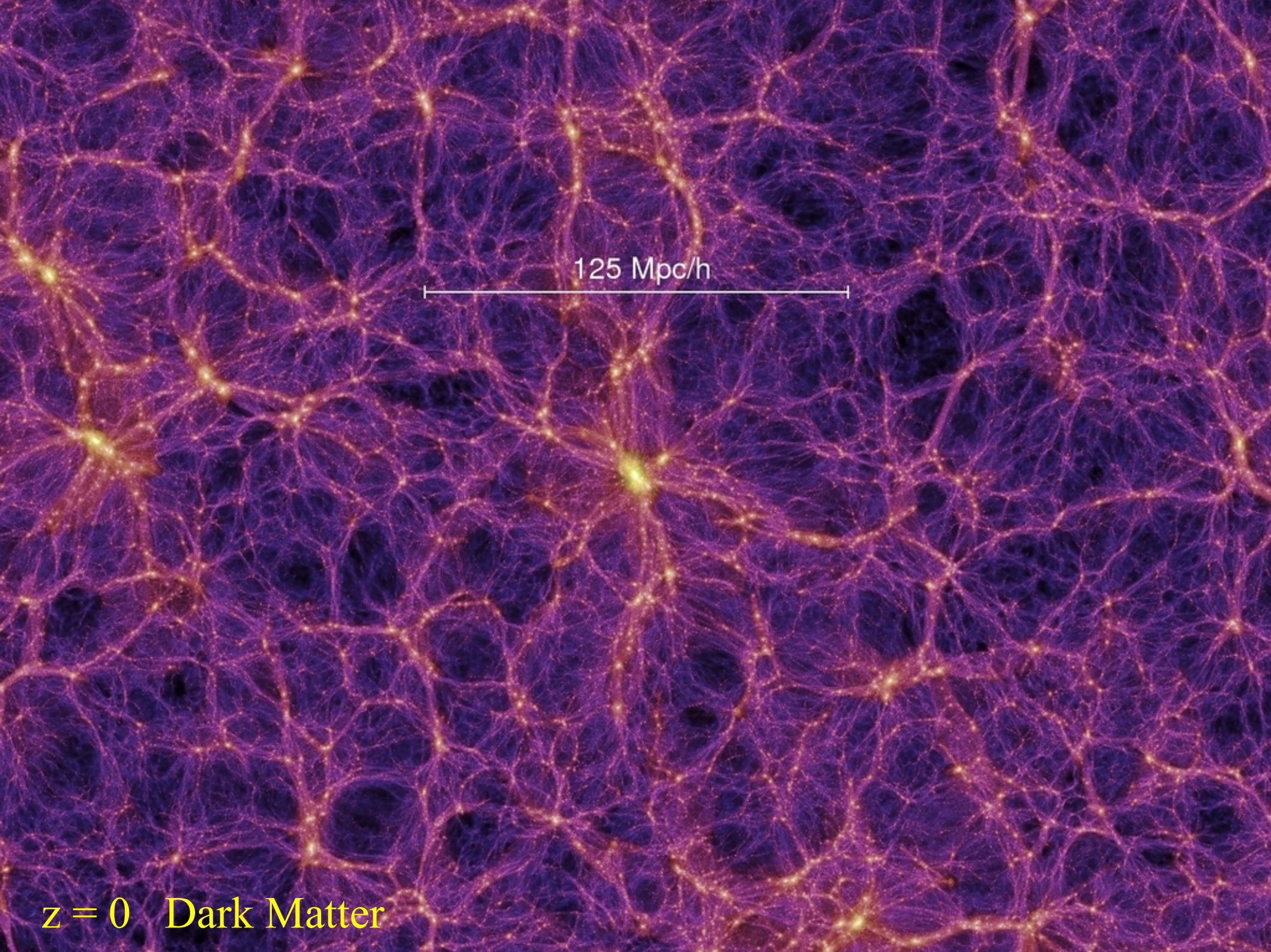


*MR-R
London
July 2007*

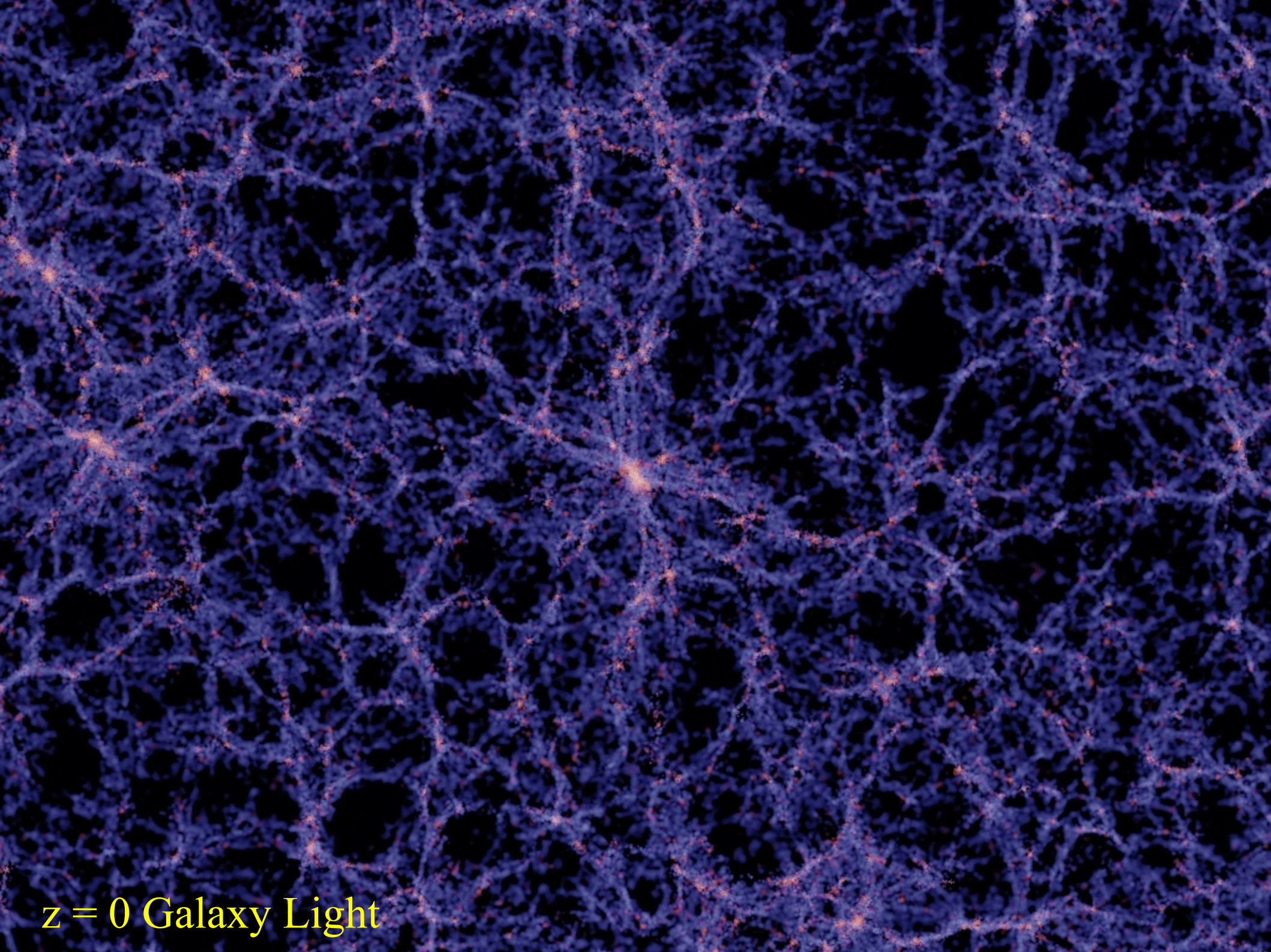
Large-scale structure from high to low redshift

