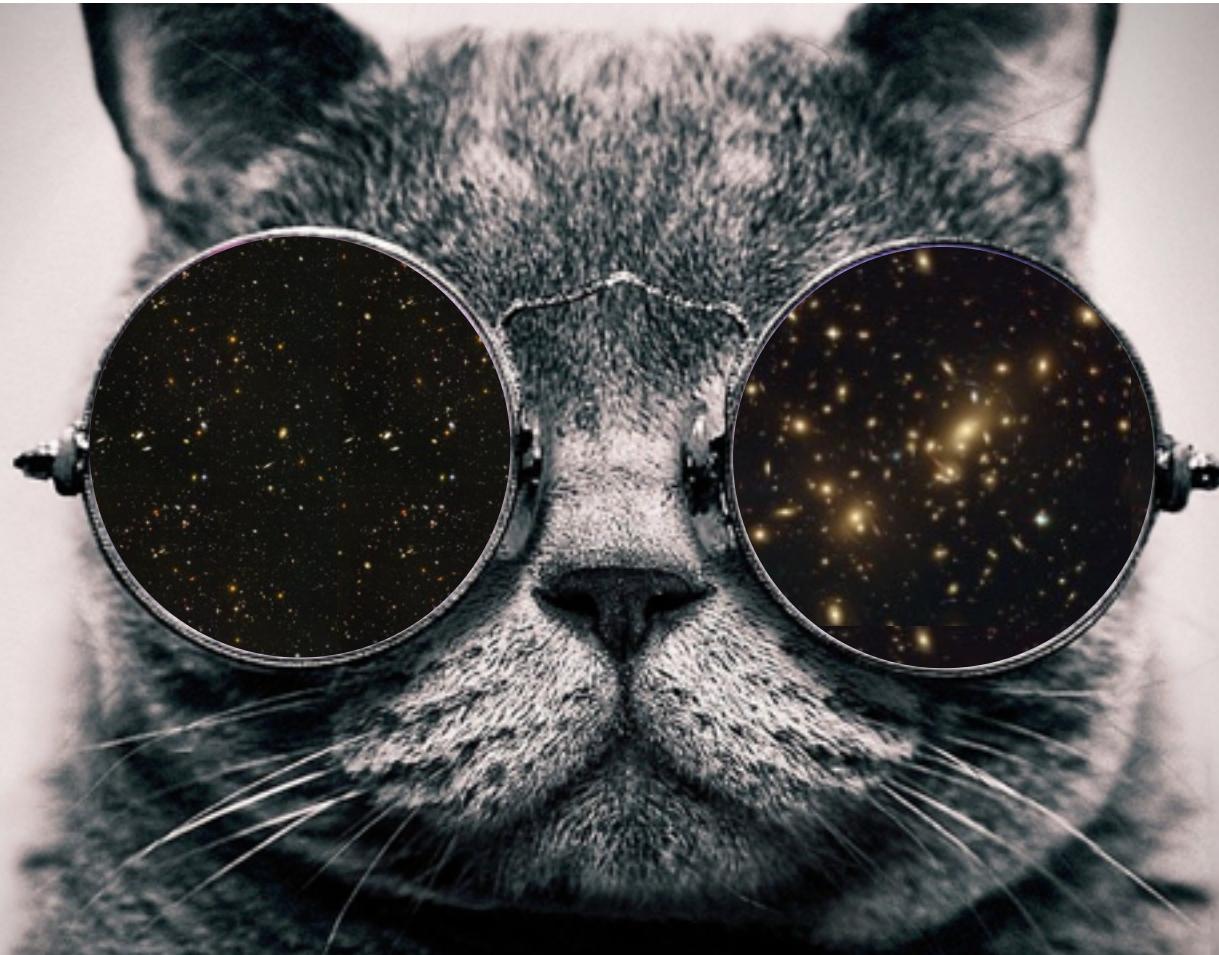


COSMO WITH COUNTS-IN-CELLS



Cora Uhlemann

DAMTP & Fitzwilliam College



