Linking galaxies with their dark halo:

clustering and HoD analyses from the PS1-MDF Taiwan stacks

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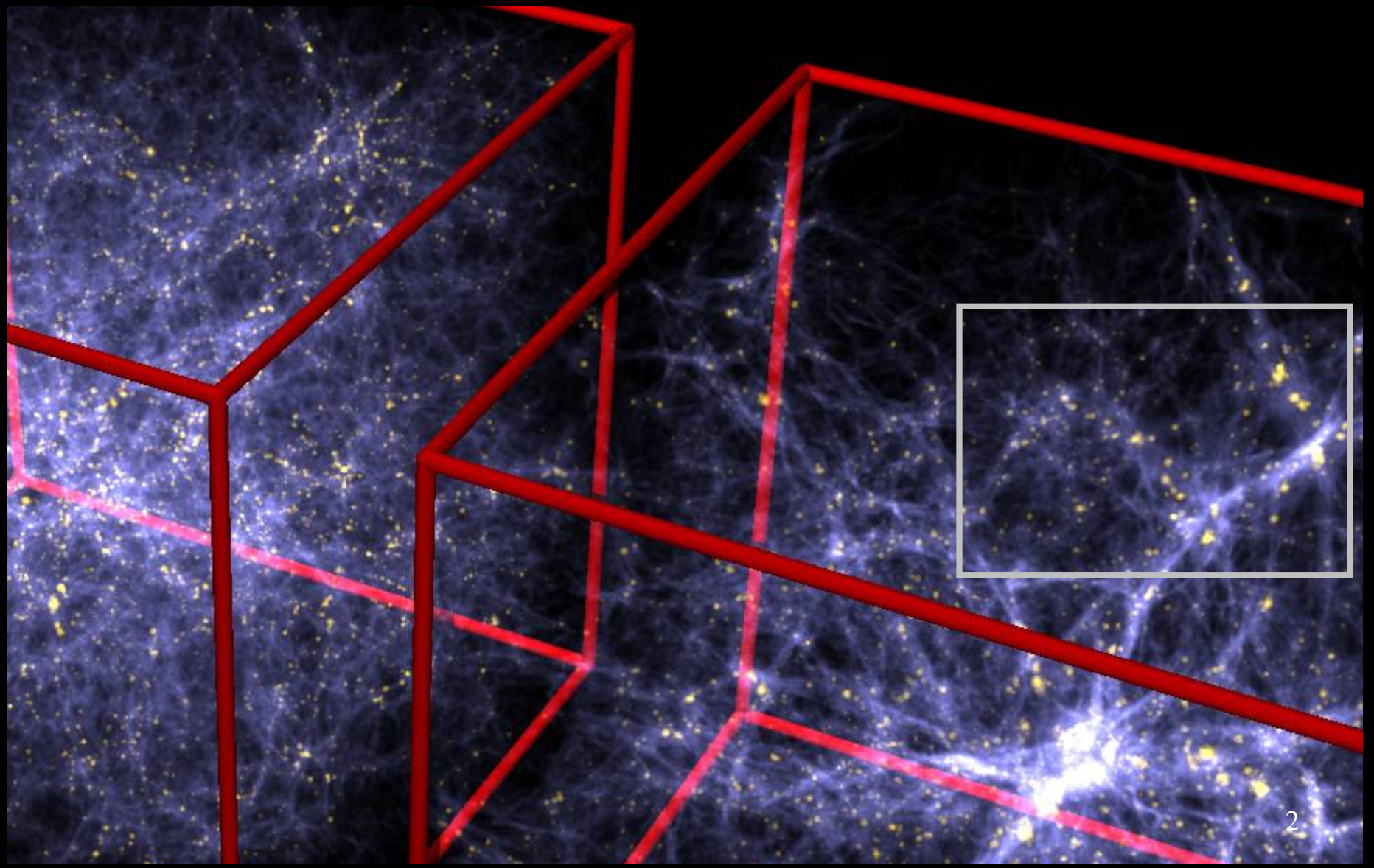
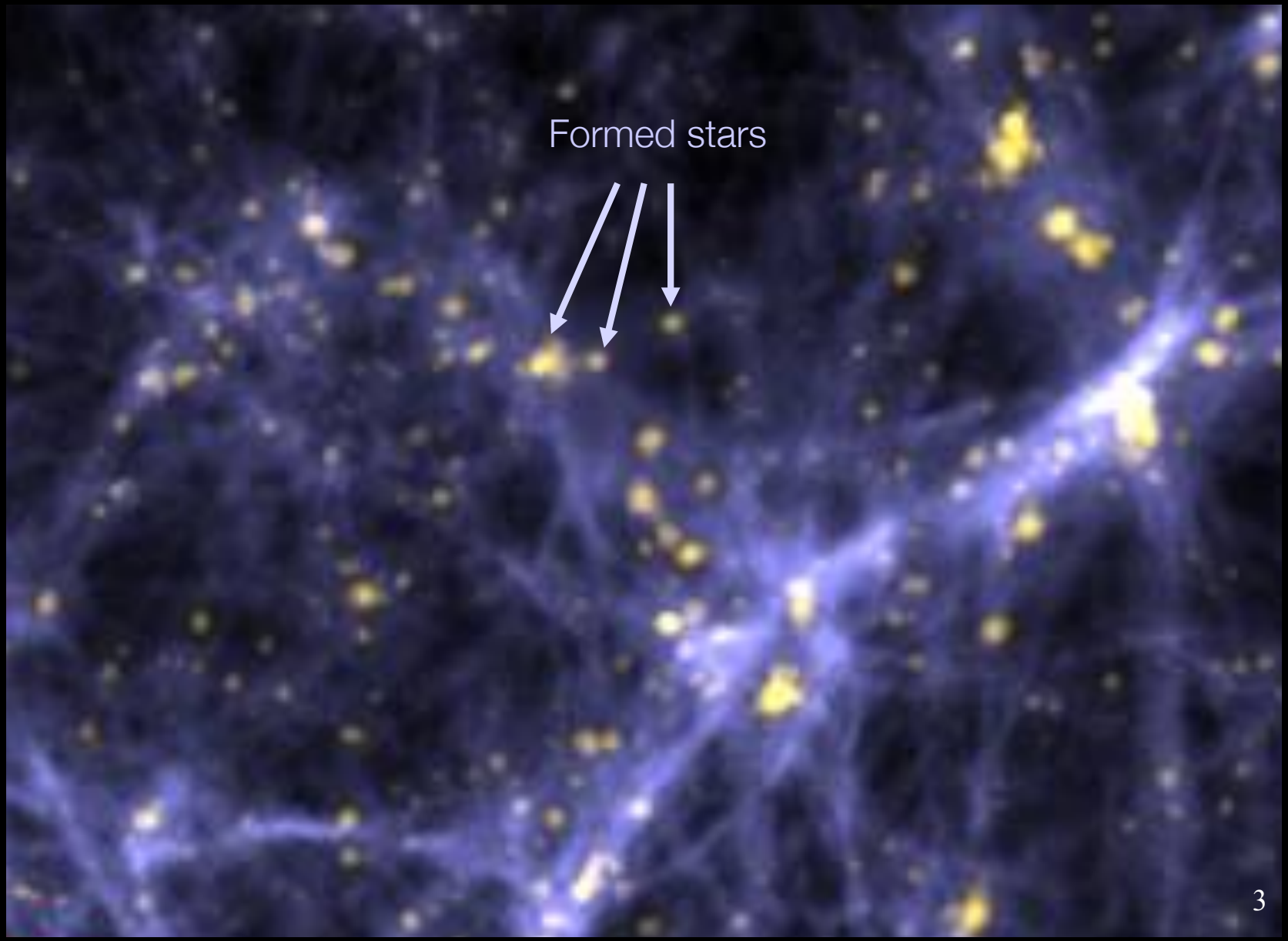
Steffi Phelps (MPE, Germany)

and the KP12 team

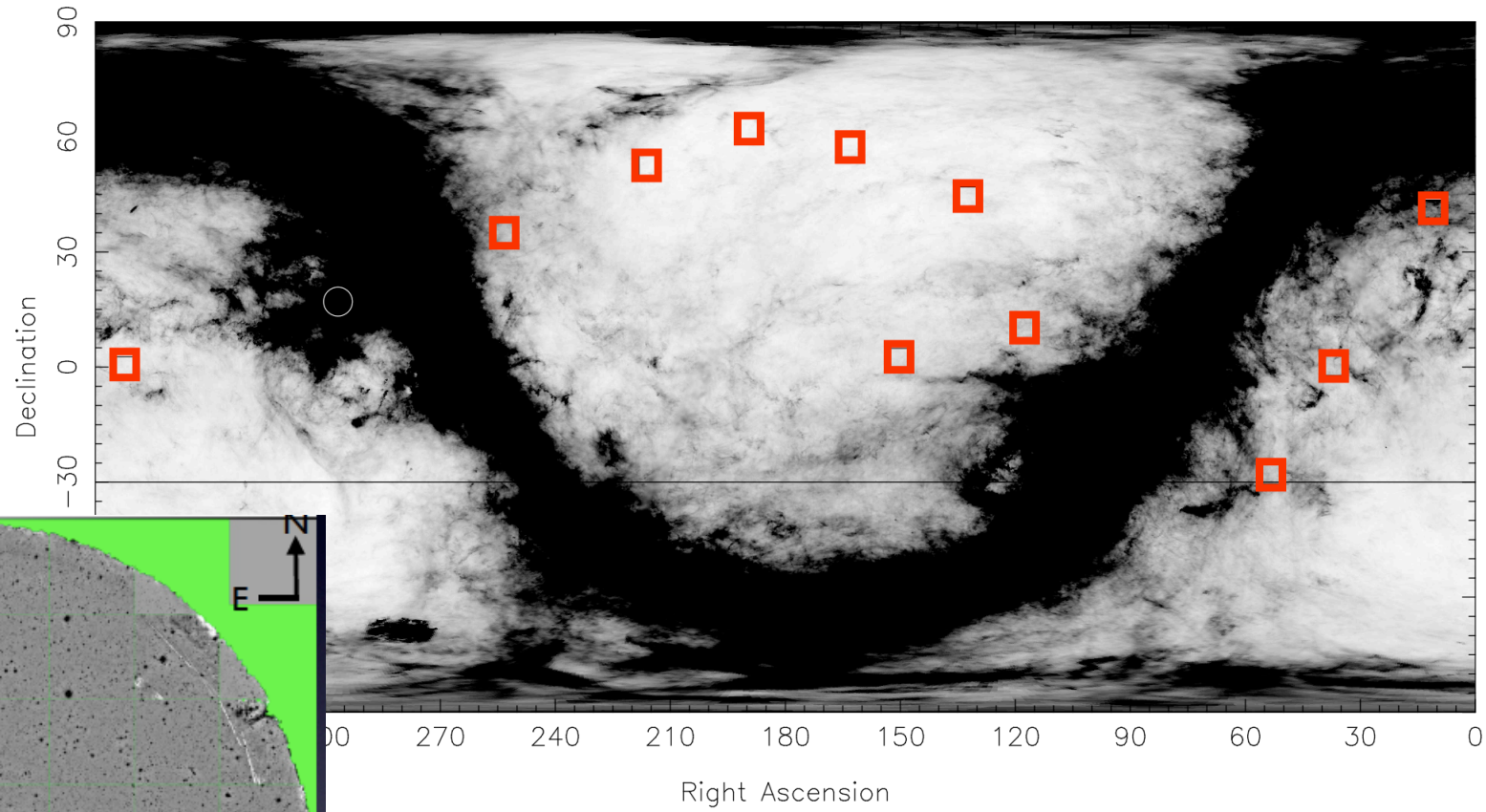
Visible galaxies embedded in the dark matter filaments

