Effects of the stochasticity of galaxy angular momentum growth on star formation

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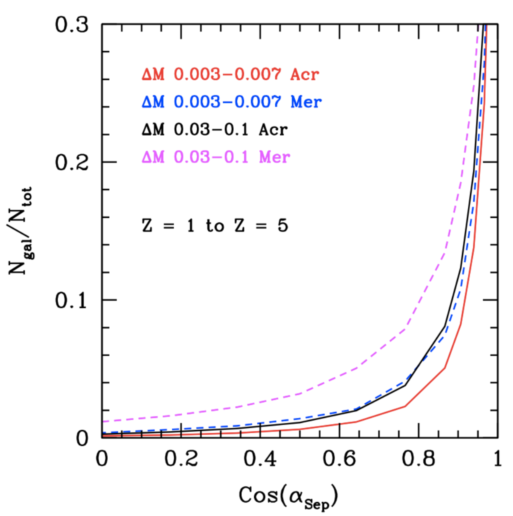
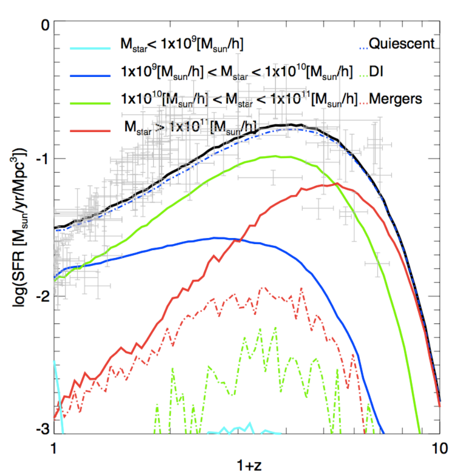
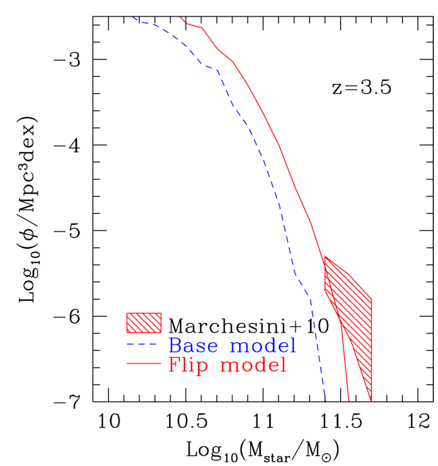
MARIE CURIE ACTIONS

OUTLINE

- 1 Models of galaxy formation
- 2 Angular mom. of infalling material and its effect in a SAM
- 3 Results on galaxy sizes and stellar masses (low and high z)







1A) MODELS OF GALAXY FORMATION

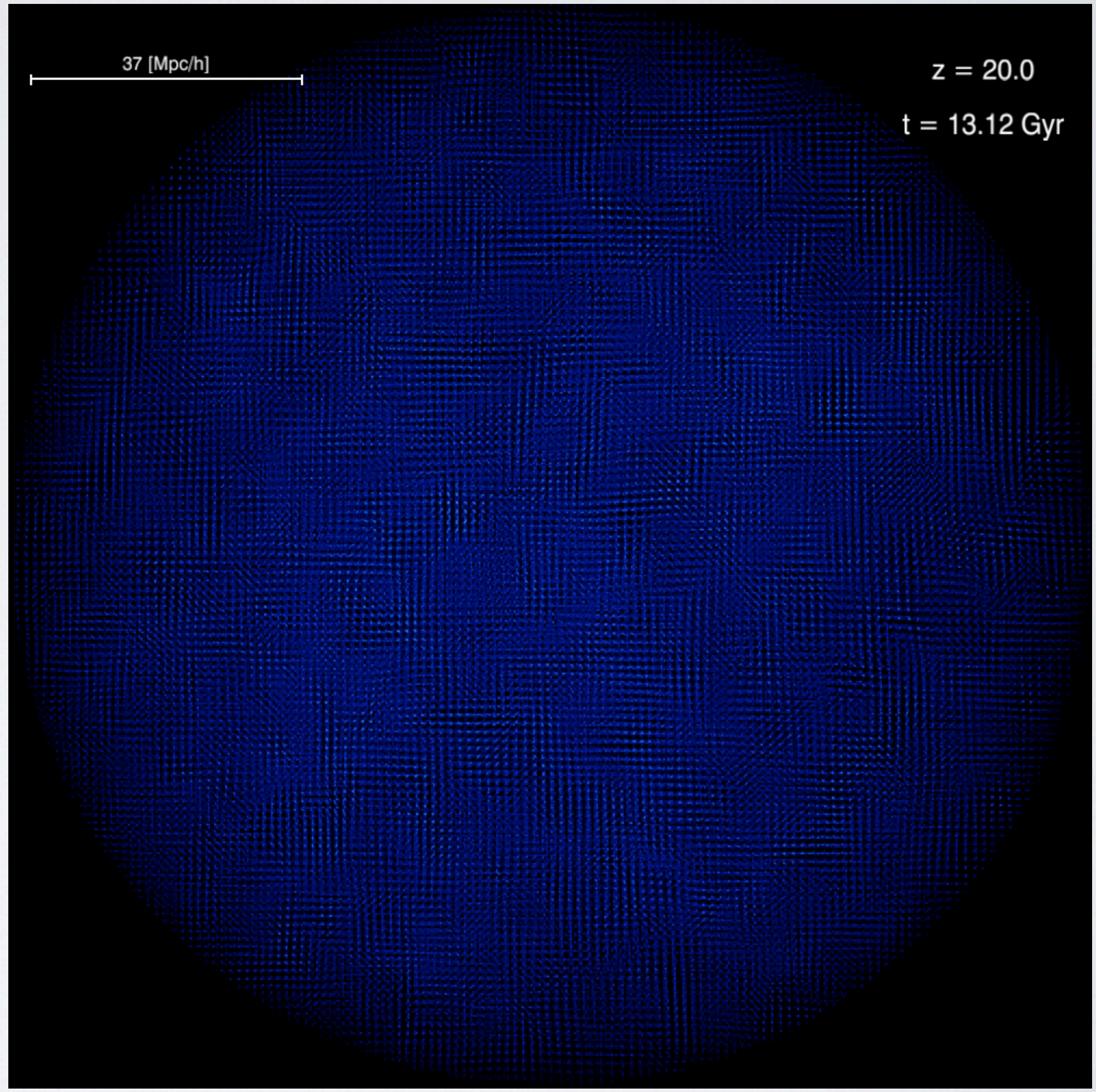
Cosmological
periodic
comoving
boxes.

DM-only:
halos of 1e10Msun and up.