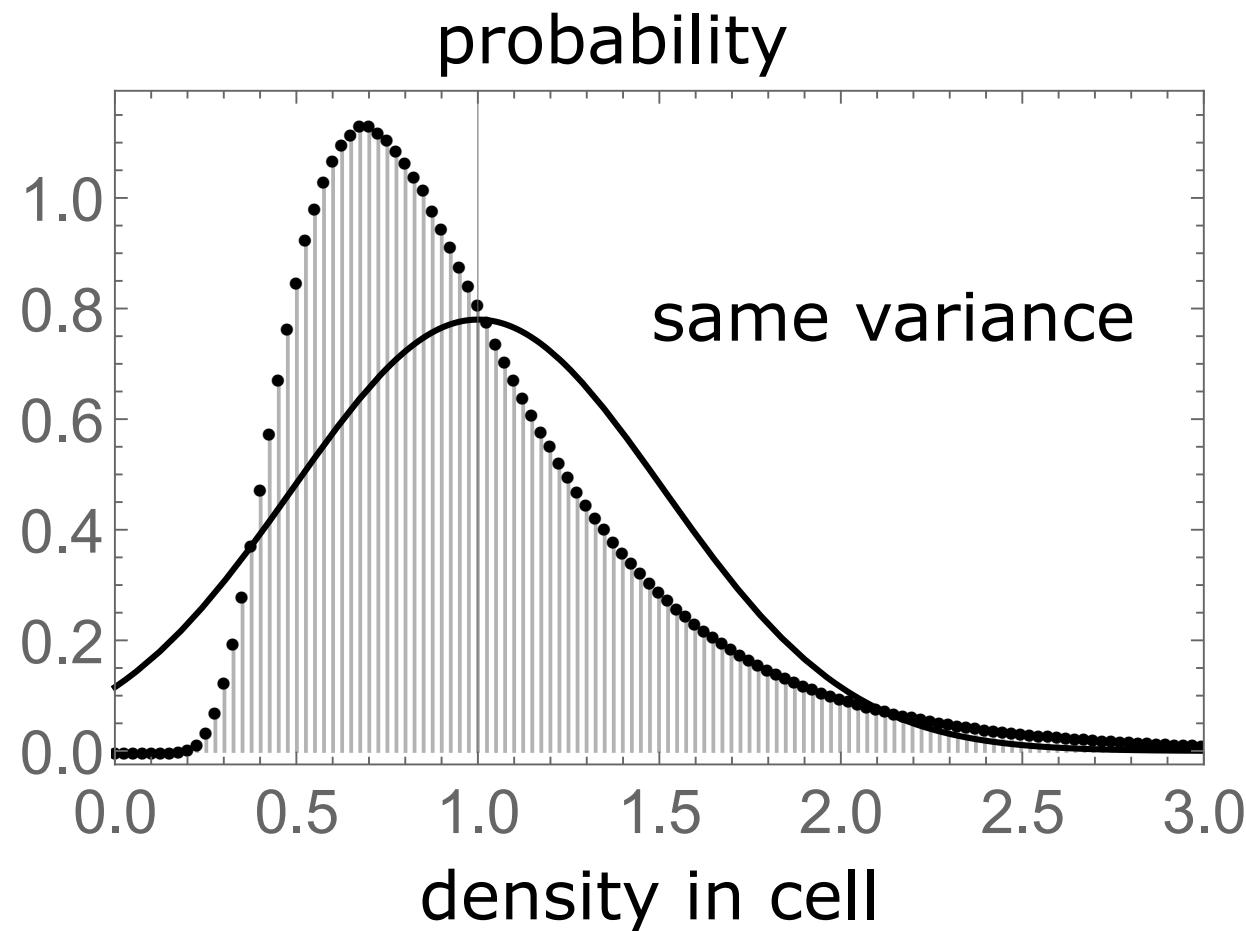
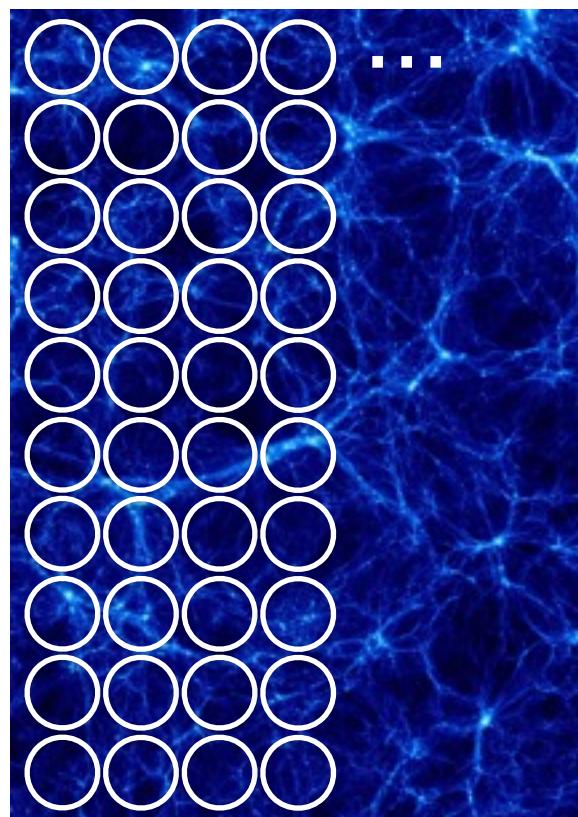
UNIVERSITY OF
CAMBRIDGE

