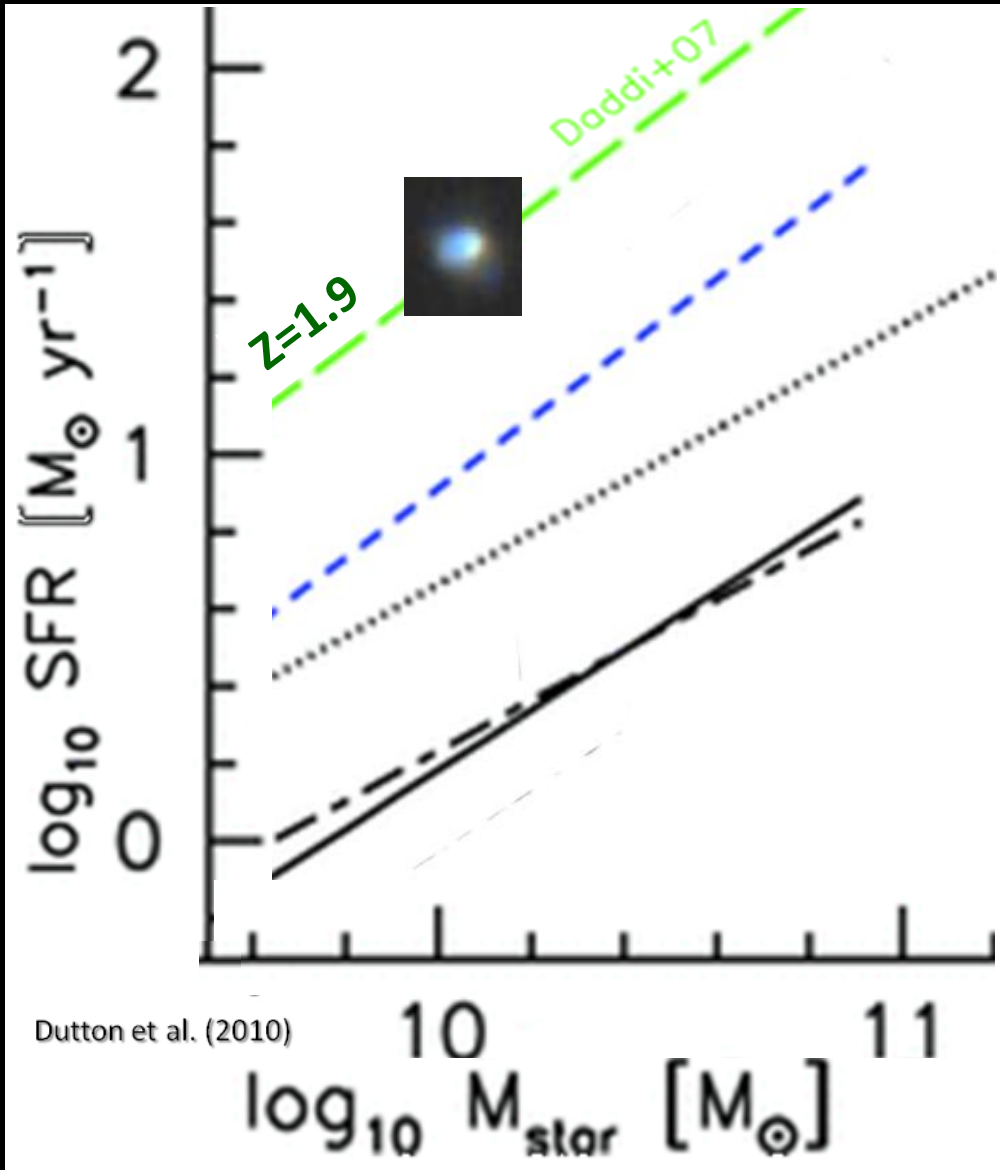
A persistent SFR main sequence

Small scatter in SFR at M_* :

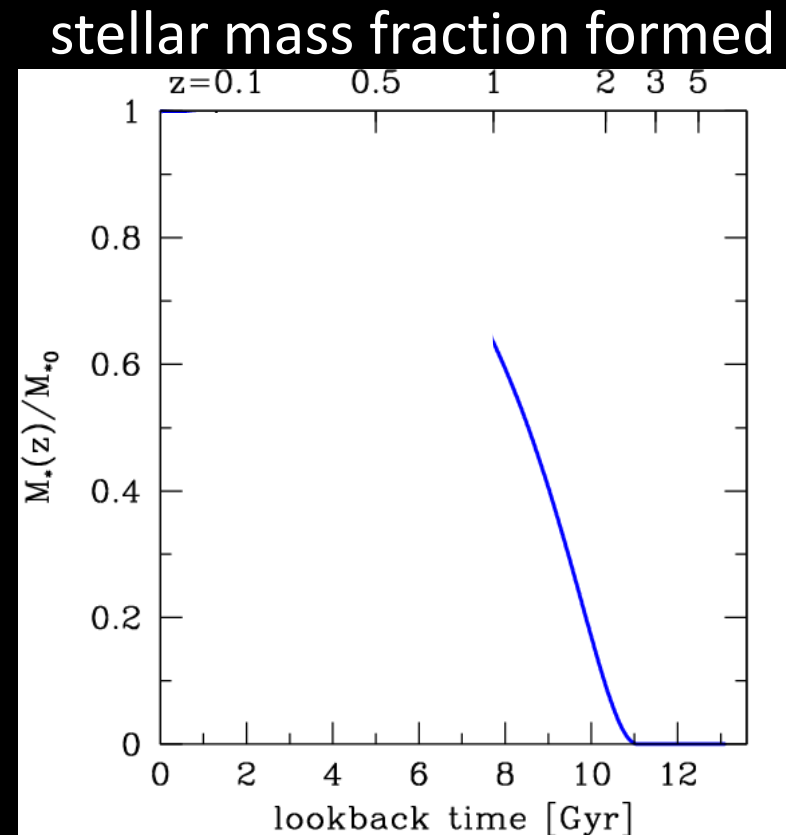
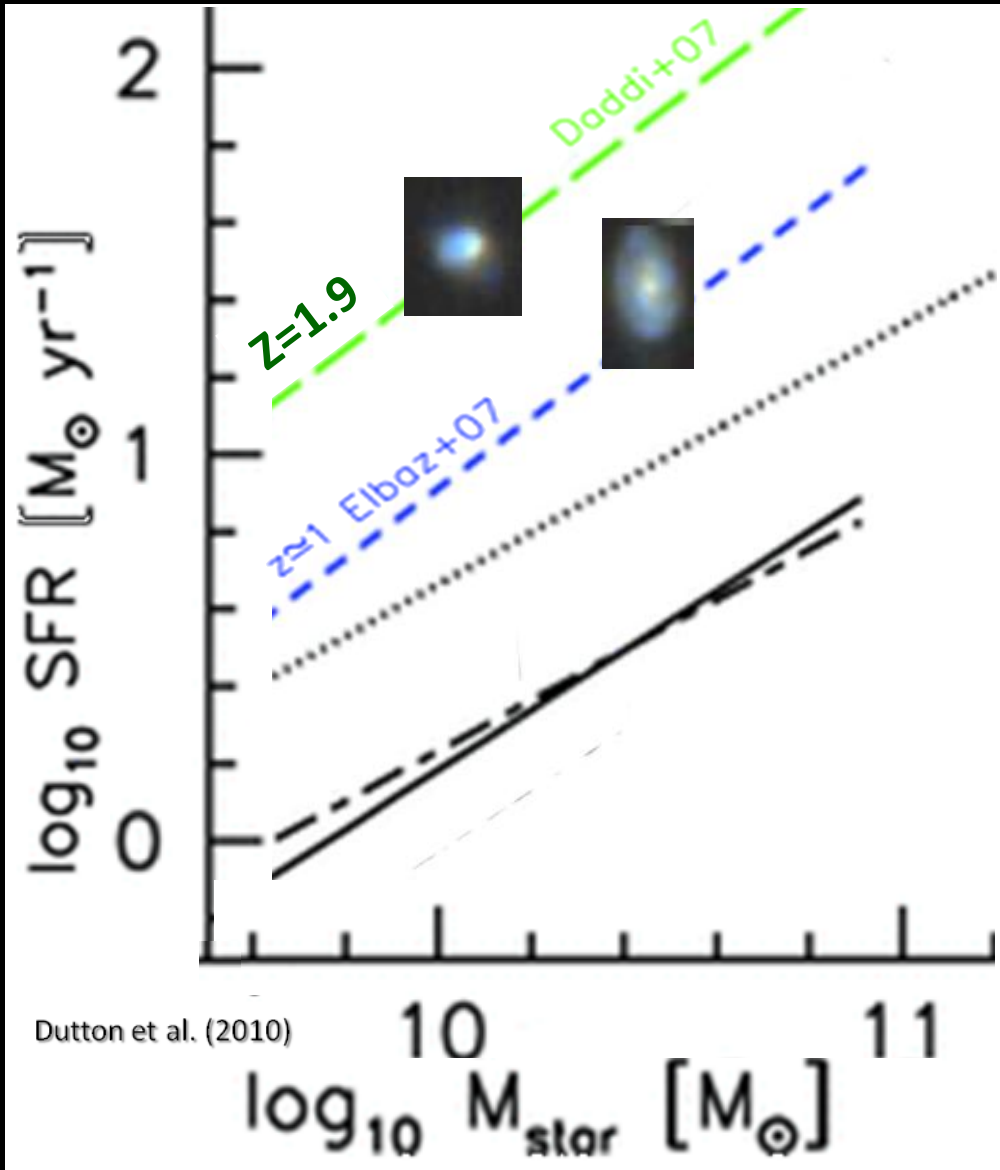
- $z \approx 0$ in SDSS (e.g. Brinchmann+04)
- $z \approx 0$ in local dwarfs (Lee+11)
- $z \approx 2$ in $M_* > 10^{10}$ (e.g. Rhodighiero+11)



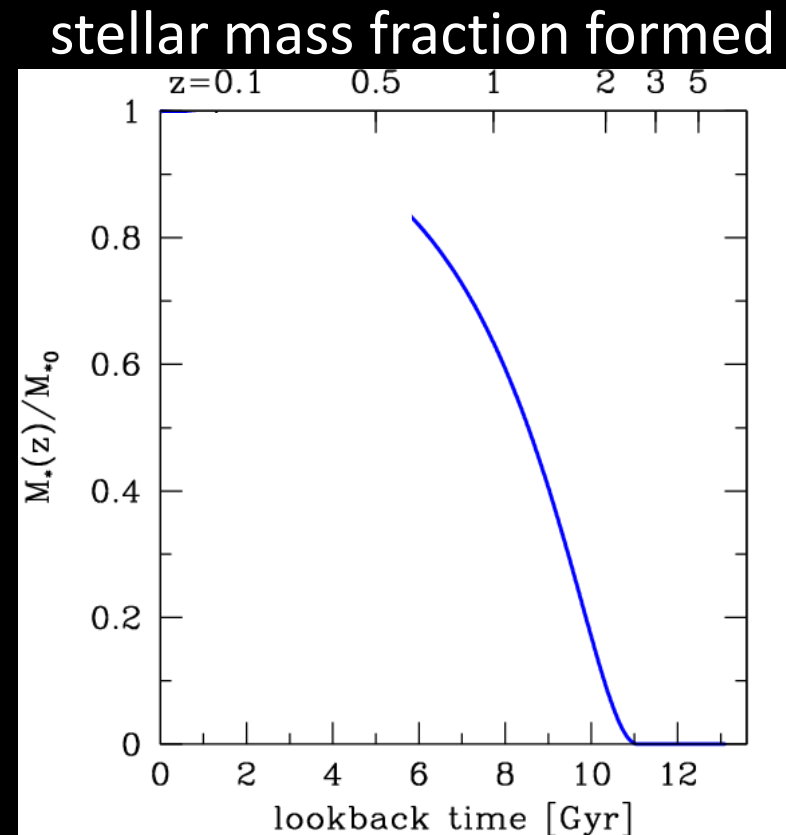
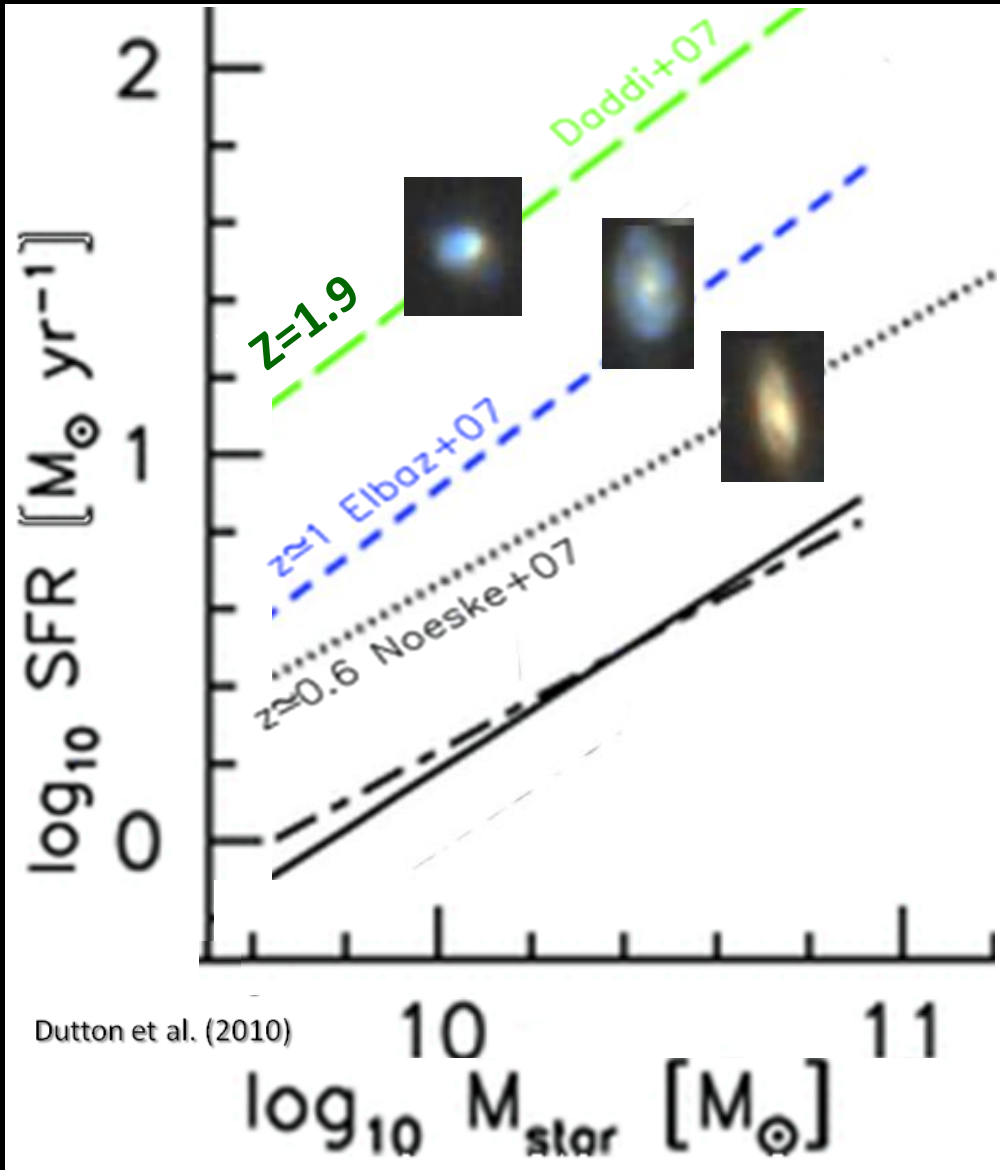
Main Sequence Integration