Our sim: 640^3 particles

Millennium II:
2000^3 particles

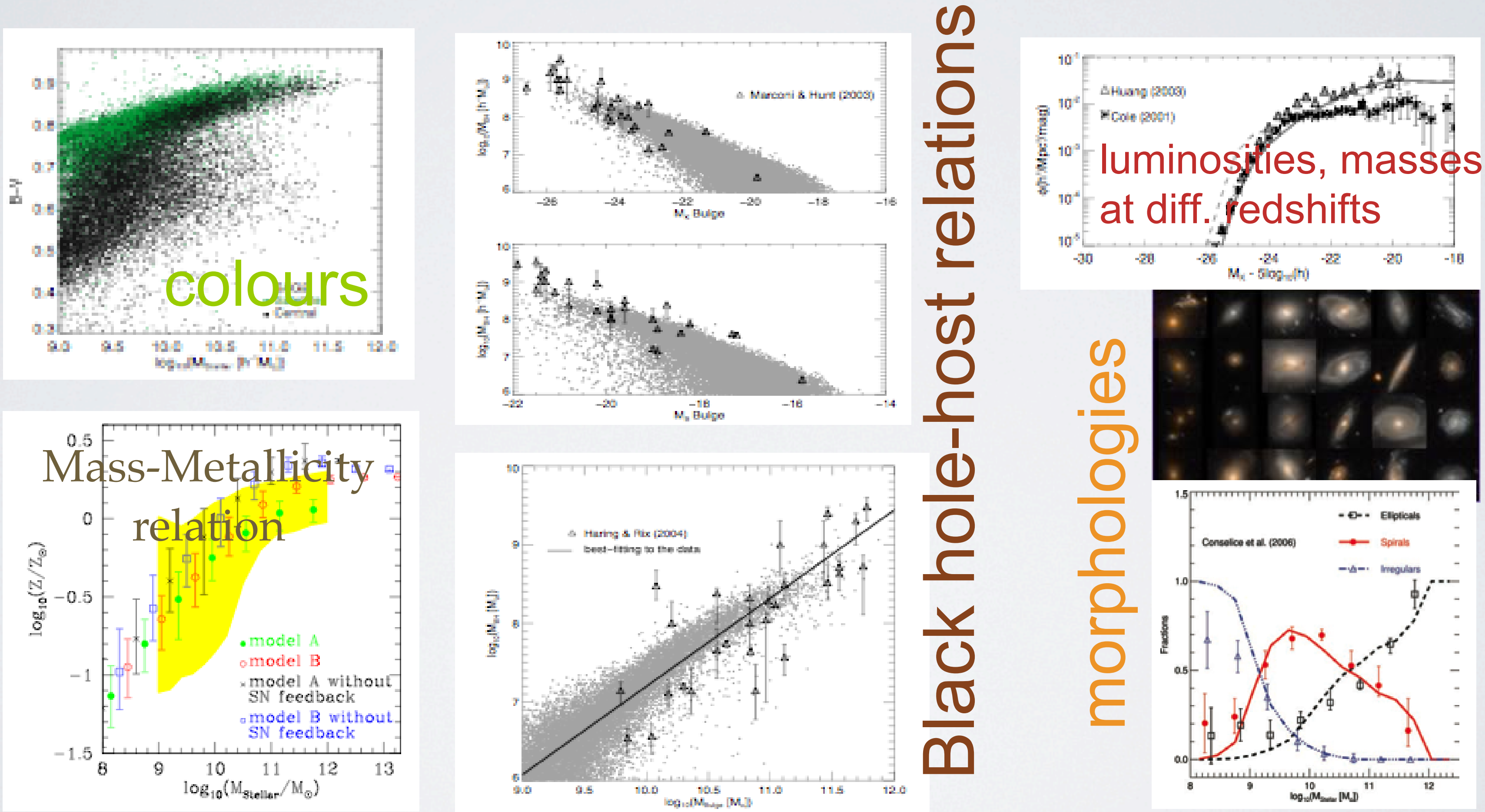
MII 100xparticles per halo of
equal mass



Gonzalez et al. 2009

1B) SEMI-ANALYTIC MODEL

Fix free parameters using a set of z=0 statistics:

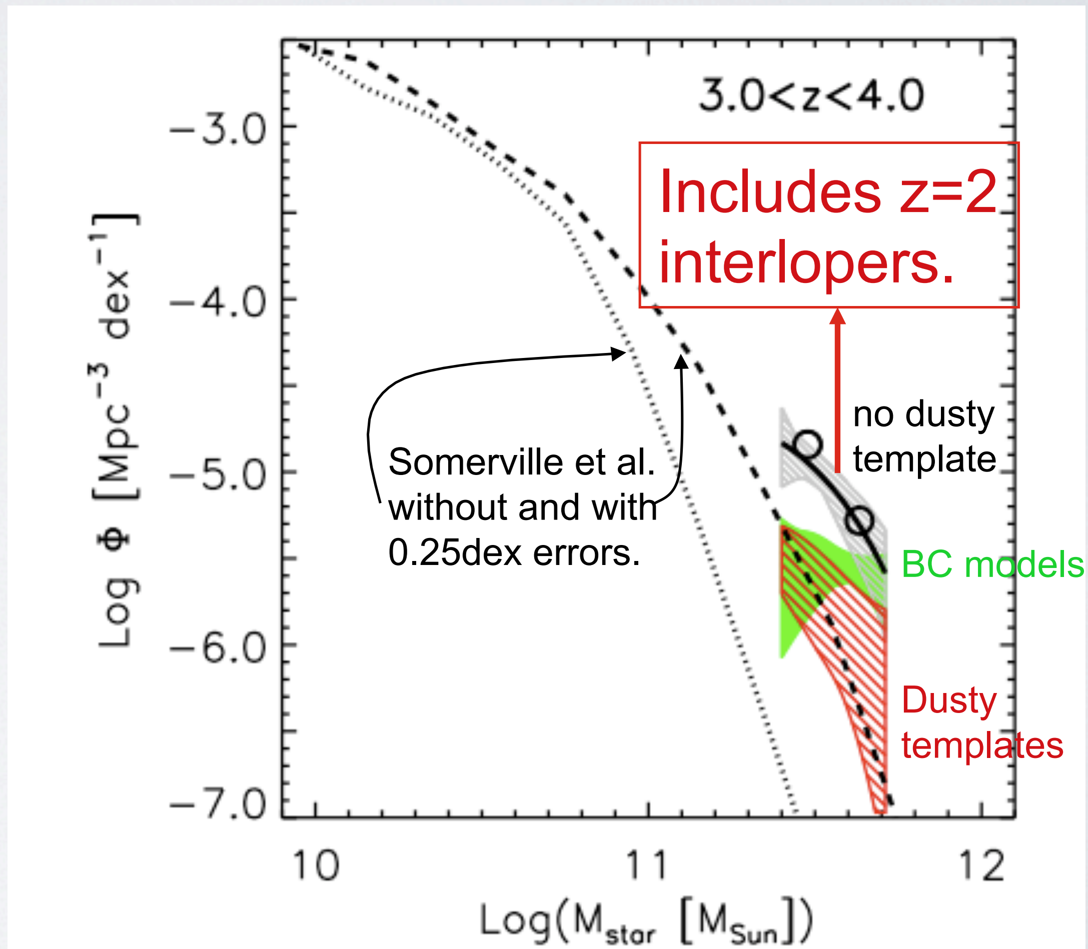


Springel et al. (2001), Lagos, Cora & Padilla (2008), Lagos, Padilla & Cora (2009), Tecce et al. (2010)