KICC Symposium
September 2019

COUNTS-IN-CELLS IDEA

One-point statistics

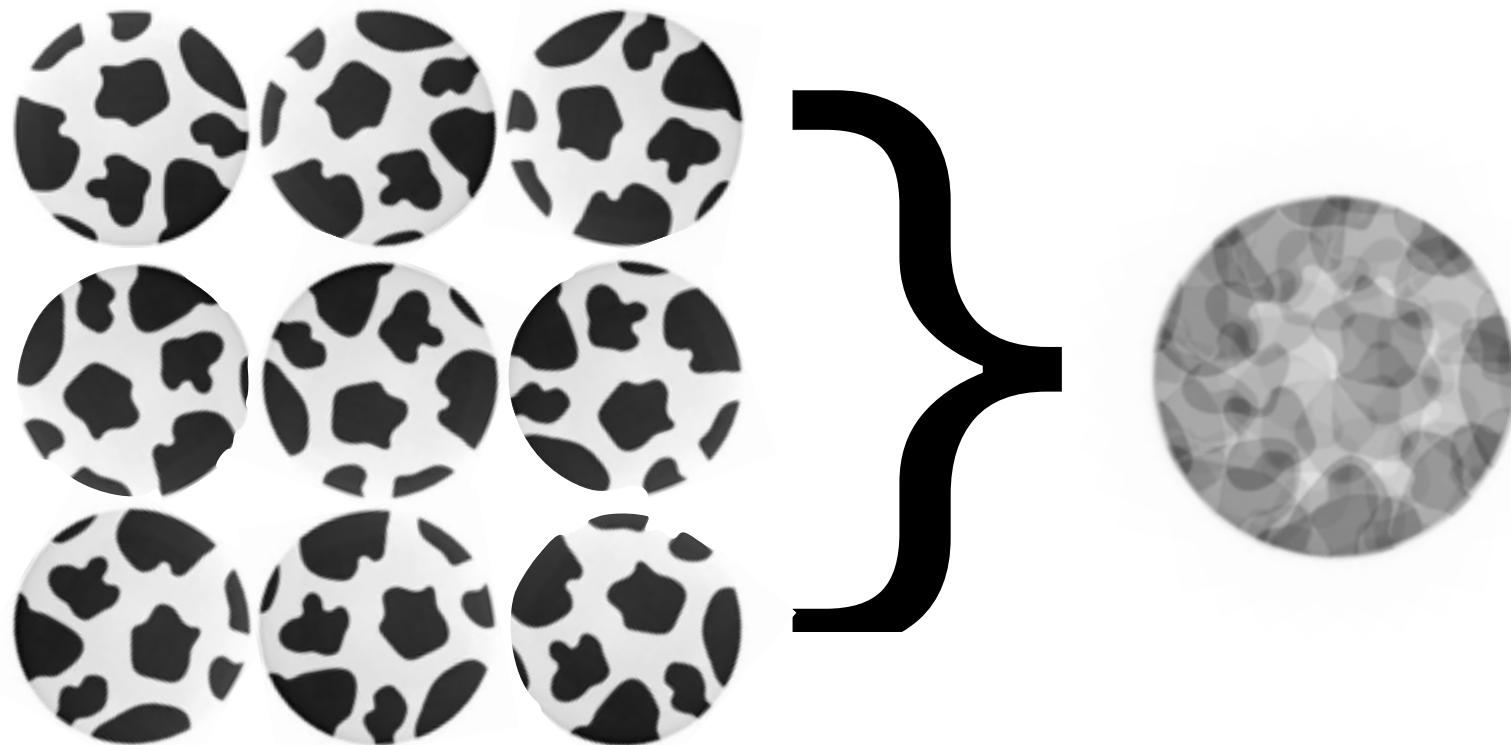
non-Gaussian matter distribution



COUNTS-IN-CELLS IDEA

matter density in symmetric cells

symmetry statistics \leftrightarrow dynamics



COUNTS-IN-CELLS THEORY

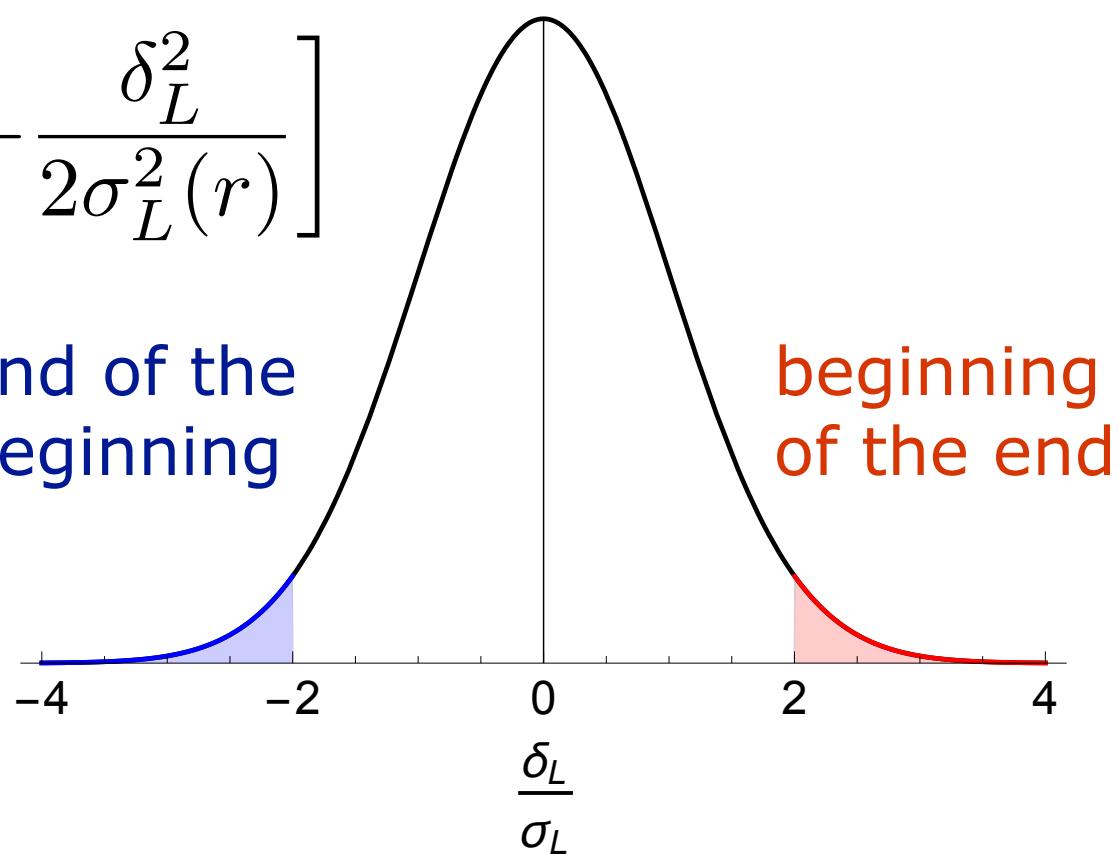
Large-deviation statistics

large deviations exp. unlikely

$$\mathcal{P}_r^{\text{ini}}(\delta_L) \sim \exp \left[-\frac{\delta_L^2}{2\sigma_L^2(r)} \right]$$

end of the
beginning

beginning
of the end



COUNTS-IN-CELLS THEORY

Large-deviation statistics

most likely path dominates

$$\mathcal{P}_{R,z}(\rho) \sim \exp \left[-\frac{\delta_L(\rho)^2}{2\sigma_L^2(z, r(R, \rho))} \frac{\sigma_L^2}{\sigma_{NL}^2} \right]$$