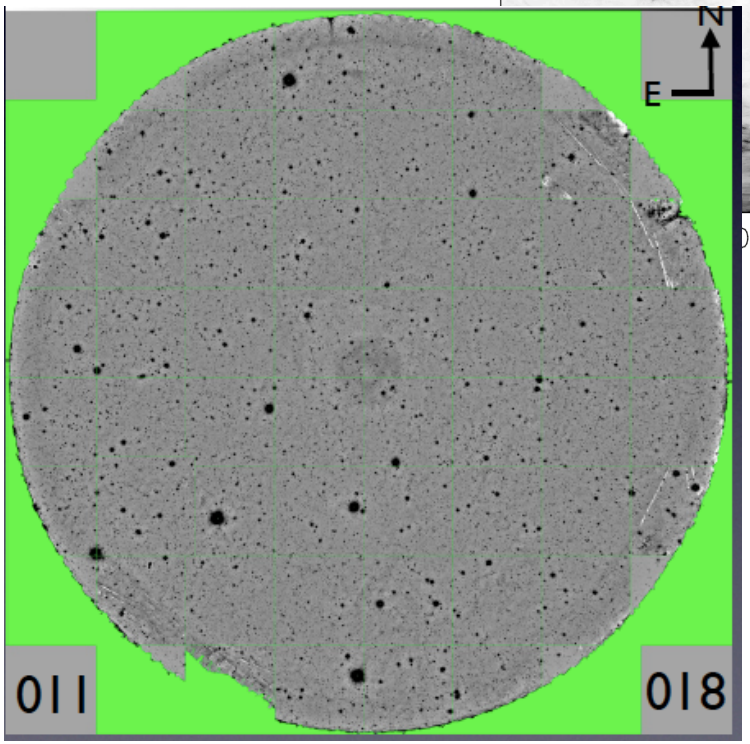


Visible galaxies embedded in the dark matter filaments



PS1-Medium Deep surveys



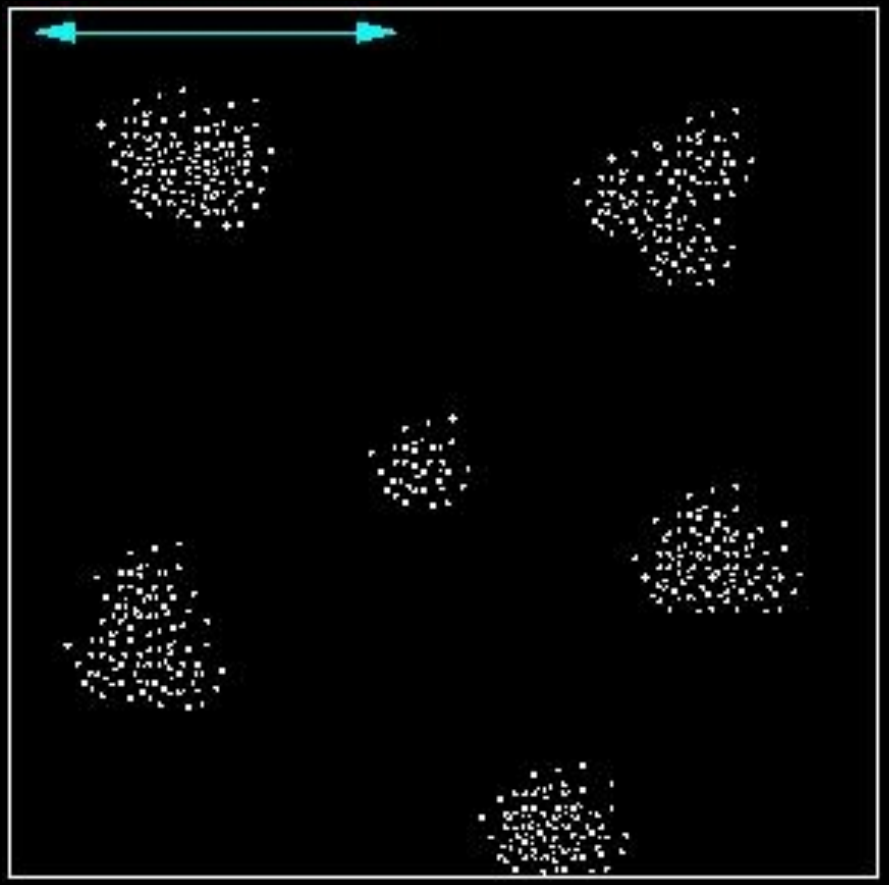


Huge volume sampled!