1C) MODELS PERFORMANCE AT HIGH-

General deficit of high-z massive galaxies

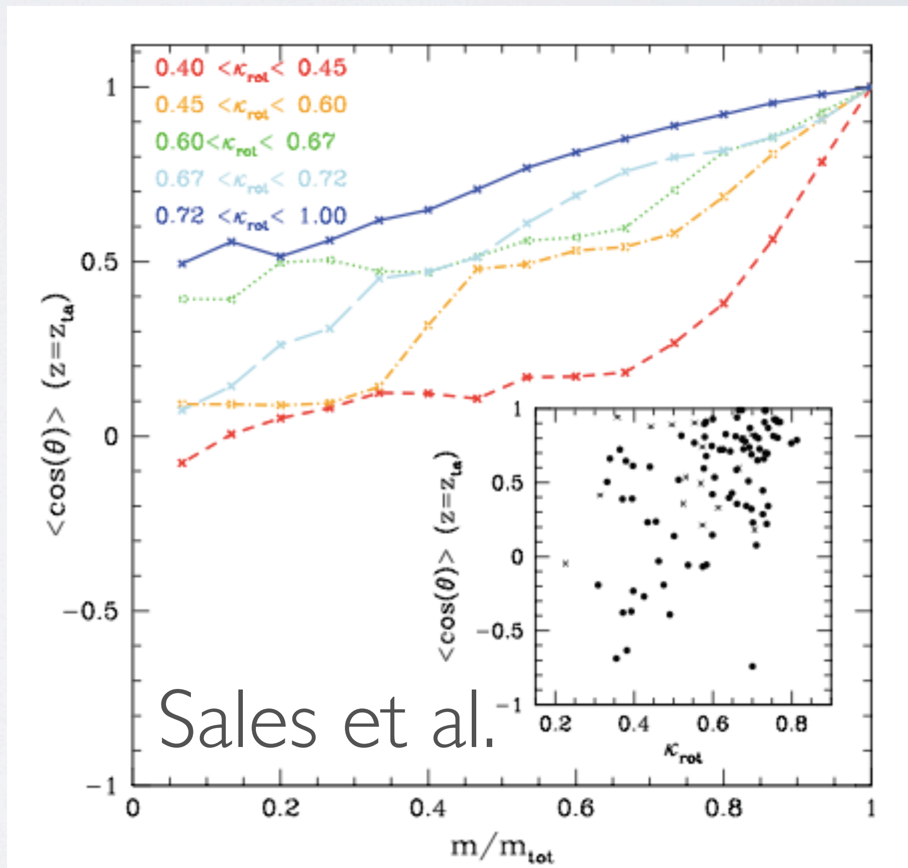
NEWFIRM Medium Band Survey
Marchesini et al. (2010)



2) ANGULAR MOMENTUM

Sales et al. (2012) show that surviving discs (k_rot high) in GIMIC show good alignment of angular momentum of mass enclosed in given radius (m/m_tot) with total angular momentum at time of turn-around.

Missalignments by accretion of material destroy the disc, and a new disc starts to form. Discs are episodic.



GIMIC

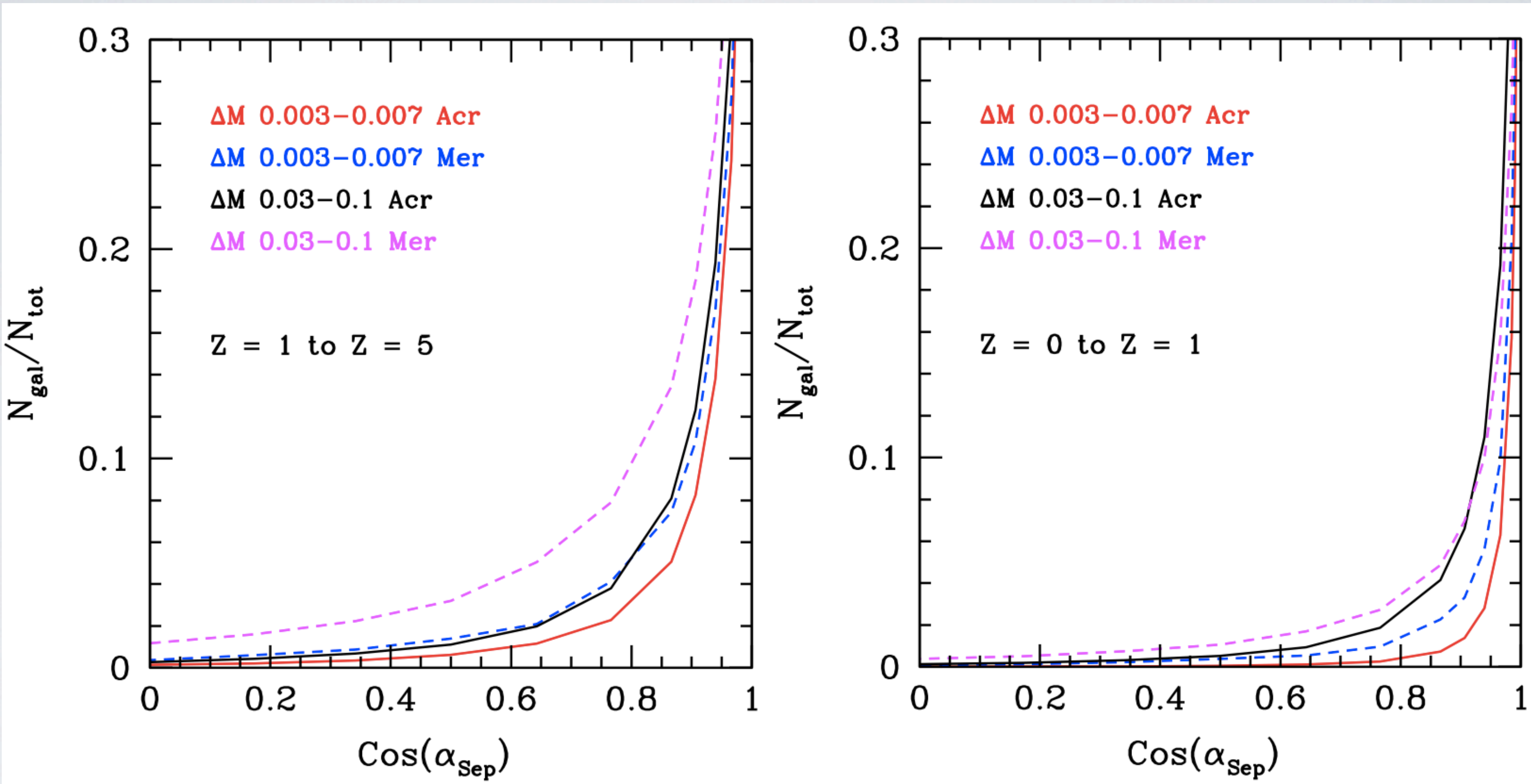
2) ANGULAR MOMENTUM IN SAMS

Enough resolution:
Angular momentum is followed numerically
A halo needs to have at least 1000 particles for a reliable measurement of the three components of its angular momentum vector.

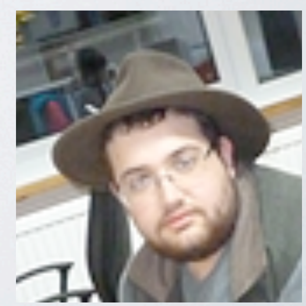
Low resolution (SAMs):
Directions of spins assigned using MC simulations

Lagos, Cora & Padilla (2008), Lagos, Padilla & Cora (2009), Tecce et al. (2010)

2) MILLENNIUM II ANALYSIS



- Notice that change in direction is larger for mergers.
- Cos(alpha_sep) as a function of fraction of accreted mass.