Bernardeau 94
CU++ 16

spherical collapse

small parameter

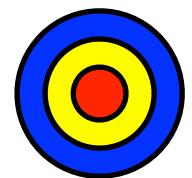
MATTER COUNTS-IN-CELLS

if we only could observe dark matter

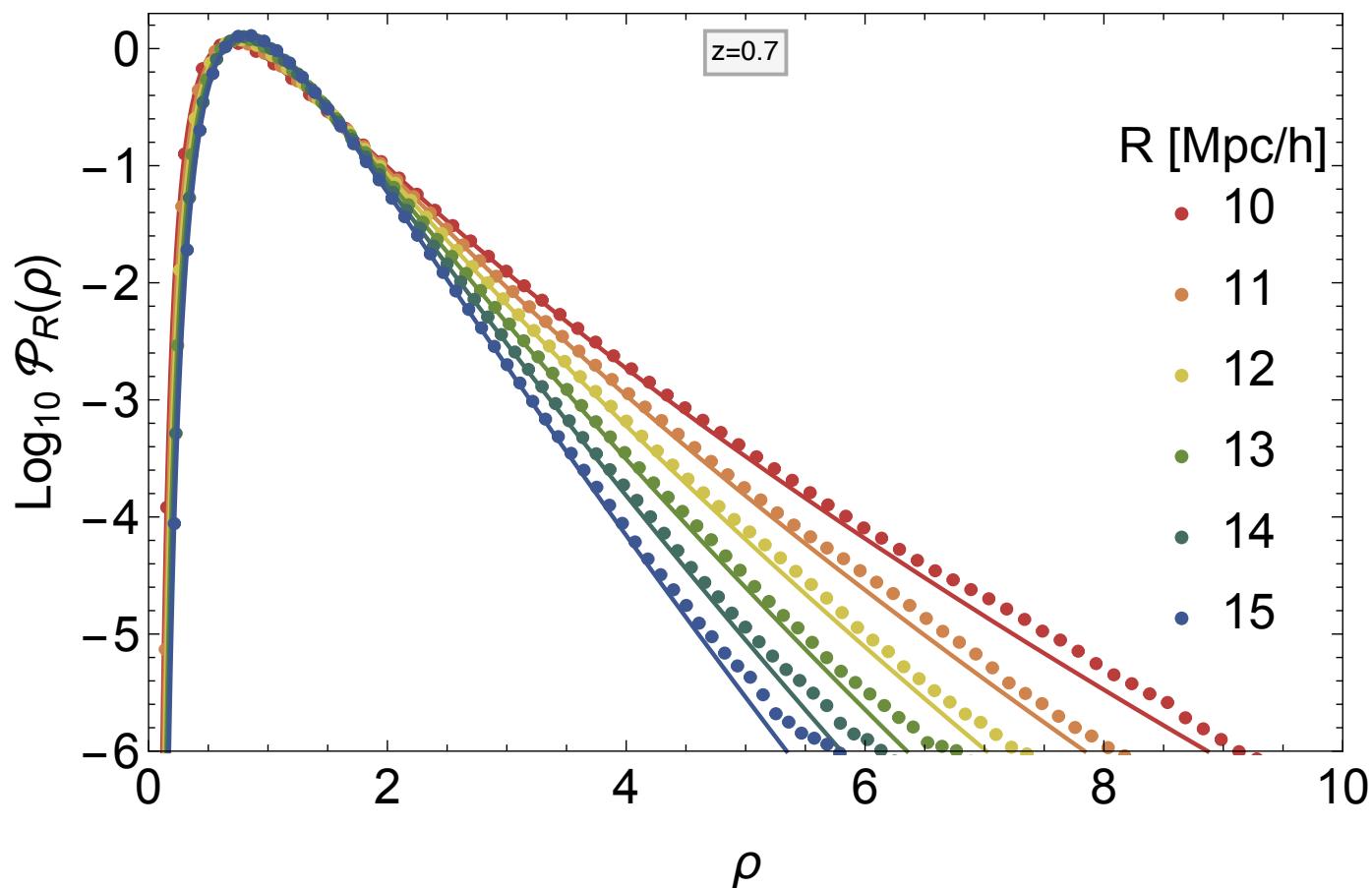


MATTER COUNTS-IN-CELLS

1pt PDF from first principles

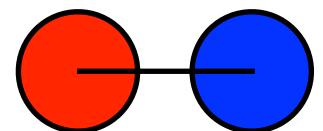


CU, Codis ++ 16