*Simon White
Max Planck Institute for Astrophysics*

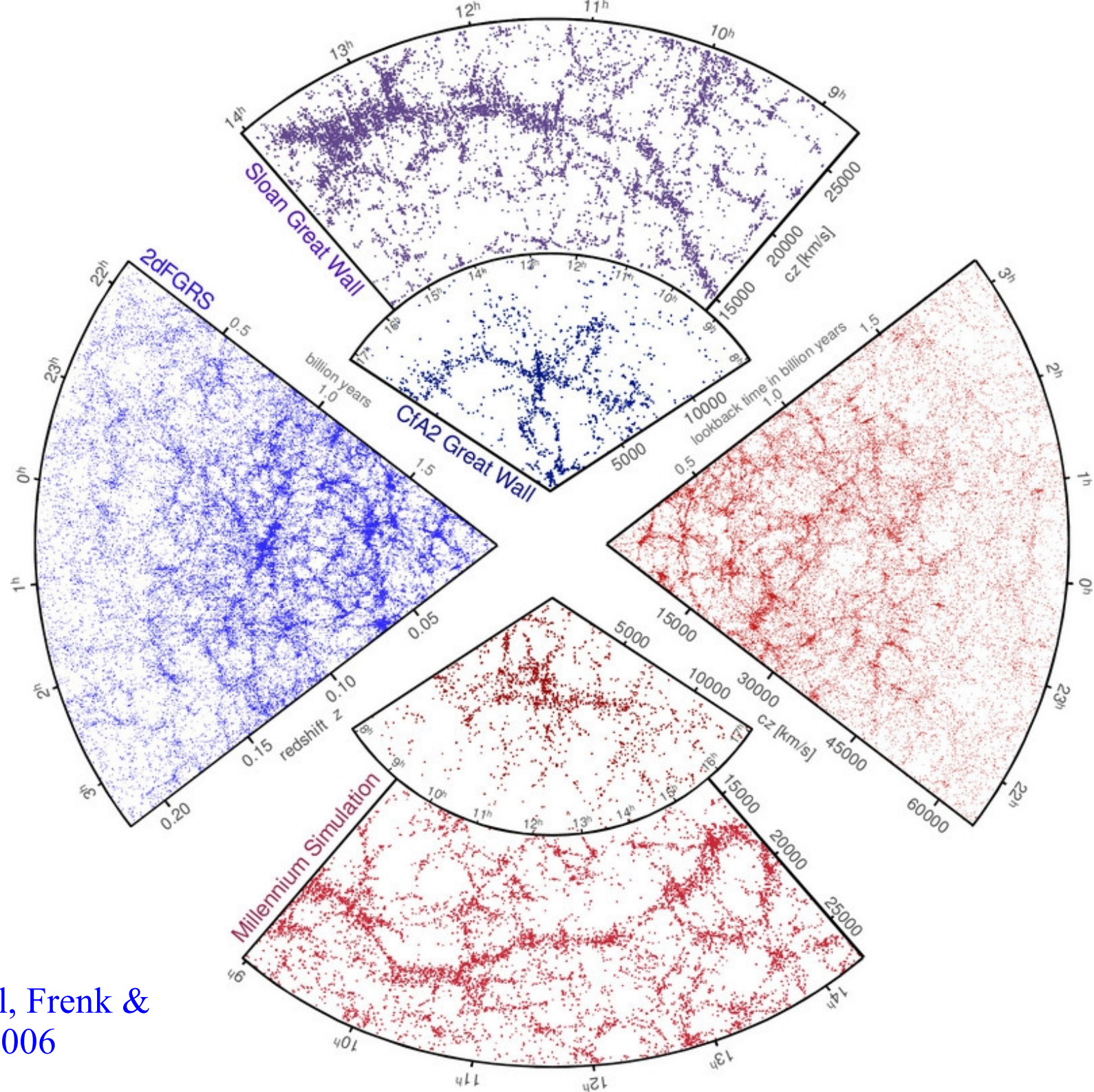


125 Mpc/h

$z = 0$ Dark Matter



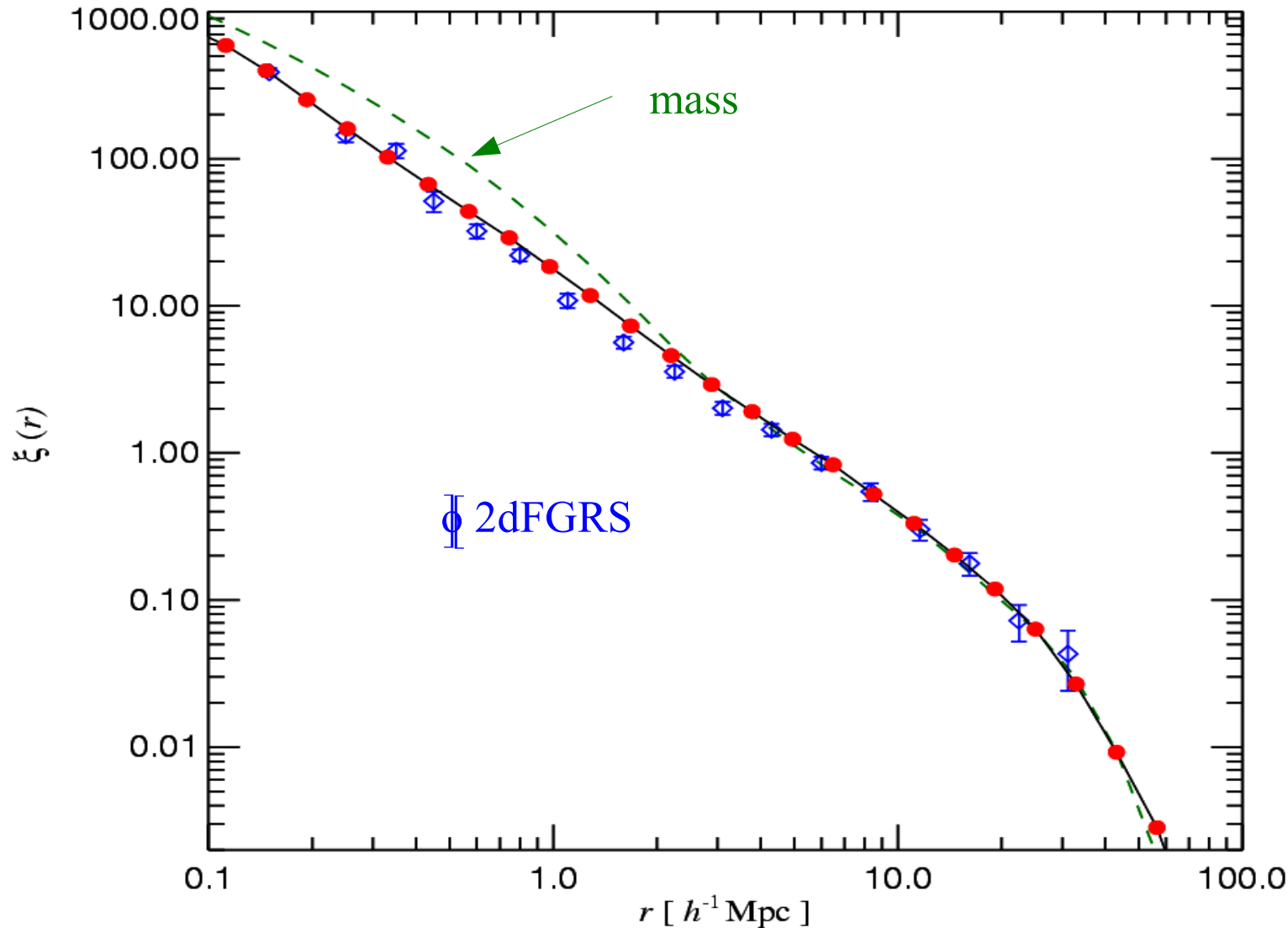
$z = 0$ Galaxy Light



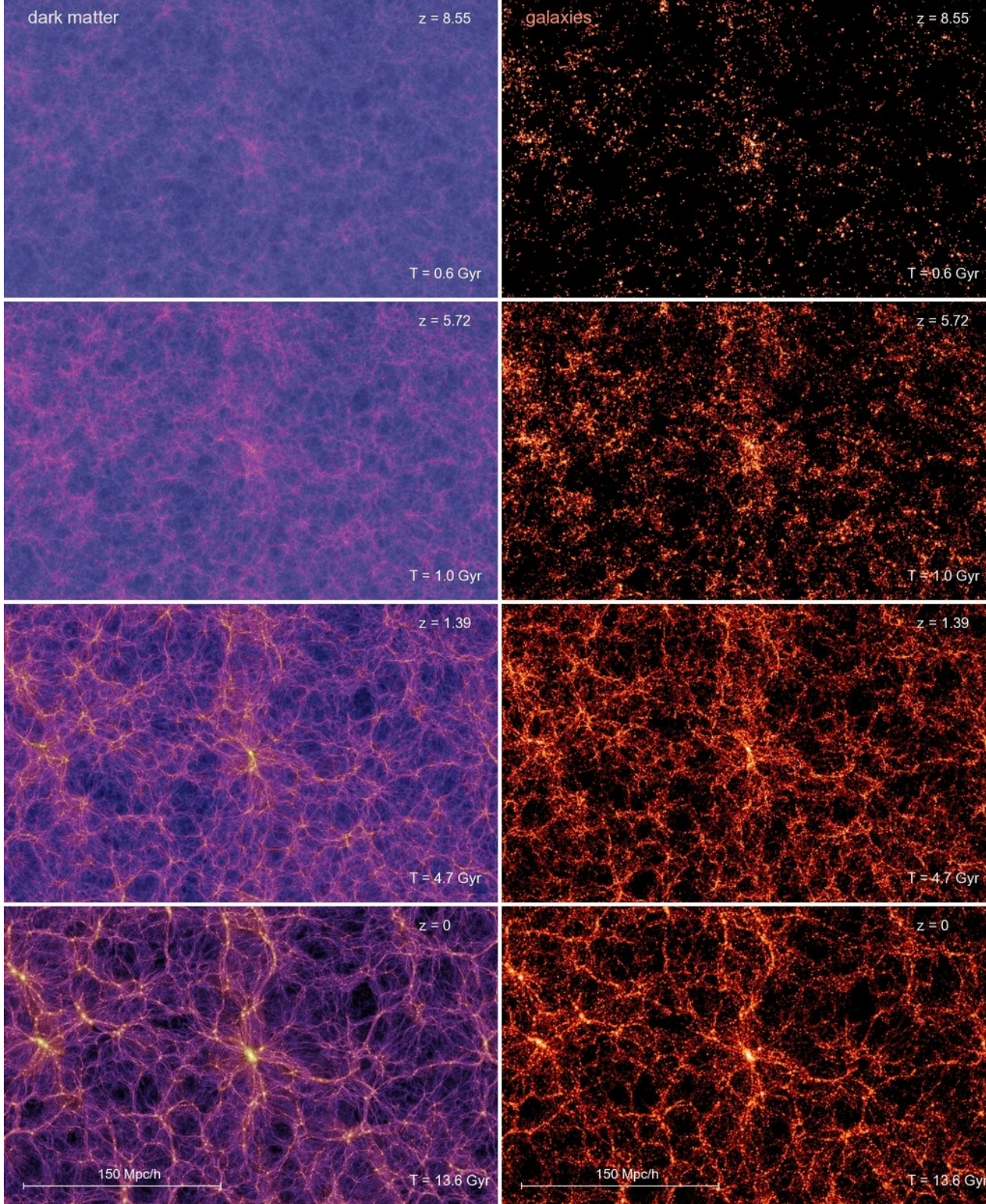
Springel, Frenk &
White 2006

Galaxy autocorrelation function

Springel et al 2005