S. Contreras

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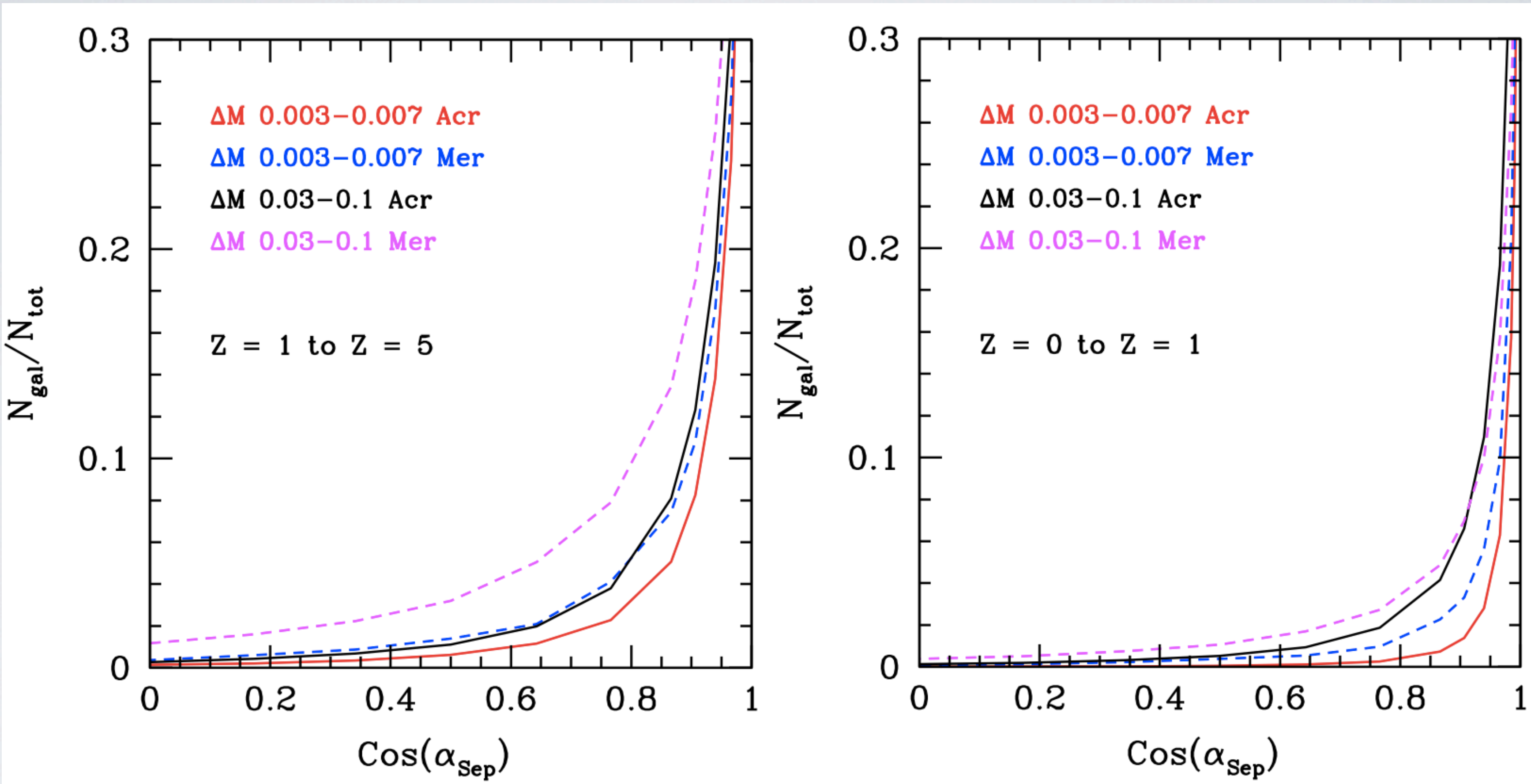

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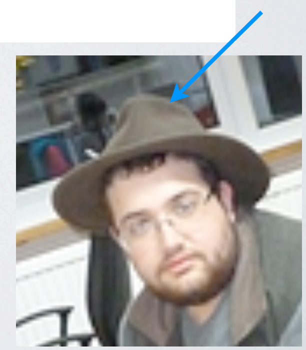

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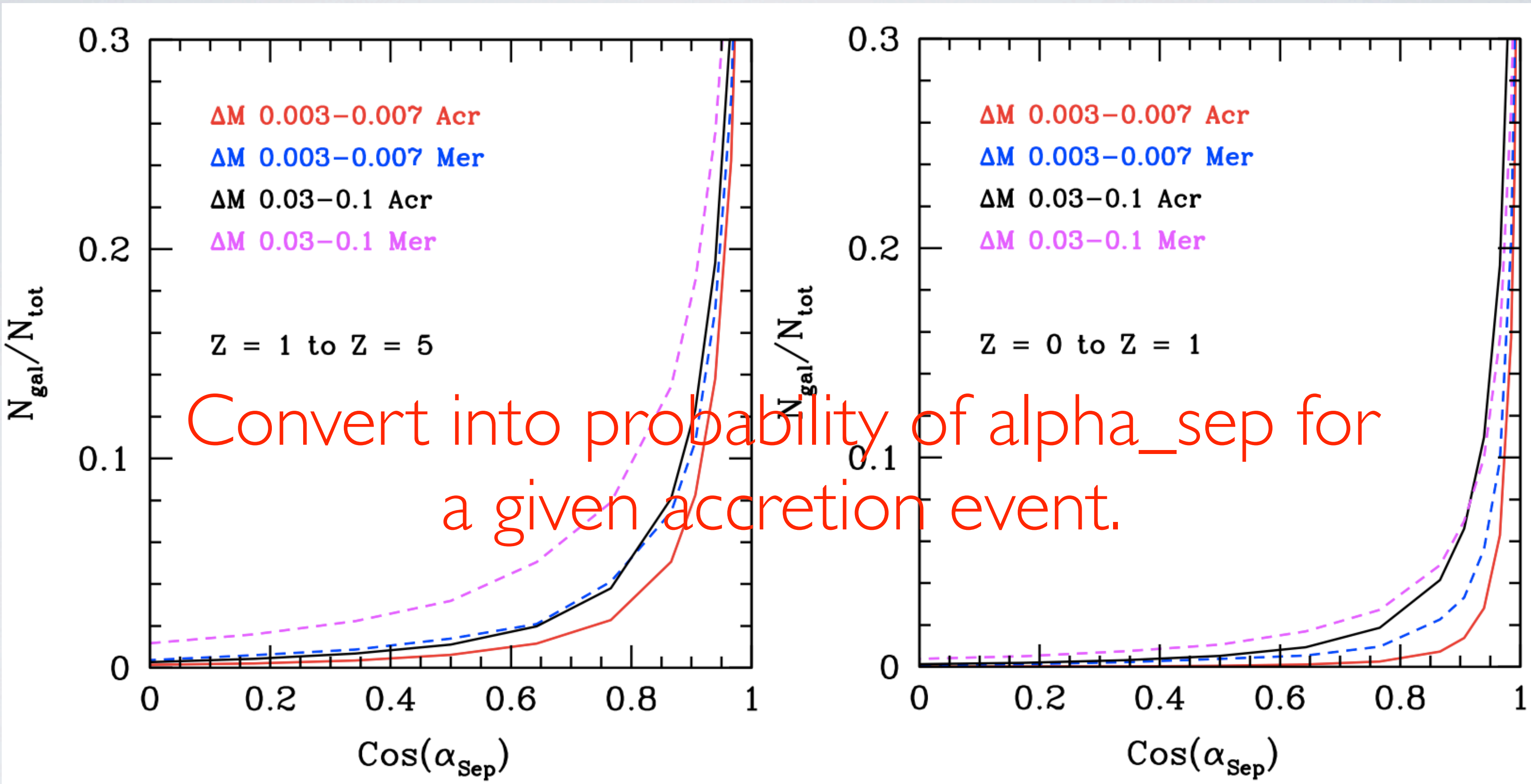

Convert into probability of alpha_sep for a given accretion event.