70deg^2 at 0.5<z<1.0 -> V~$10^8 h^{-3} Mpc^3$

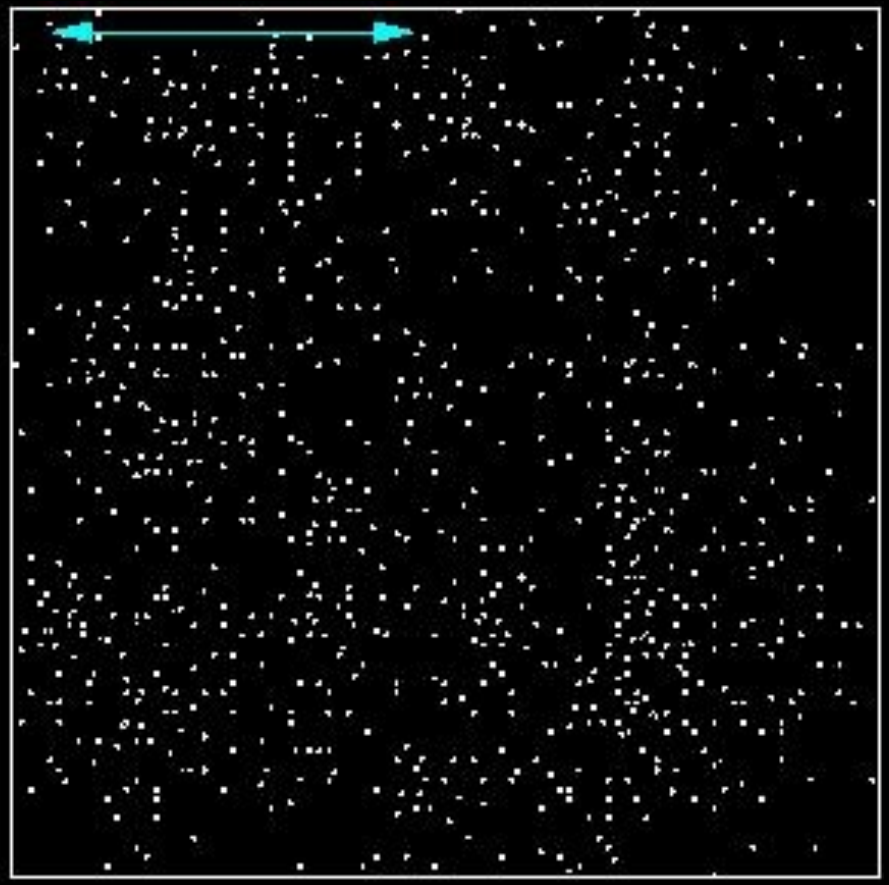
Clustering properties

Strong correlation



r_0 large

Weak correlation

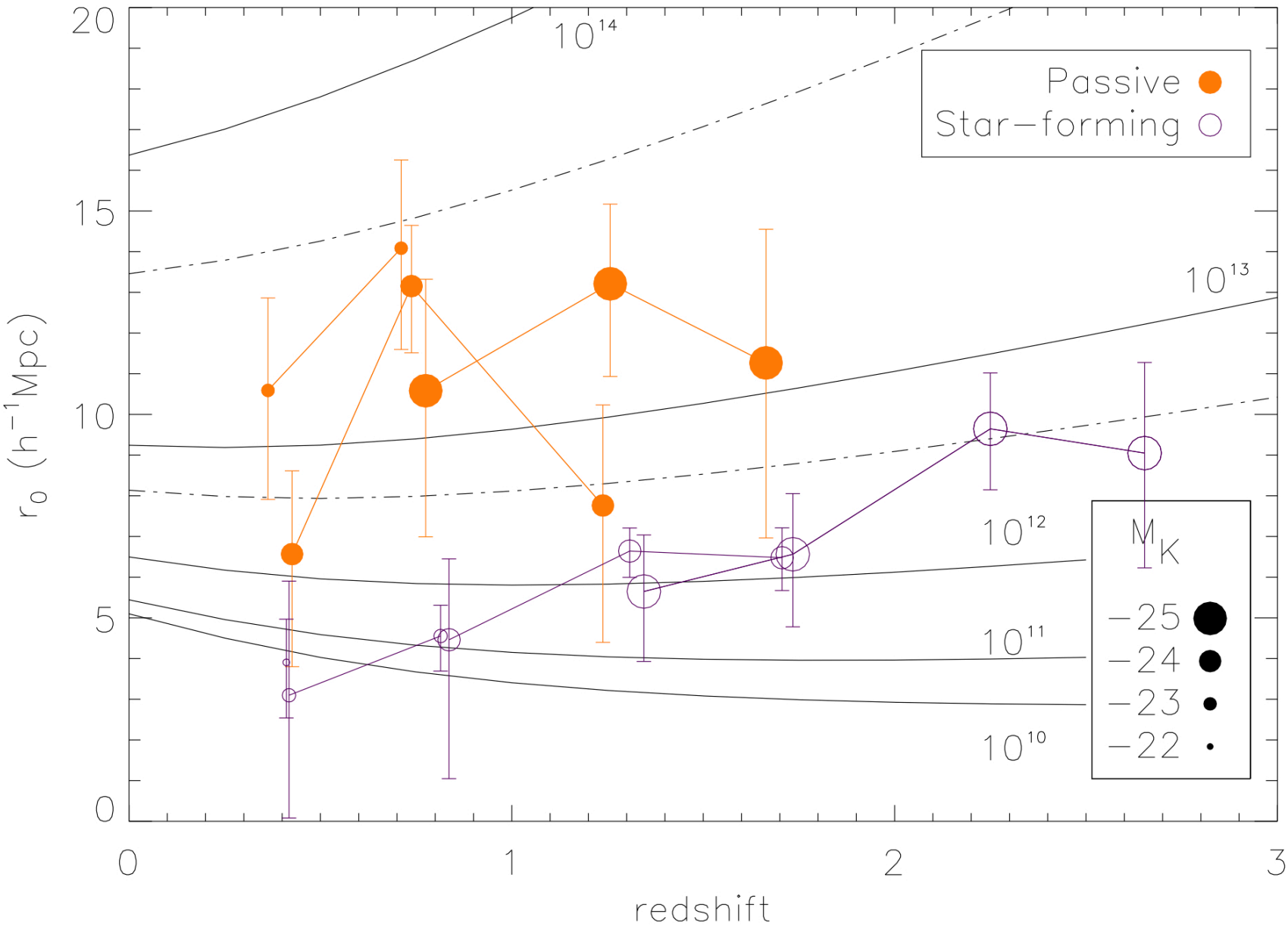


r_0 small

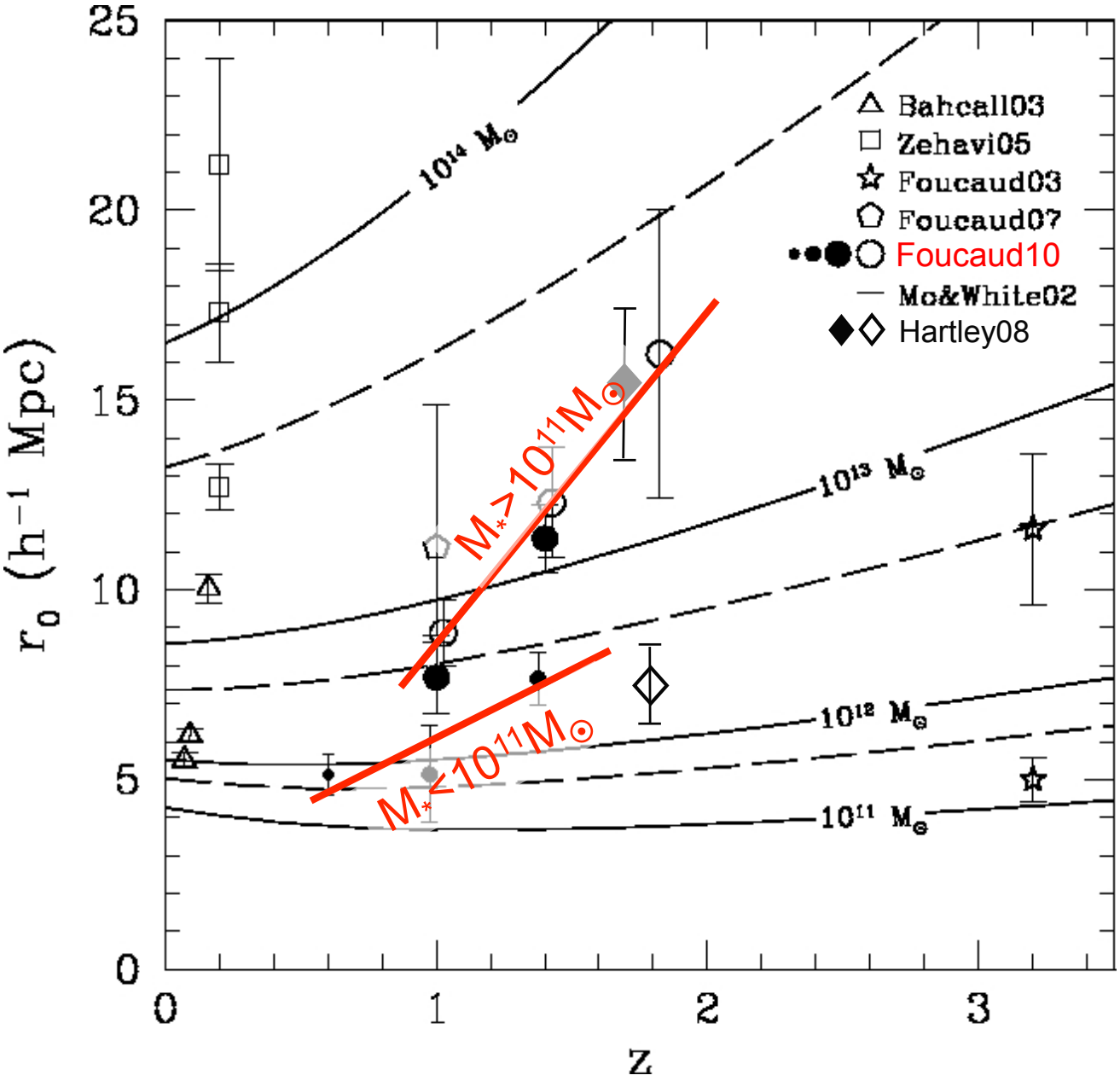
$$\xi(r)=(r/r_0)^{-\gamma}$$

Passive and star-forming galaxies

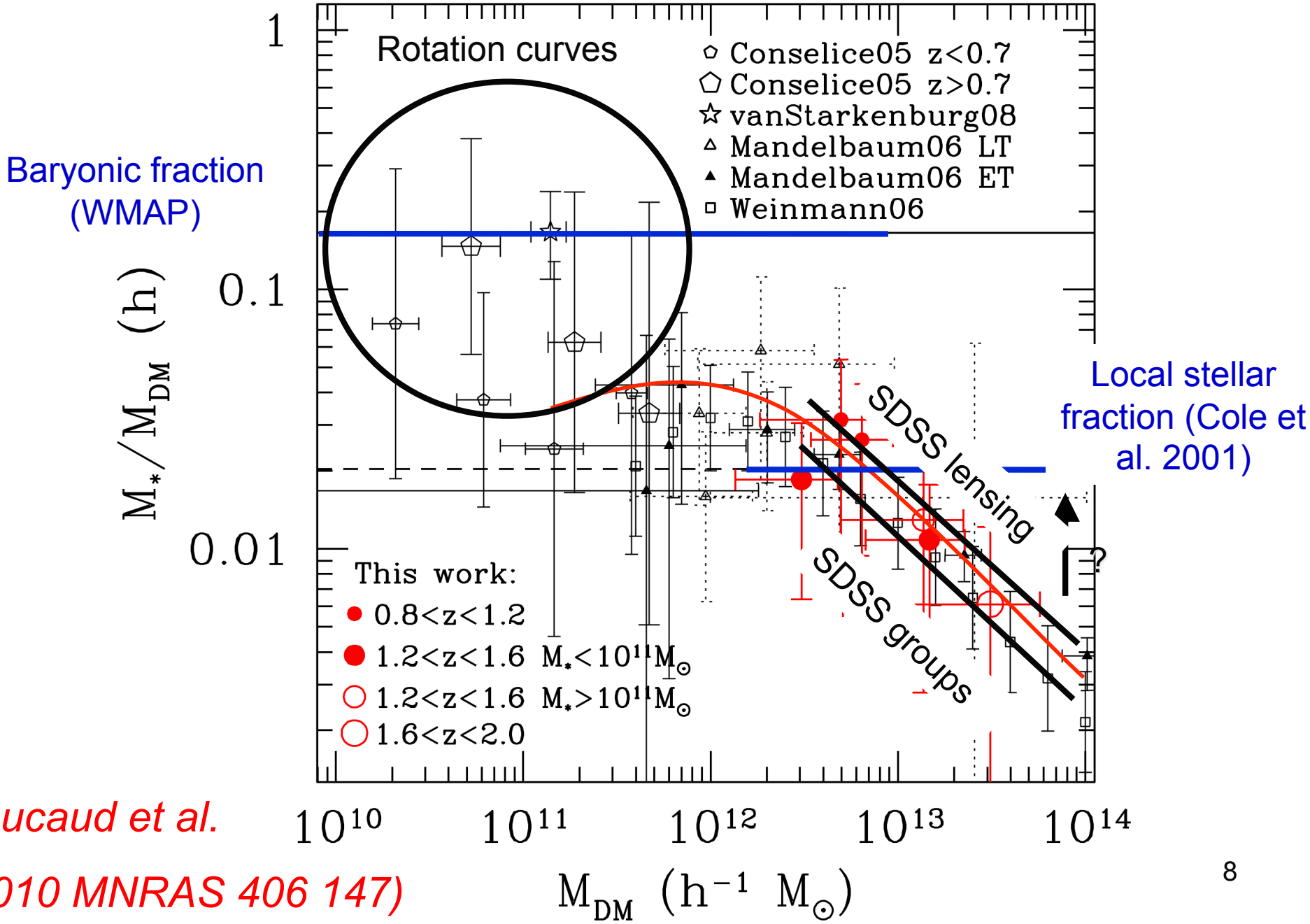
Hartley, et al. (2010 MNRAS 407 1212)



Following the evolution of massive galaxies via dark matter halos



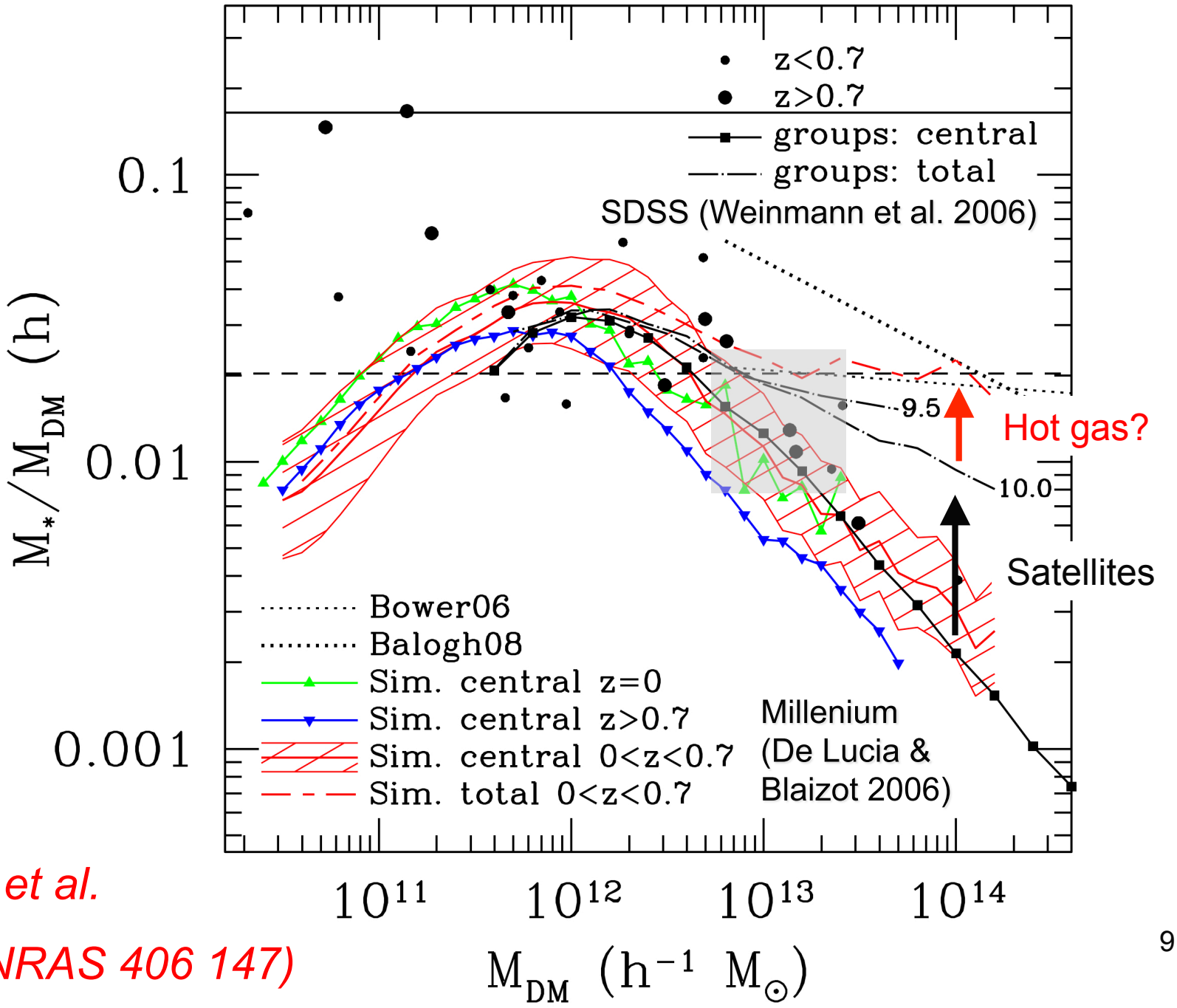
Linking dark and luminous matter



Foucaud et al.

(2010 MNRAS 406 147)

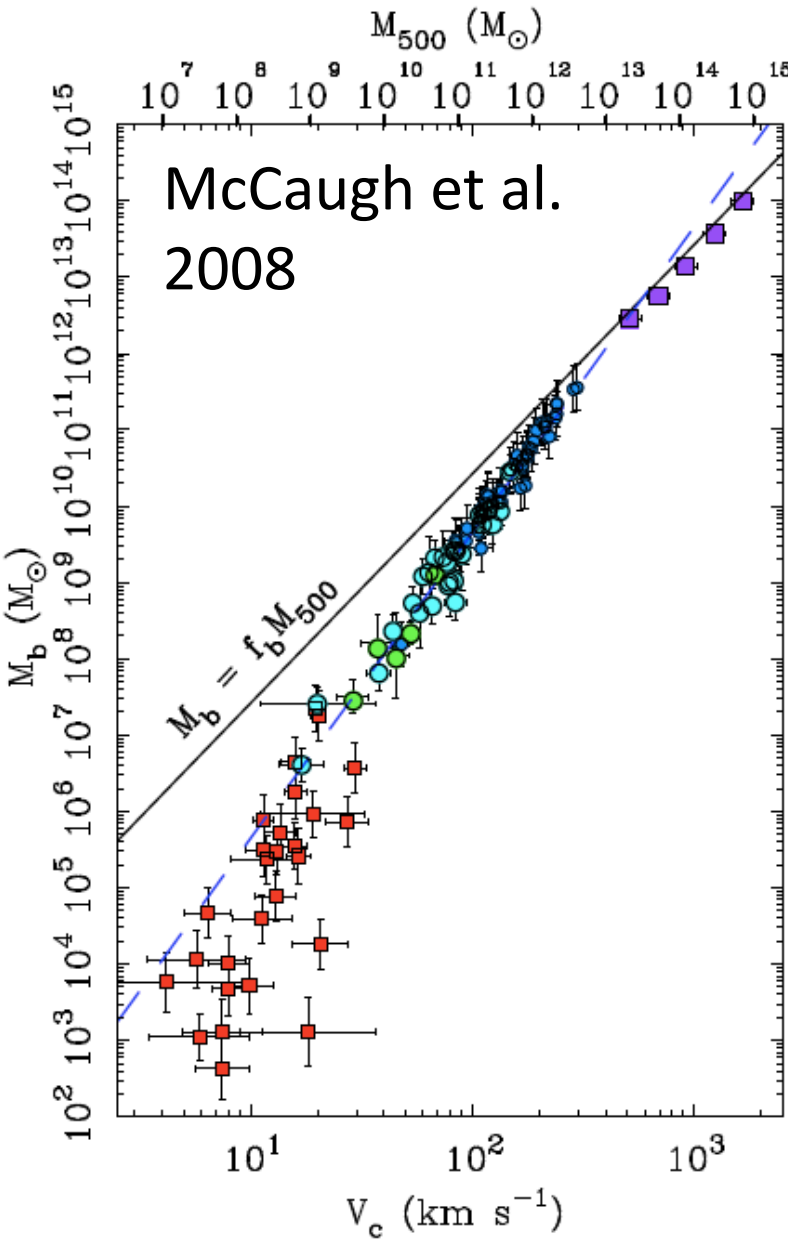
Linking dark and luminous matter

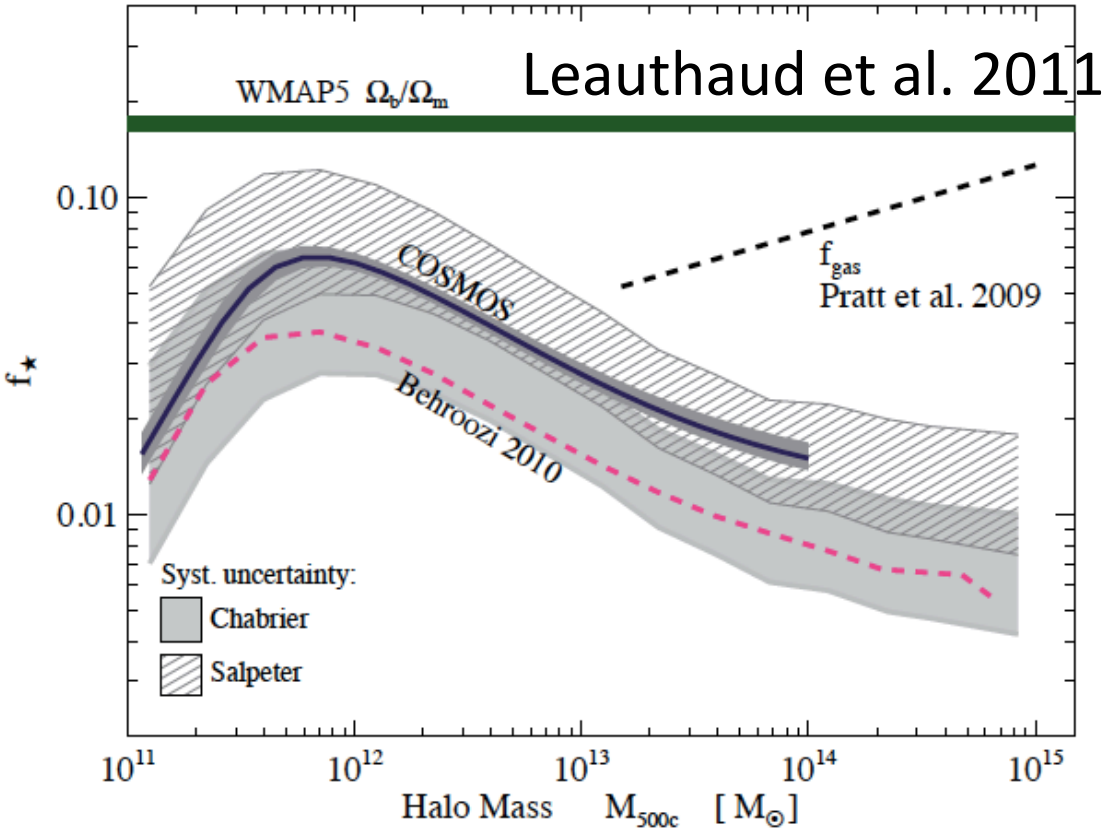


Foucaud et al.