For such a large simulation the purely statistical error bars are negligible on ξ even for **galaxies**



Large-scale structure at high redshift

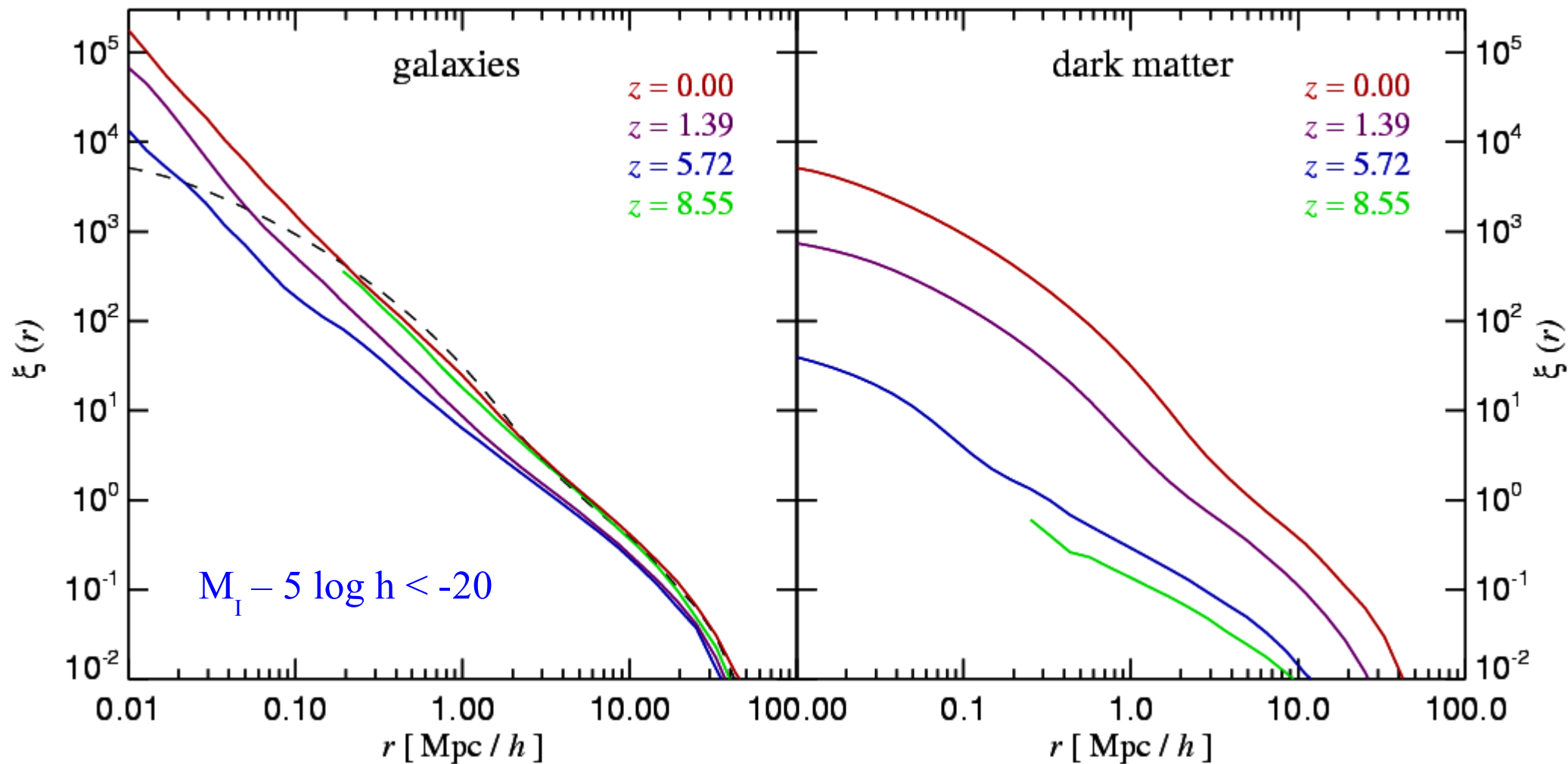
Springel, Frenk & White 2006

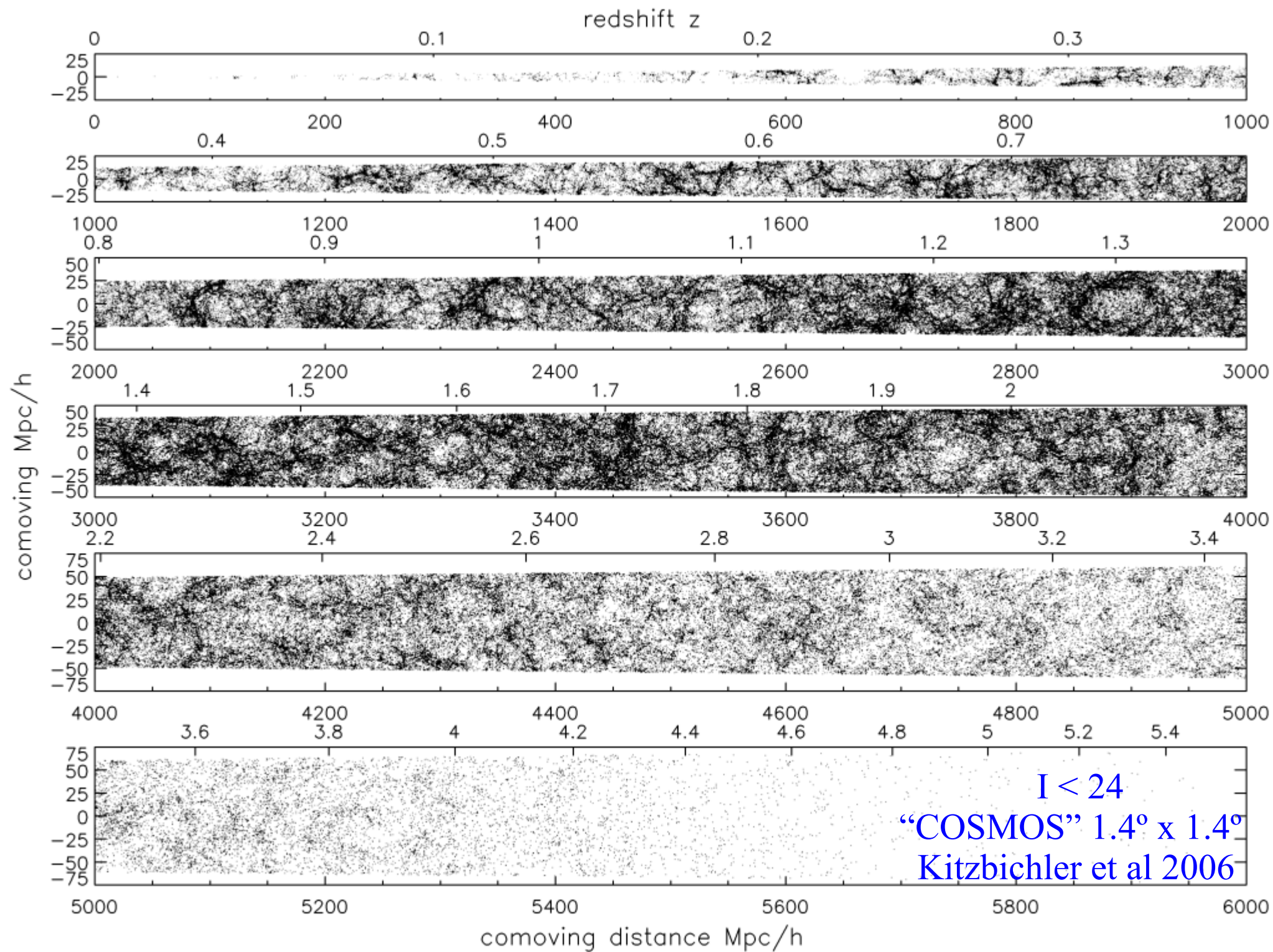
Large-scale structure in the galaxy distribution evolves very little with redshift

