Simulating Gravitational Lensing

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Outline

- Introduction
- Results:
  - Strong lensing by clusters
  - Weak lensing by LSS: cosmic shear
  - Weak galaxy-galaxy lensing
  - Weak group and cluster lensing
  - Weak lensing of galaxies in clusters
  - Weak lensing mass reconstruction
  - Weak lensing: shear peak statistics
- Summary

Outline

- Introduction
- Results:
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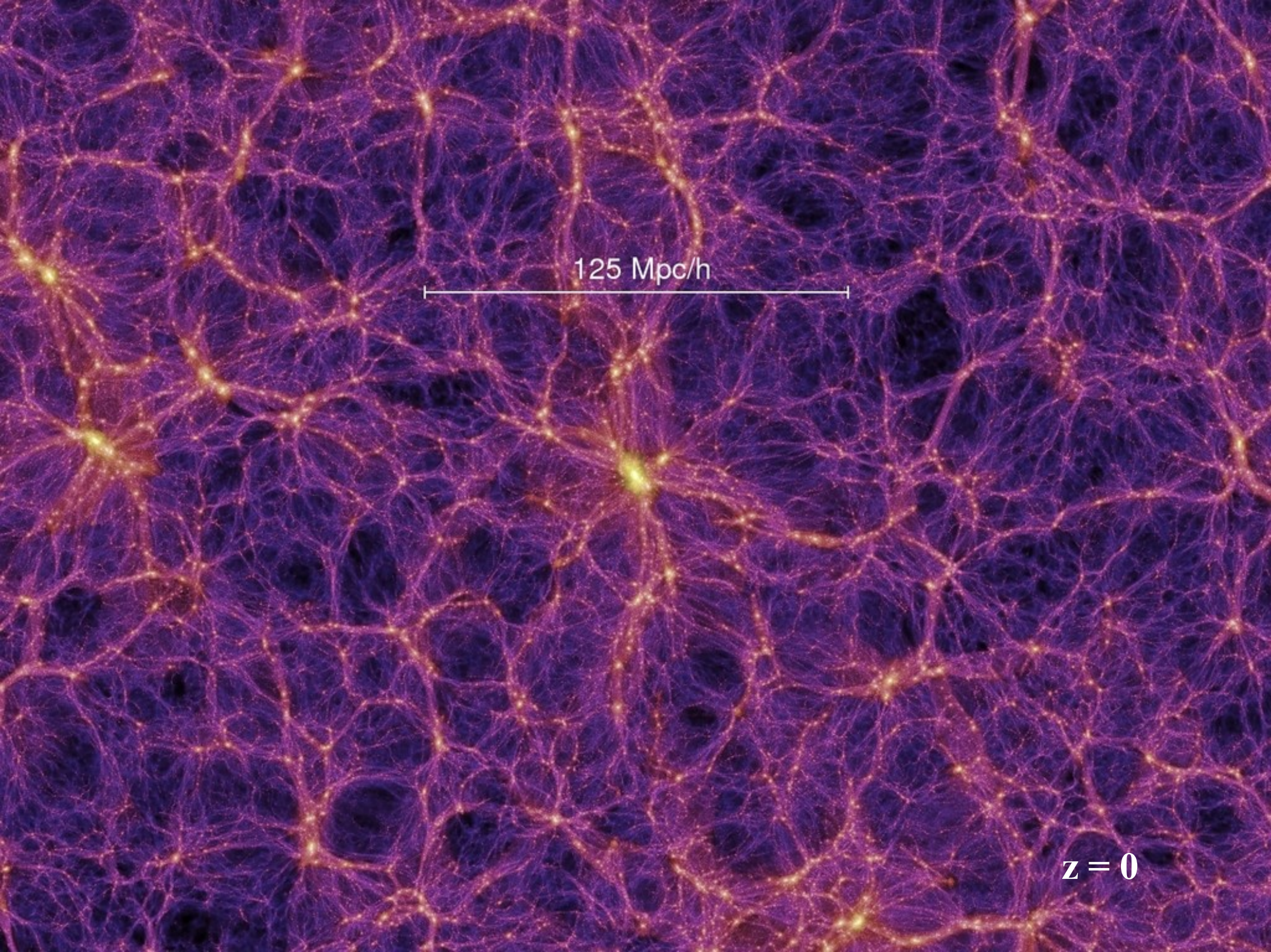
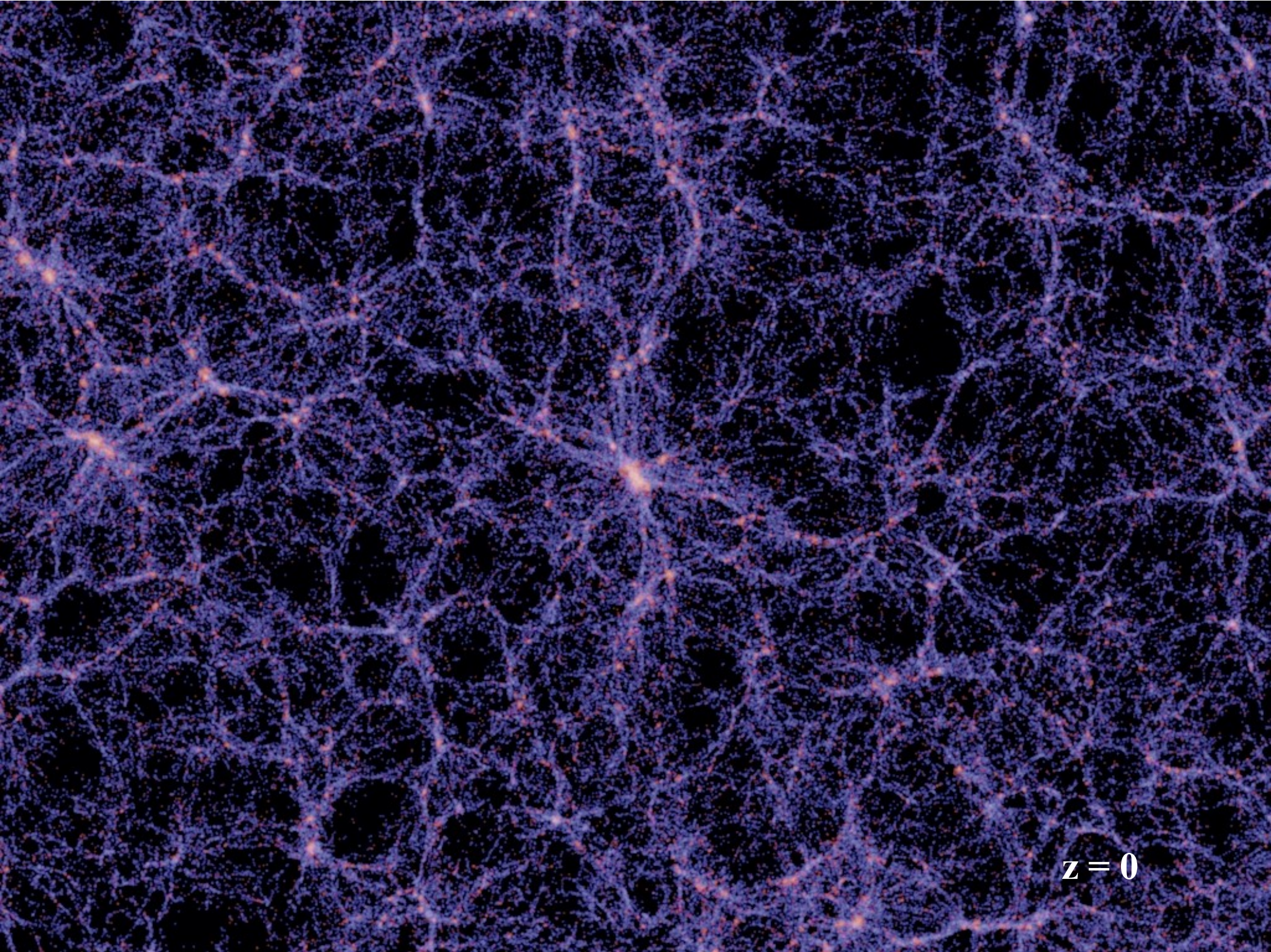
  - Weak lensing: shear peak statistics
-