(2010 MNRAS 406 147)

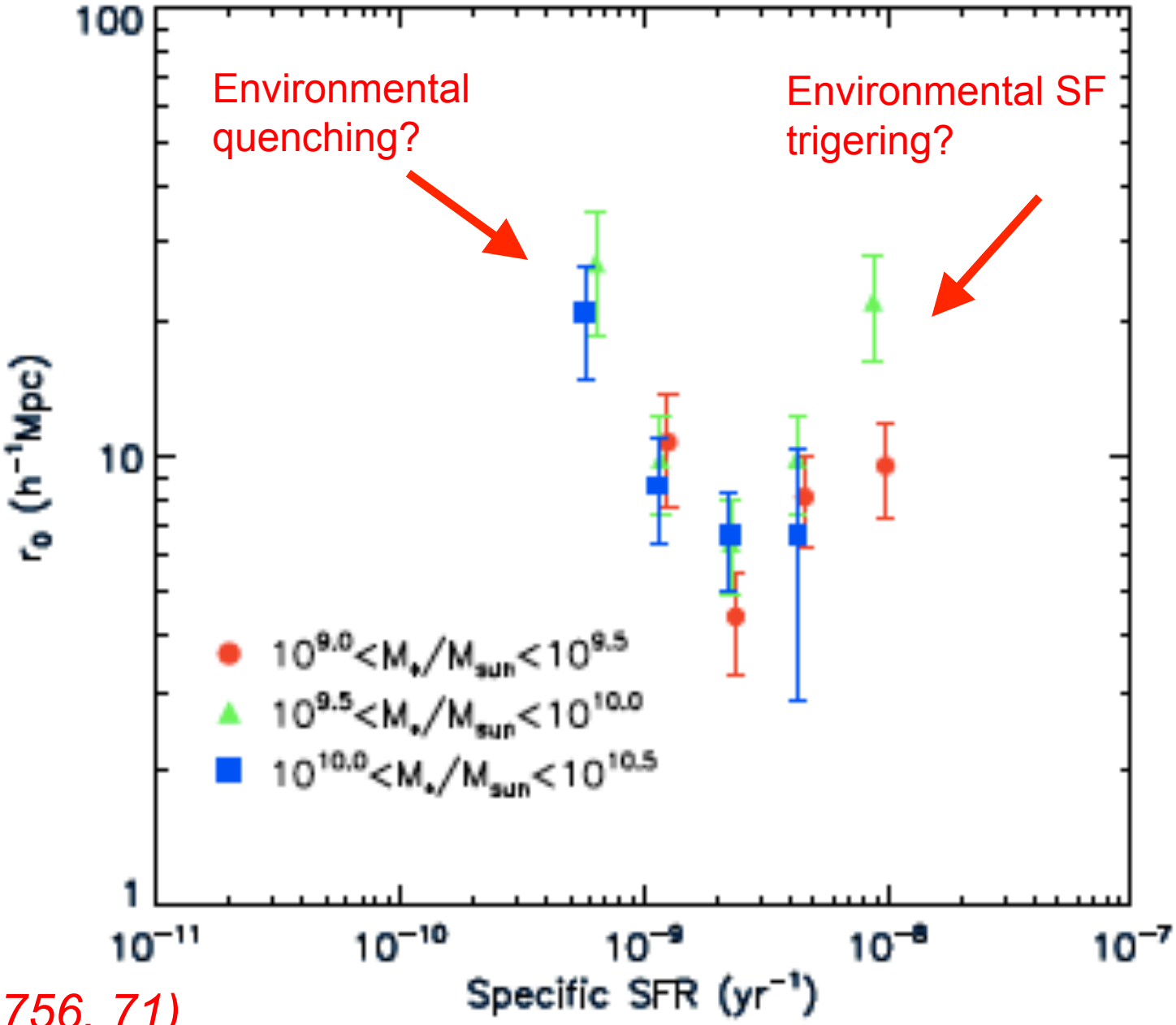
Missing baryons?





- Outflows
- Warm gas
- other (neutral, molecular gas, etc …)

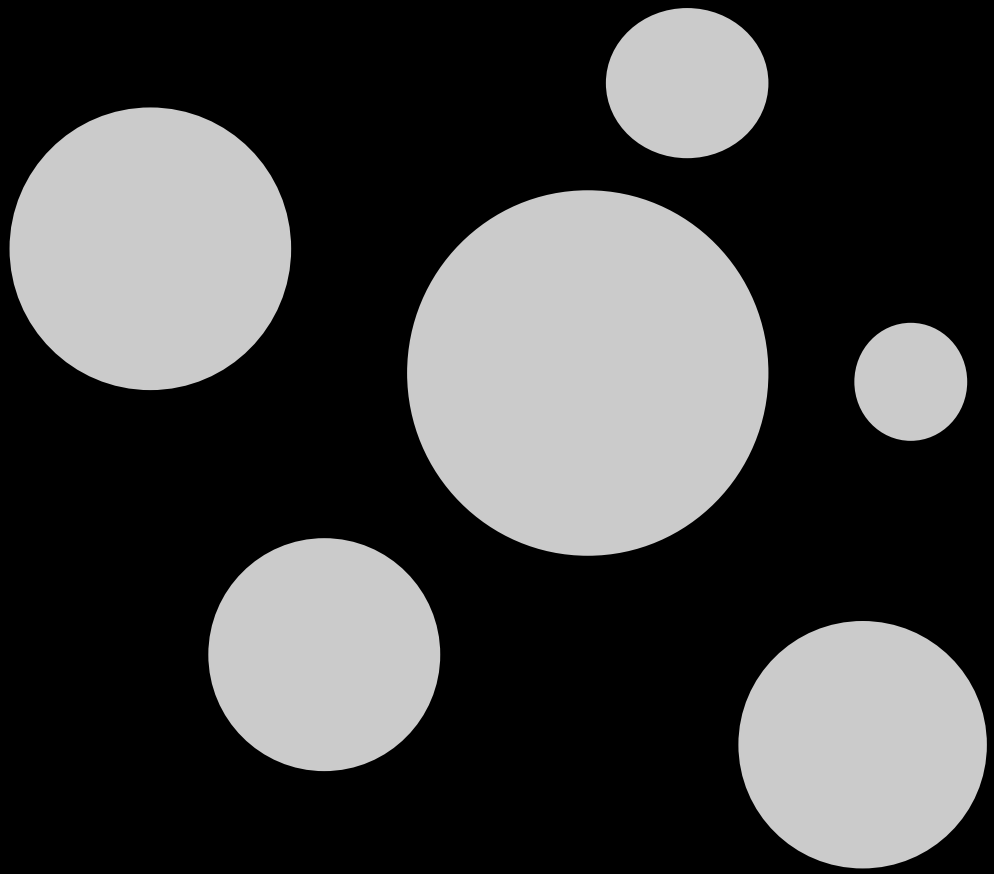
Linking dark and luminous matter



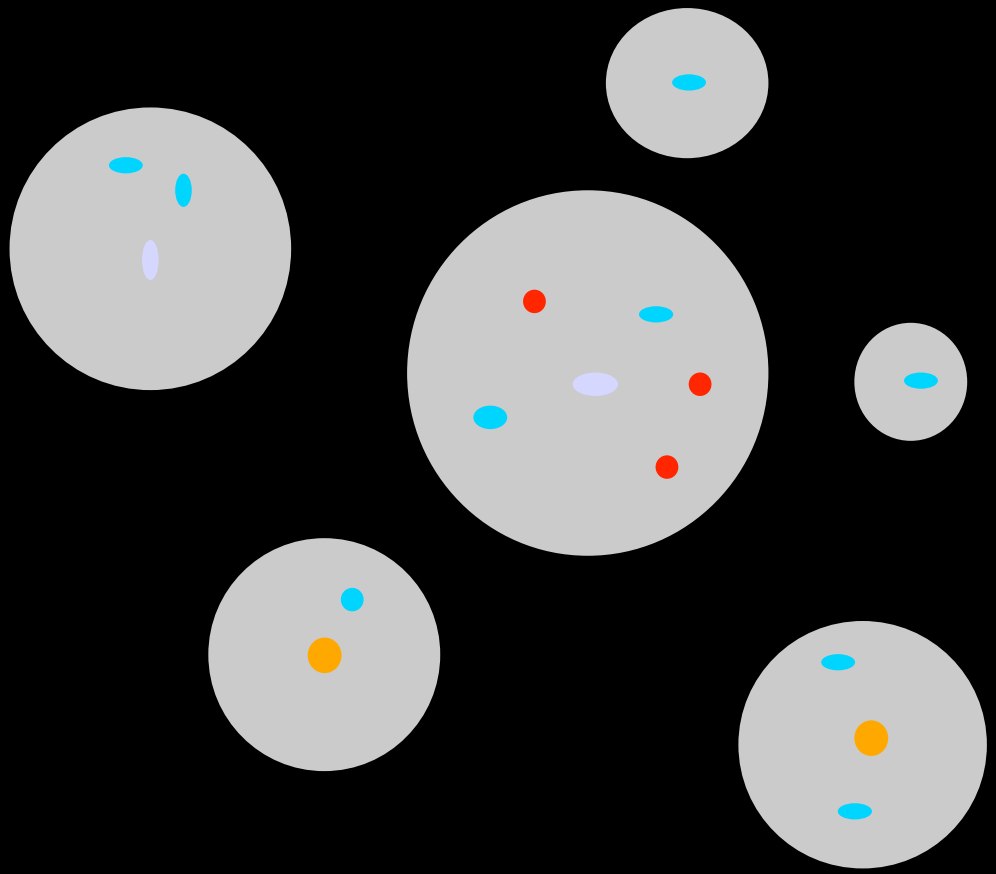
Lin et al.

(2012, ApJ, 756, 71)

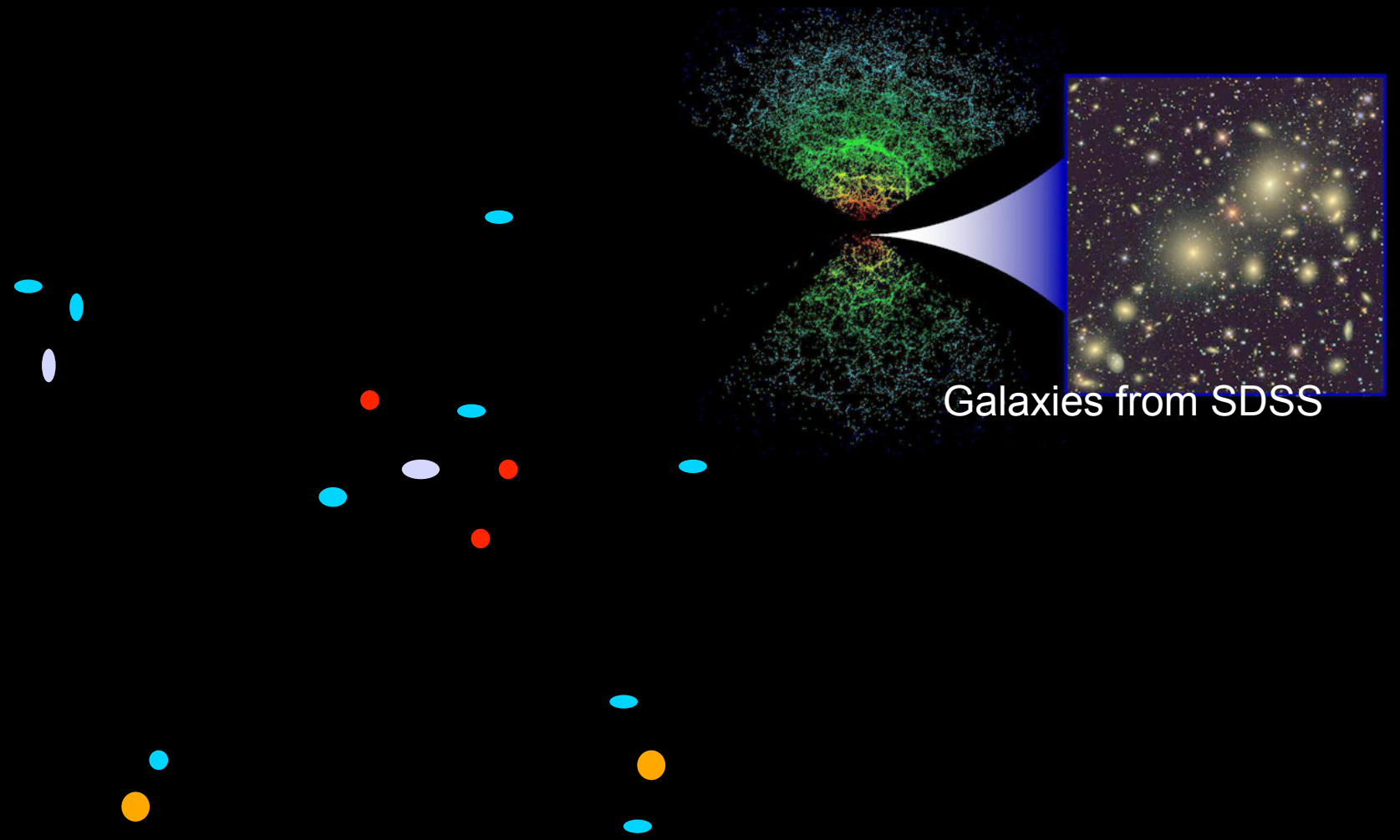
Halo Occupation Distribution (HOD)