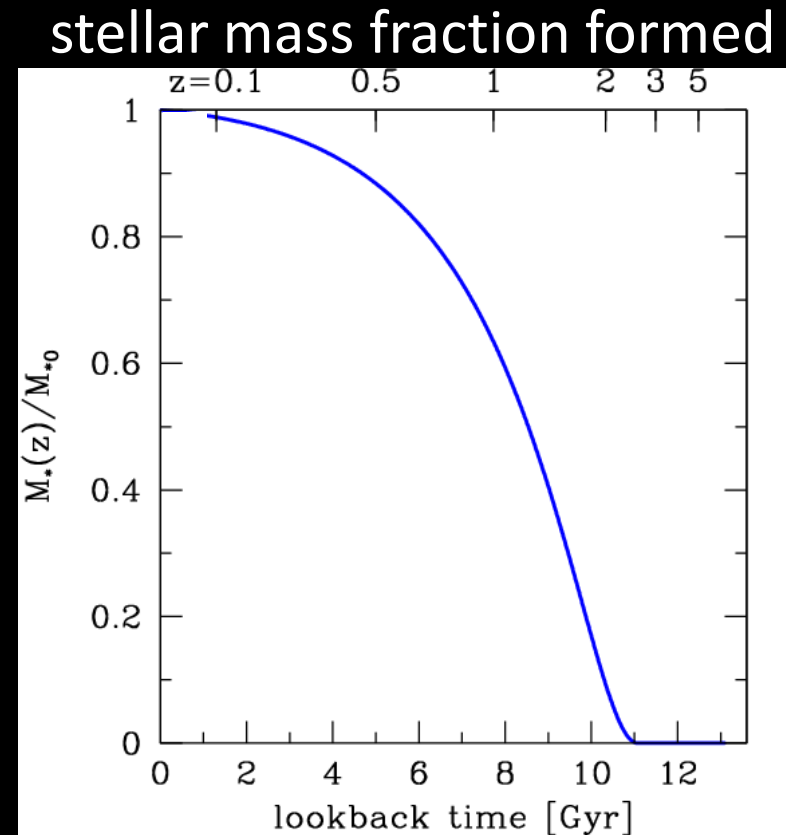
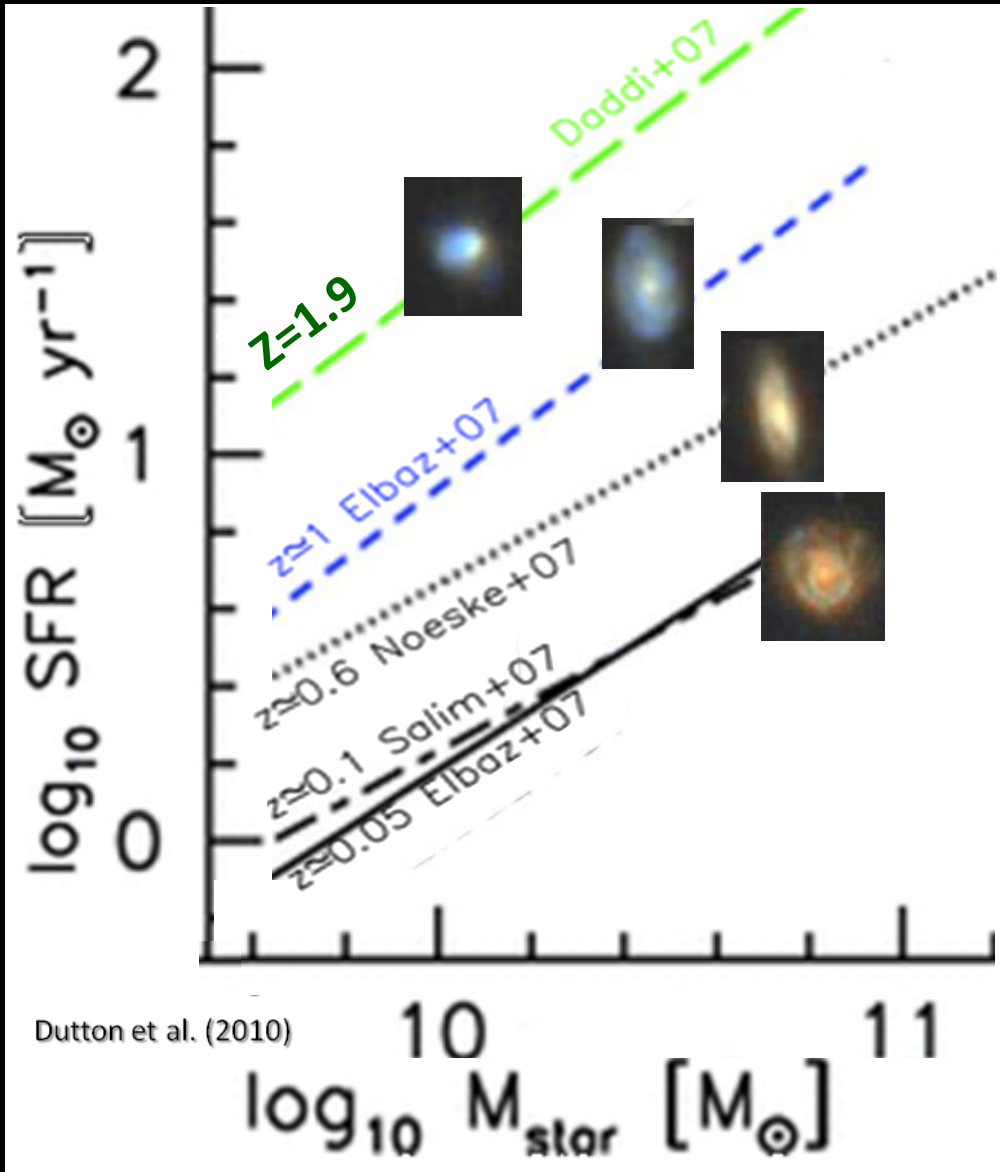
Main Sequence Integration



Main Sequence Integration



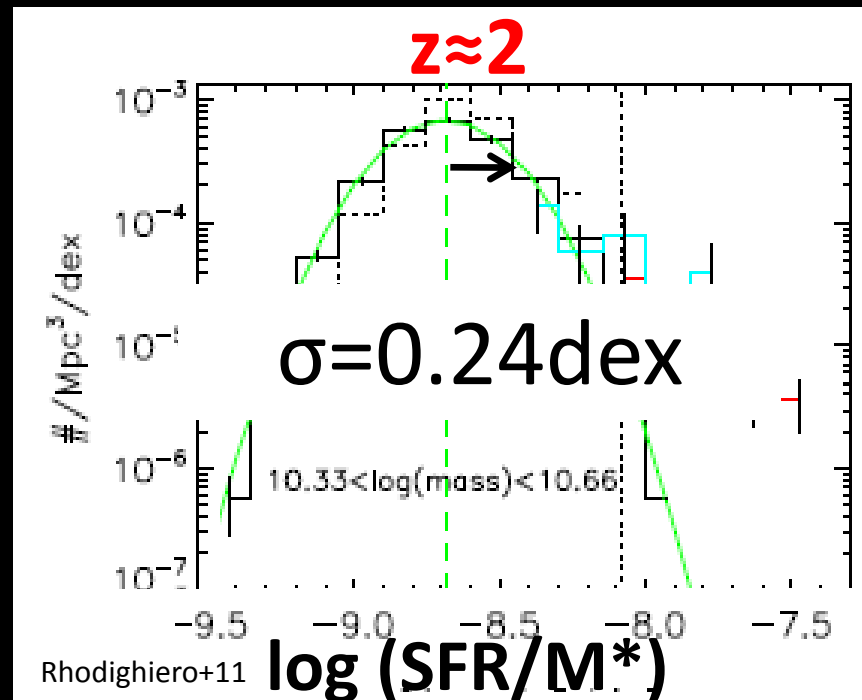
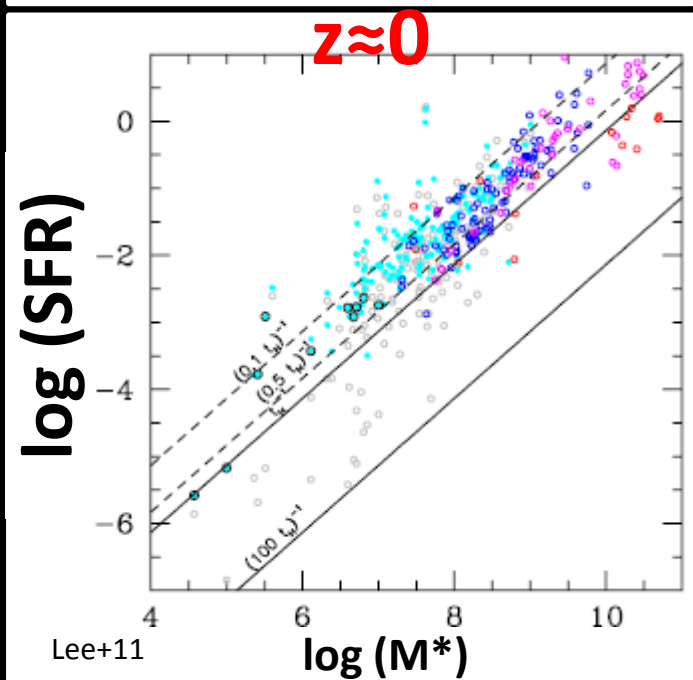
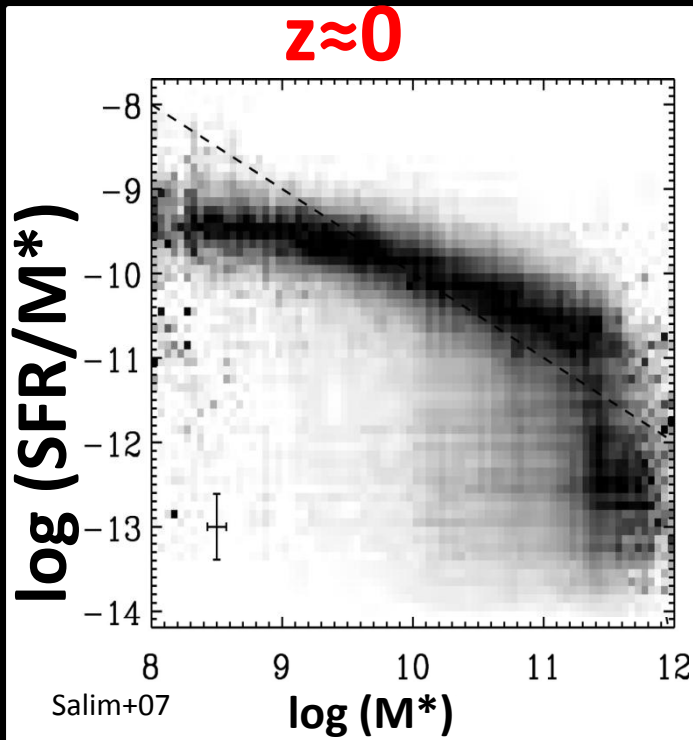
Main Sequence Integration