It is as strong at $z=8.5$ as at $z=0$

Evolution of mass and galaxy correlations

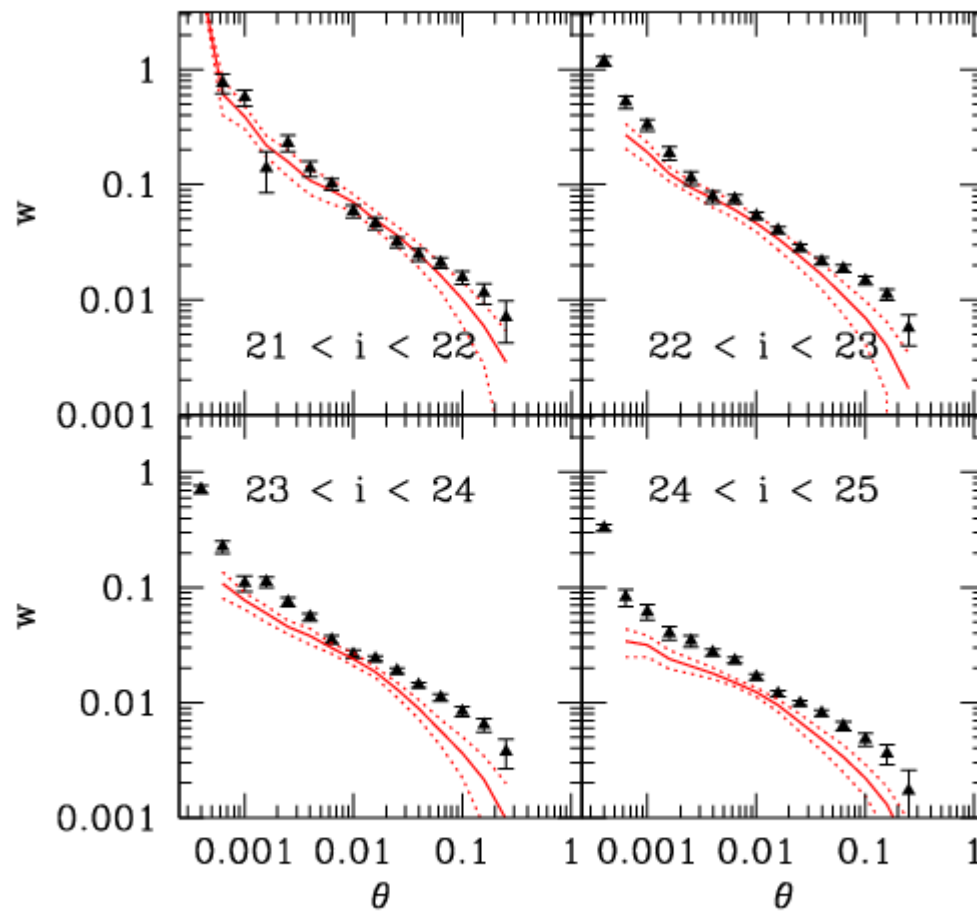
Springel, Frenk & White 2006





Comparison with COSMOS survey $w(\theta)$

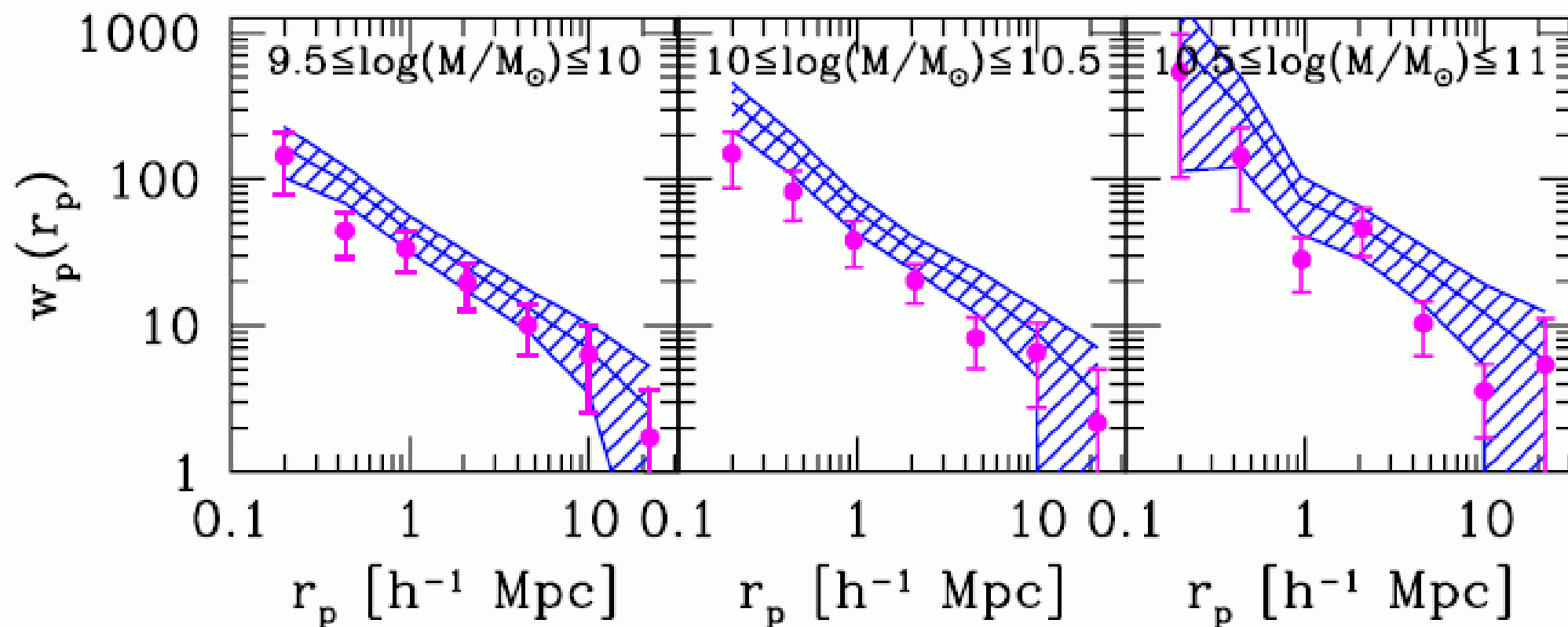
McCracken et al 2007



Comparison with VVDS survey $w_p(r_p)$

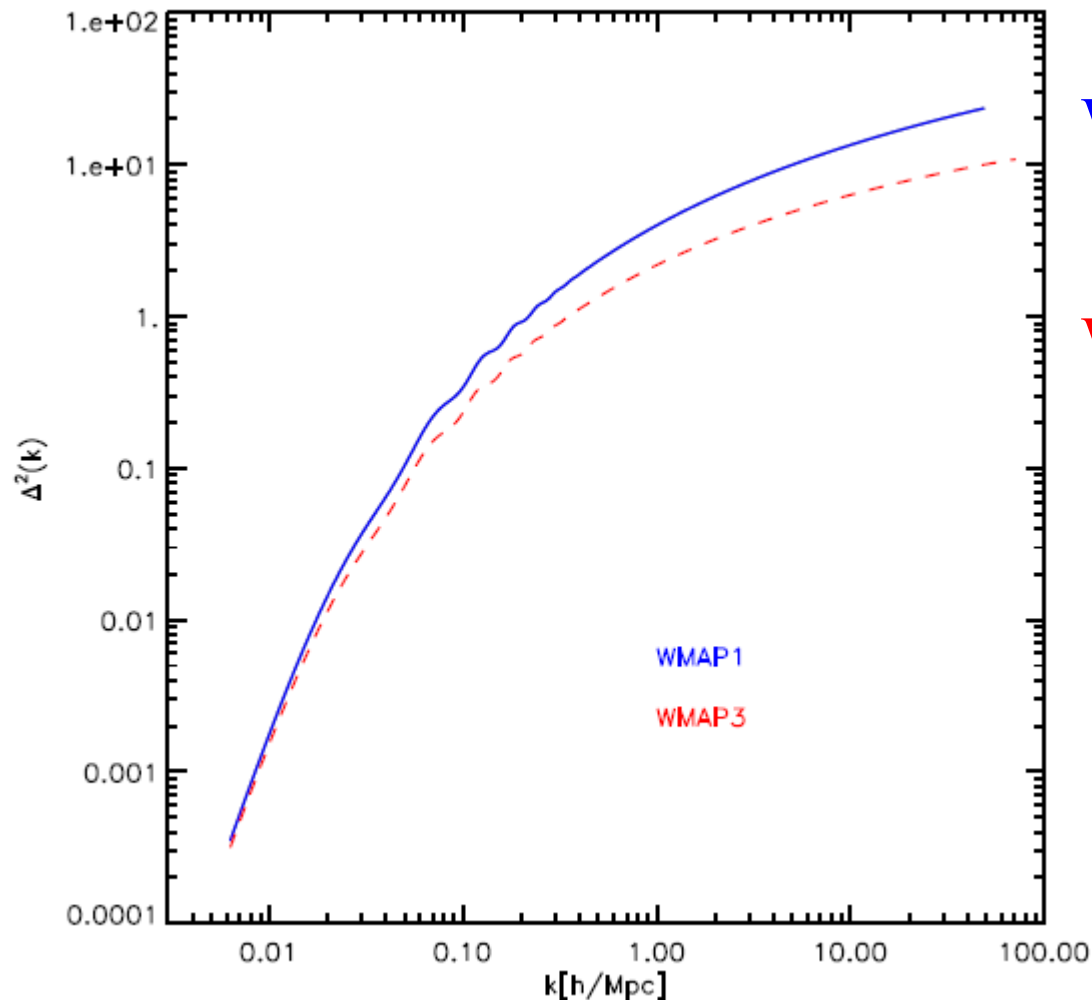
Meneux et al 2007

$$\langle z \rangle \sim 0.6$$



WMAP1 vs WMAP3 fluctuation amplitudes

Wang et al 2007



WMAP1: $\Omega_m = 0.25$, $\sigma_8 = 0.9$,
 $n = 1$, $\Omega_b = 0.045$

WMAP3: $\Omega_m = 0.226$, $\sigma_8 = 0.72$,
 $n = 0.947$, $\Omega_b = 0.04$

WMAP1

30Mpc



This visualization shows the large-scale structure of the universe, often referred to as the cosmic web. It features a complex network of dark matter filaments, represented by green and blue lines, which form the backbone of the universe. Scattered throughout this network are numerous galaxy clusters