Halo Occupation Distribution (HOD)



Halo Occupation Distribution (HOD)



HoD analyses in CFHTLS wide: Coupon et al. 2012

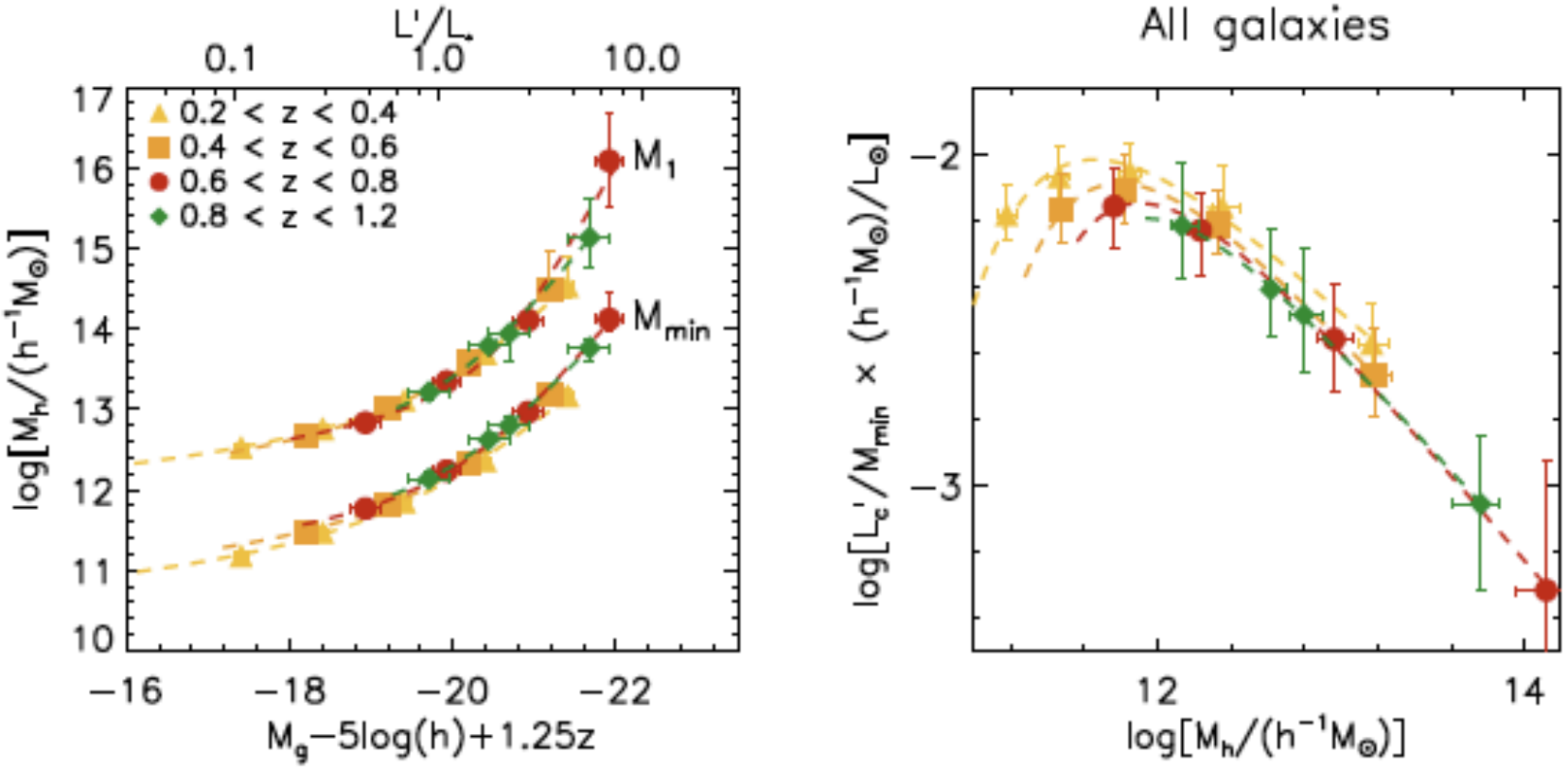


Figure 3. From Coupon et al. (2011) - Left panel: halo mass estimates $M_{\rm min}$ and M_1 for all galaxy samples from the CFHTLS-wide survey, as function of luminosity threshold, corrected for passive redshift evolution to approximate stellar mass selected samples. The dashed lines correspond to the relation between central galaxy luminosity $L'_{\rm c}$ and the halo mass stated in Zehavi et al. (2011b). Right panels: light-to-halo mass ratios $L'_{\rm c}/M_{\rm min}$ with identical parameters as those fitted with the same relation but as function of halo mass.

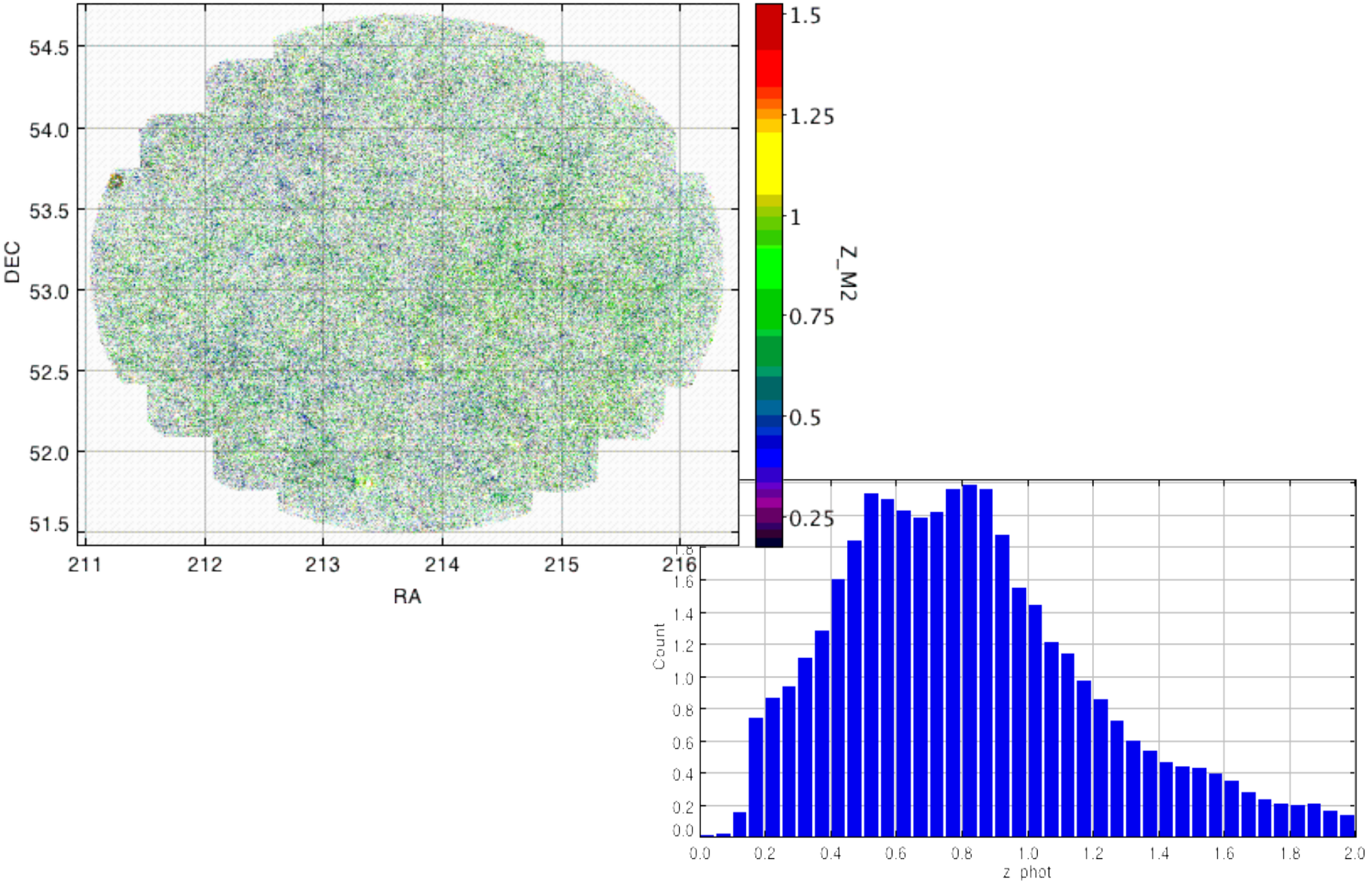
120deg^2 vs 70deg^2 for PS, but PS will be deeper and will have better NIR coverage (better M_*)

PS1-MD Clustering analyses

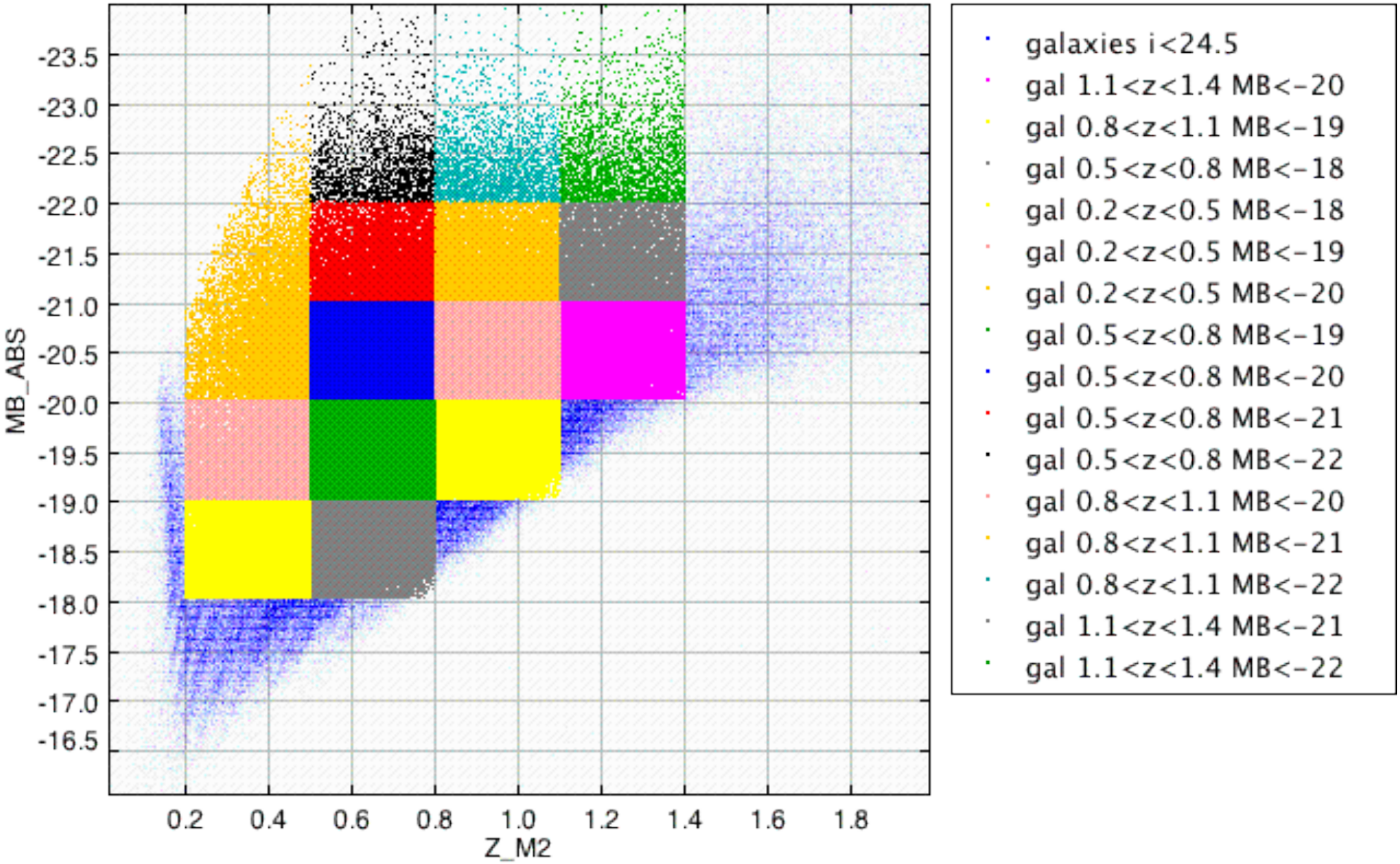
- TW stacks and catalogs
- Compute ACF with SWOT (Coupon et al. 2012)
- Masks around saturated stars (other defects to be implemented)