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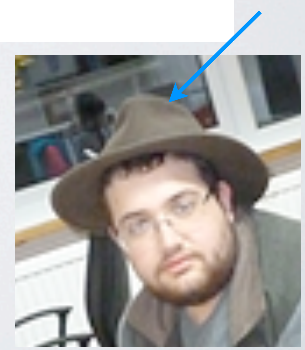

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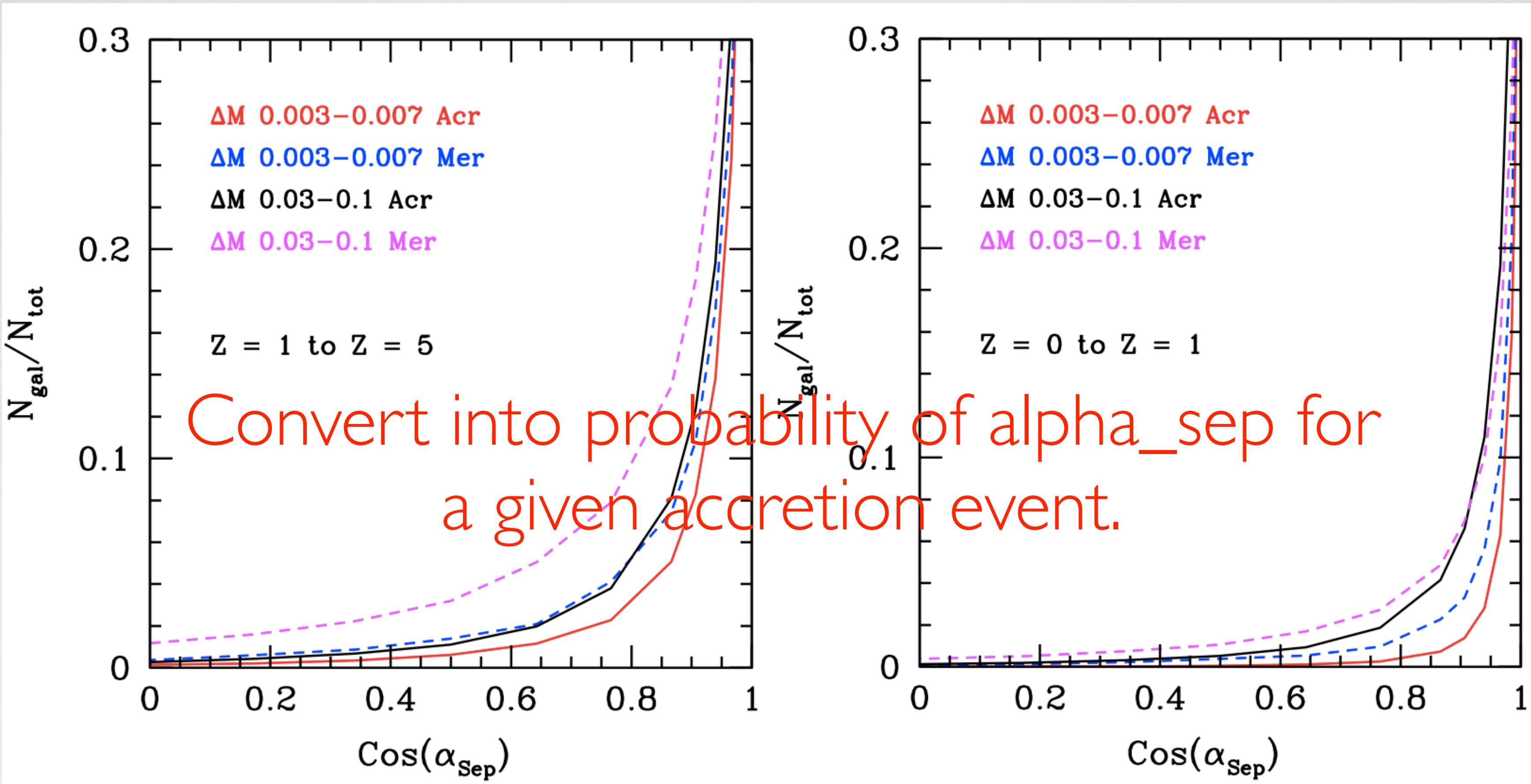

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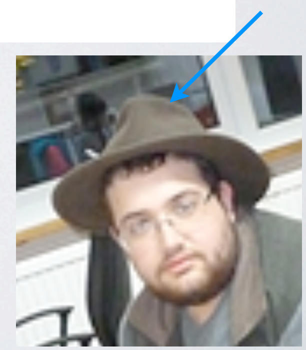
- Notice that change in direction is larger for mergers.
- Cos(alpha_sep) as a function of fraction of accreted mass.
- Rdisc_new=Rdisc_old*Cos(apha_sep) (Stochastic)