and individual galaxies, depicted as bright red and orange spots. The density of these objects is higher along the filaments and at their intersections. A scale bar in the bottom left corner indicates a distance of 30 Mpc (megaparsecs). The text 'WMAP1' in the top right corner identifies the data source as the first release of the Wilkinson Microwave Anisotropy Probe.

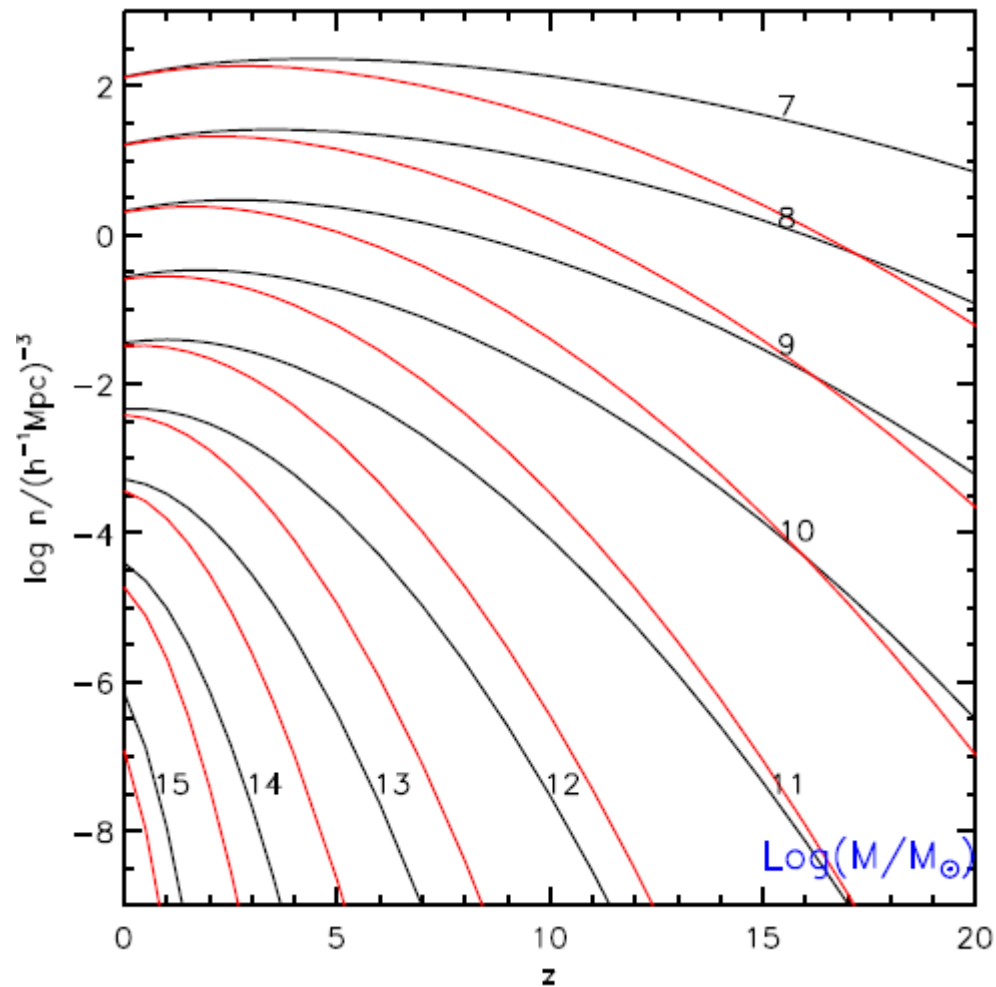
WMAP3

30Mpc

A visualization of the cosmic web, showing a complex network of dark matter filaments and galaxy clusters. The filaments are depicted as a dense, interconnected web of green and blue lines, while the galaxy clusters are represented by bright, elongated structures of red and orange. The background is a deep blue. In the top right corner, the text "WMAP3" is displayed in white. In the bottom left corner, a white horizontal line is shown next to the text "30Mpc", indicating the scale of the image.