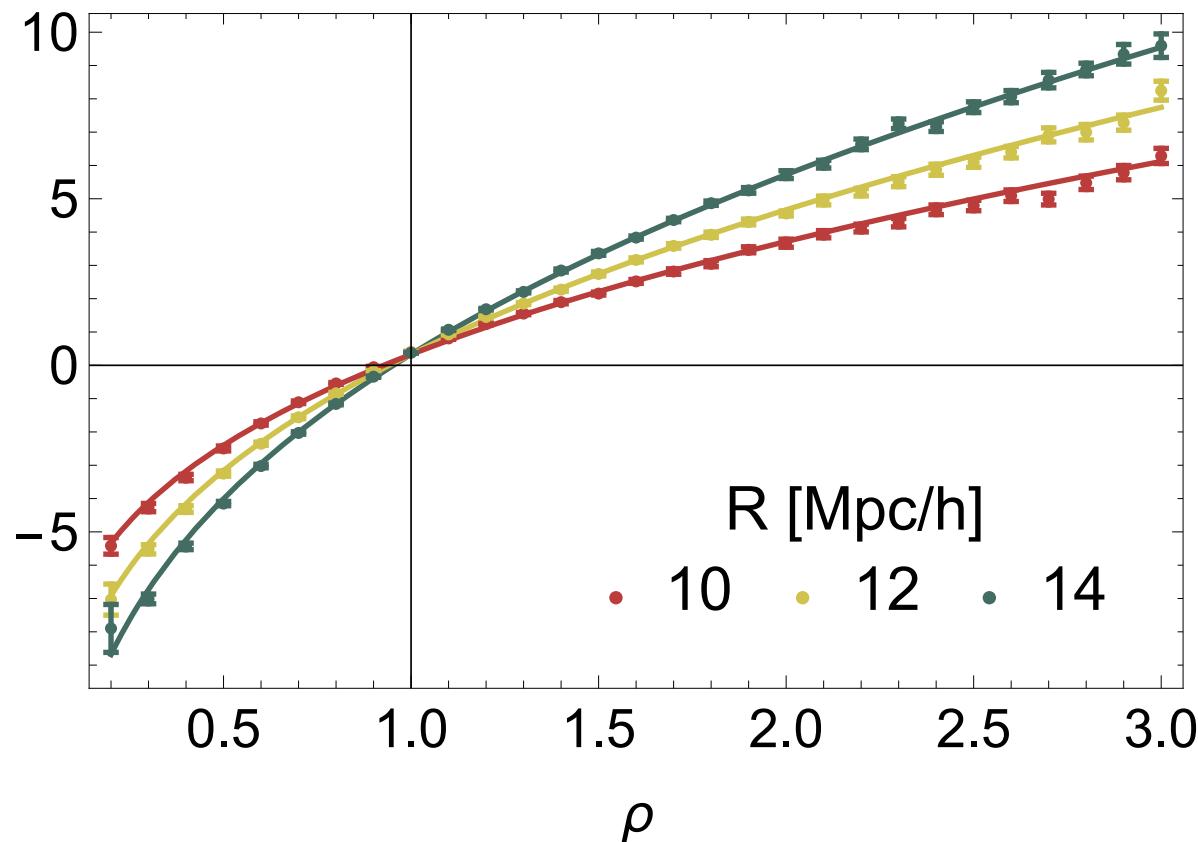
MATTER COUNTS-IN-CELLS

density-dependent clustering



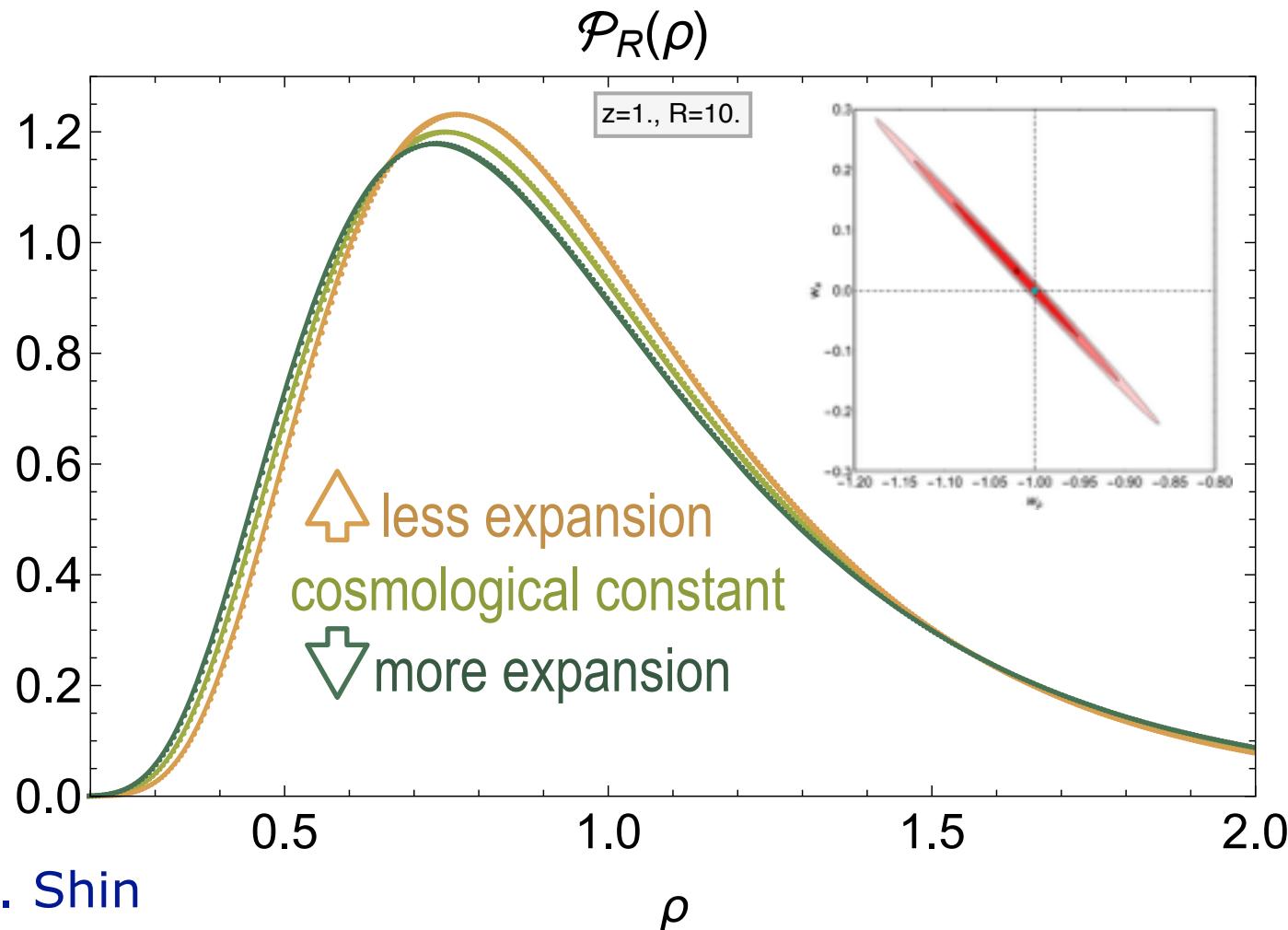
CU, Codis ++ 17

$$\frac{\langle \rho'(r) | \rho \rangle - 1}{\xi_R(r)}$$



COUNTS-IN-CELLS COSMO

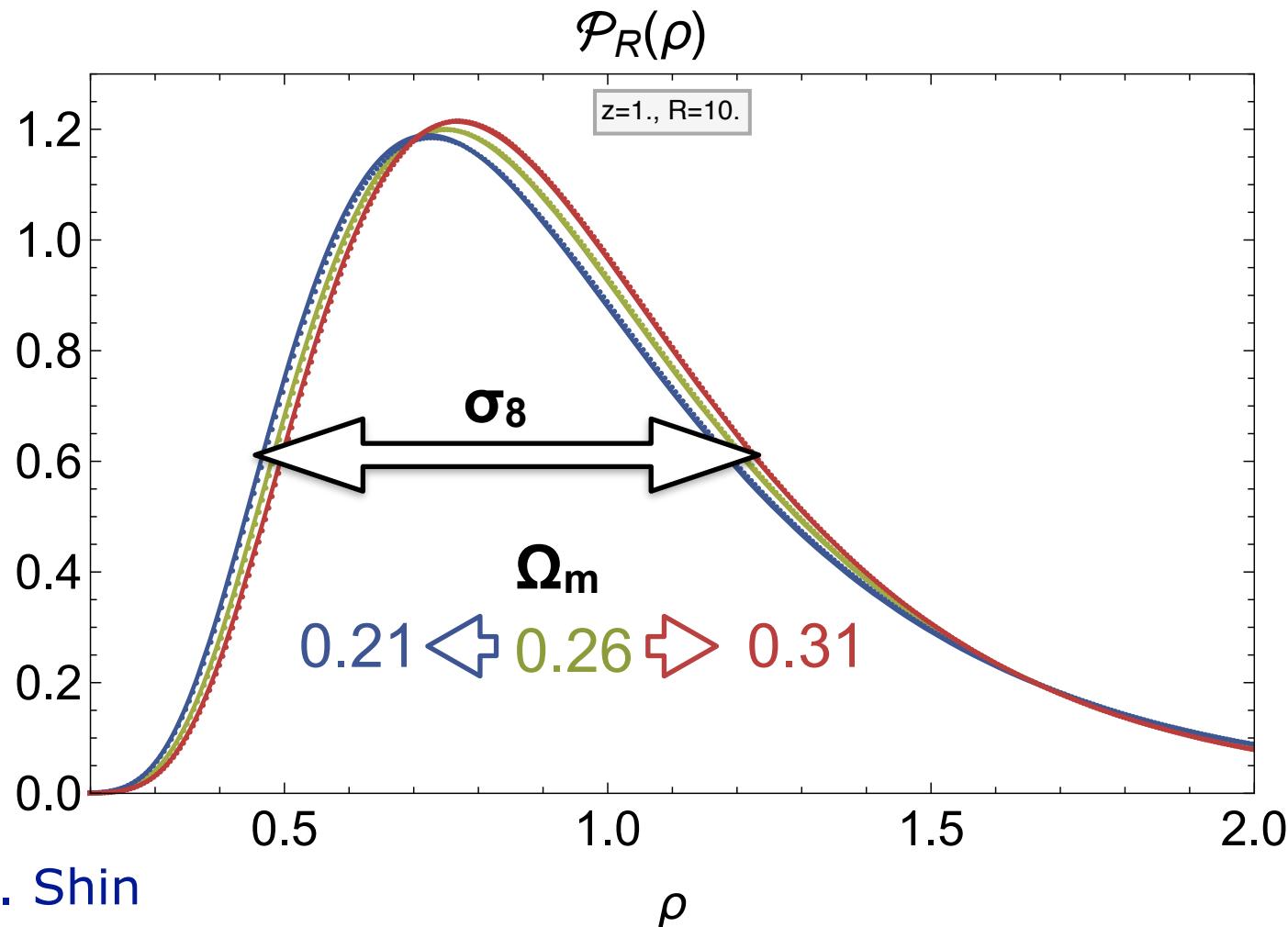
dark energy w_0, w_a Codis ++ (incl CU) 16