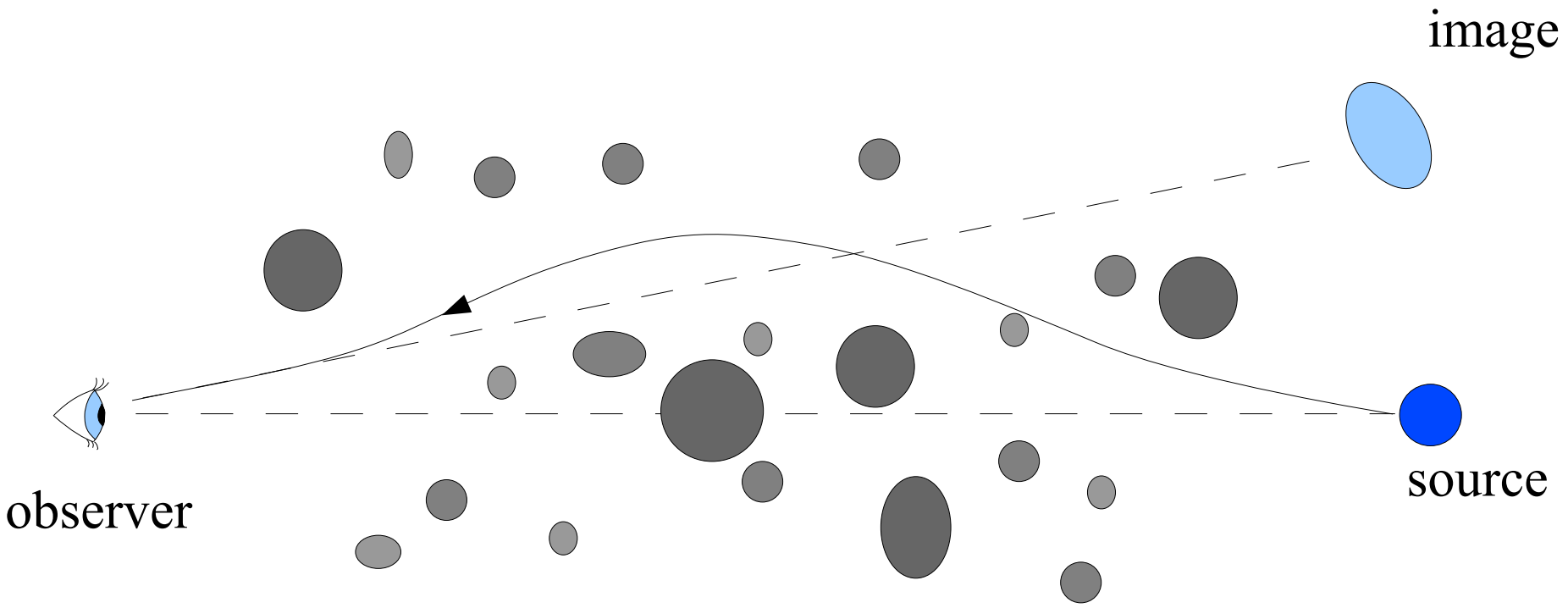
Introduction

- cosmic structure formation:
  - highly non-linear
  - numerical simulations required


125 Mpc/h
z = 0

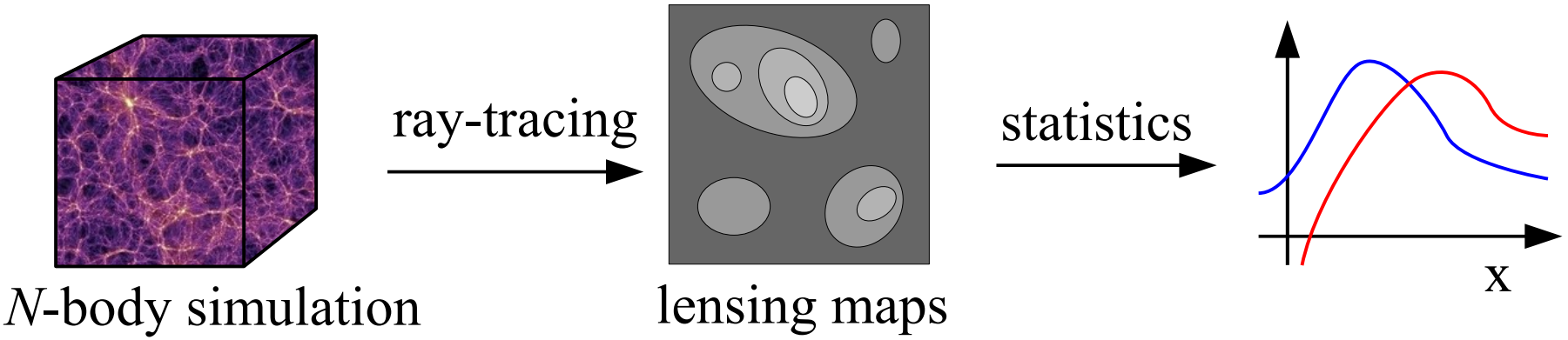

z = 0

Gravitational Lensing



Simulating Gravitational Lensing

- algorithm:



- use lensing simulations to:
  - obtain predictions for GL observations
  - study capability of GL to measure mass distribution, and constrain galaxy physics, cosmology and fundamental physics

Primordial Non-Gaussianity

- origin and properties of primordial perturbations?
- some models of inflation:
  - perturbations (almost) Gaussian random field
  - local non-Gaussianity:

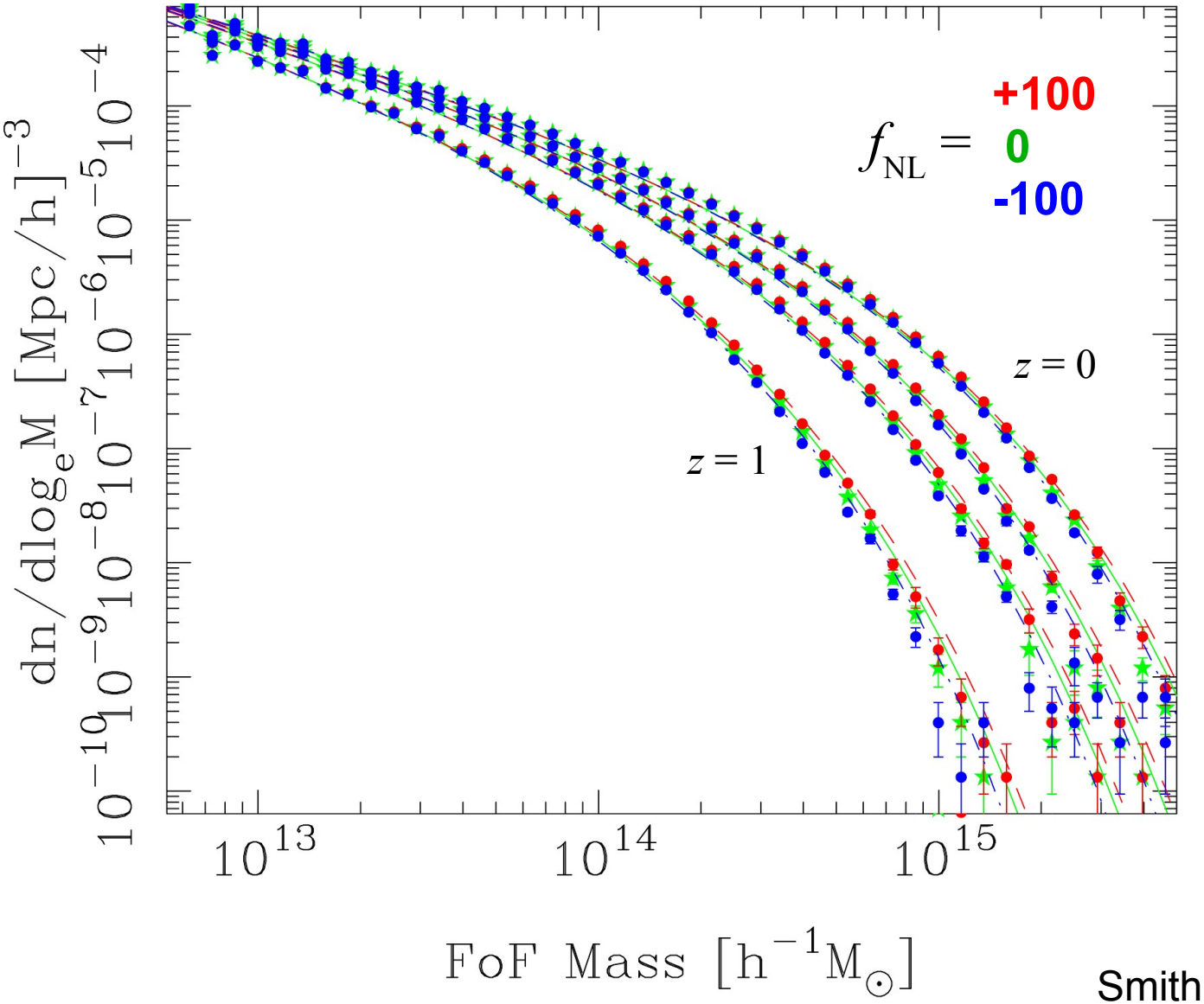
$$\Phi(\mathbf{x}) = \varphi(\mathbf{x}) + f_{NL}\,[\varphi(\mathbf{x})^2 - \langle\varphi(\mathbf{x})^2\rangle]$$