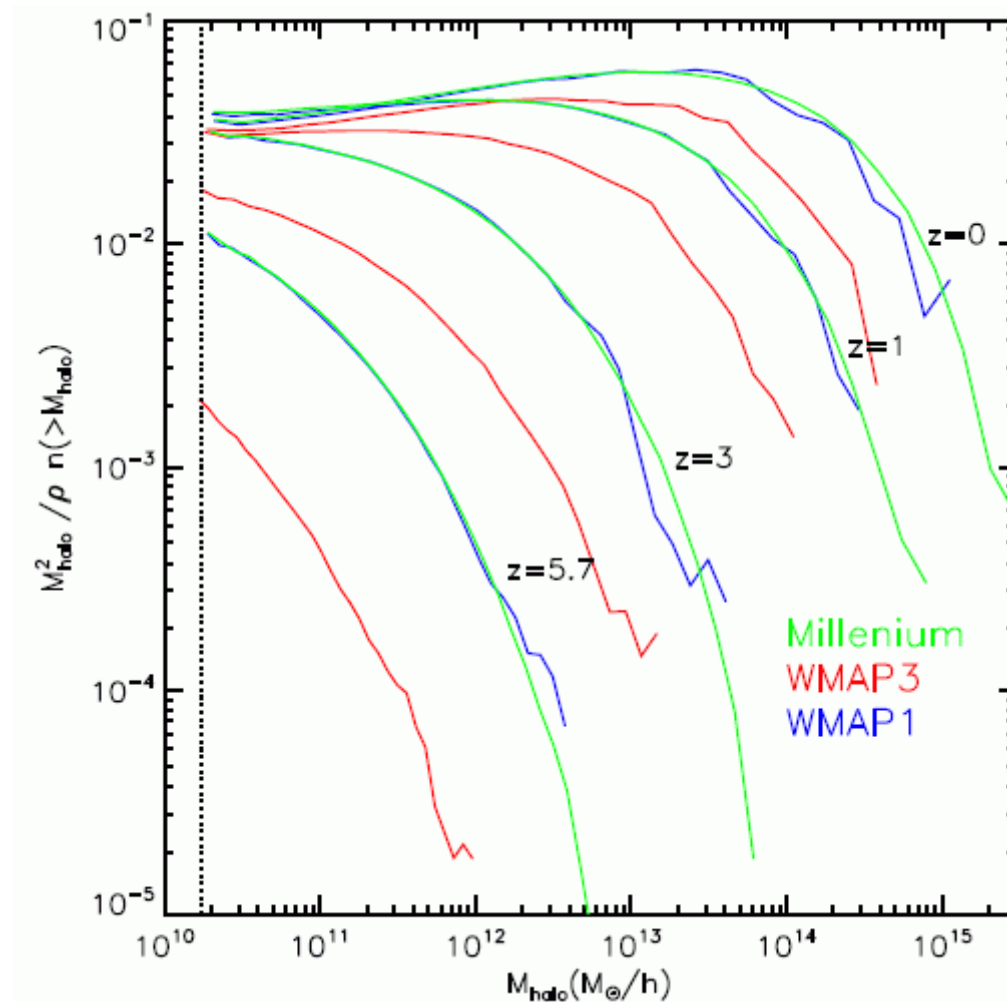
WMAP1 vs WMAP3 halo mass functions

Wang et al 2007



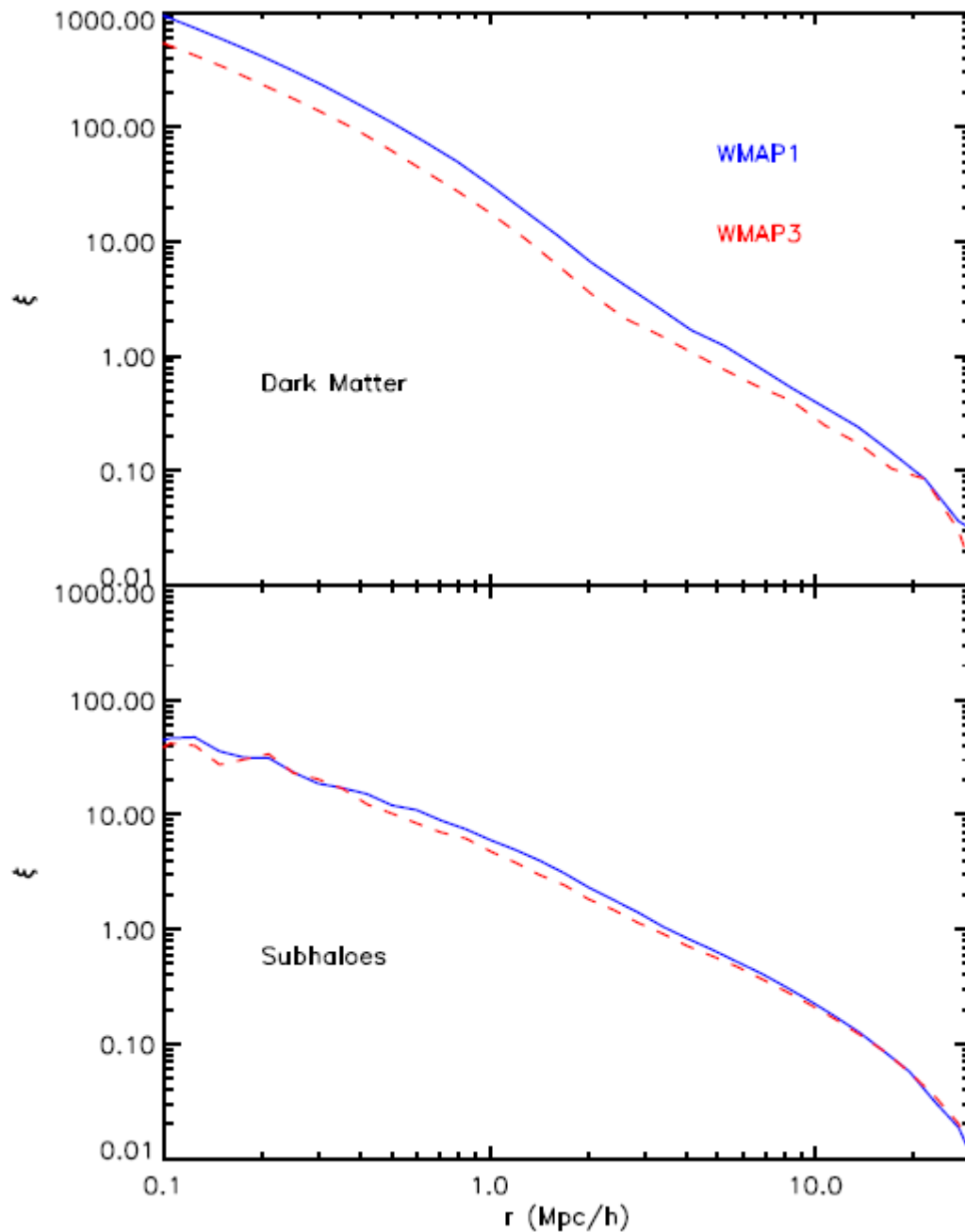
WMAP1 vs WMAP3 halo mass functions

Wang et al 2007



WMAP1 vs WMAP3 mass correlations

Wang et al 2007

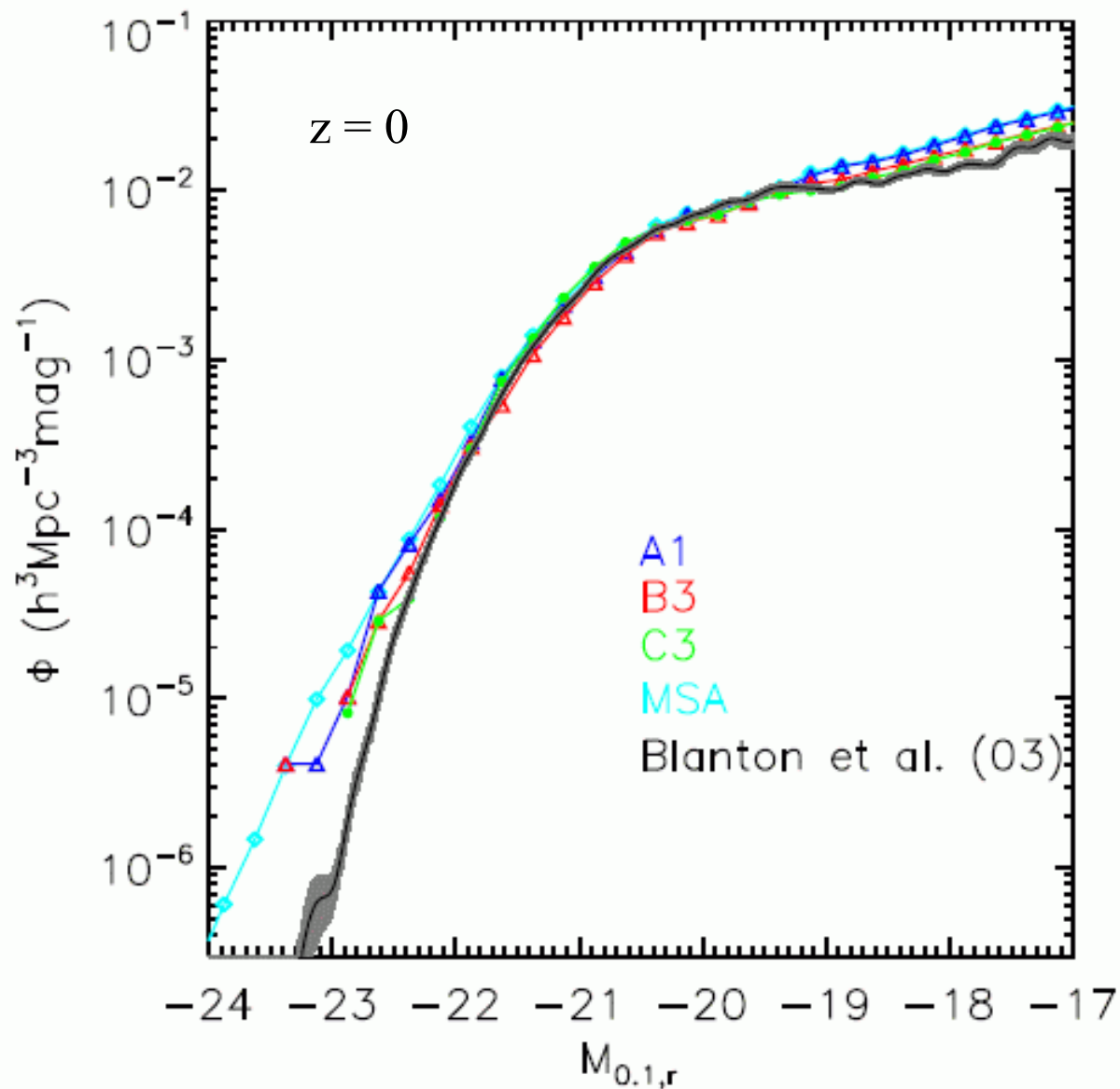


← mass correlations

← correlations of (sub)halos
with $M > 2 \times 10^{10} M_{\odot}$

WMAP1 vs WMAP3 luminosity functions

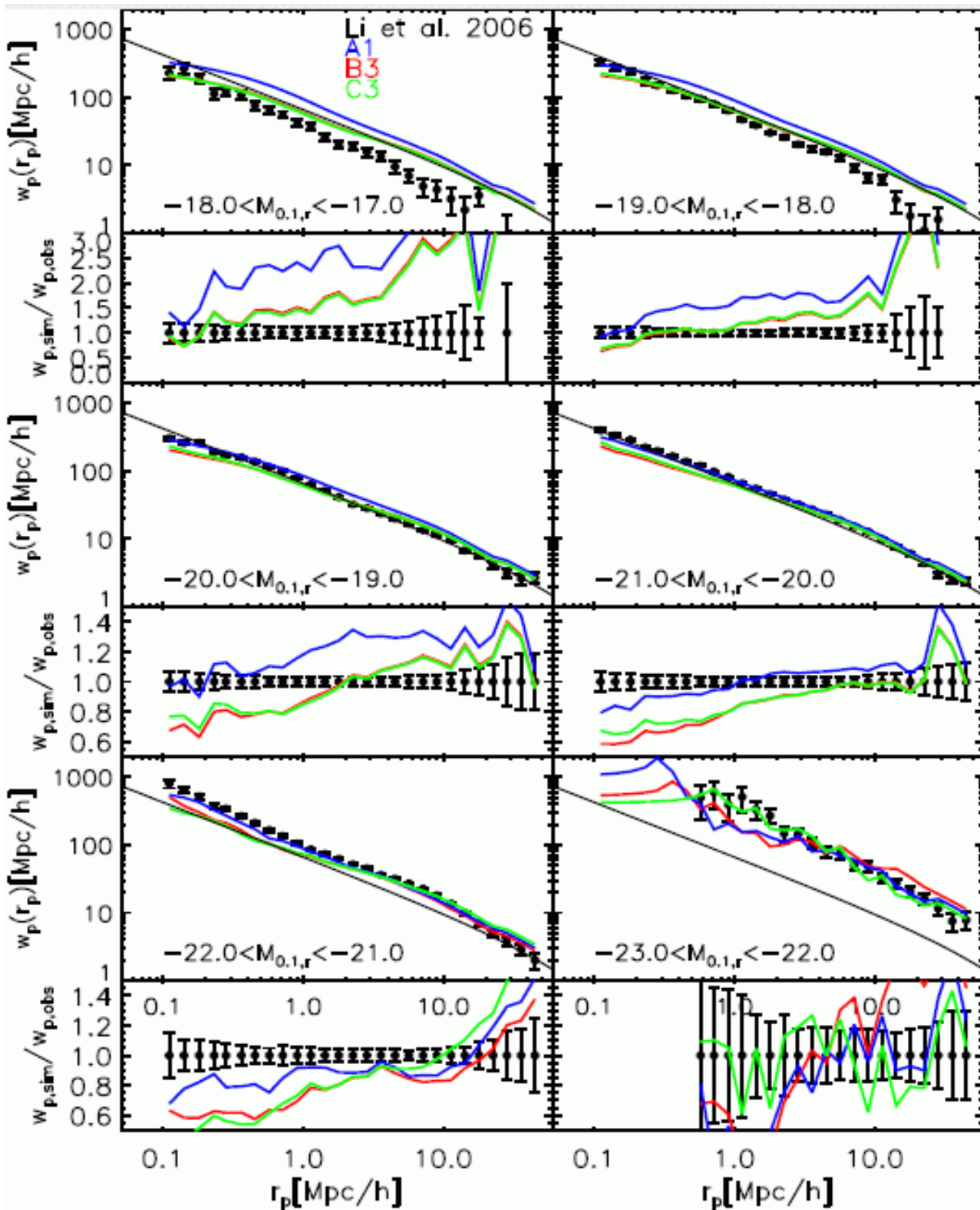
Wang et al 2007