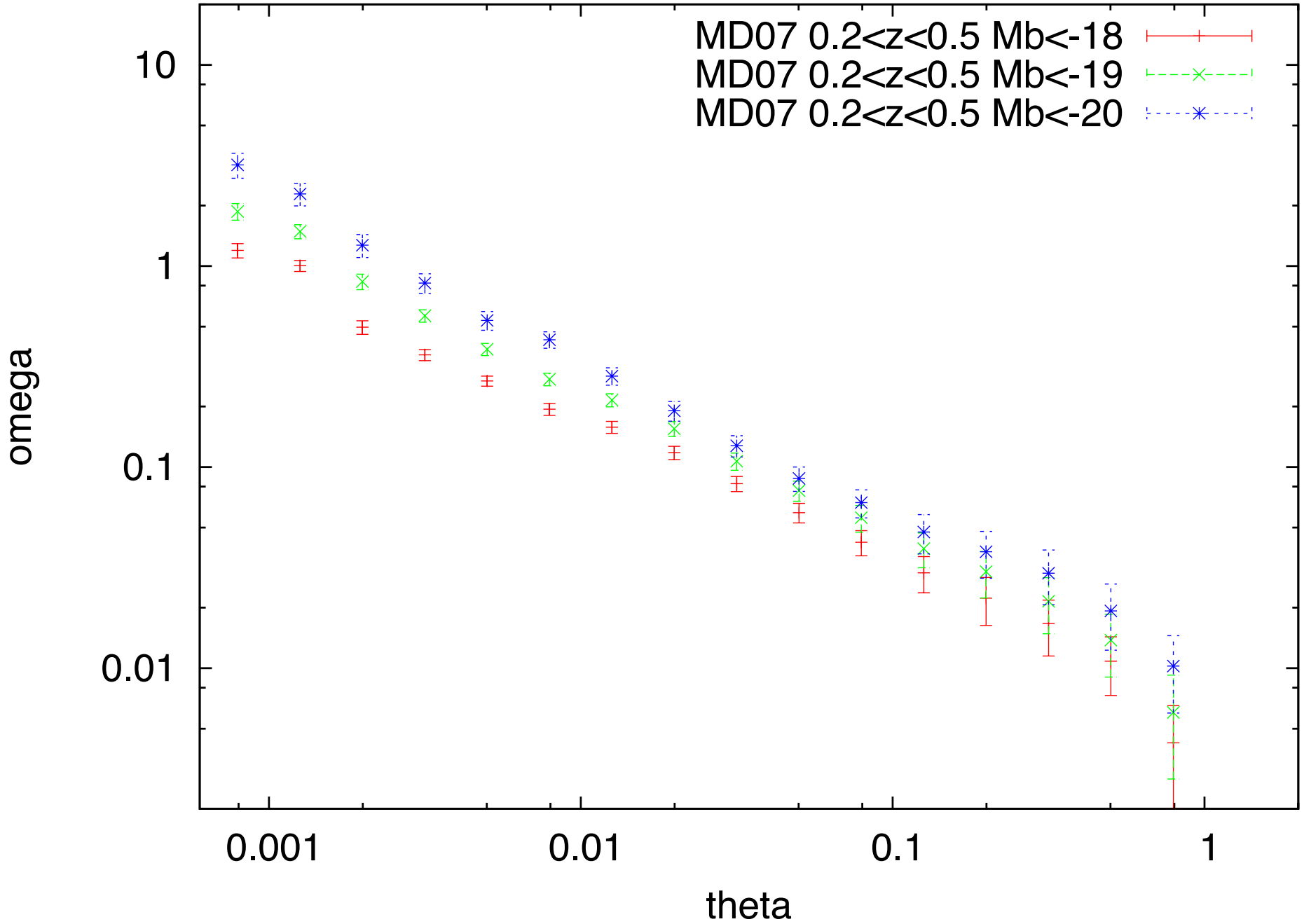
- Galaxy selection:
  - i<24.5
  - i_CLASS_STAR <0.7 (I know, I know …)
  - z_{phot} χ^2<100
  - Detected in all bands at 1σ (get reed of some weird junk, need to be investigated)
  - 410k galaxies in MD07 (40% rejected from all i<24.5)

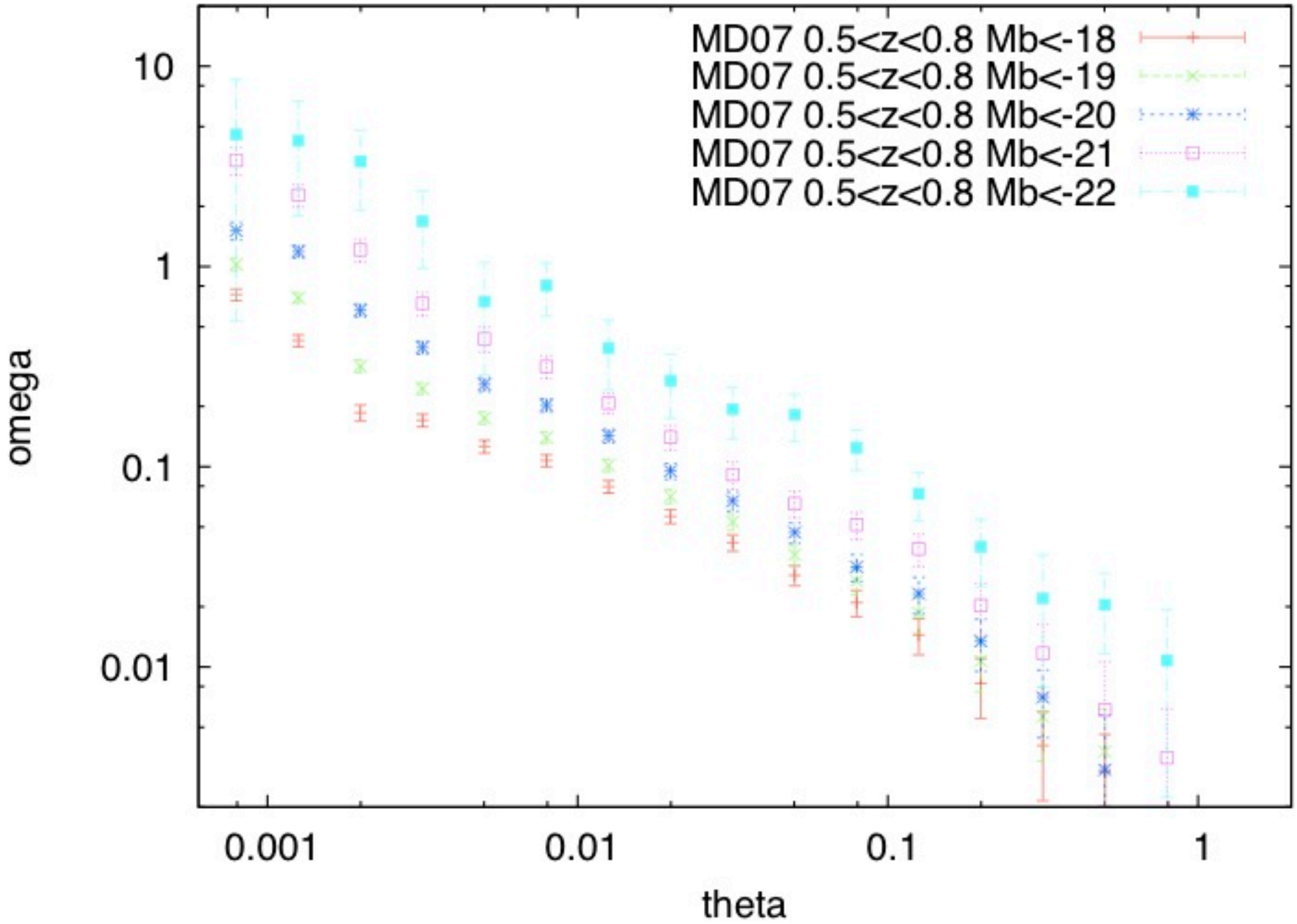
MD07

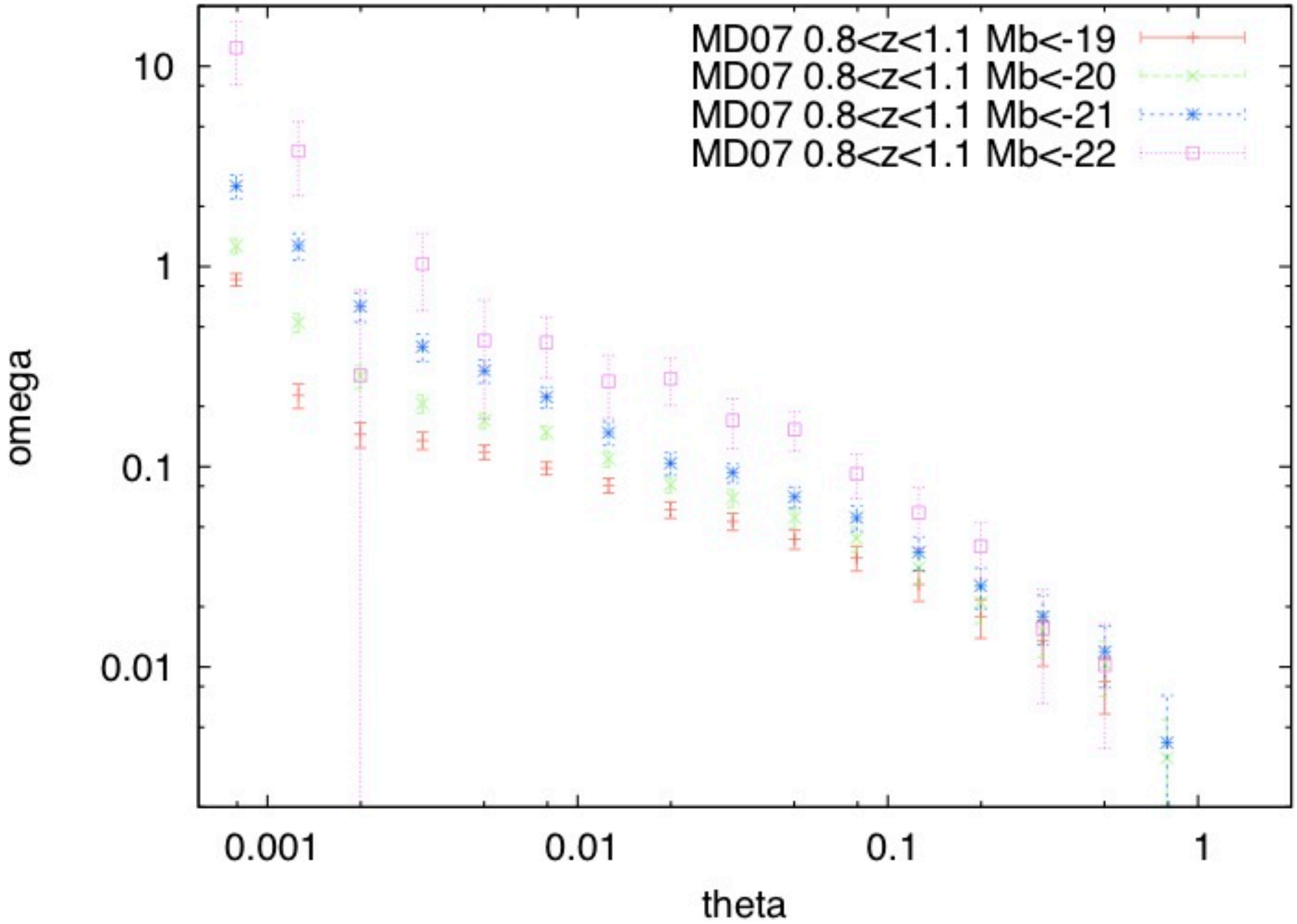

DEC
RA
54.5
54.0
53.5
53.0
52.5
52.0
51.5
211
212
213
214
215
216
Z_MZ
1.5
1.25
1
0.75
0.5
0.25
Count
z_phot
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