grav. potential

Gaussian random field

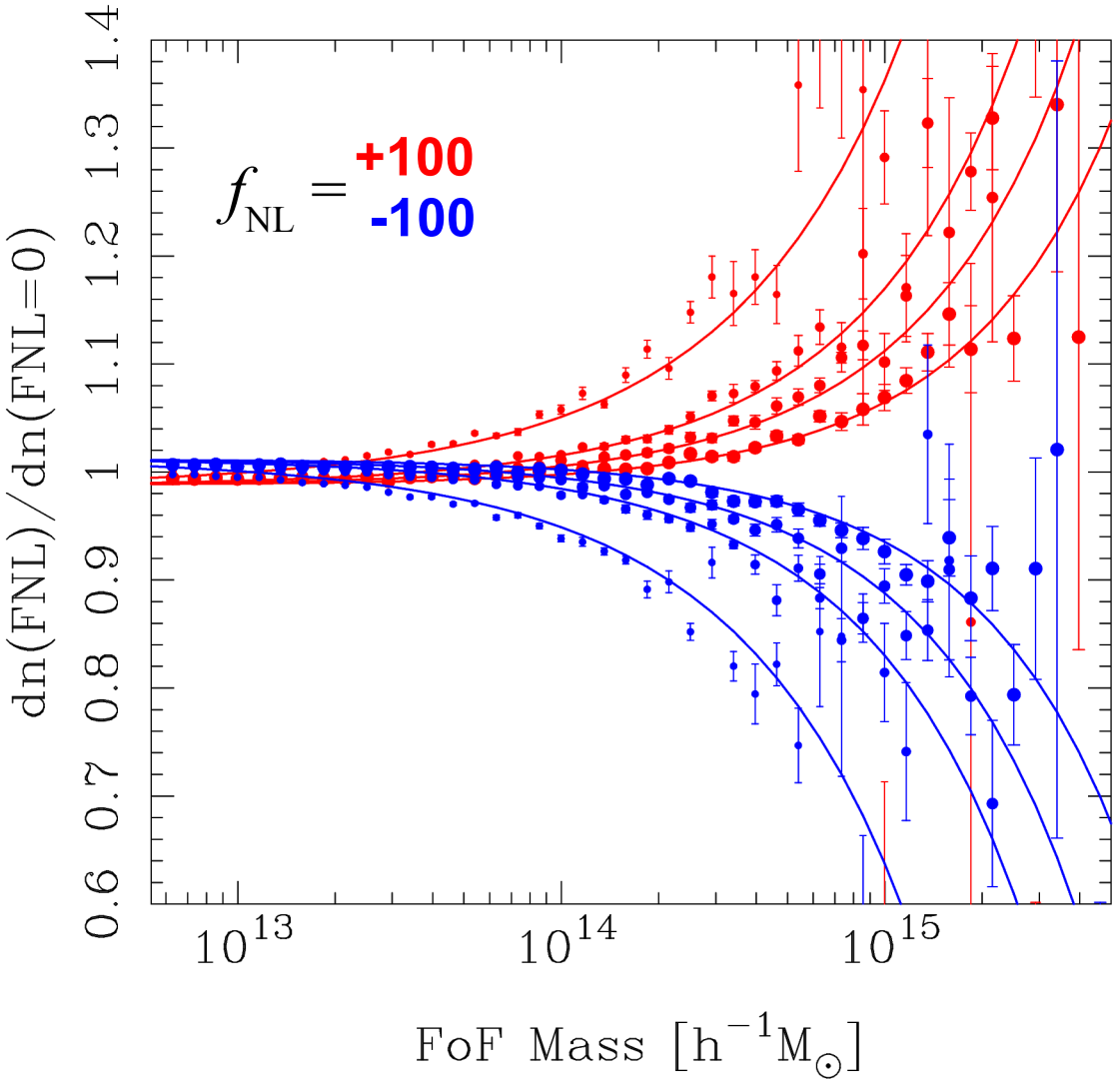
non-Gaussianity parameter