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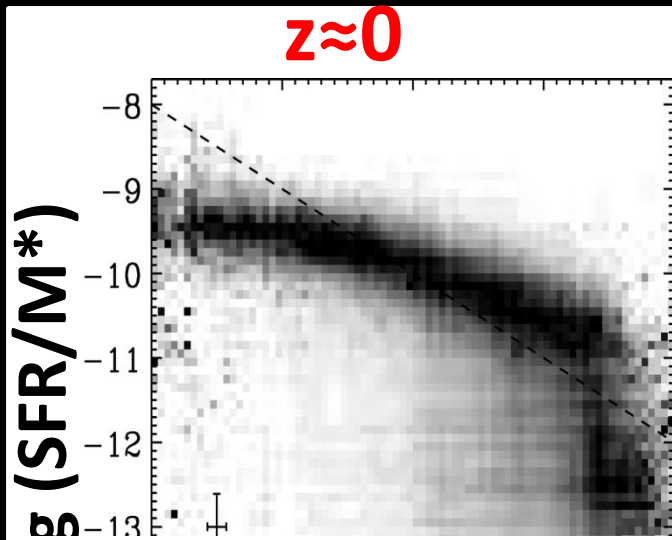
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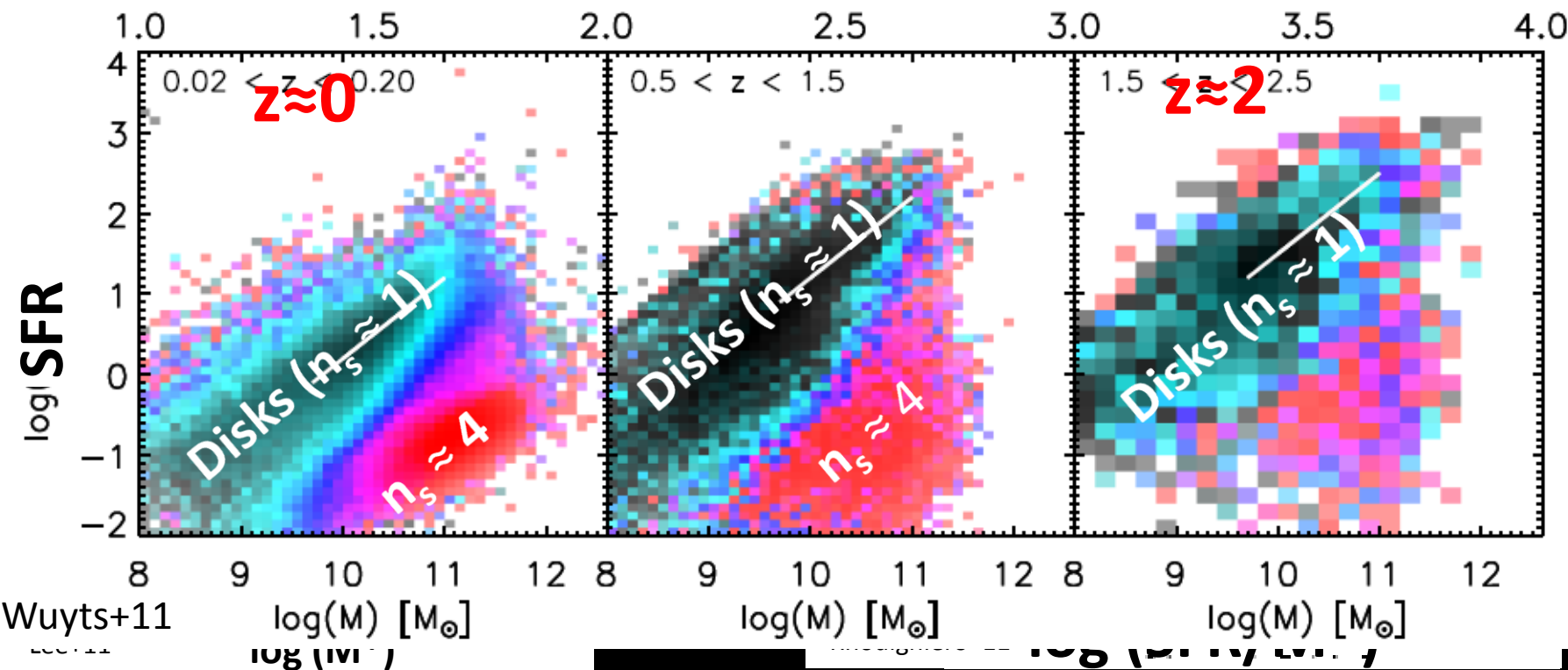
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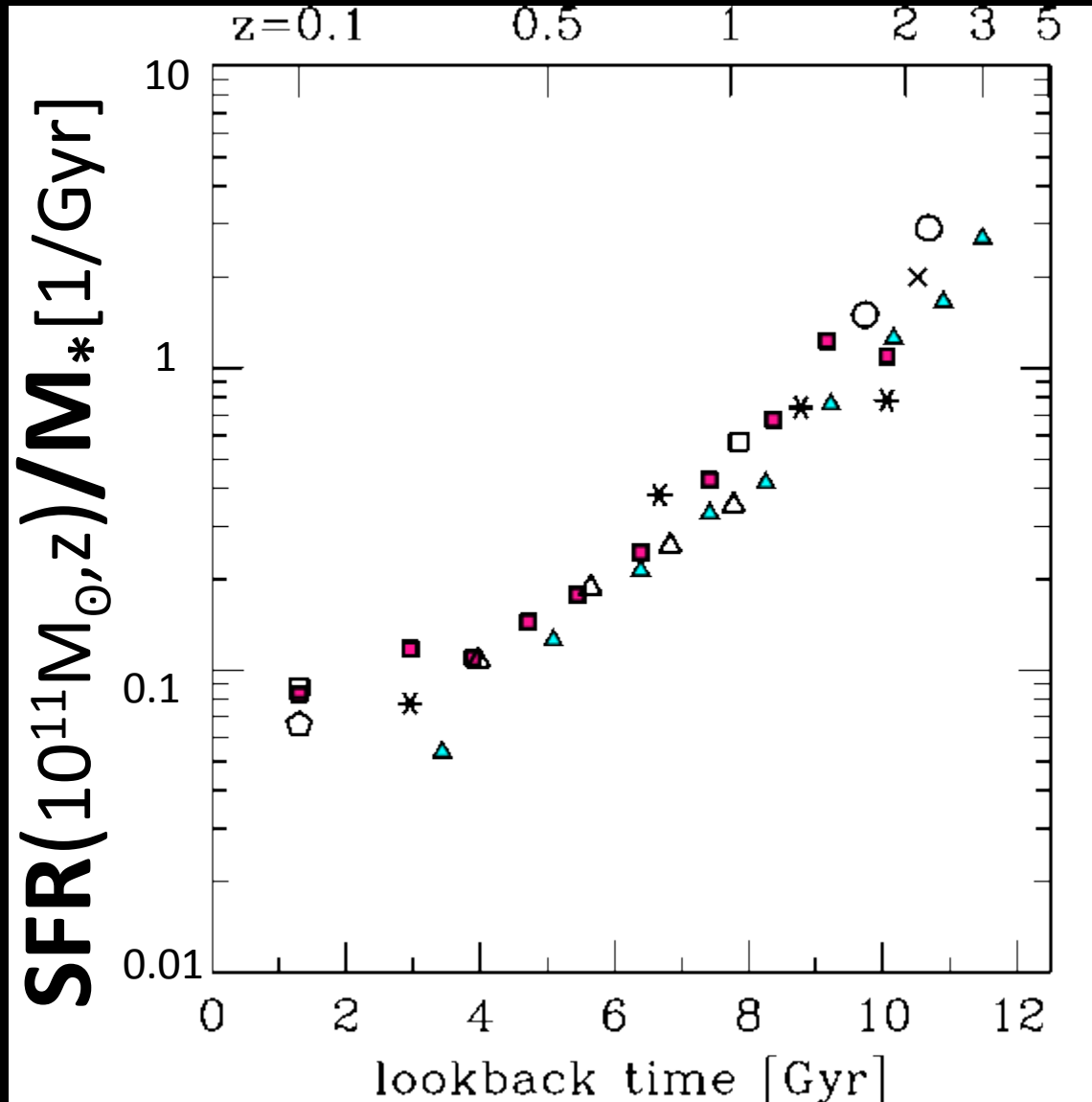
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median n_{Sersic}