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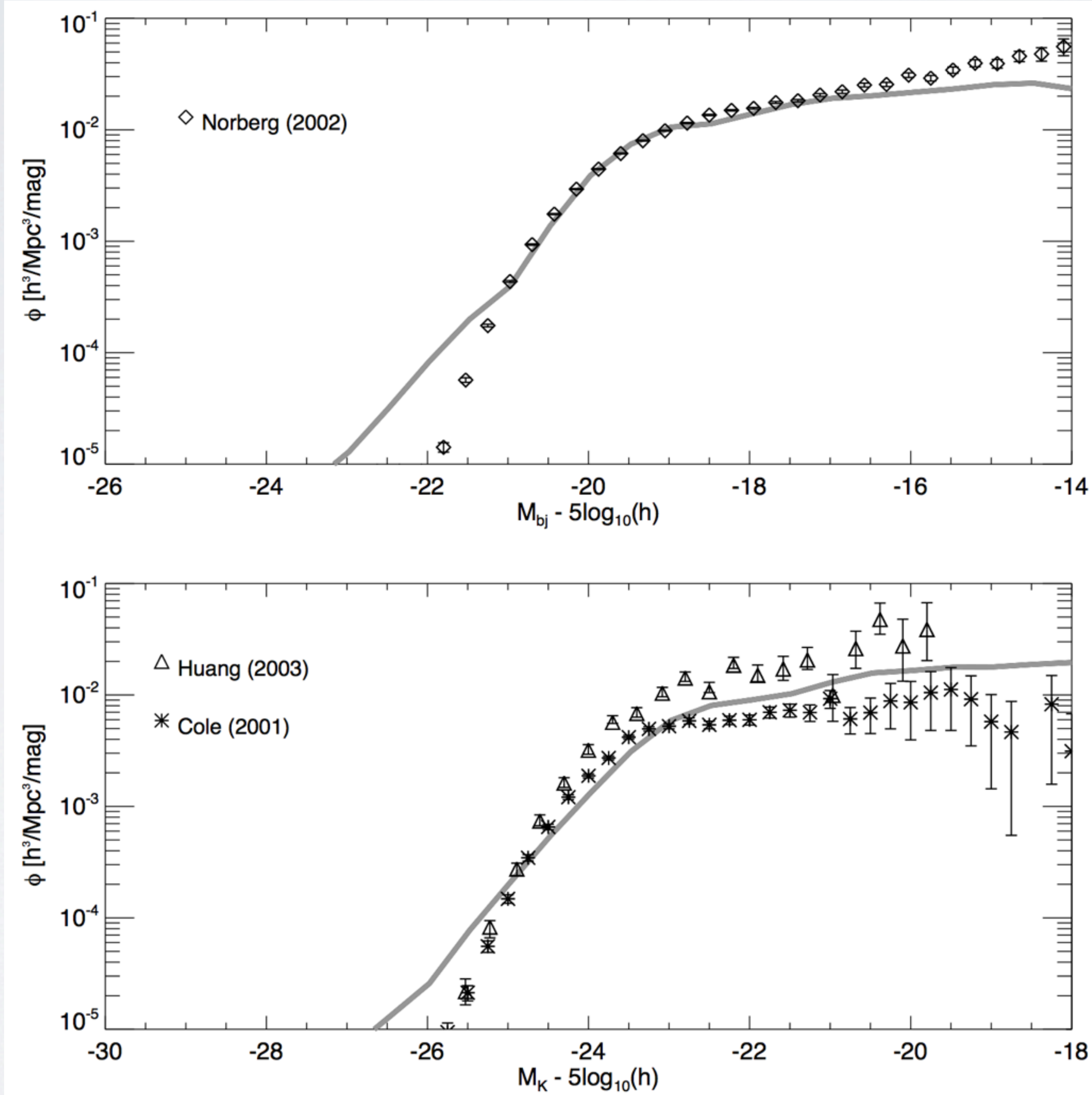
SAM PARAMETERS FIXED WITH LF