Halo Mass Function



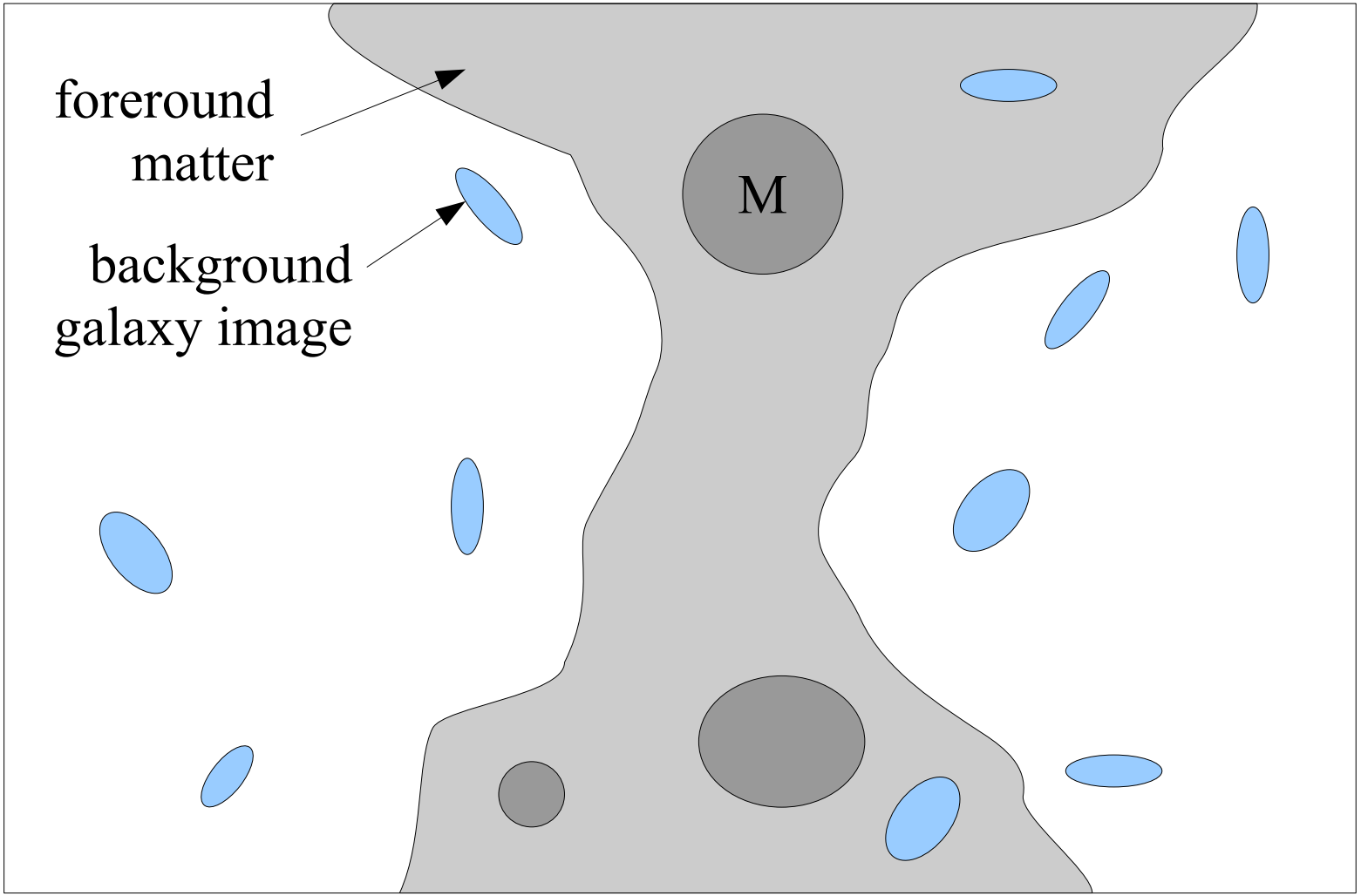
Smith et al. (2010)