COUNTS-IN-CELLS COSMO

matter content Ω_m, σ_8

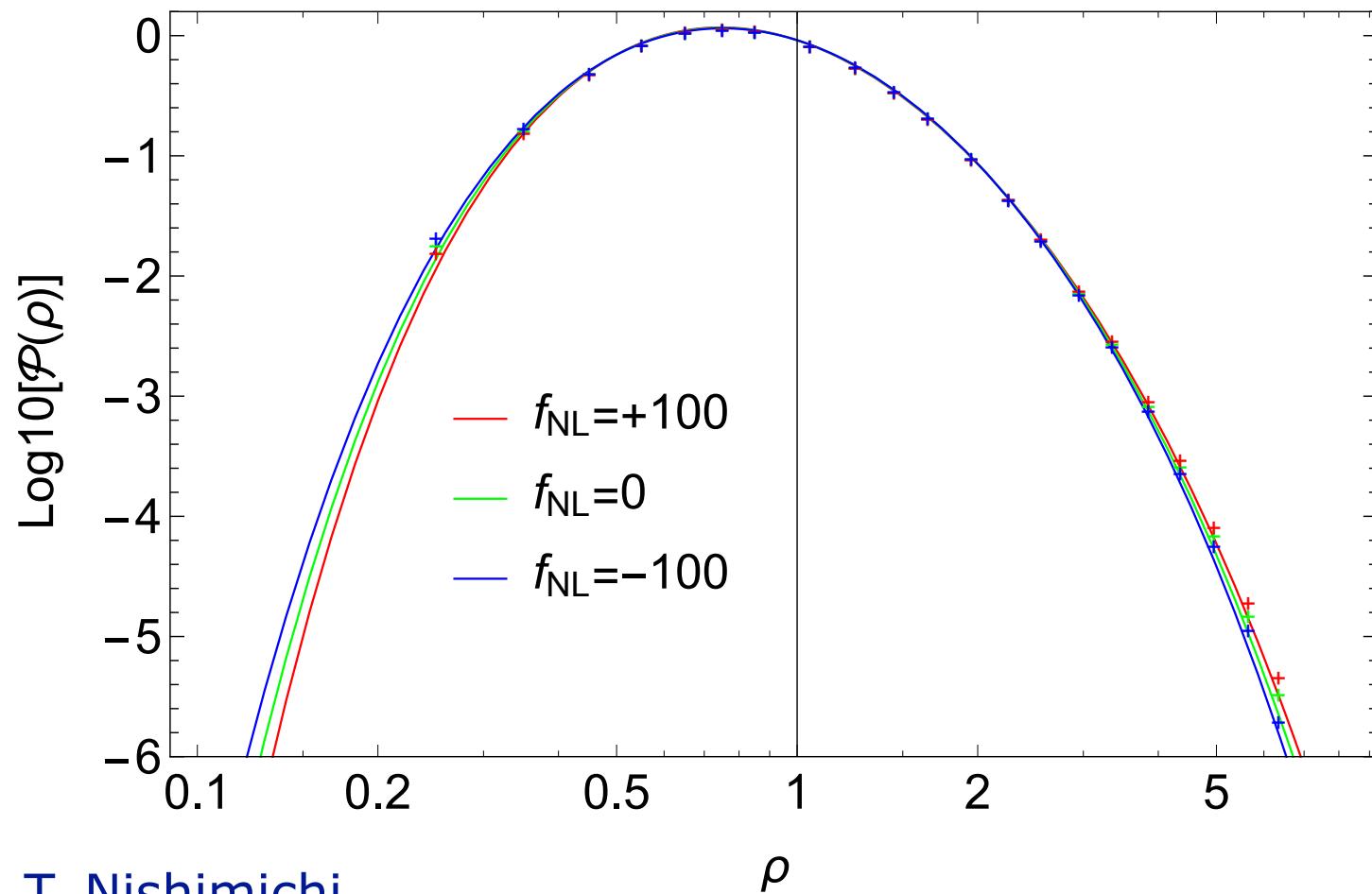
in progress



COUNTS-IN-CELLS COSMO

prim. non-Gaussianity

CU, Pajer ++ 18

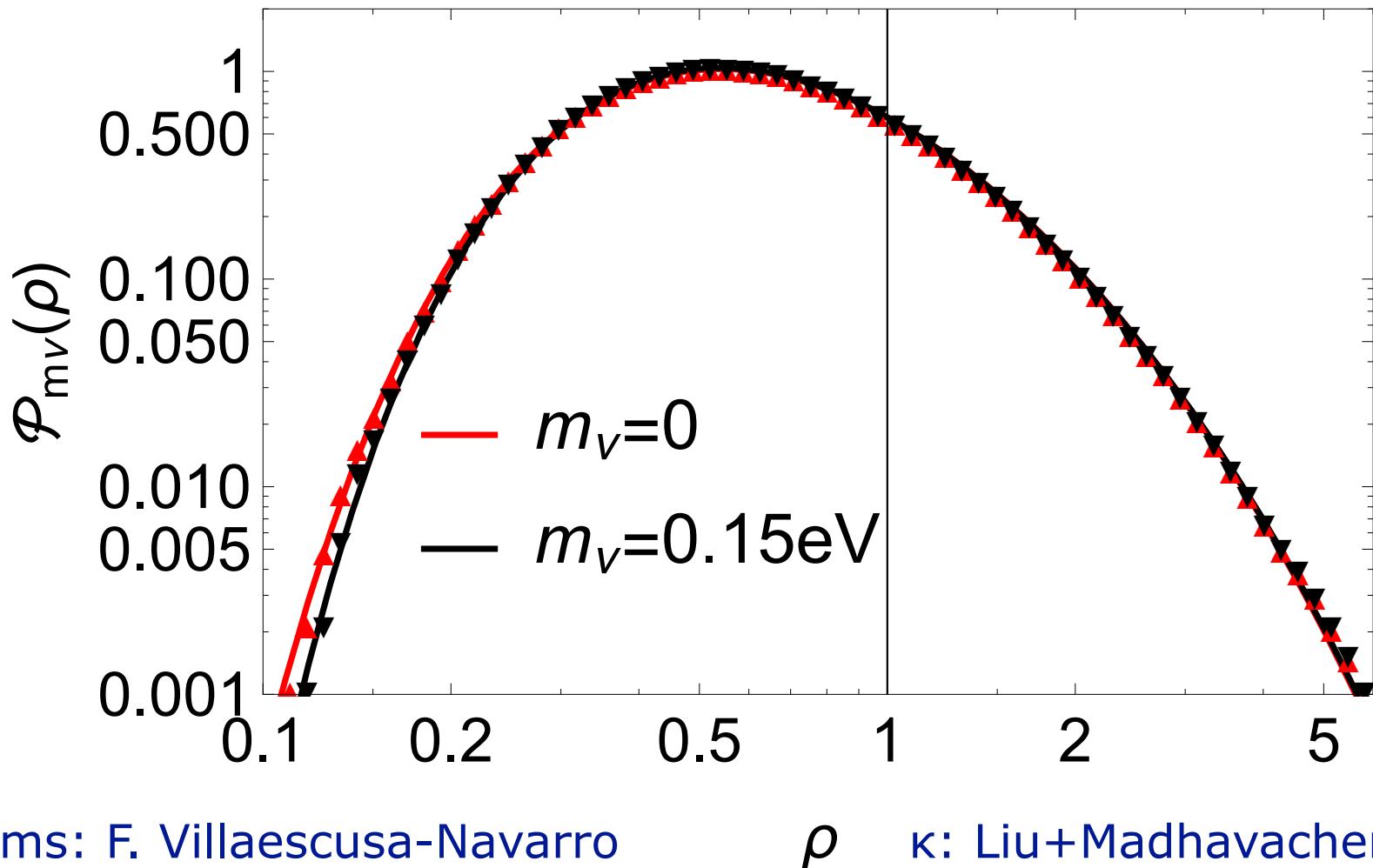


sims: T. Nishimichi

COUNTS-IN-CELLS COSMO

neutrino mass m_ν

in progress