WMAP1 vs WMAP3 galaxy correlations

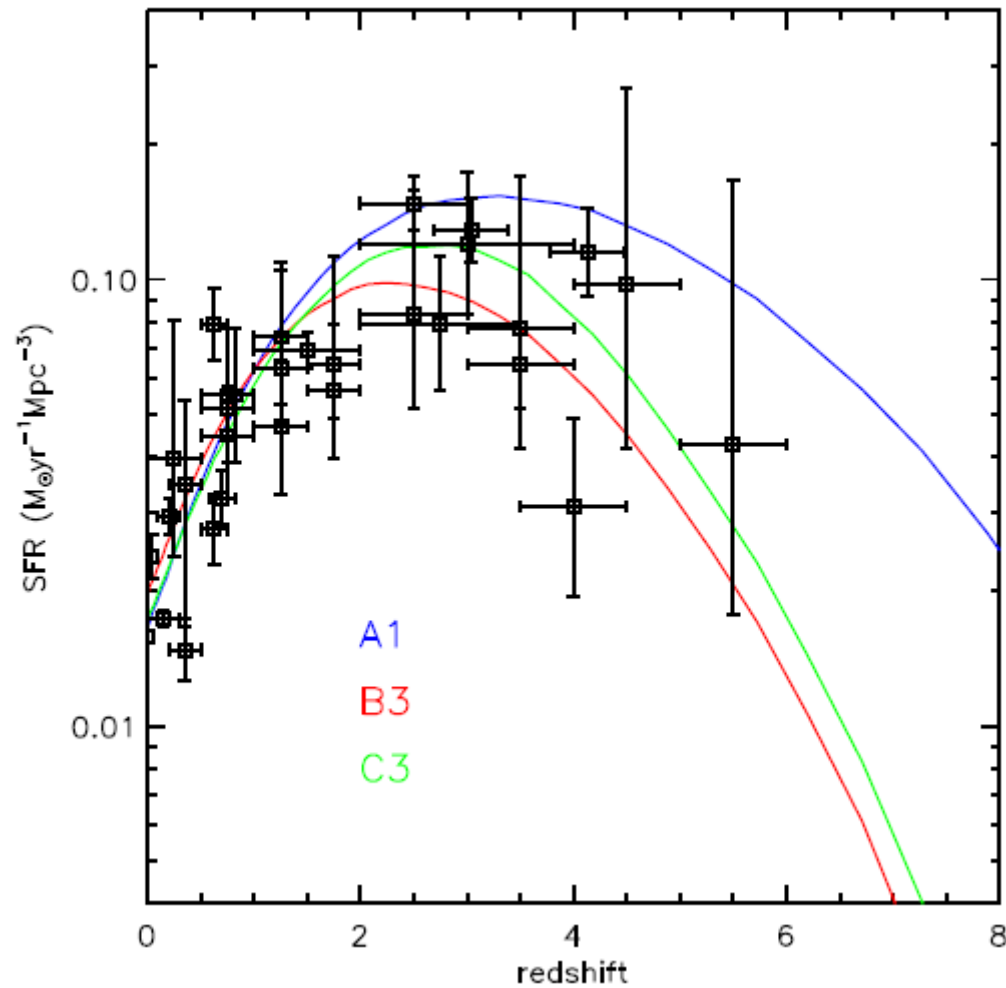
Wang et al 2007

$z = 0$



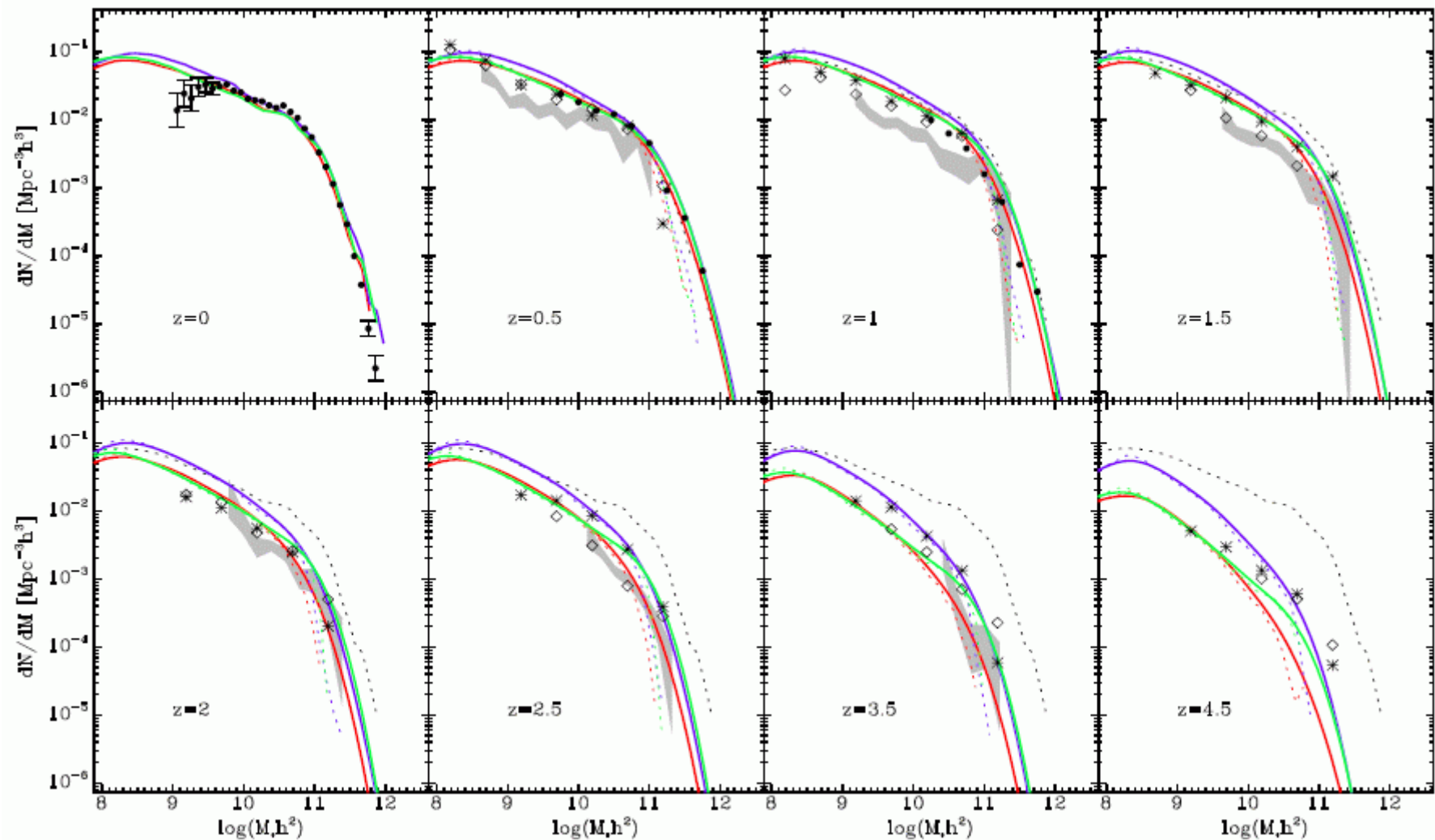
WMAP1 vs WMAP3 cosmic SFH

Wang et al 2007



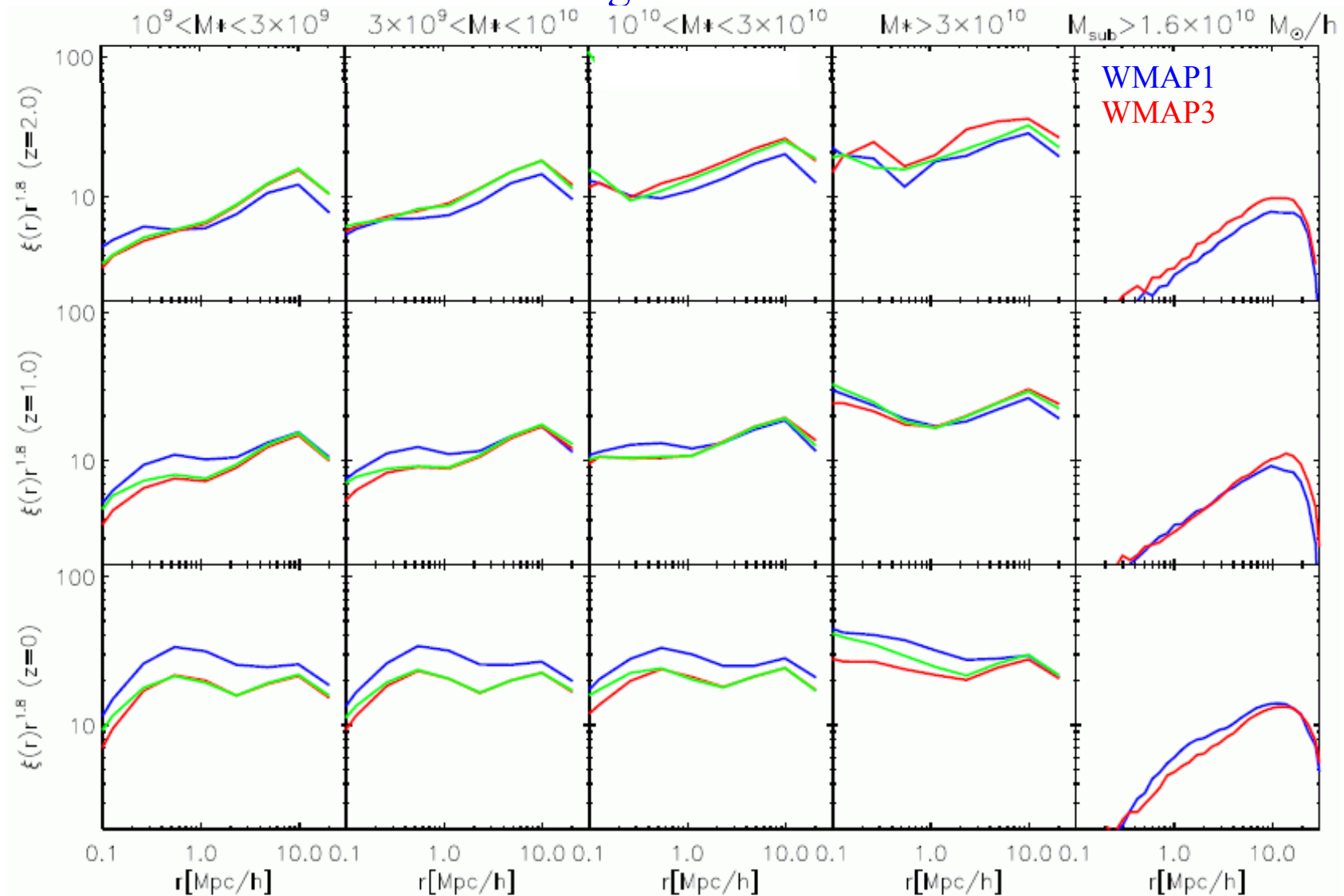
WMAP1 vs WMAP3 galaxy mass functions

Wang et al 2007



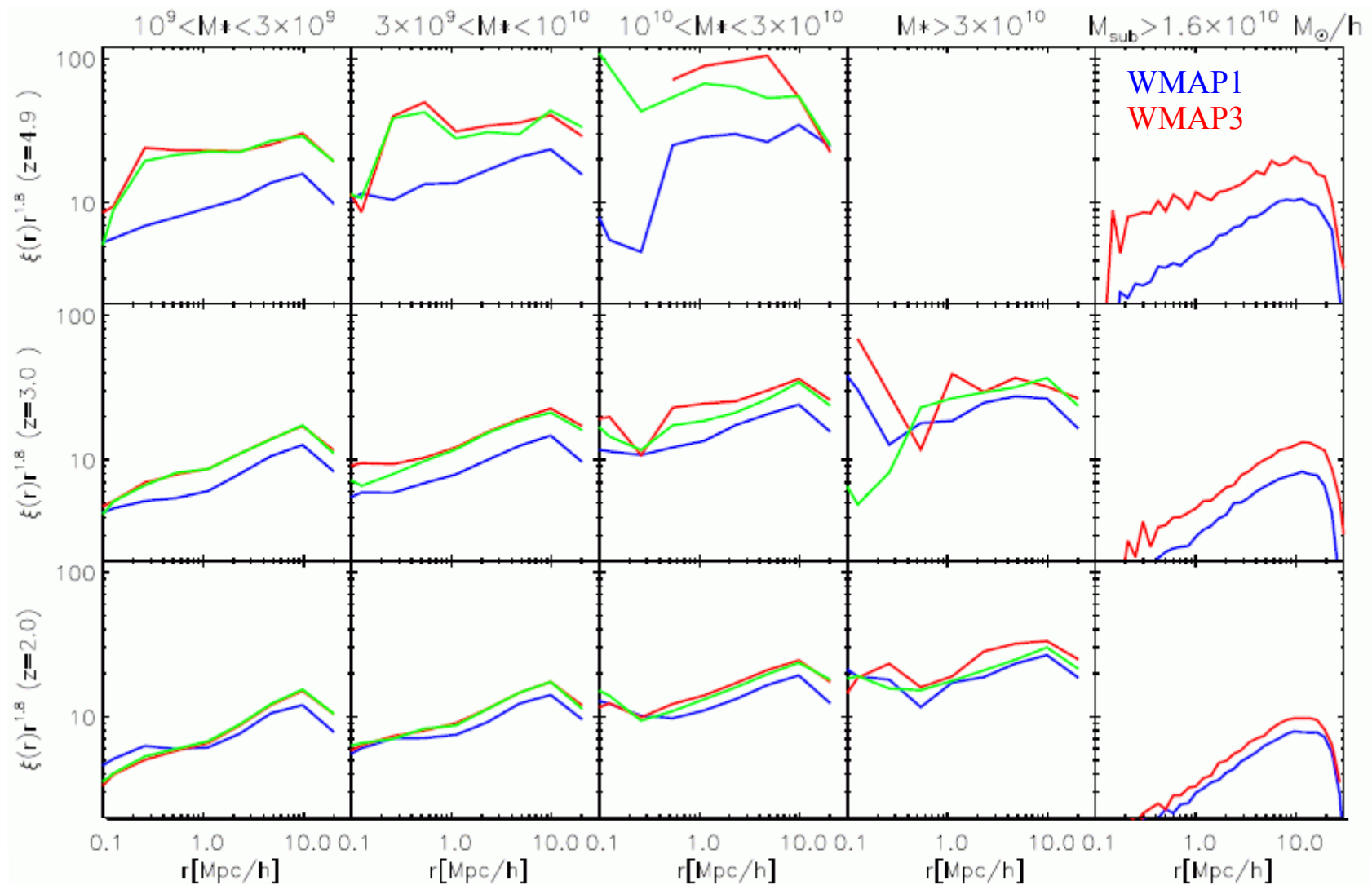
WMAP1 vs WMAP3 high-z galaxy correlations

Wang et al 2007



WMAP1 vs WMAP3 high-z galaxy correlations

Wang et al 2007



- Large-scale structure in observable galaxy populations should fall off much less rapidly to high redshift than that in the dark matter
- While the dark matter distribution is more weakly clustered for WMAP3 than for WMAP1 parameters, $z=0$ galaxy halos are *equally* clustered in the two cases
- At high redshift objects of given mass are less abundant in the WMAP3 case, but they are *more* strongly clustered

Galaxy and halo catalogues at all z , and also lightcones available at:
<http://www.mpa-garching.mpg.de/millennium>