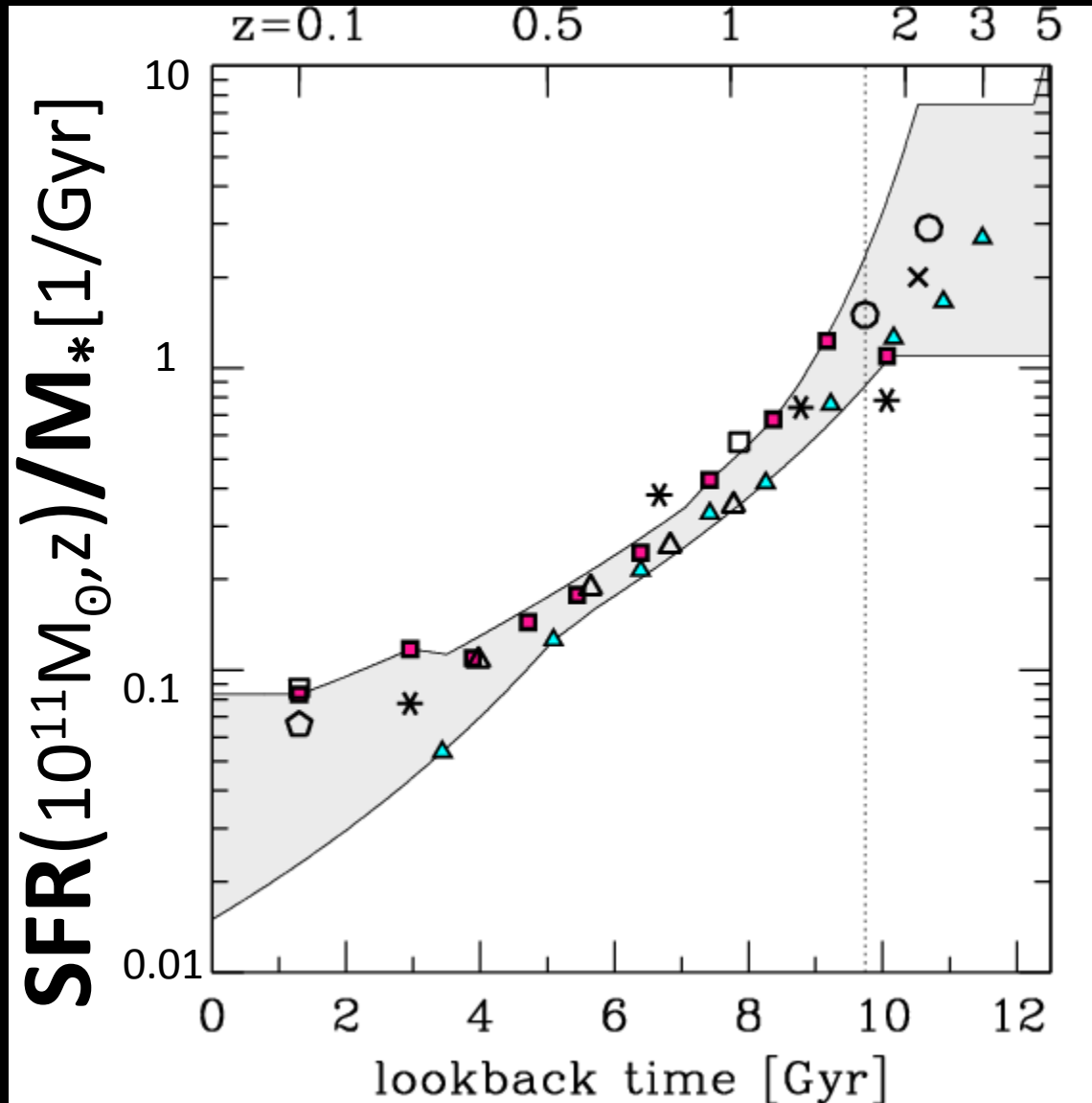


Observations: normalization of SFR-M_{*}



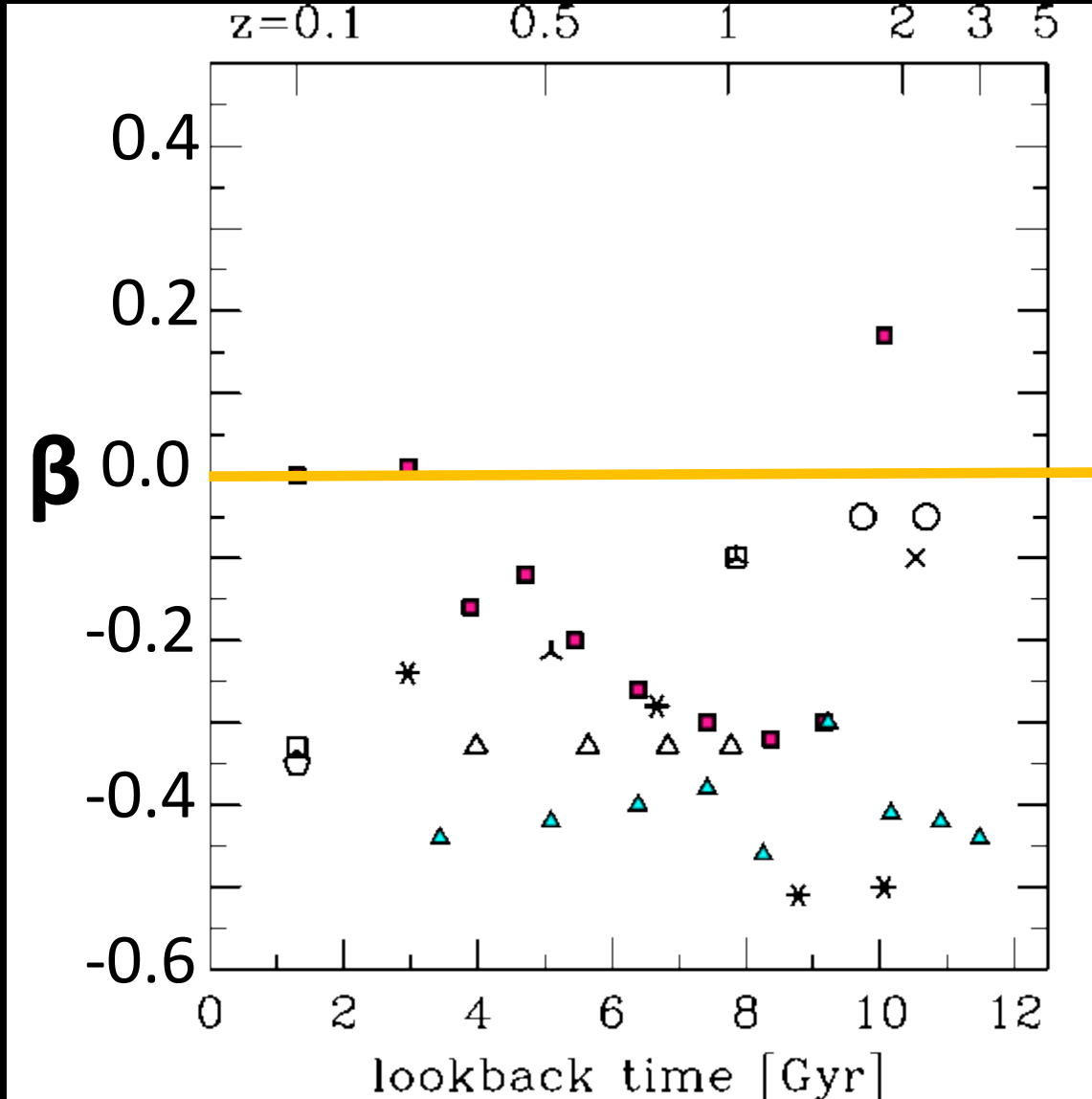
Salim et al. 2007;
Noeske et al. 2007b;
Elbaz et al. 2007;
Pannella et al. 2009;
Daddi et al. 2007;
Dunne et al. 2009;
Oliver et al. 2010;
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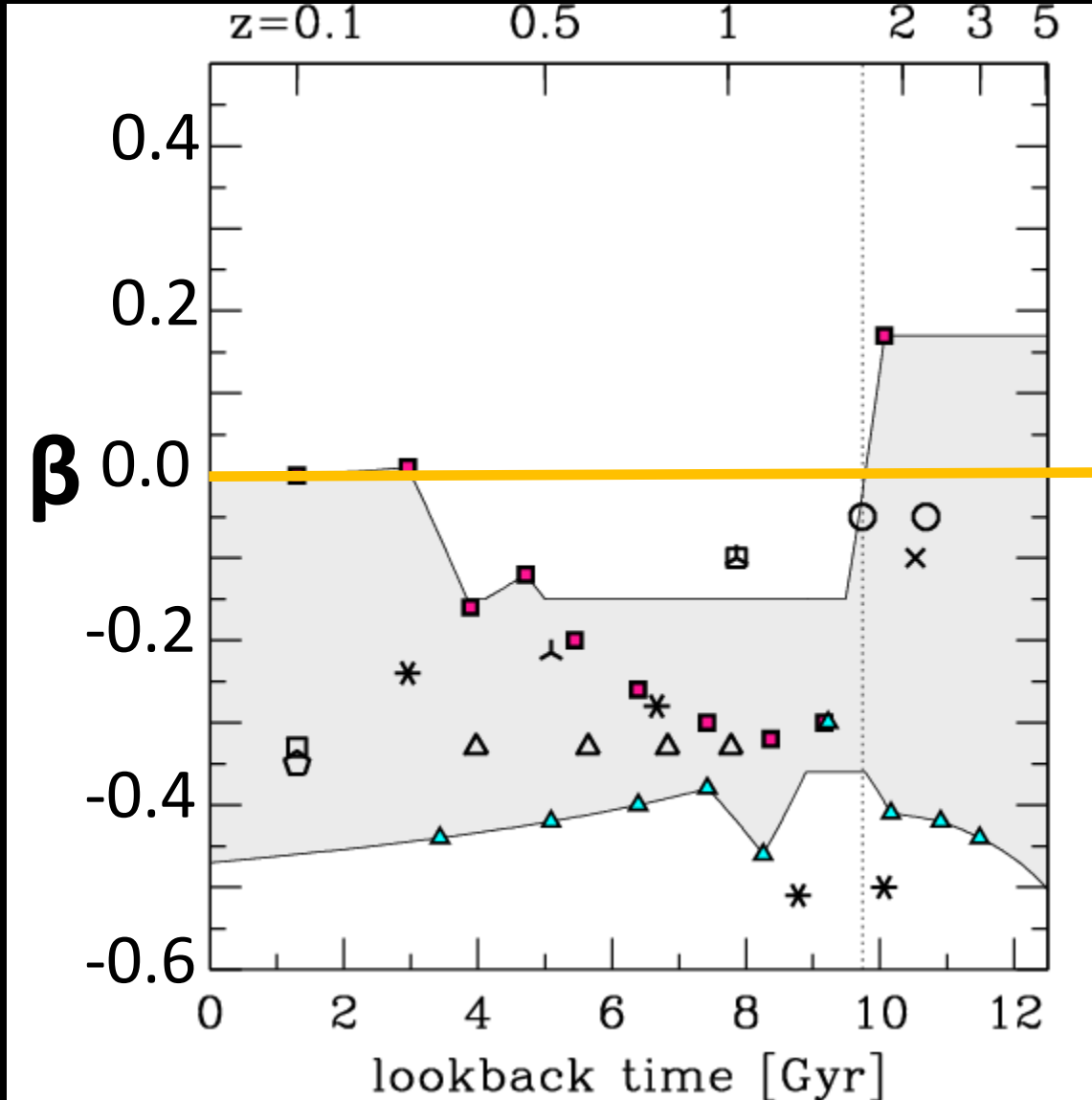
Observations: slope $SFR/M_* \sim M_*^\beta$



**smaller galaxies
grow faster
(implies
downsizing)**



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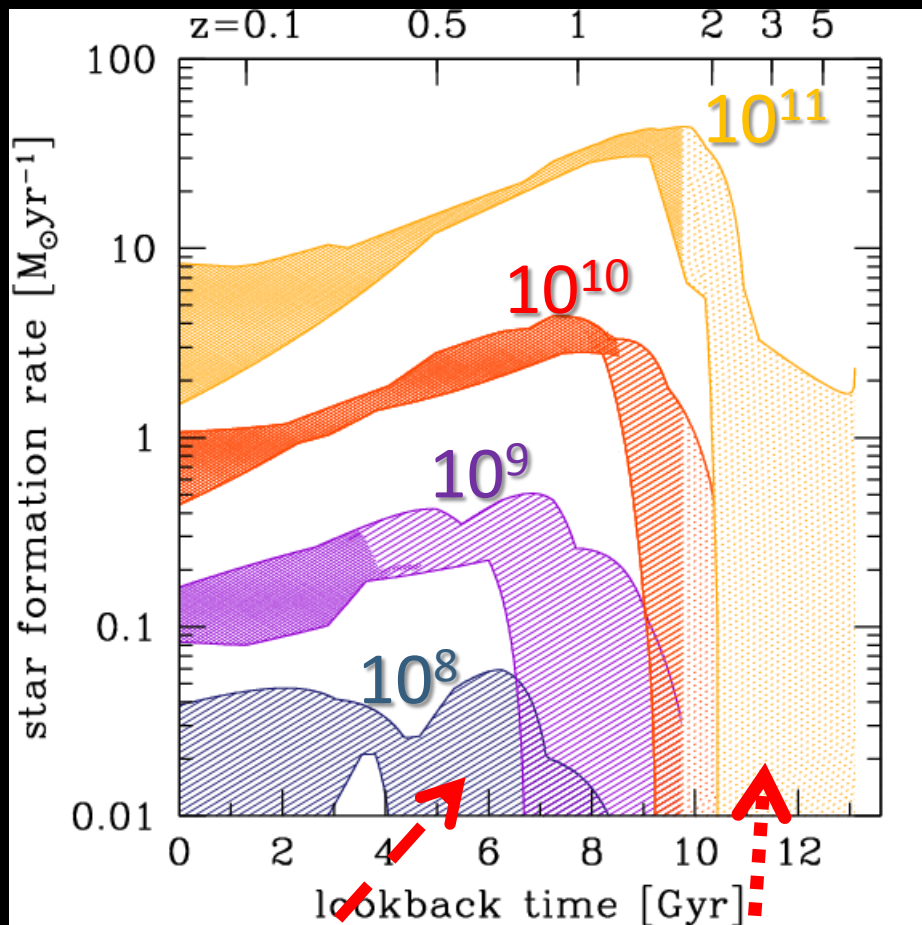


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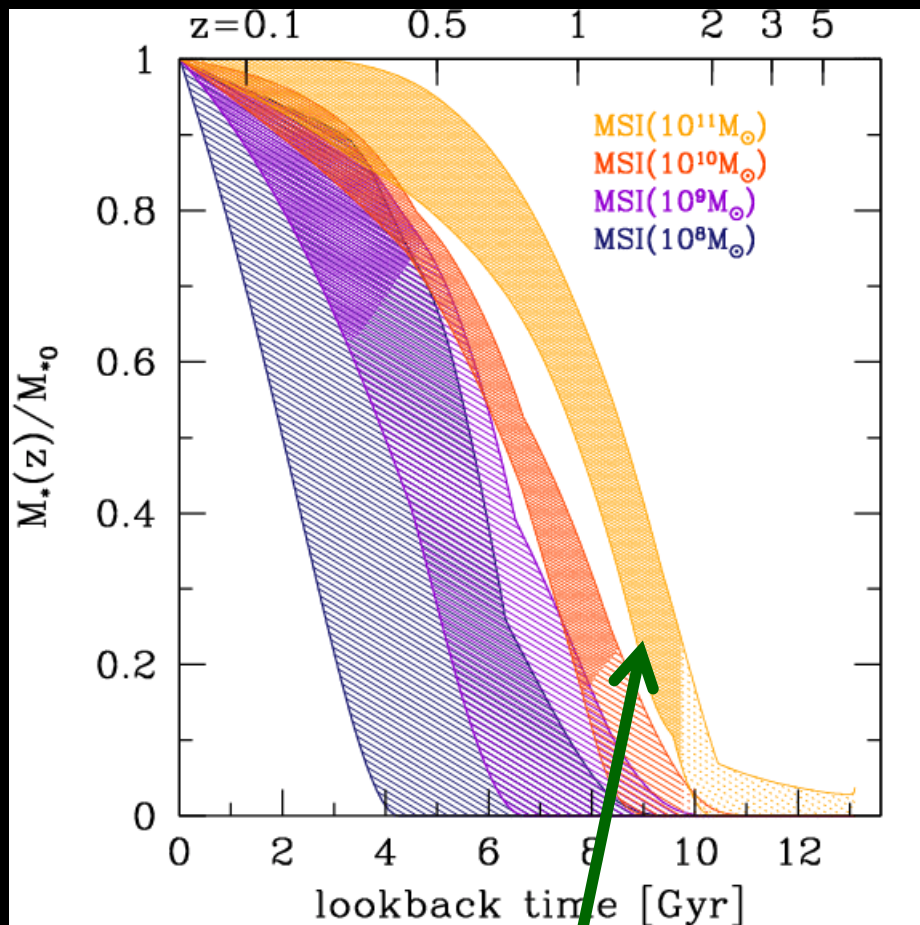