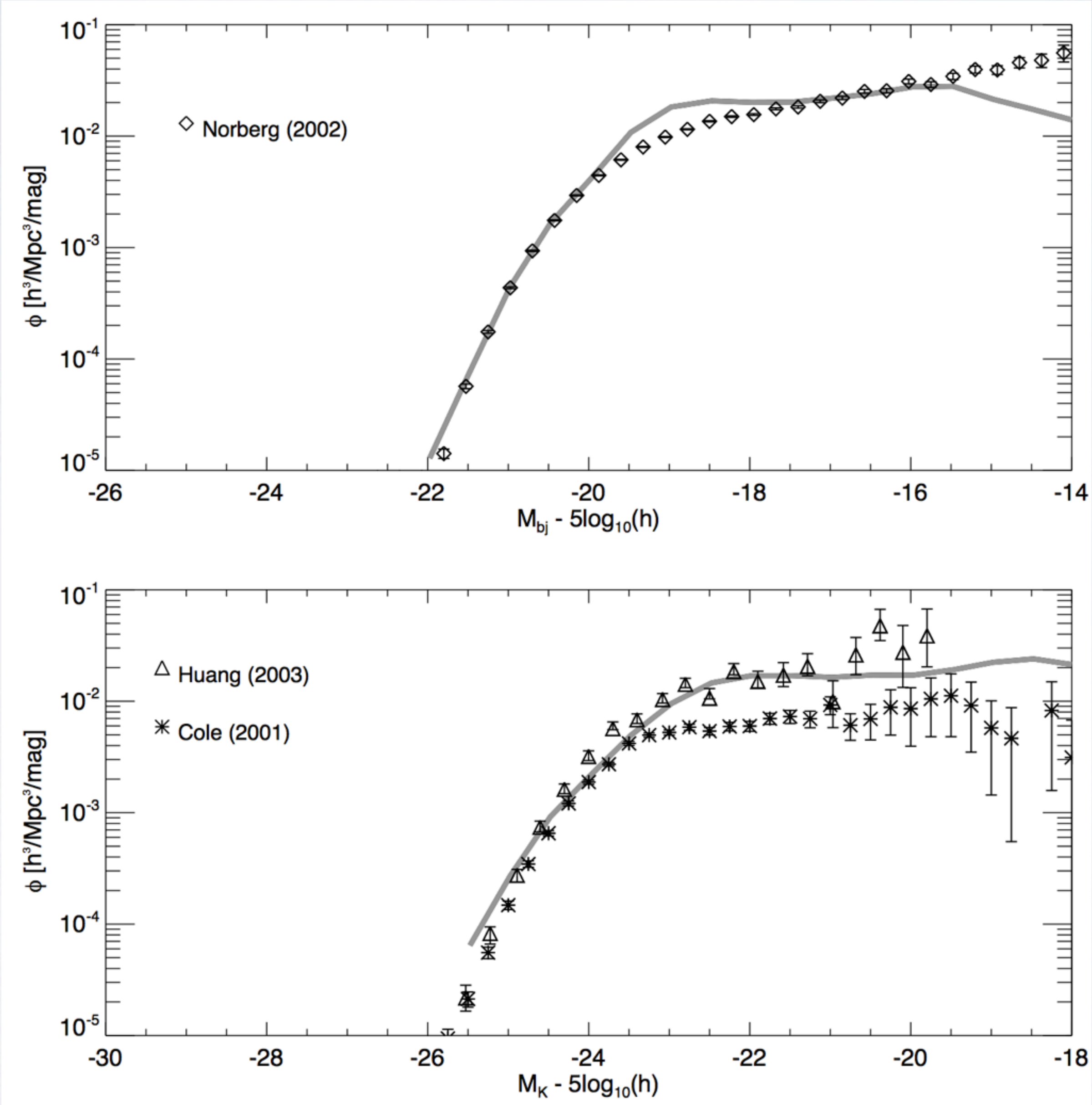
Smooth growth in disc size



SAM PARAMETERS FIXED WITH LF

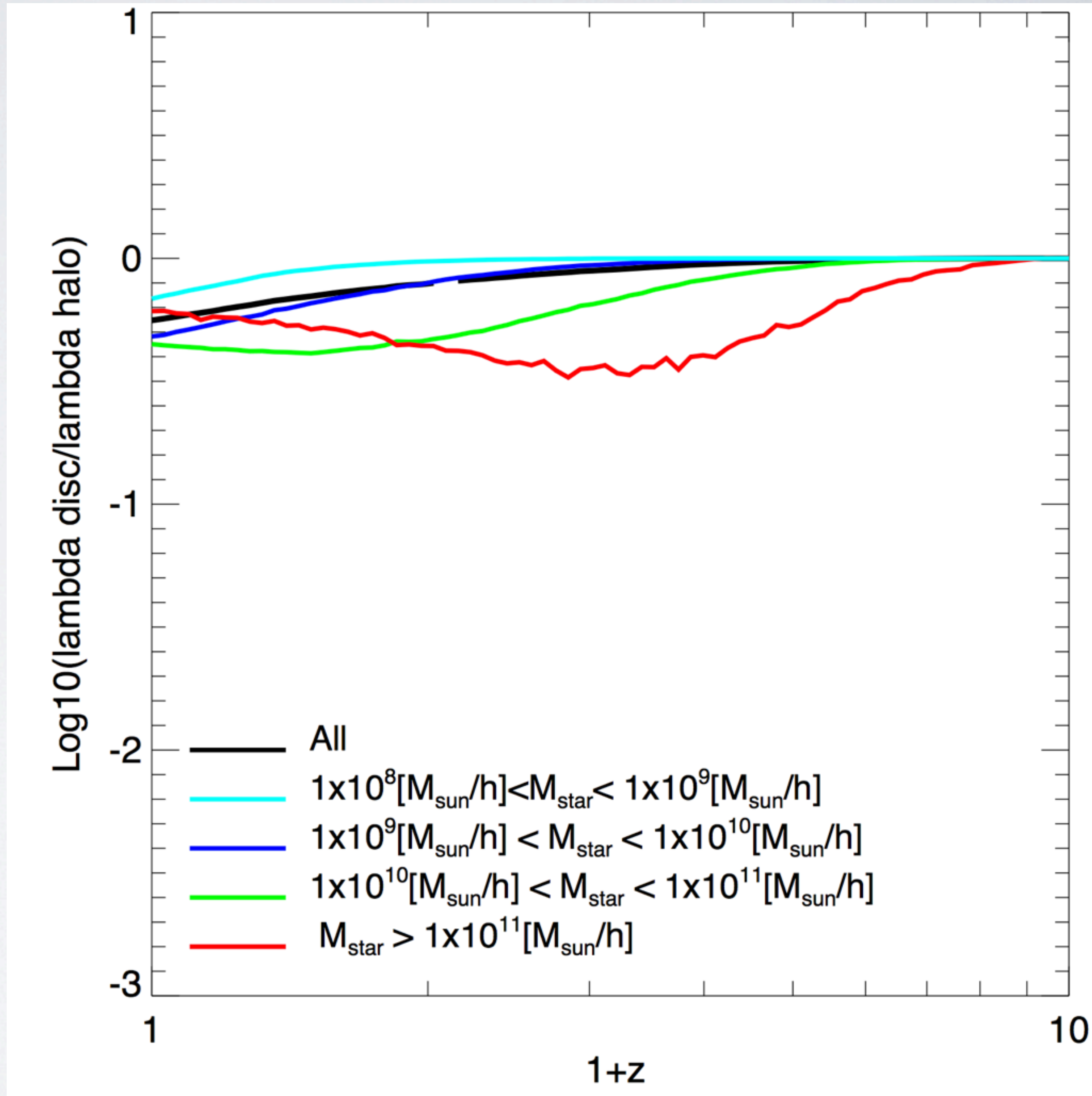
With episodic discs

SF efficiency lowered to reproduce LF at z=0



2) EFFECT ON SF

Resulting ratios between specific angular momenta of disc to halo



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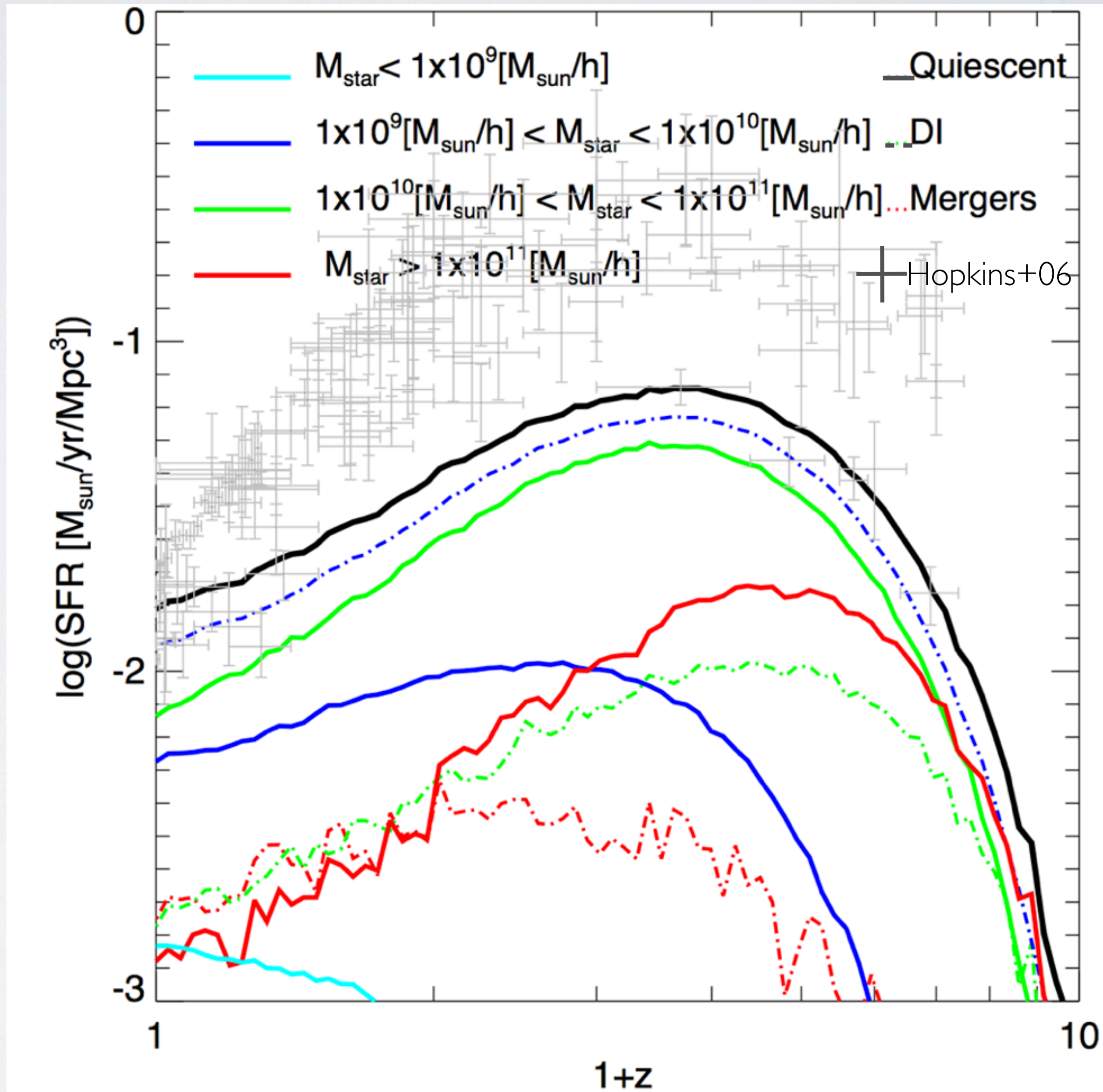
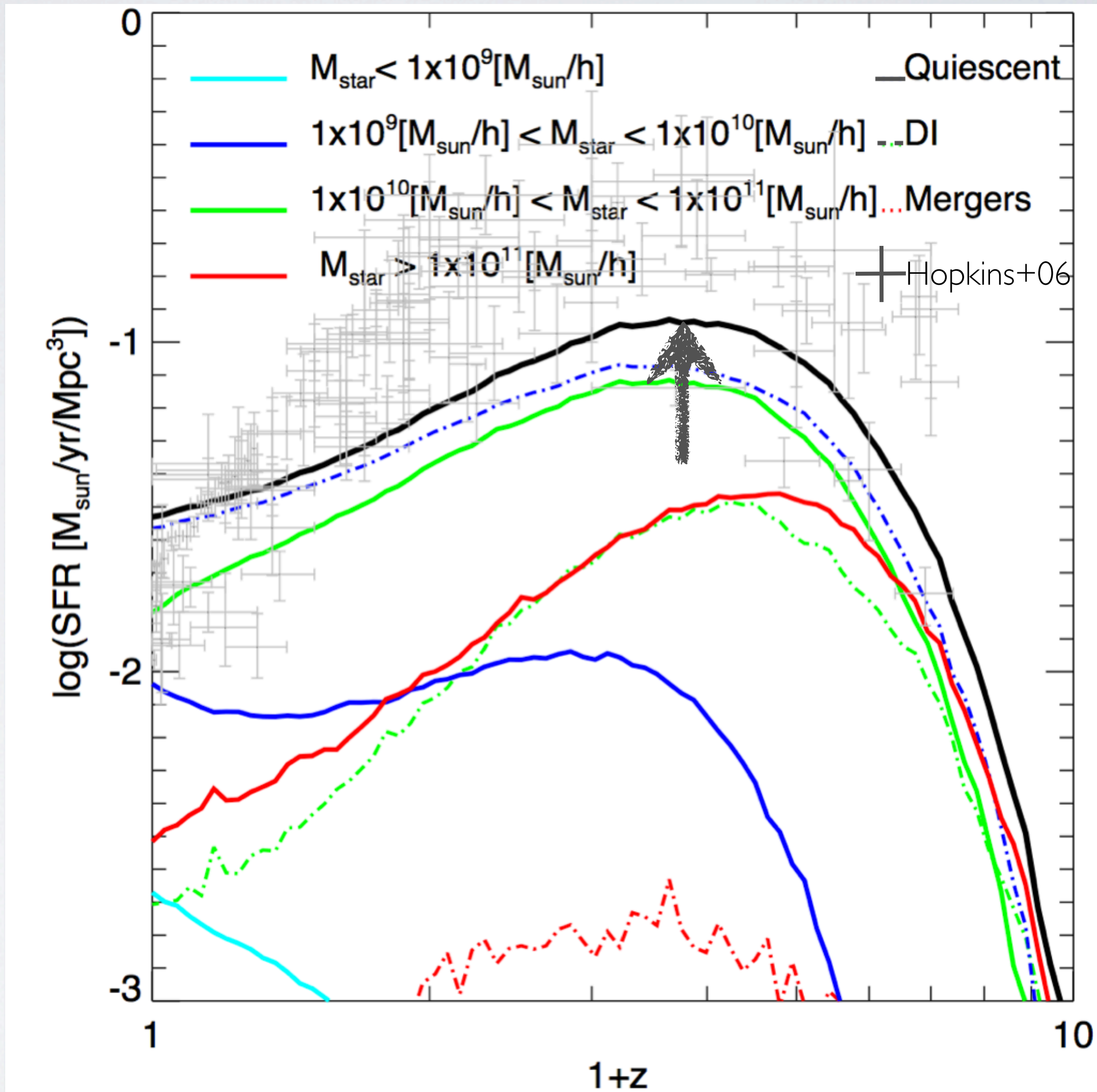