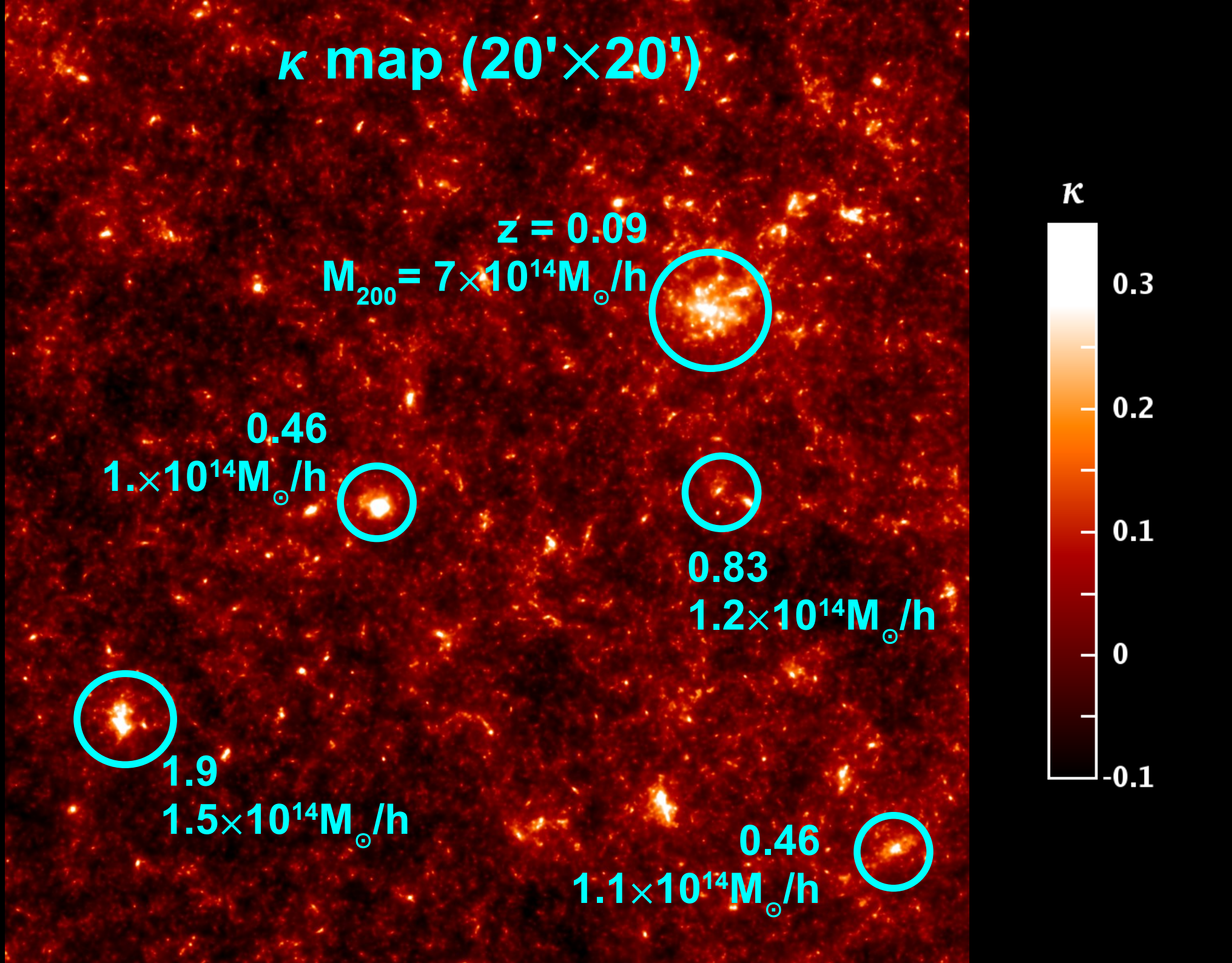
Halo Mass Function

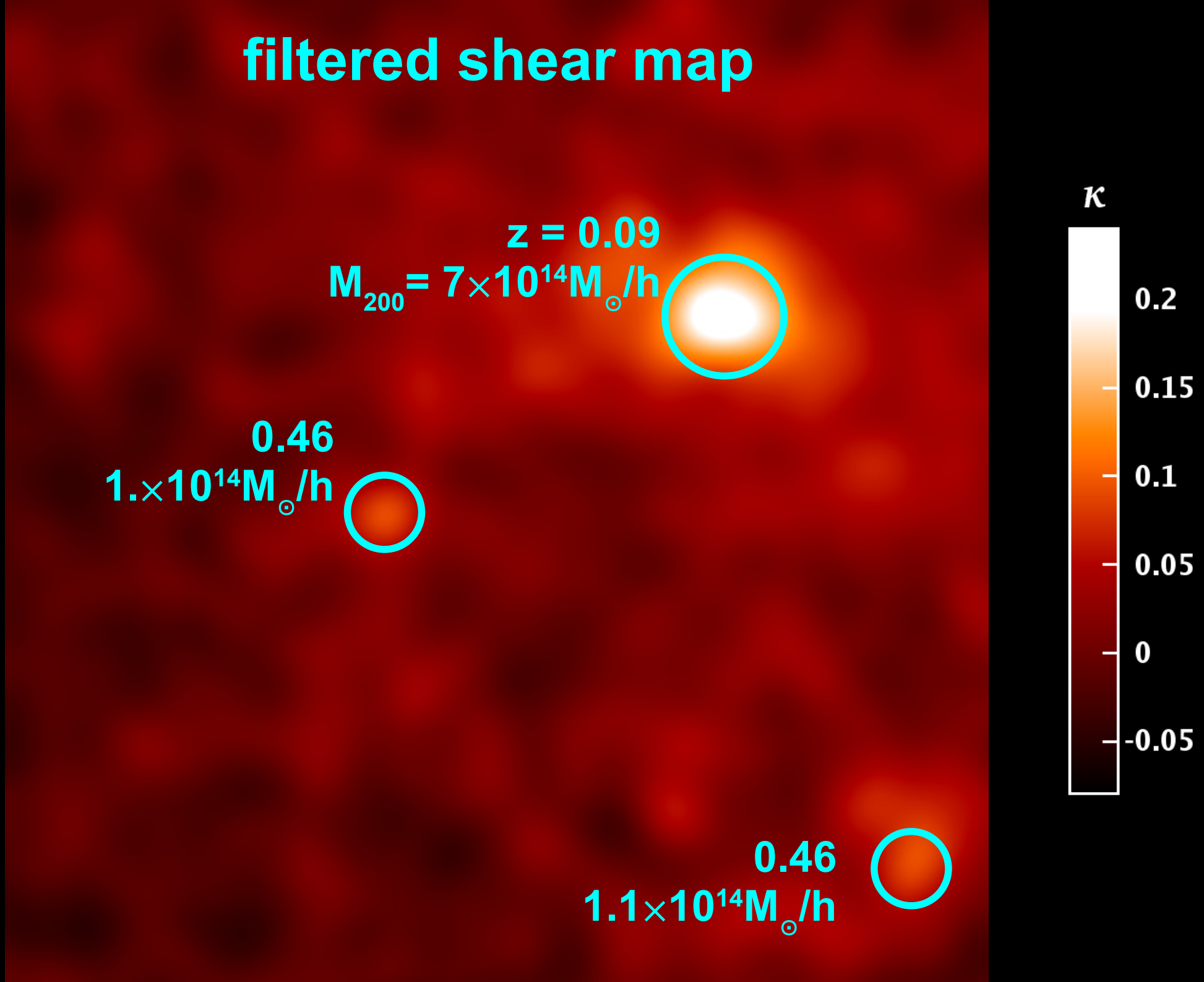


Smith et al. (2010)