Typical stellar mass growth from main sequence integration

star formation histories



stellar mass growth



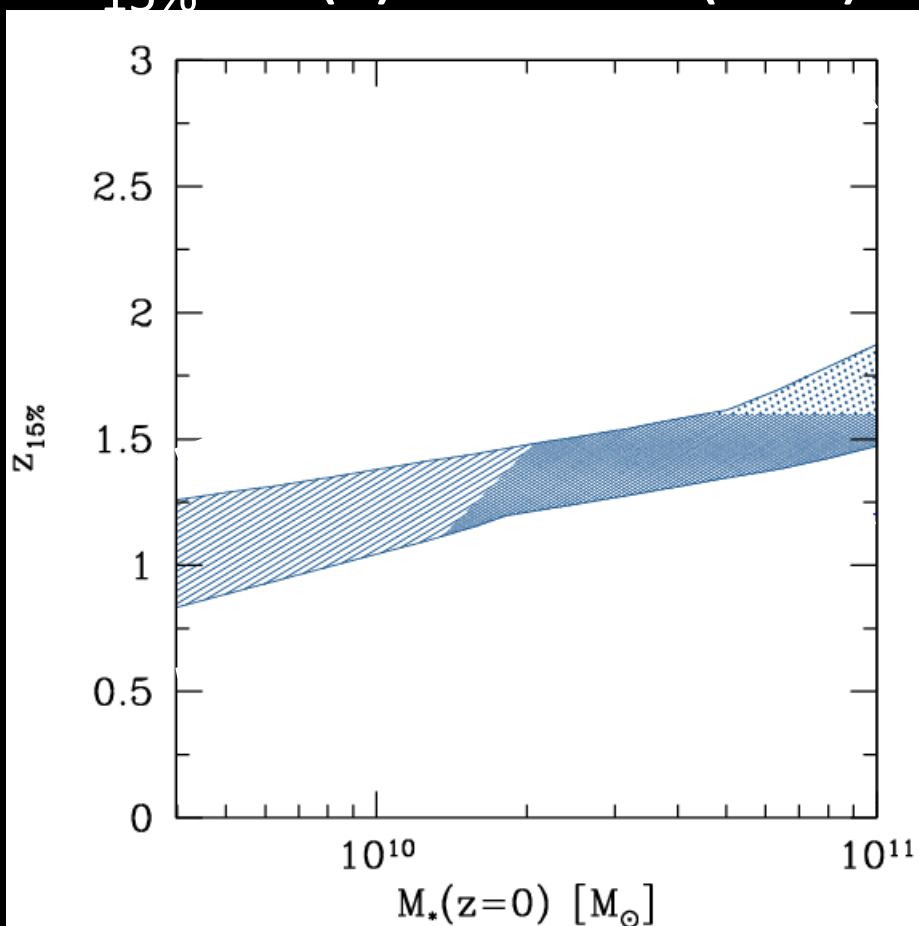
Extrapolated data

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

Robust early growth

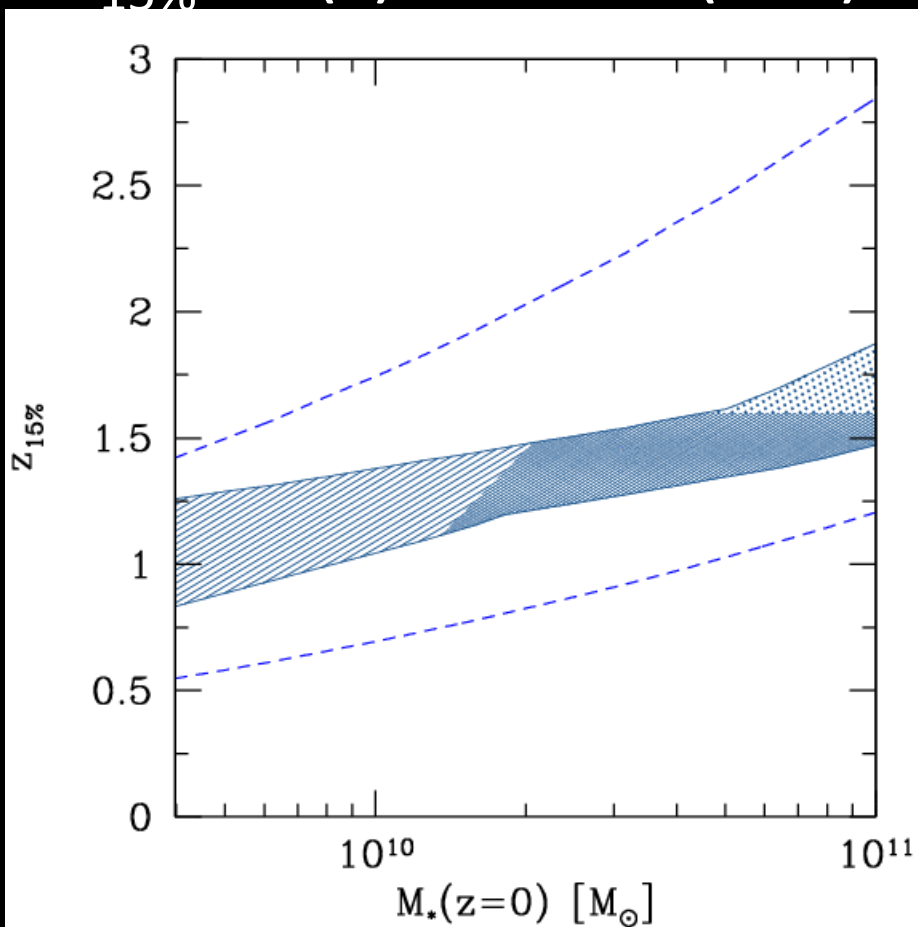
Quantifying the late formation of star forming galaxies

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



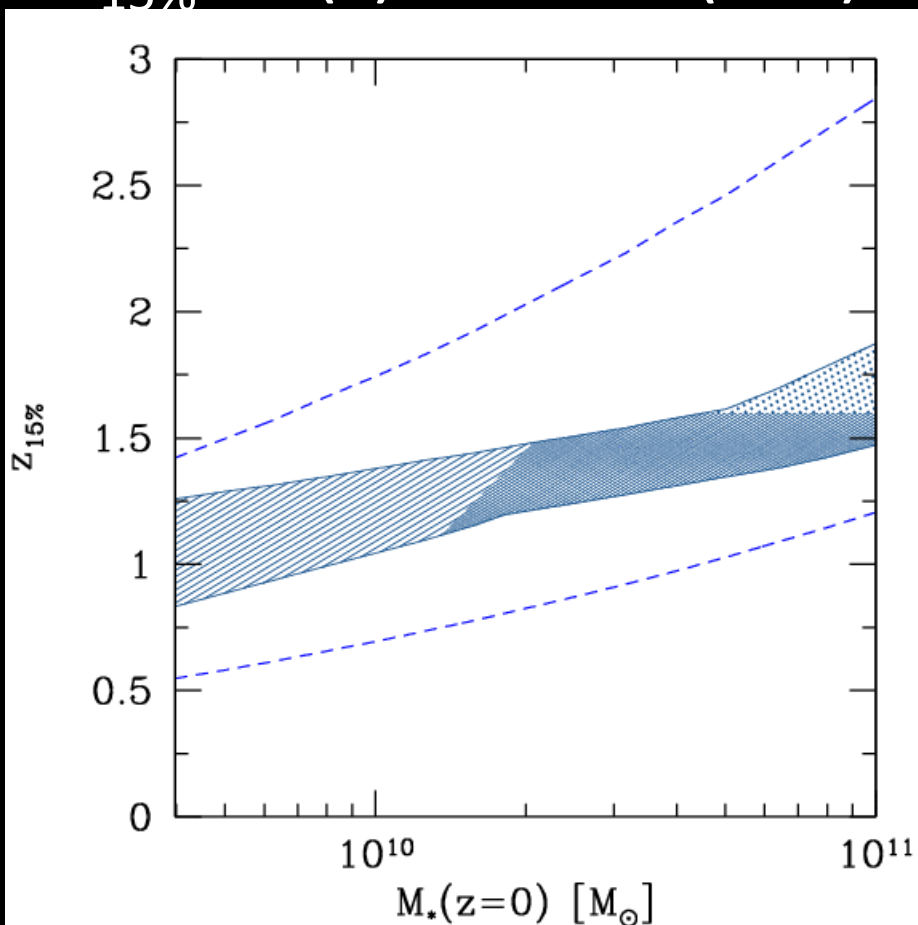
Quantifying the late formation of star forming galaxies

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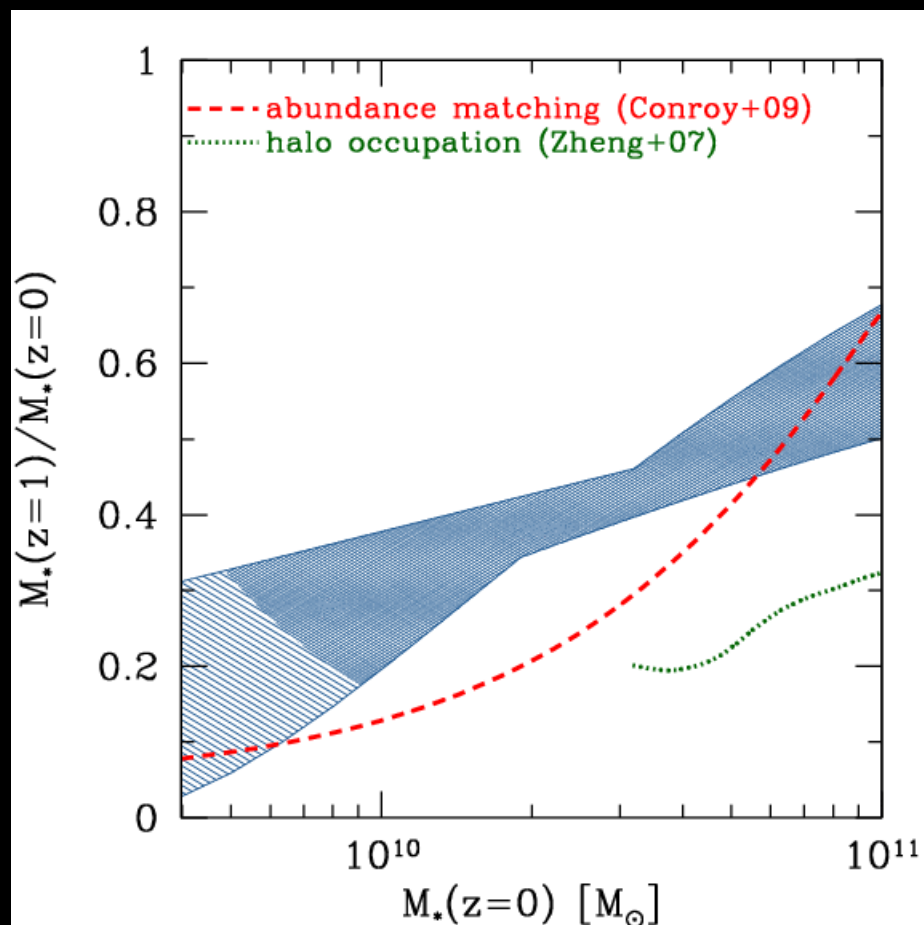


Quantifying the late formation of star forming galaxies

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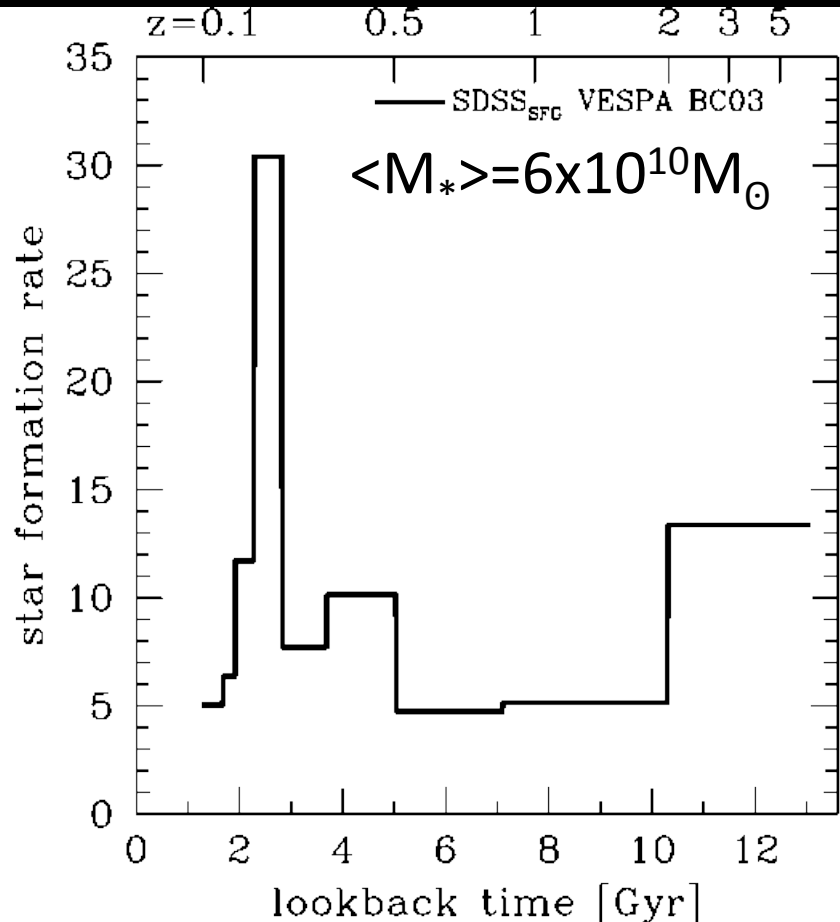
stellar mass at $z=1$