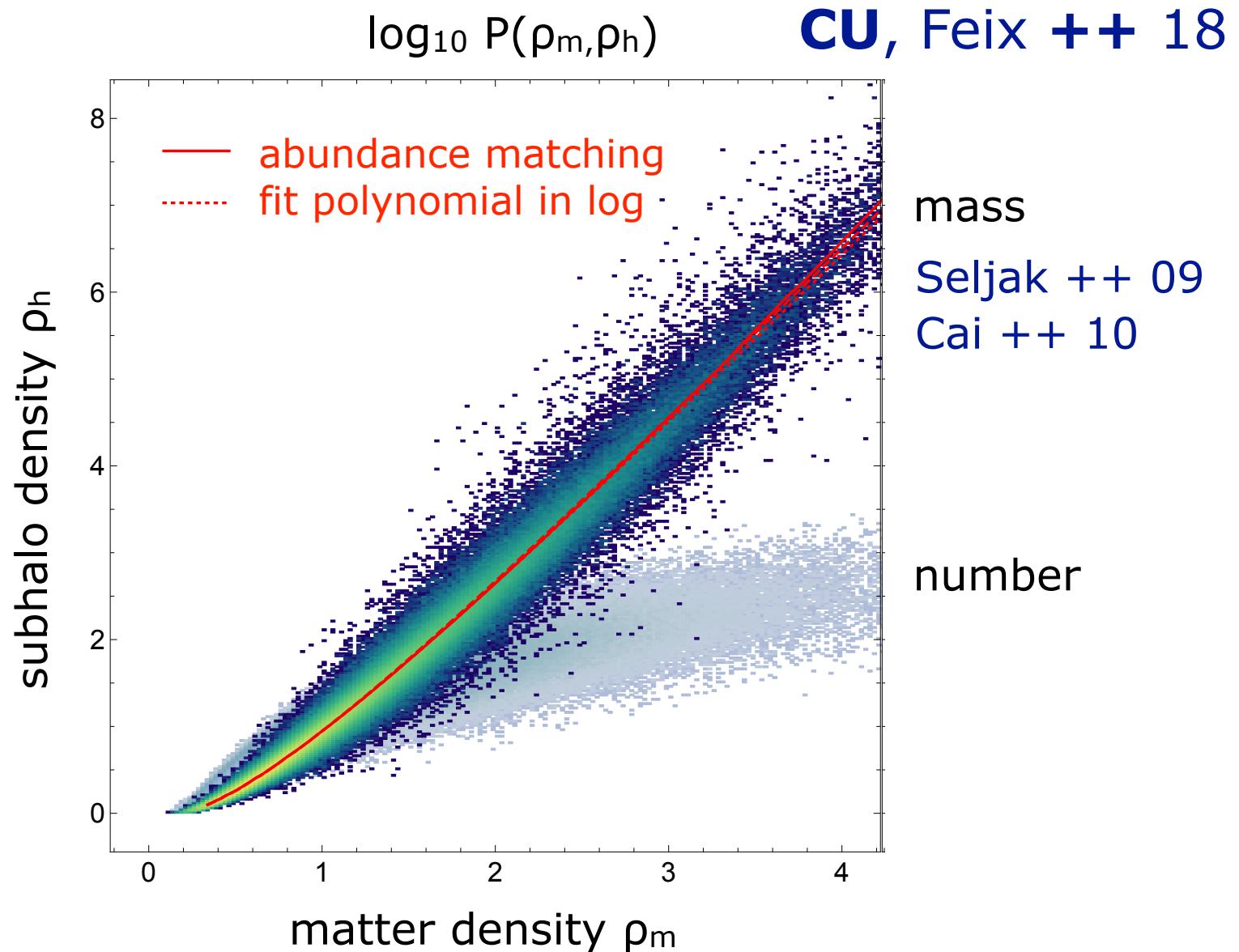


REAL COUNTS-IN-CELLS

observe: tracers or weak lensing

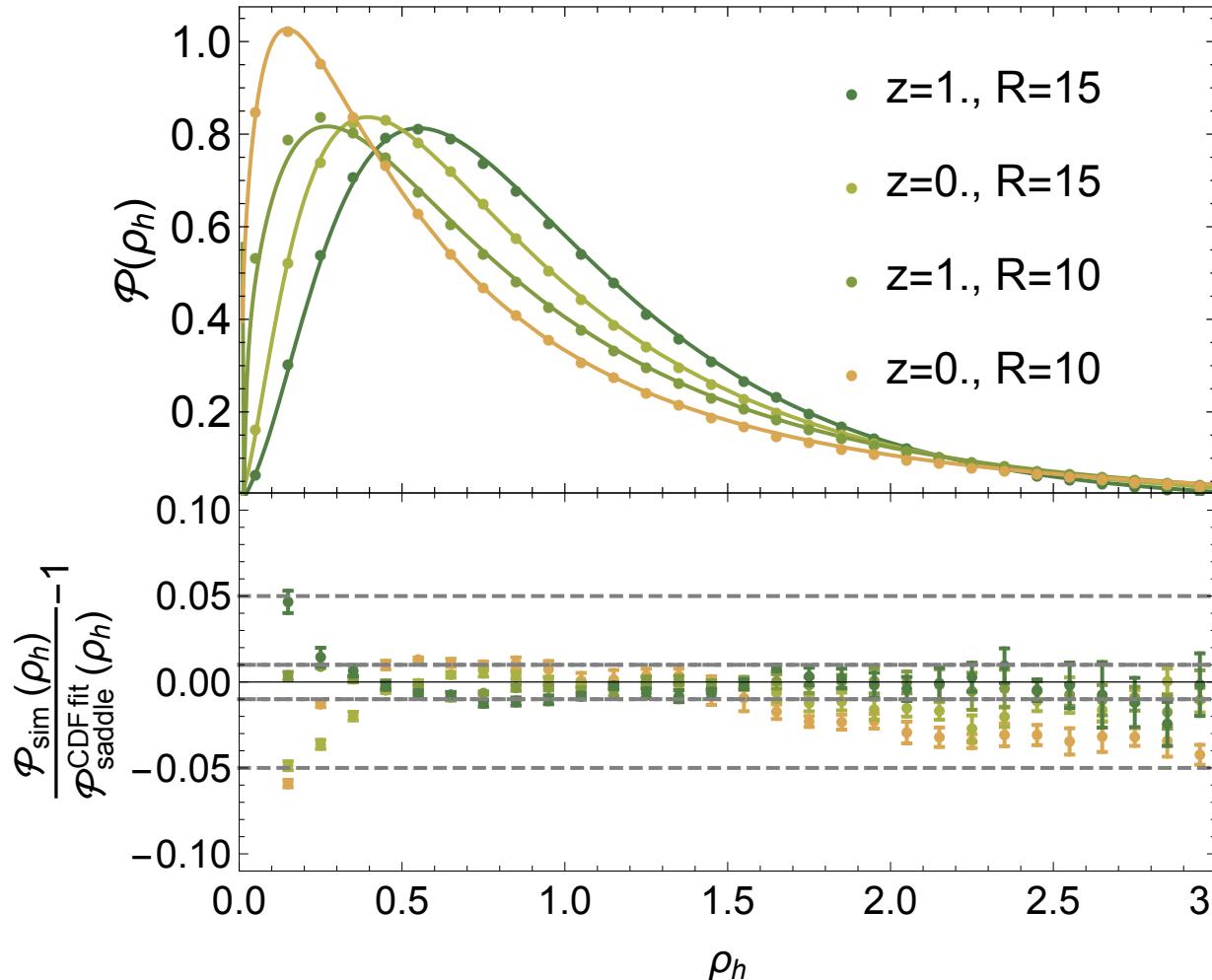


TRACER COUNTS-IN-CELLS



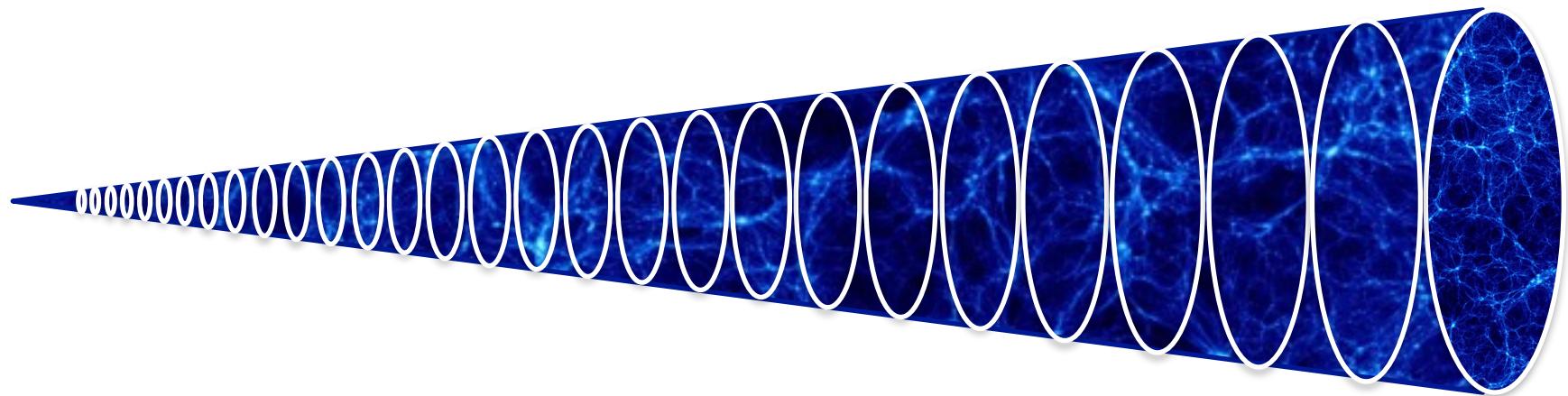
TRACER COUNTS-IN-CELLS

mean bias good enough $P(\rho_h) = P(\rho_m(\rho_h)) \frac{d\rho_m}{d\rho_h}$