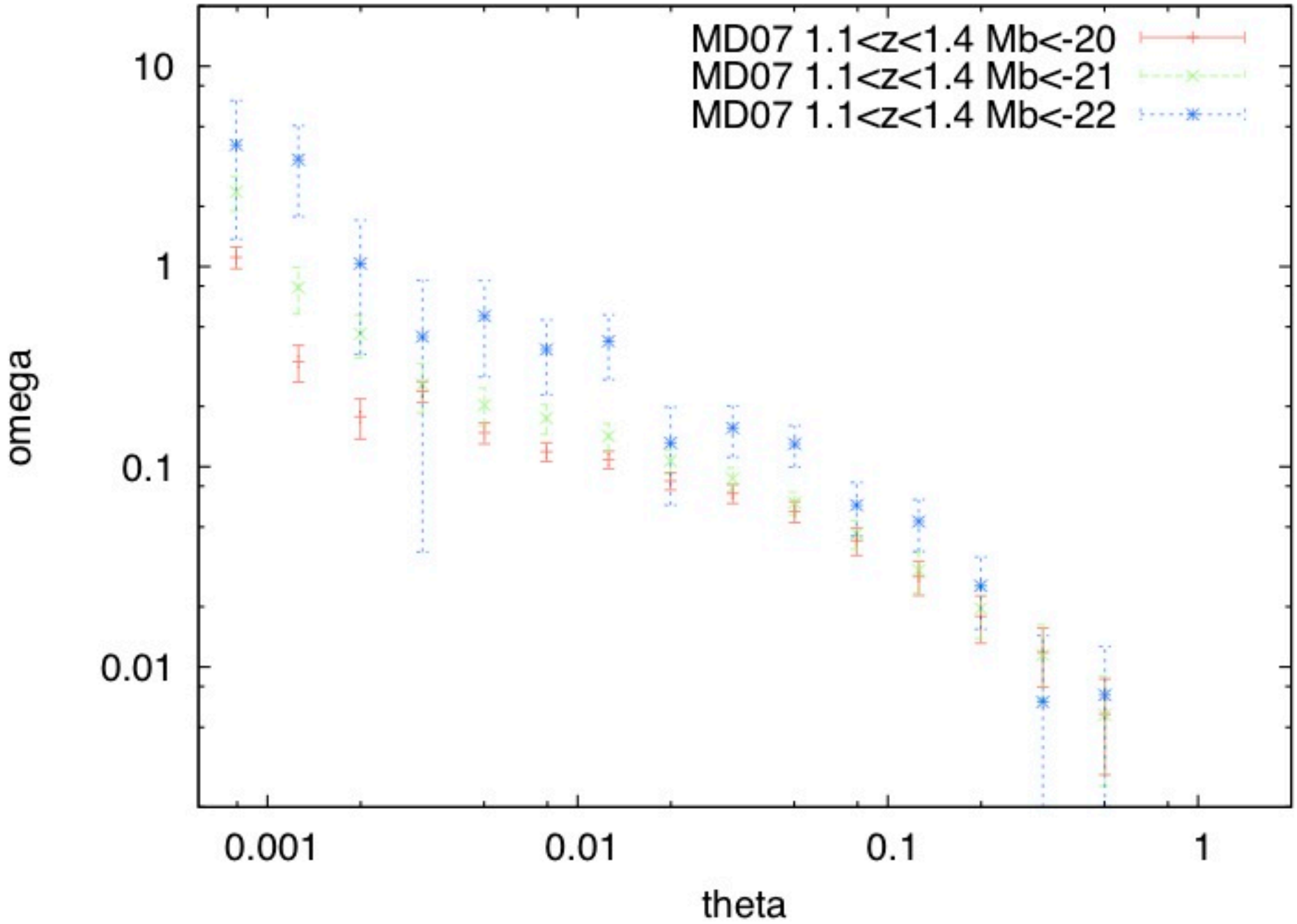
MD07: $M_{B\ abs}$ vs z_{phot}

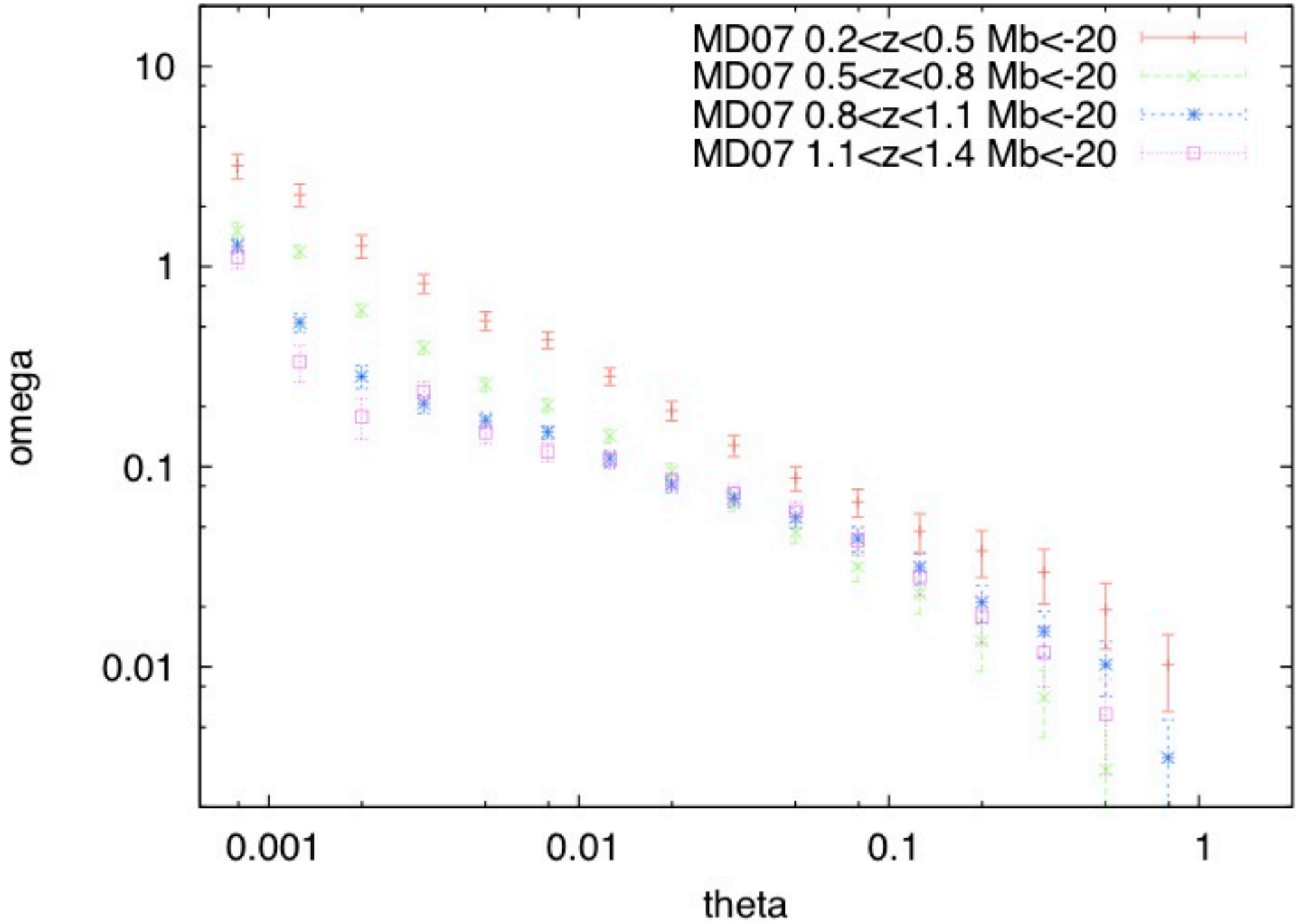


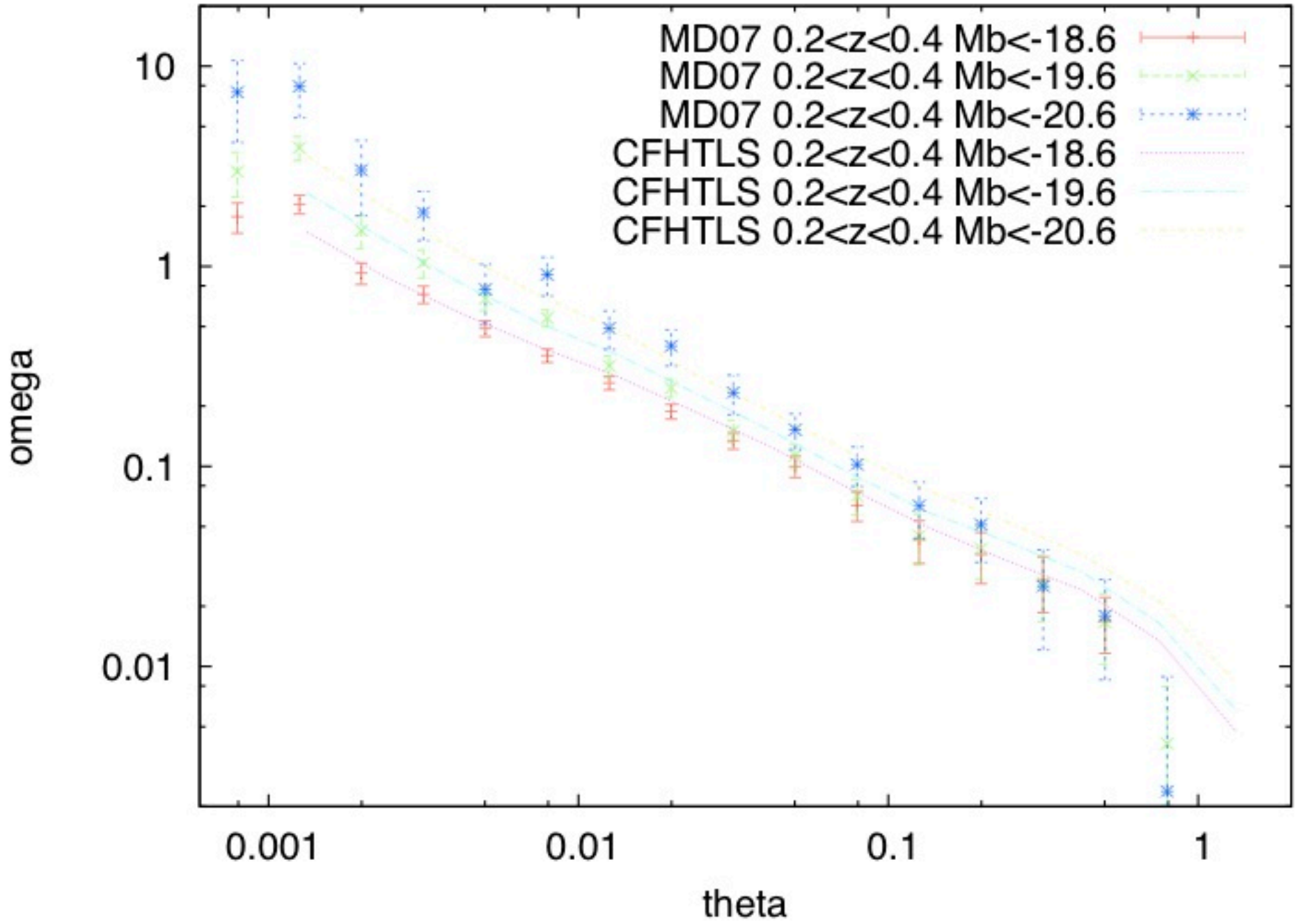

MD07 0.2<z<0.5 Mb<-18
MD07 0.2<z<0.5 Mb<-19
MD07 0.2<z<0.5 Mb<-20
omega
theta
10
1
0.1
0.01
0.001
0.01
0.1
1


MD07 0.5<z<0.8 Mb<-18
MD07 0.5<z<0.8 Mb<-19
MD07 0.5<z<0.8 Mb<-20
MD07 0.5<z<0.8 Mb<-21
MD07 0.5<z<0.8 Mb<-22
omega
theta
10
1
0.1
0.01
0.001
0.01
0.1
1


MD07 0.8<z<1.1 Mb<-19
MD07 0.8<z<1.1 Mb<-20
MD07 0.8<z<1.1 Mb<-21
MD07 0.8<z<1.1 Mb<-22
omega
theta
10
1
0.1
0.01
0.001
0.01
0.1
1


MD07 1.1<z<1.4 Mb<-20
MD07 1.1<z<1.4 Mb<-21
MD07 1.1<z<1.4 Mb<-22
omega
theta
10
1
0.1
0.01
0.001
0.01
0.1
1


MD07 0.2<z<0.5 Mb<-20
MD07 0.5<z<0.8 Mb<-20
MD07 0.8<z<1.1 Mb<-20
MD07 1.1<z<1.4 Mb<-20
omega
10
1
0.1
0.01
0.001
0.01
0.1
1
theta


MD07 0.2<z<0.4 Mb<-18.6
MD07 0.2<z<0.4 Mb<-19.6
MD07 0.2<z<0.4 Mb<-20.6
CFHTLS 0.2<z<0.4 Mb<-18.6
CFHTLS 0.2<z<0.4 Mb<-19.6
CFHTLS 0.2<z<0.4 Mb<-20.6
10
1
0.1
0.01
omega
0.001
0.01
0.1
1
theta

PS1-MD Clustering analyses

- Excitement level up!
- We are on the edge of producing proper science!

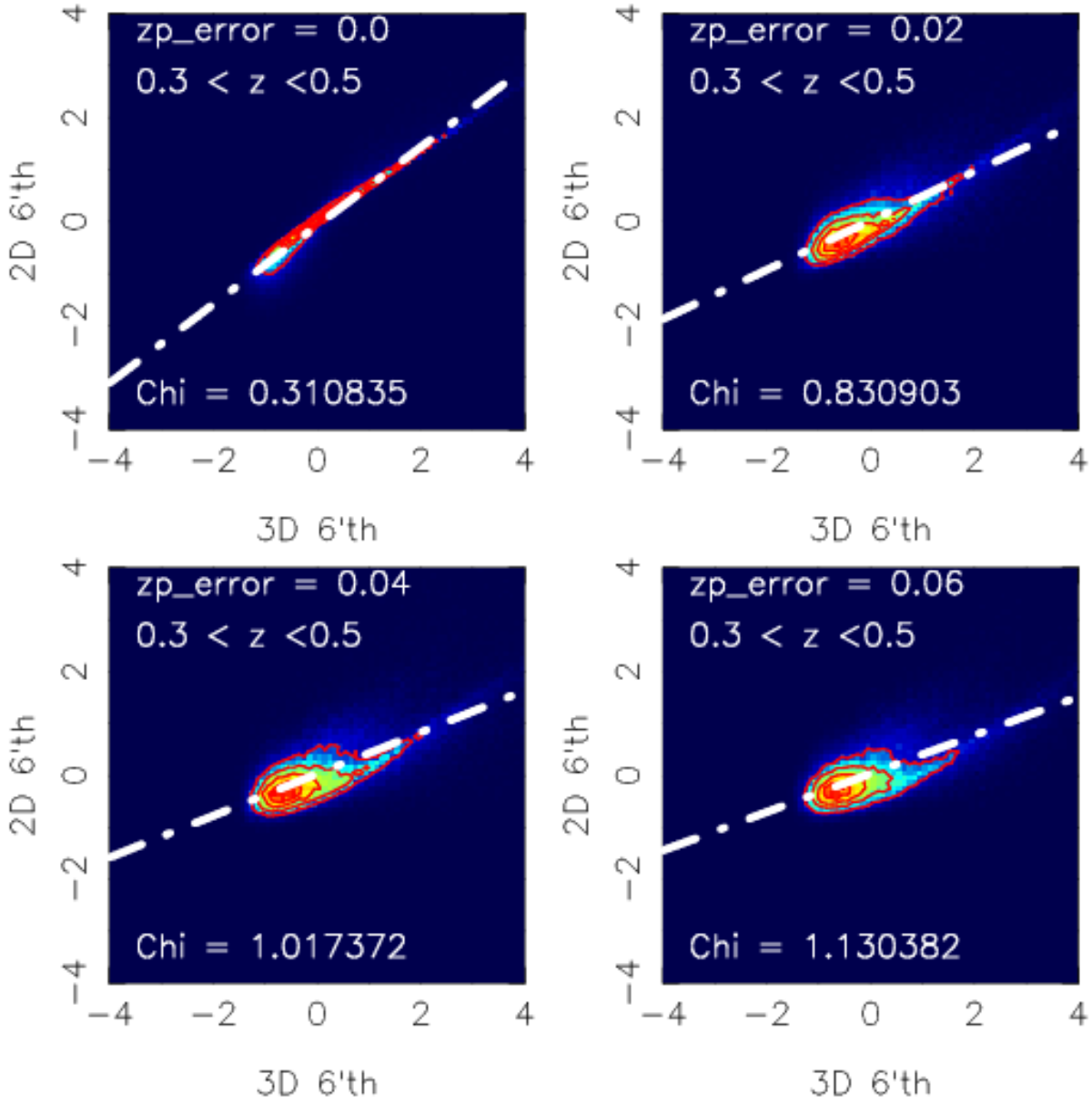
- Need to plug HoD in… was about to do it but small problems with covariance maps and lack of time, so it will be next time!