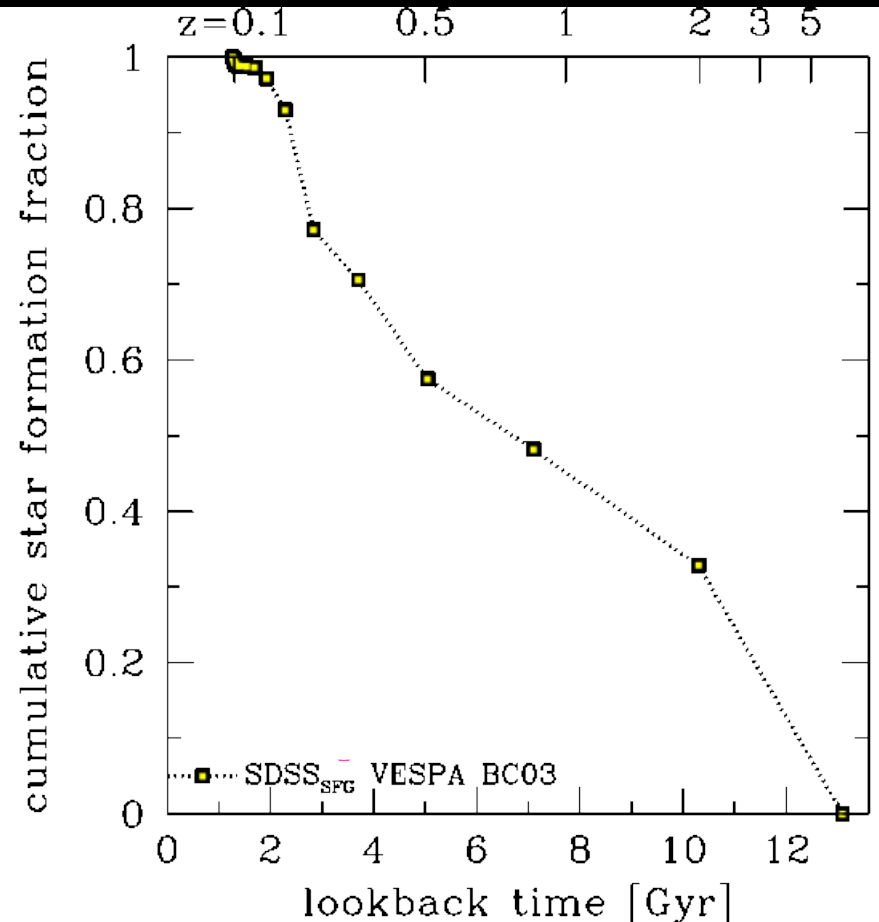
Stellar mass growth from spectra

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

star formation histories



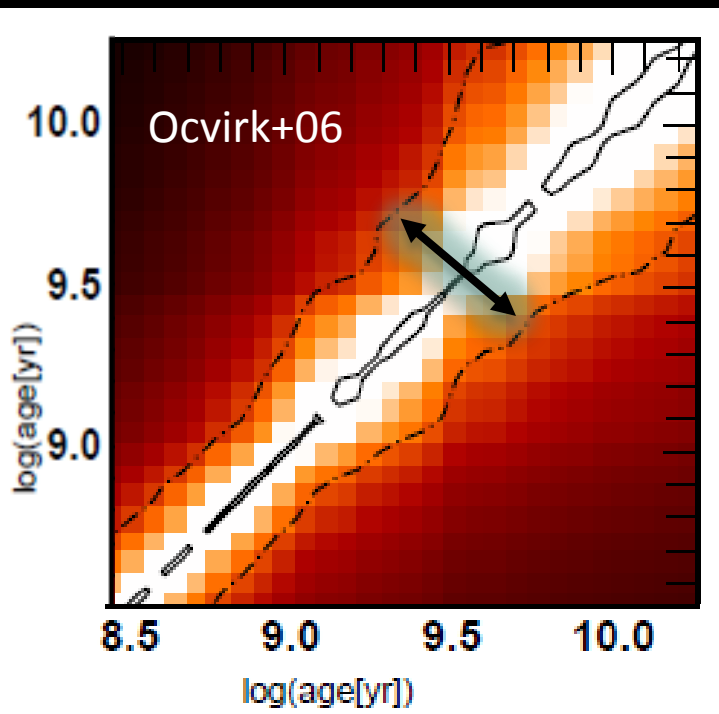
stellar mass growth



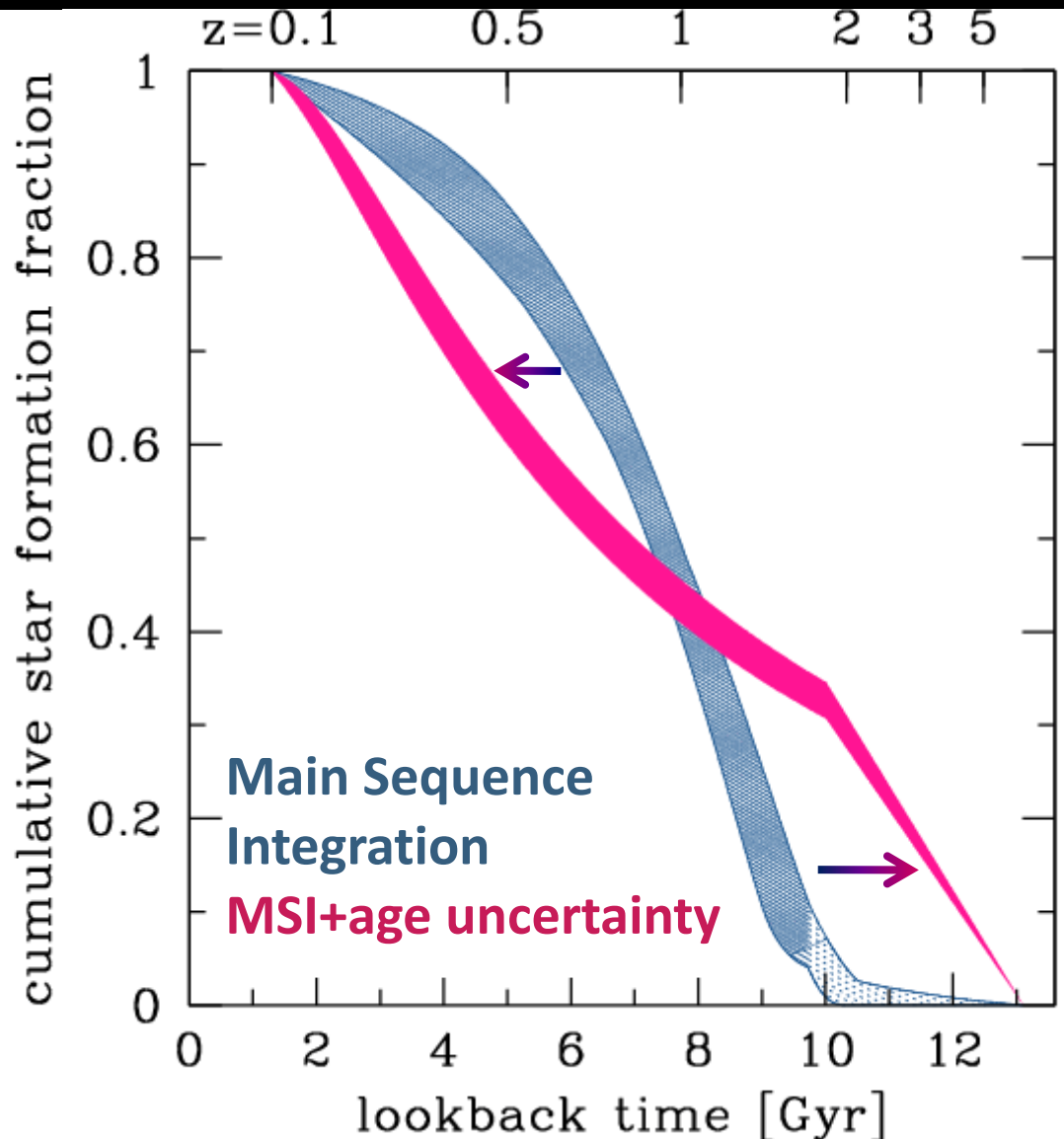
Mimicking age uncertainty

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

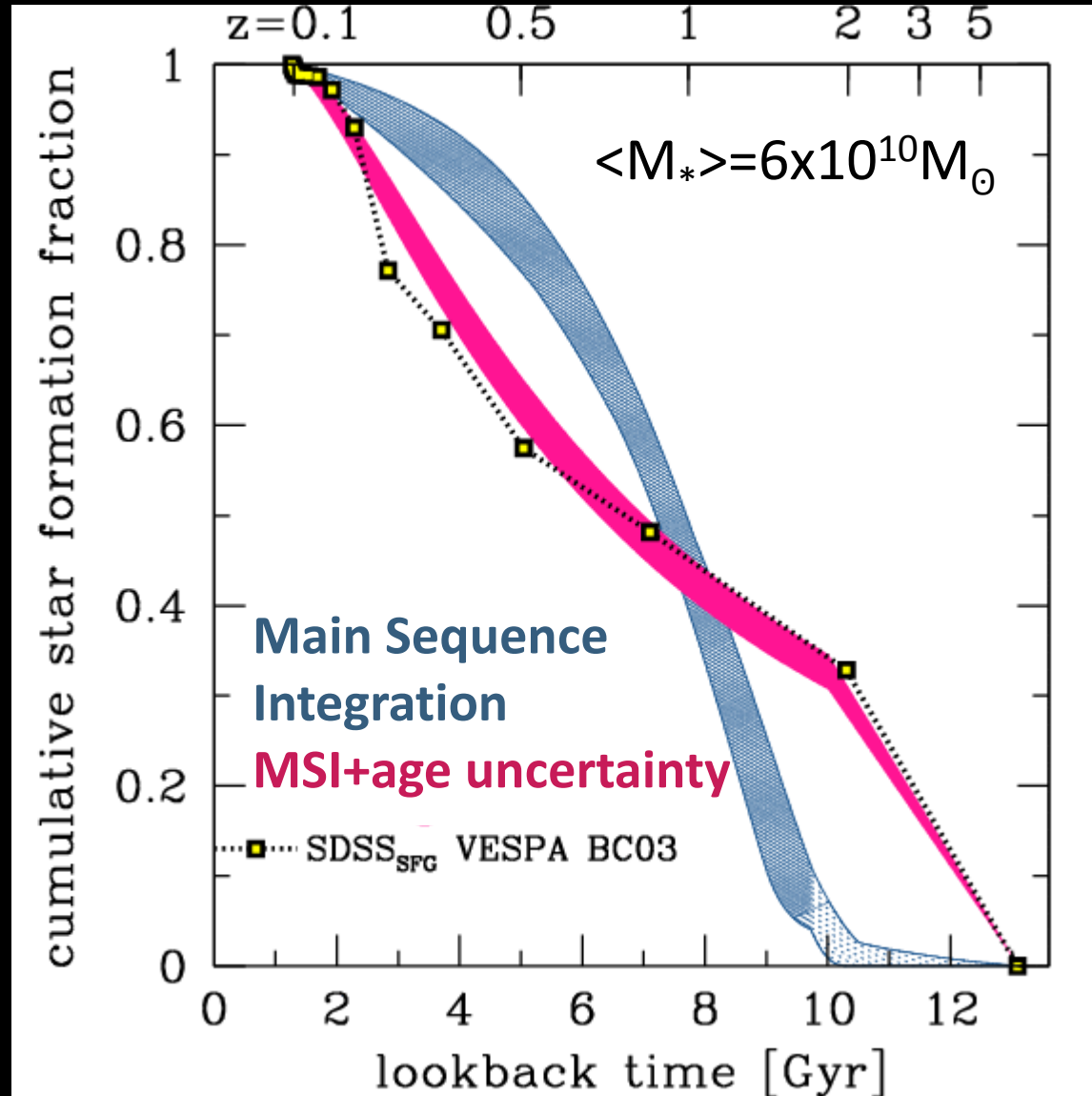
-> Smooth by $\sigma=0.5$ dex in log-age



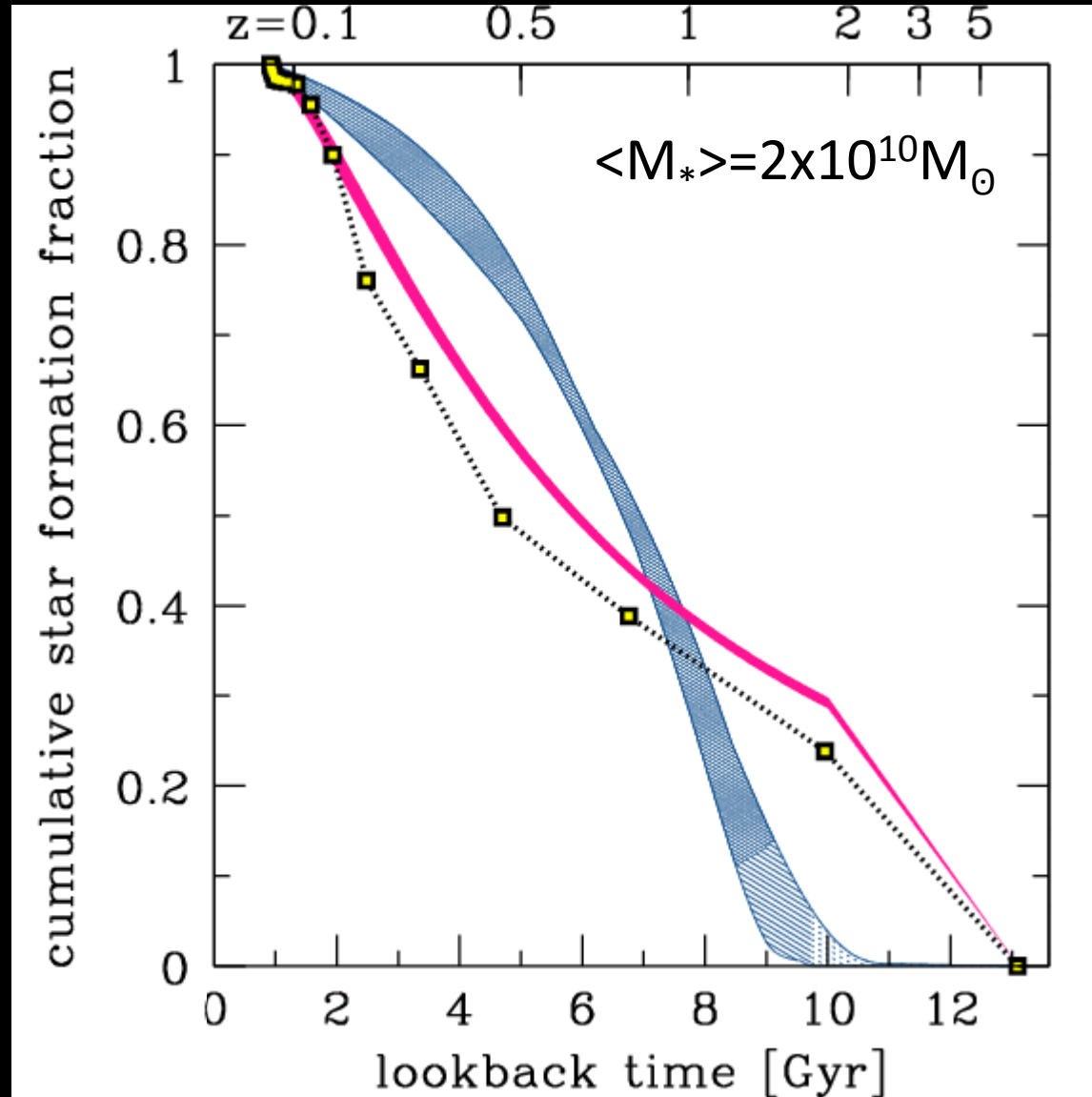
Tests show little bias, but resolution ~ 1 dex for non-SSPs with unknown metallicity