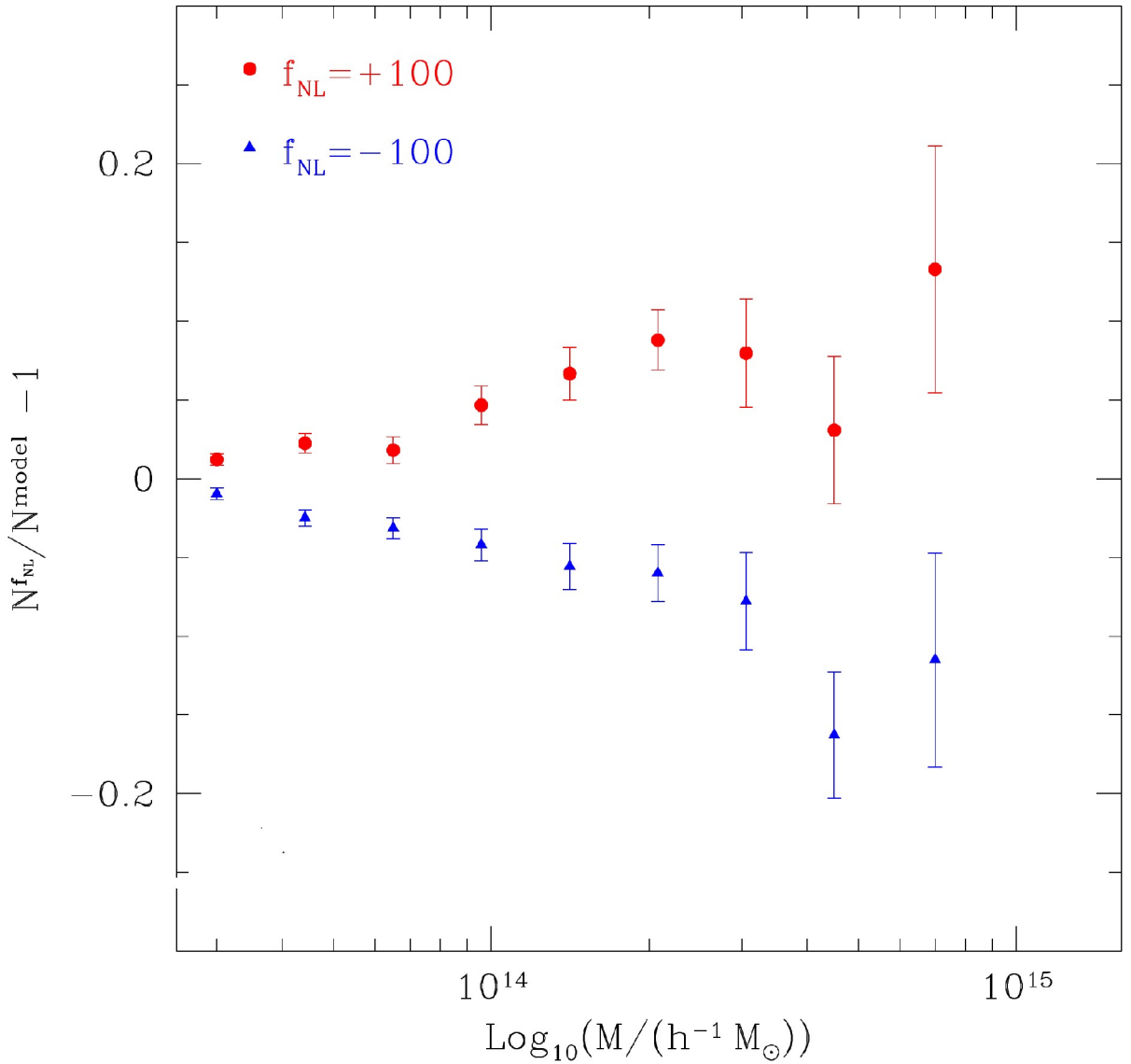
Weak Lensing: Shear Peaks




κ map (20'×20')
z = 0.09
M200= 7×10^14M⊙/h
0.46
1.×10^14M⊙/h
0.83
1.2×10^14M⊙/h
1.9
1.5×10^14M⊙/h
0.46
1.1×10^14M⊙/h
κ
0.3
0.2
0.1
0
-0.1


filtered shear map
z = 0.09
M200= 7×10^14M⊙/h
0.46
1.×10^14M⊙/h
0.46
1.1×10^14M⊙/h
κ
0.2
0.15
0.1
0.05
0
-0.05

Shear-Peak Function



EUCLID-like s.:

$A = 15\,000\ \mathrm{deg}^2$

$z_{\mathrm{median}} = 0.9$

$n_{\mathrm{gal}} = 40/\mathrm{arcmin}^2$

Marian et al. (in prep.)

Thanks
for
Your Attention!