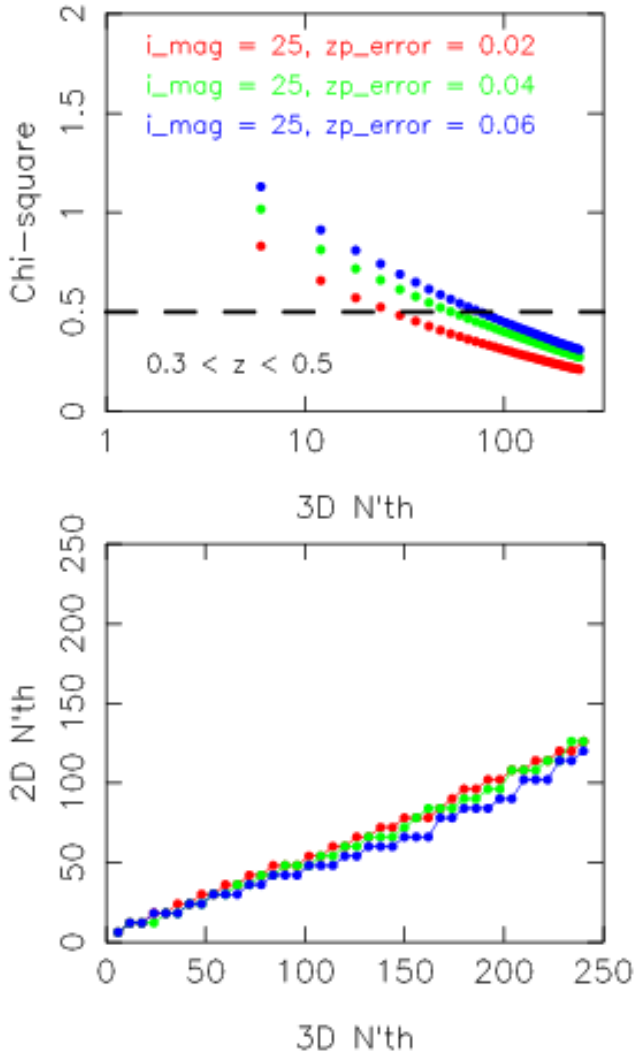
- Compute clustering and HoD as function of stellar mass, Star formation rate, Specific Star formation rate, etc.

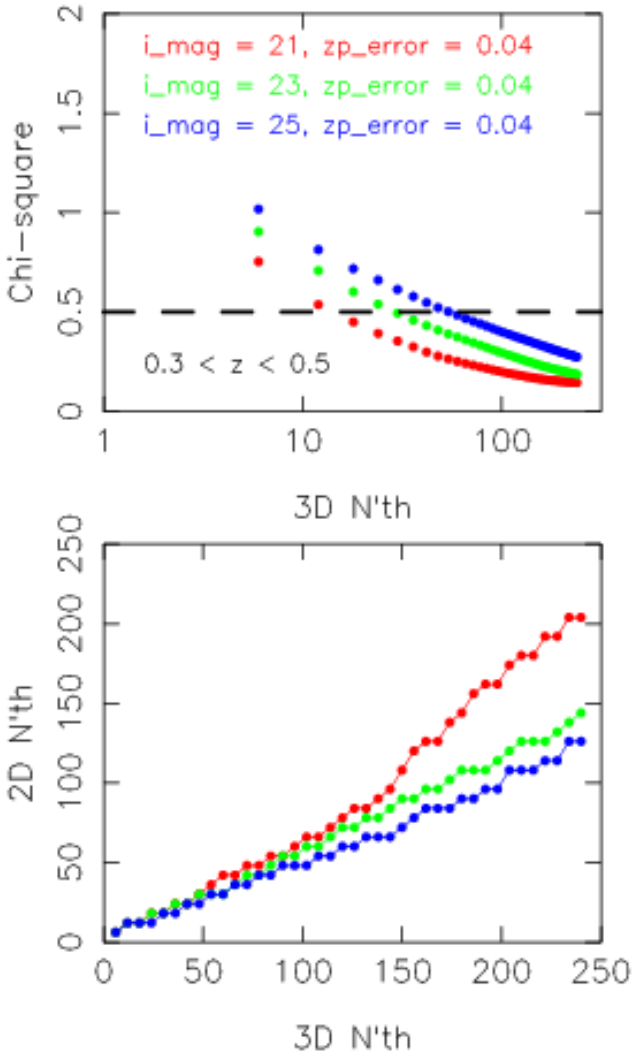
Can the environmental effect be probed with the photoz sample ?

Chuan-Chin Lai (NTU Msc)
Lihwai Lin (ASIAA)
Hung-Yu Jian (NTU)

2D vs 3D overdensity measurement

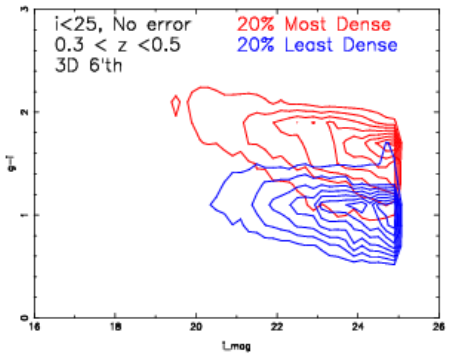


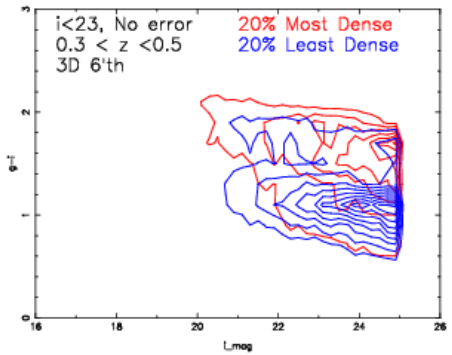


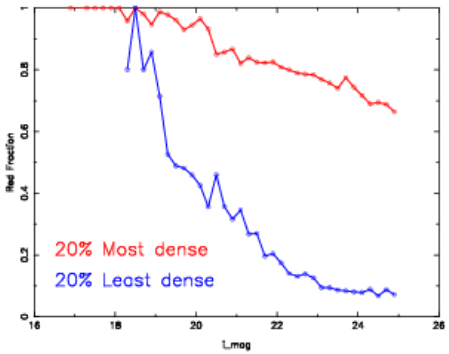


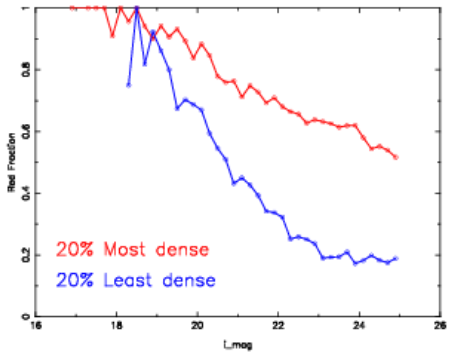
- Recovering 3D overdensity from projected overdensity (2D)
  - Brighter magnitude cut is better

The environmental effect on the red faction in the Durham mock



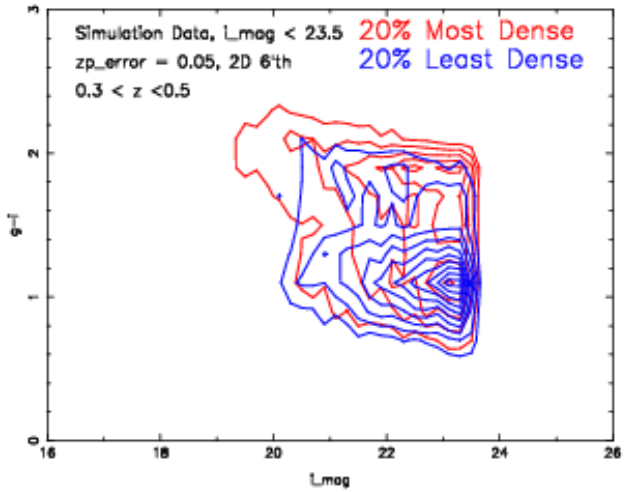


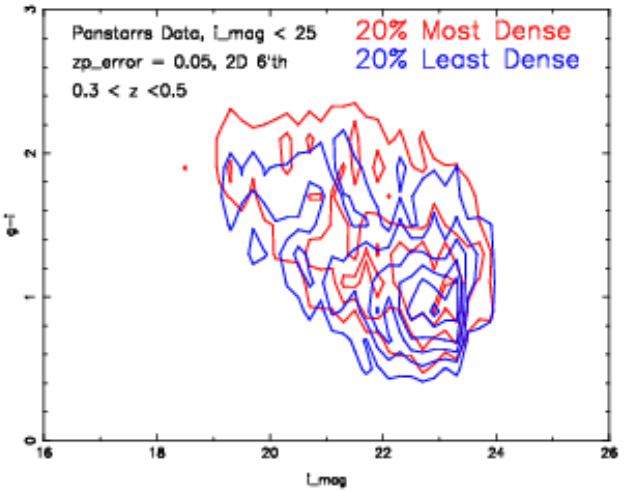


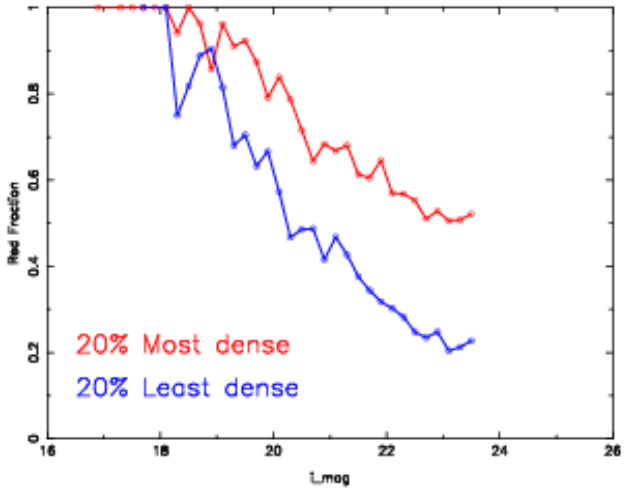


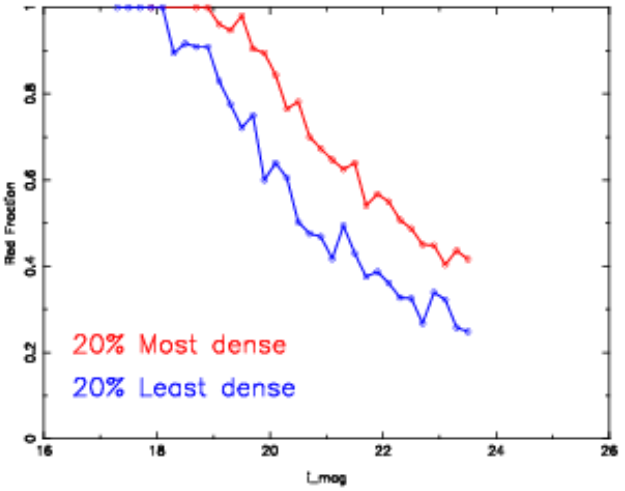
The environmental effect is stronger when using fainter magnitude cut (this is because the overdensity computed with fainter mag cut correlates better with the halo mass)

The environmental effect in the PS1/MD









Conclusion

- Brighter mag cut yields more reliable projected overdensity, which nevertheless correlates worse (as opposed to fainter mag cut) with the halo mass, and hence galaxy properties (according to Durham mock).

- With the photoz accuracy in MD fields, it is possible to differentiate the galaxy properties between the most 20% and least 20% overdense environment.

Thanks!