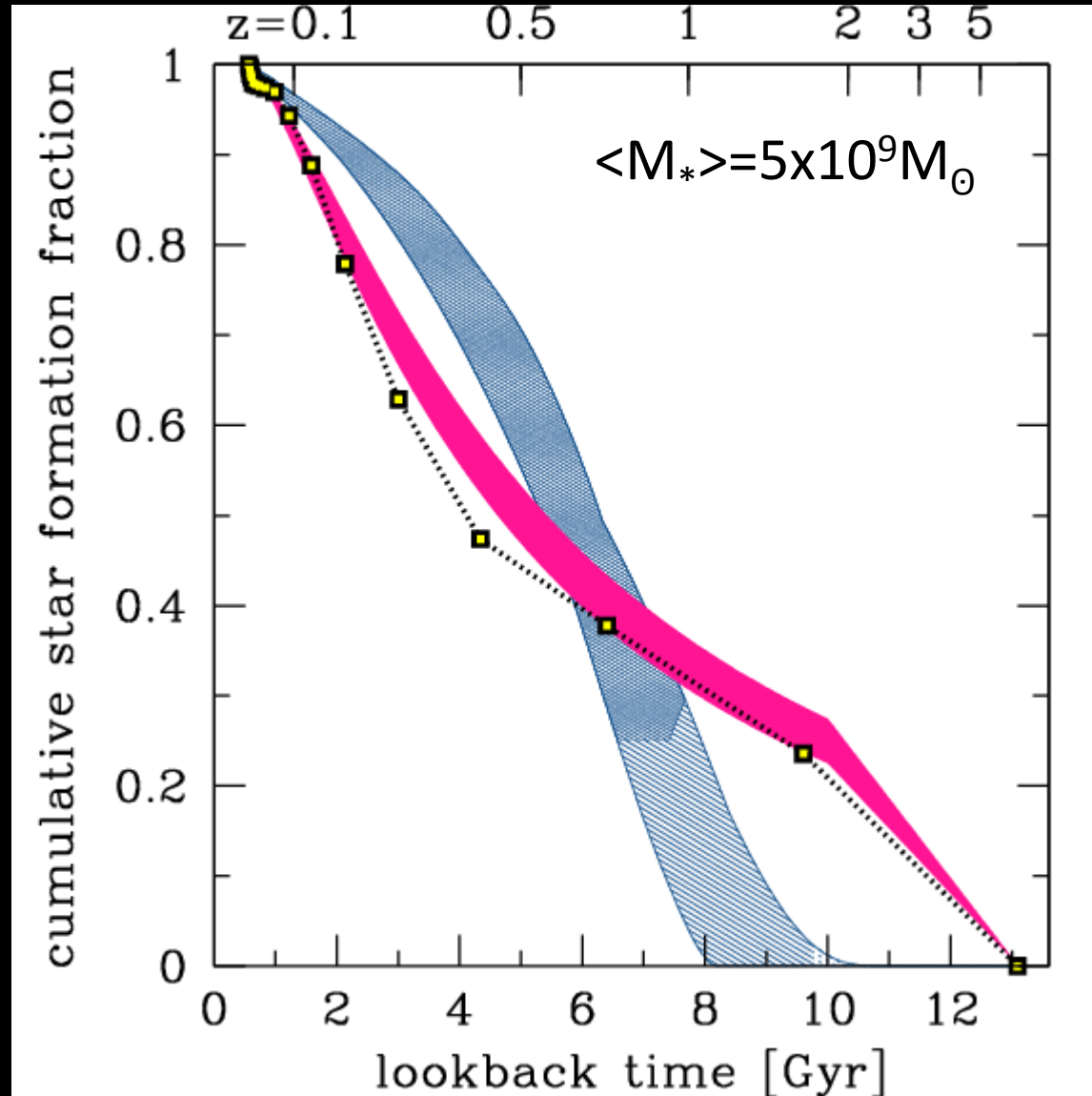
Main sequence integration and SEDs



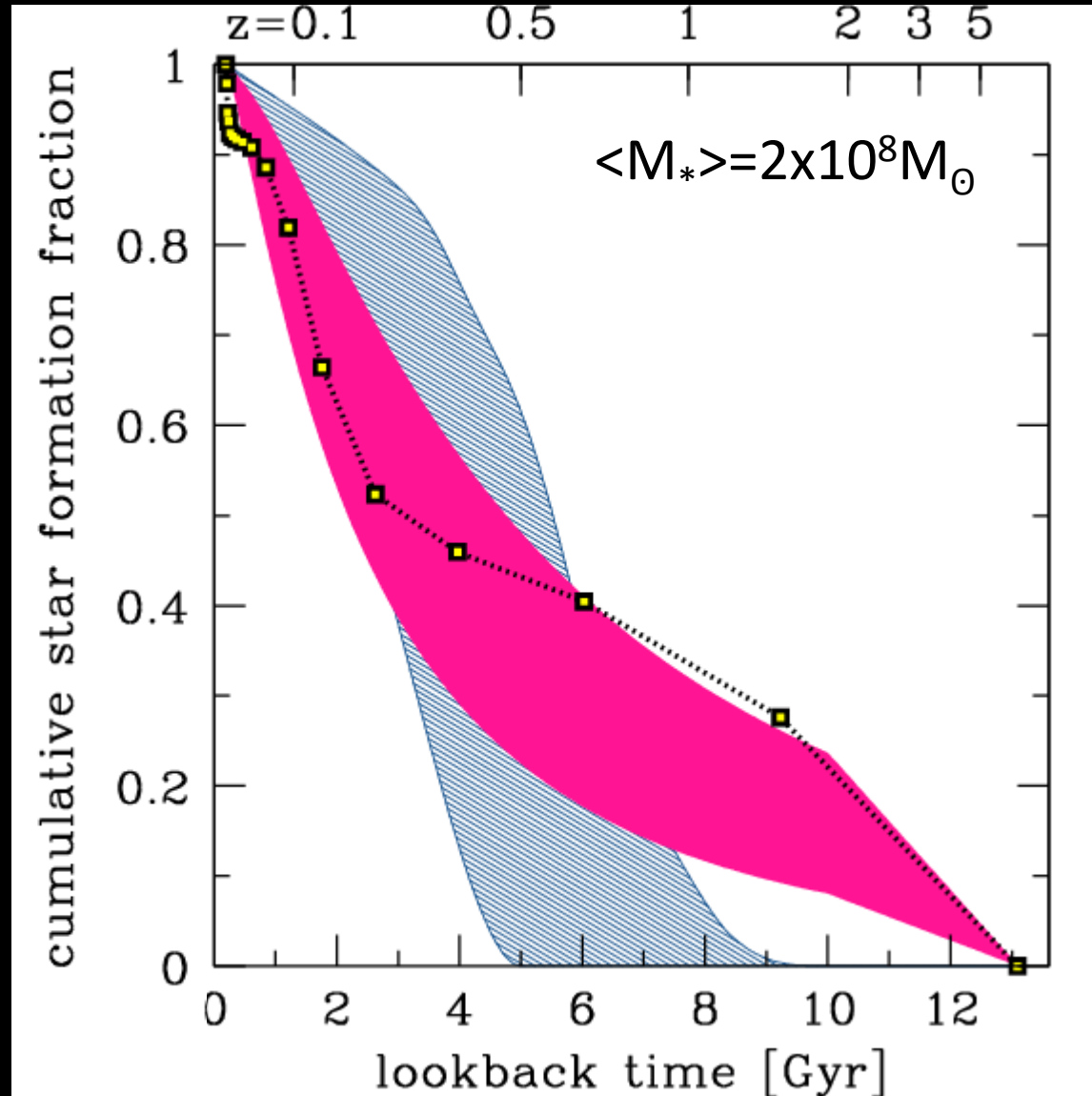
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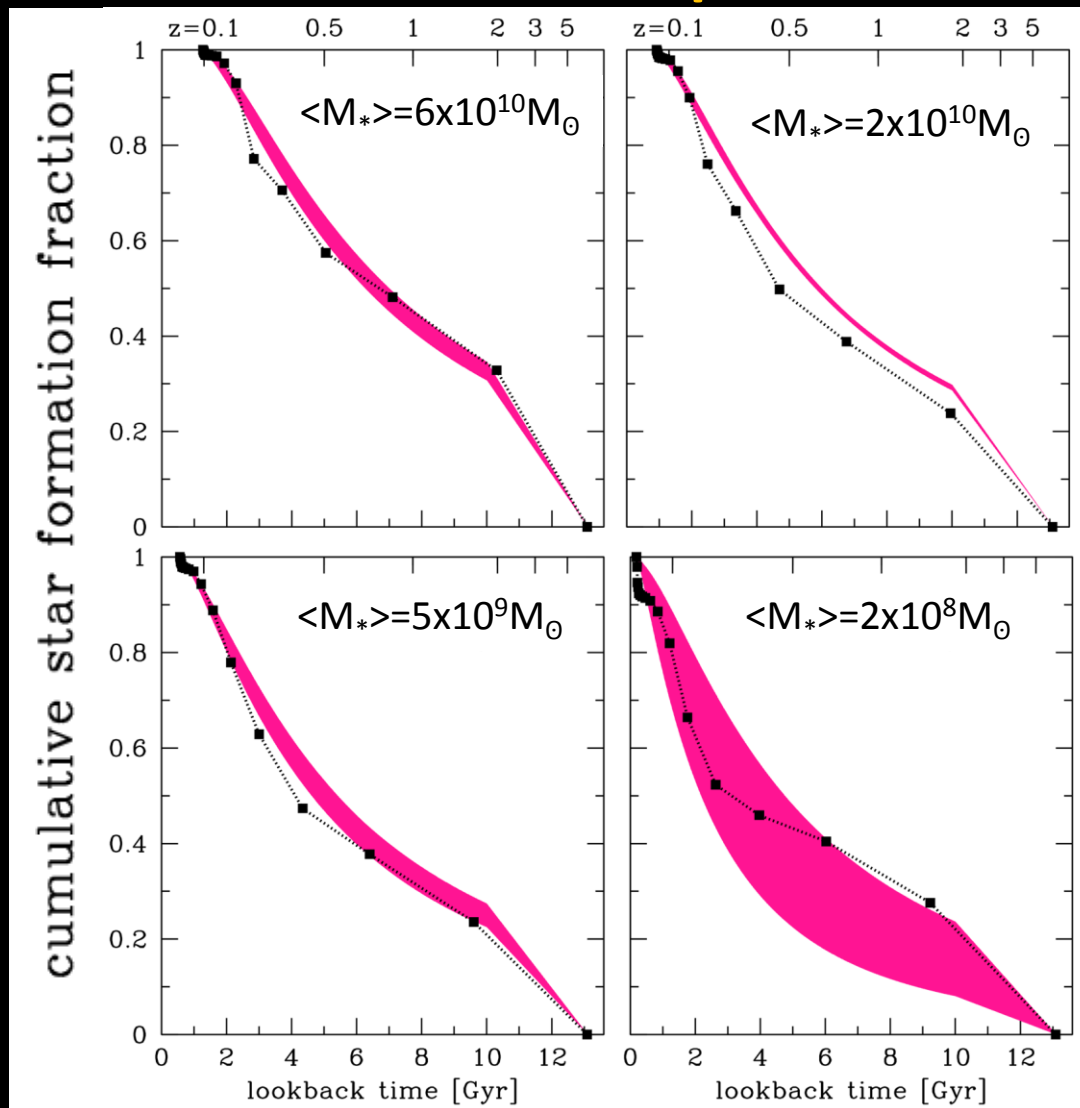
Main sequence integration and SEDs