2) EFFECT ON SF

With episodic discs

Rdisk is smaller
Tdyn is smaller
SFR is higher



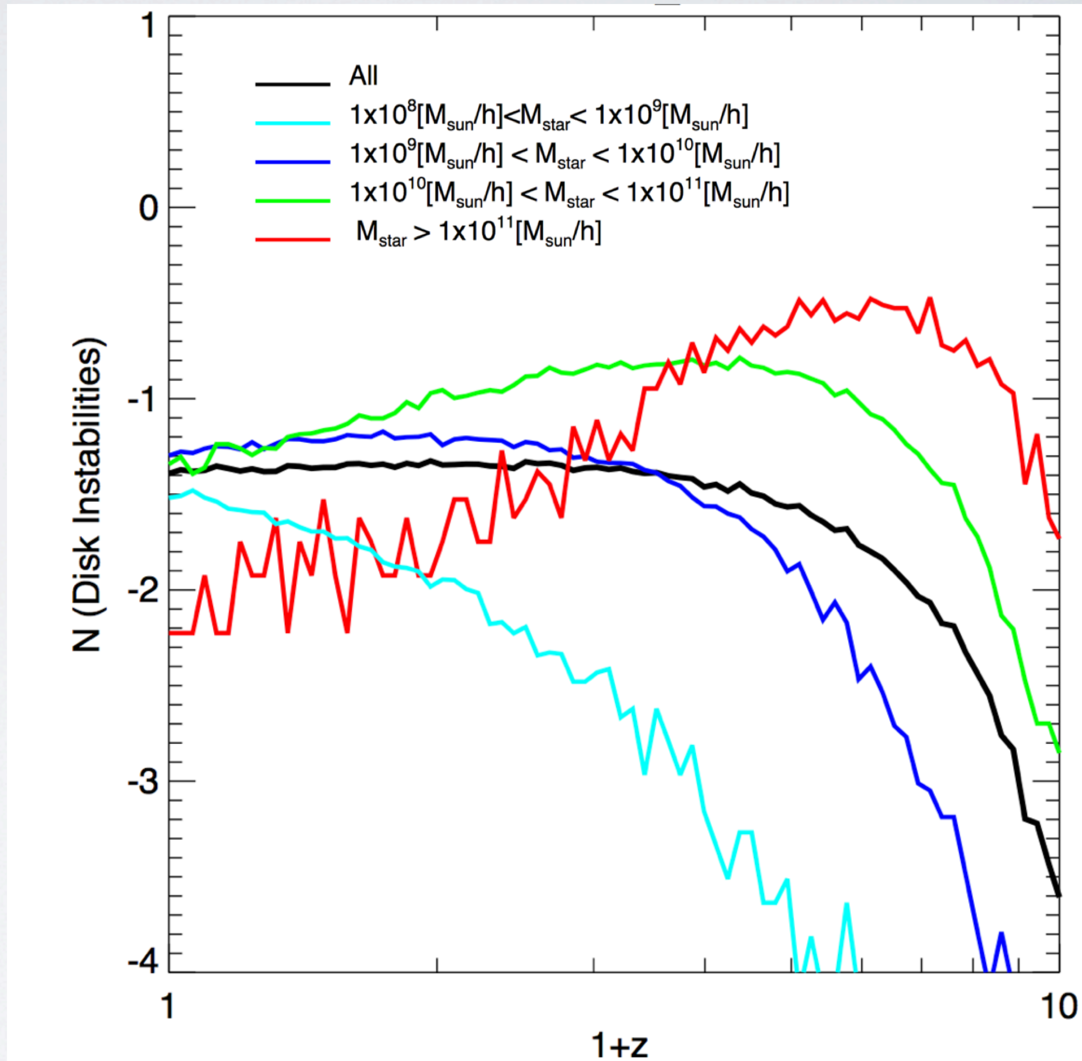
2) EFFECT ON SF

Number of disc instabilities

$$\epsilon = \frac{V_{\rm max}}{(GM_{\rm disc}/r_{\rm disc})^{1/2}},$$

if lower than critical value disc is unstable

r_disc is now subject to changes due to accretion which make epsilon very low



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With episodic discs:
50% global increase in instabilities