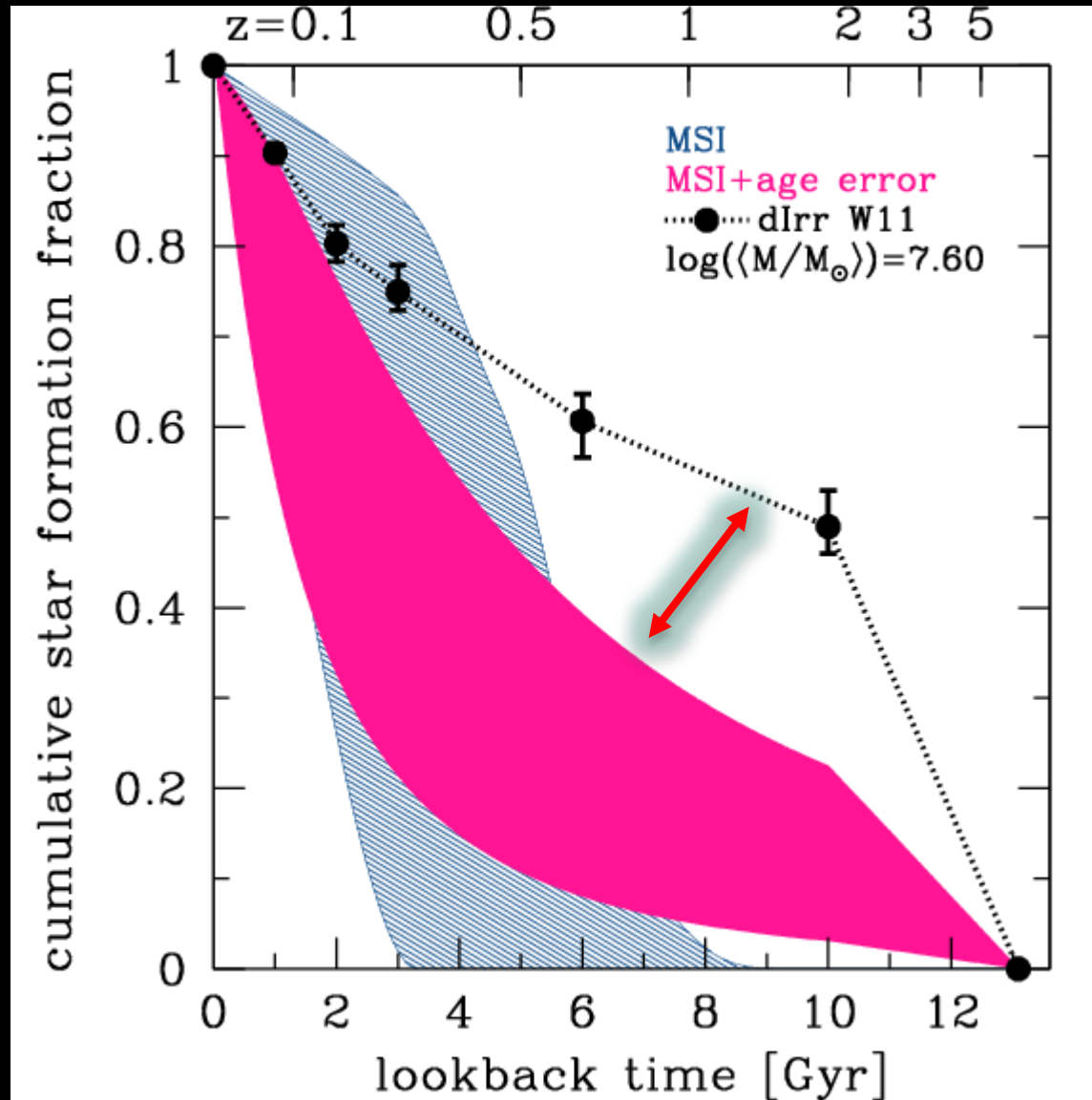
Main sequence integration and SEDs



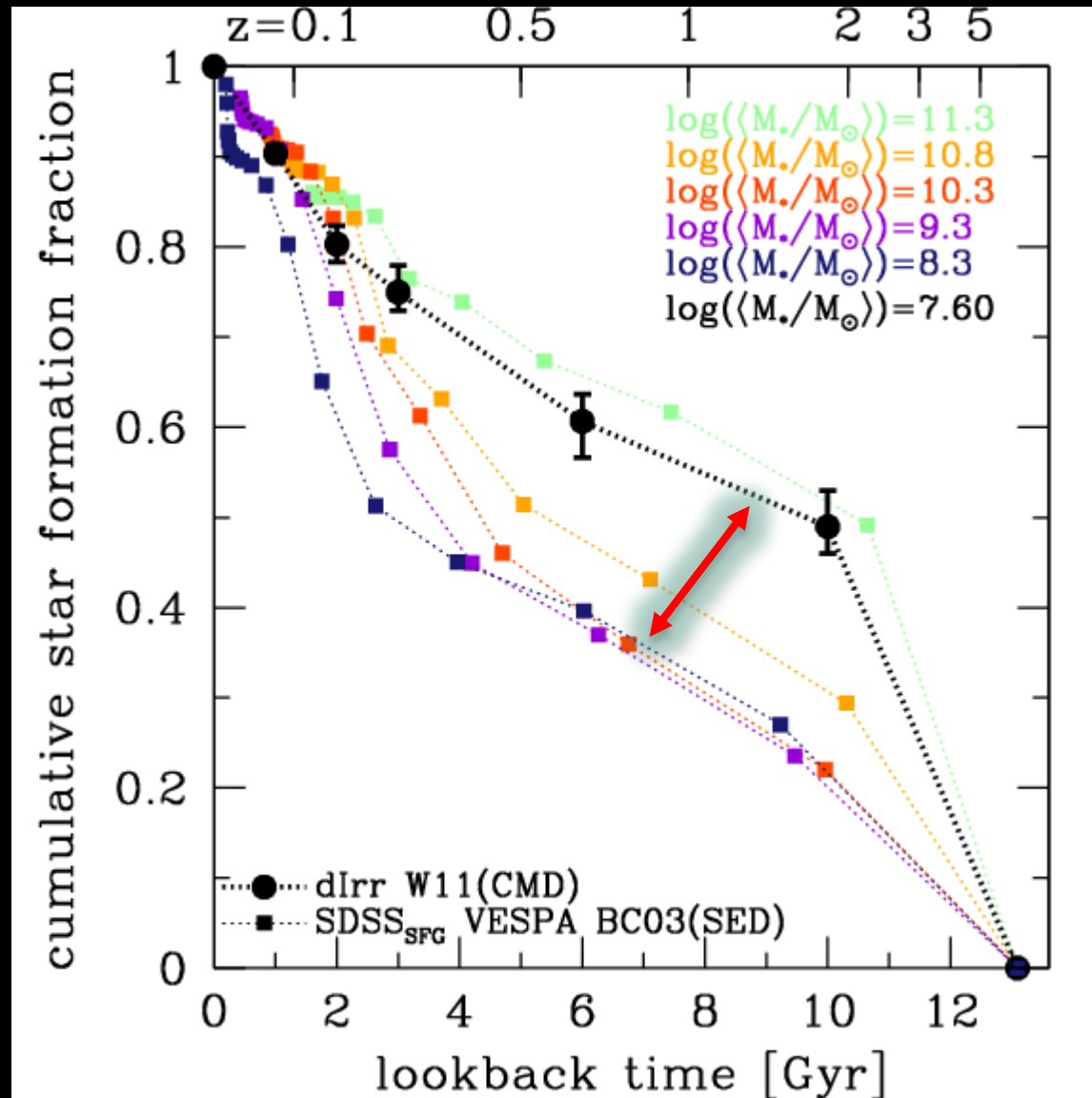
Consistency between SEDs and the main sequence



A transition at low masses?



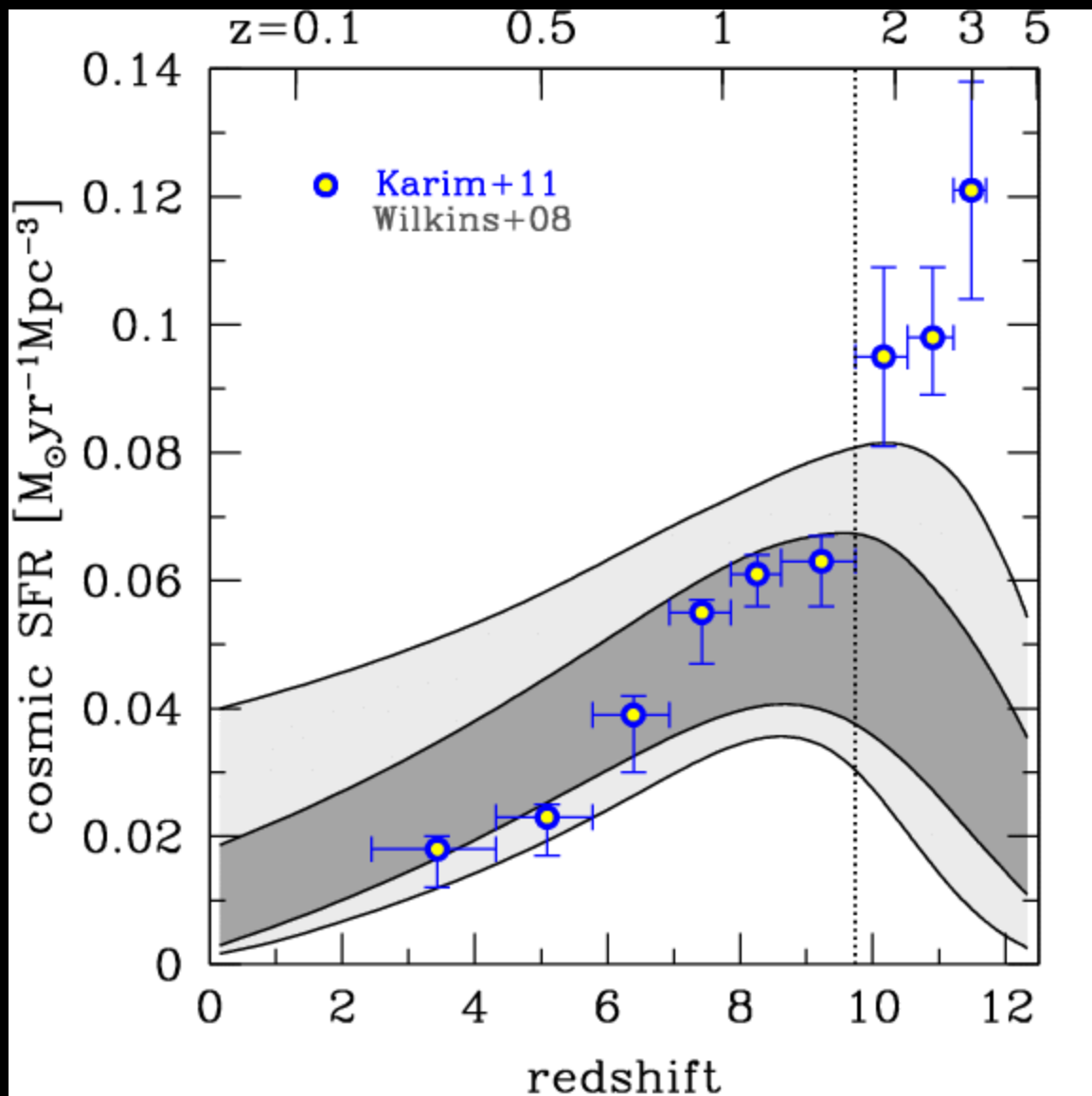
A transition at low masses? An SED/CMD discrepancy?



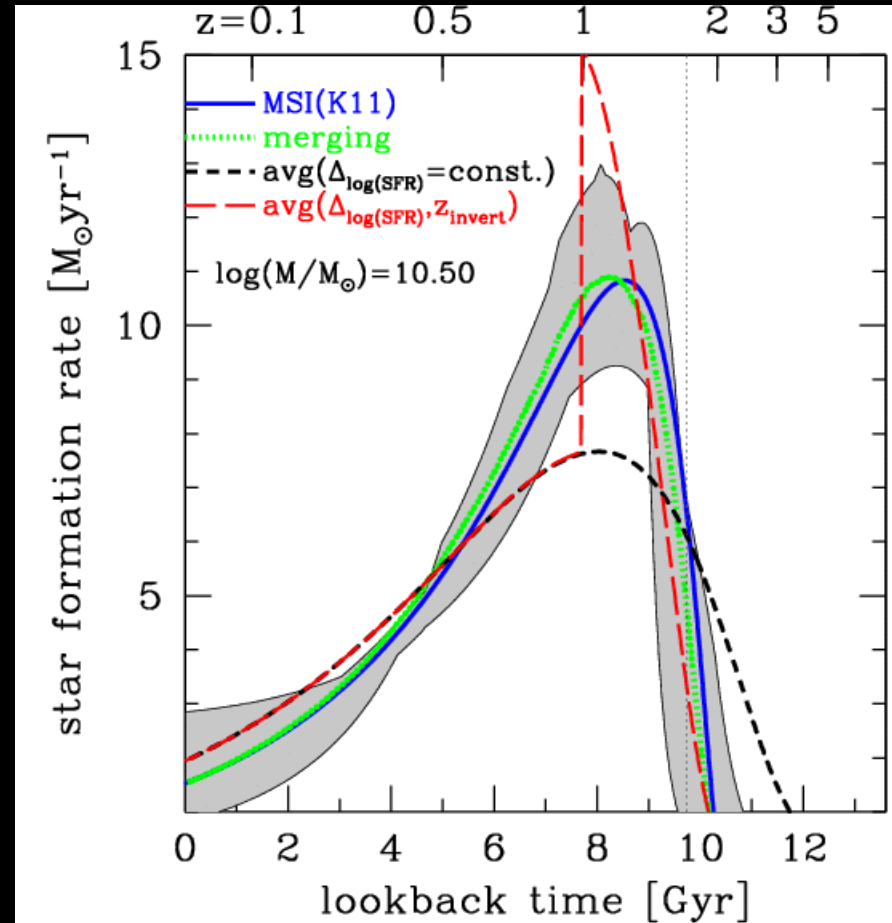
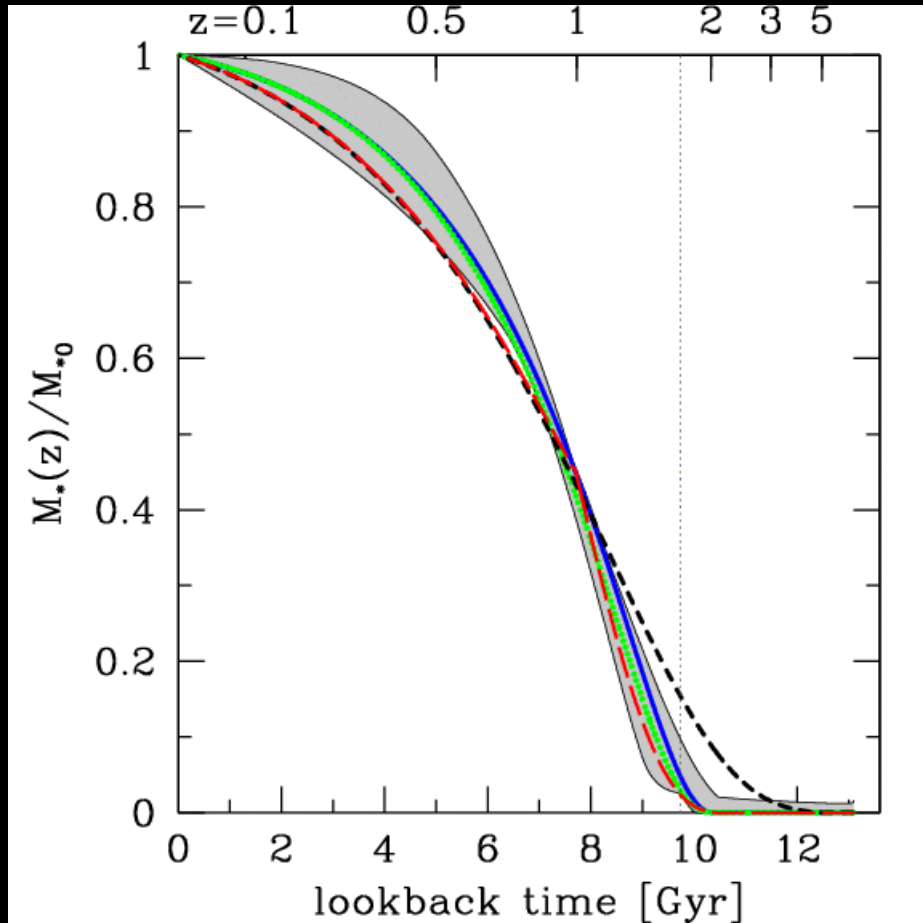
Summary and Conclusions

- 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 $M_* = 1-5 \times 10^{10}$ 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, $\rho_{\text{SFR}} \neq \Delta\rho_*$, effect of scatter in SFR- M_* , other high S/N SED- and CMD-based disk observations.

arXiv:1108.0938



Merging and Scatter



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