WEAK LENSING-IN-CELLS

convergence: weight density slices



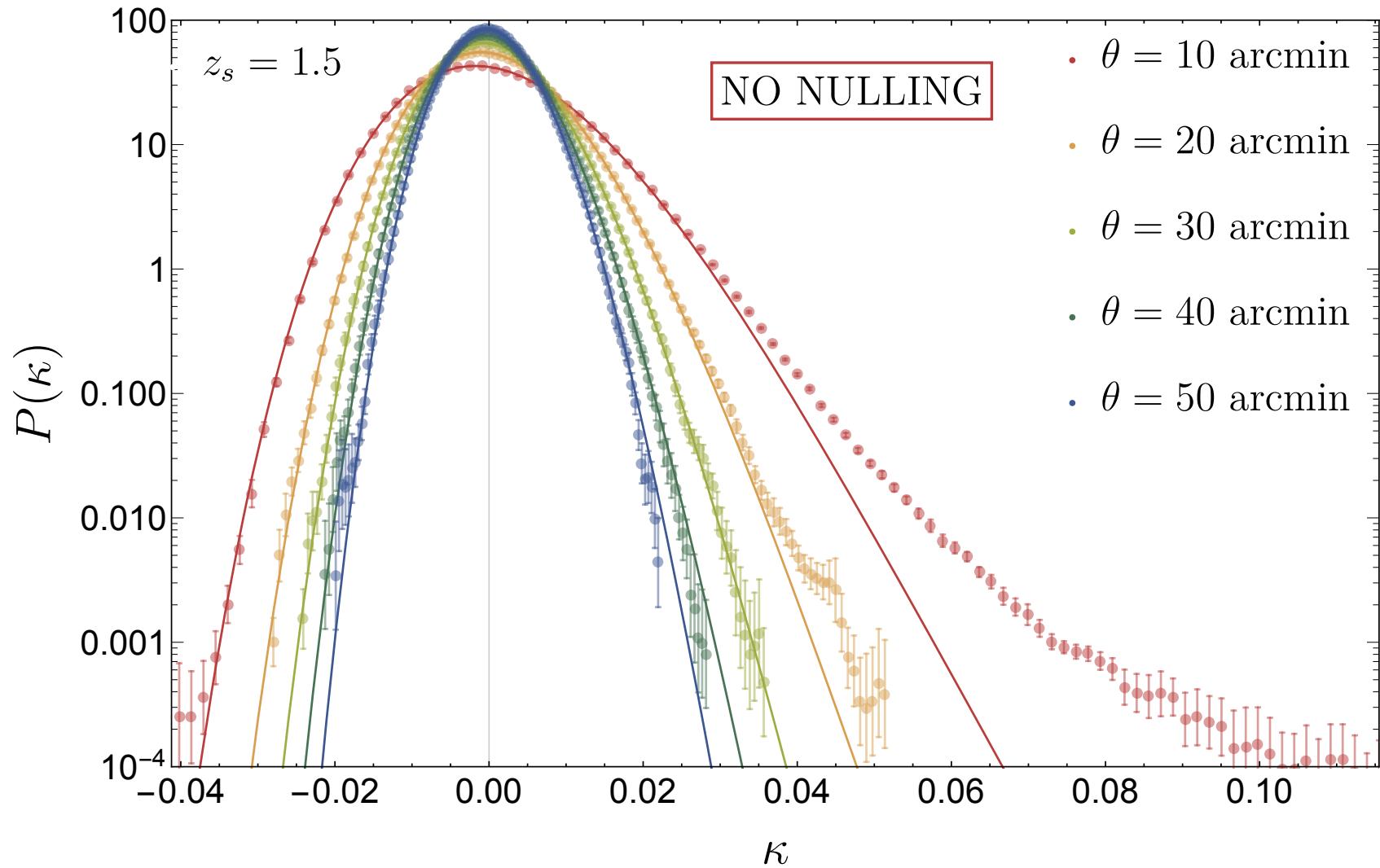
$$\kappa_{<\theta} = \int_0^{\mathcal{D}(z_s)} d\mathcal{D}(z) \delta_{<\theta\mathcal{D}(z)}^{\text{disk}} w(z, z_s)$$

scale mixing

WEAK LENSING-IN-CELLS

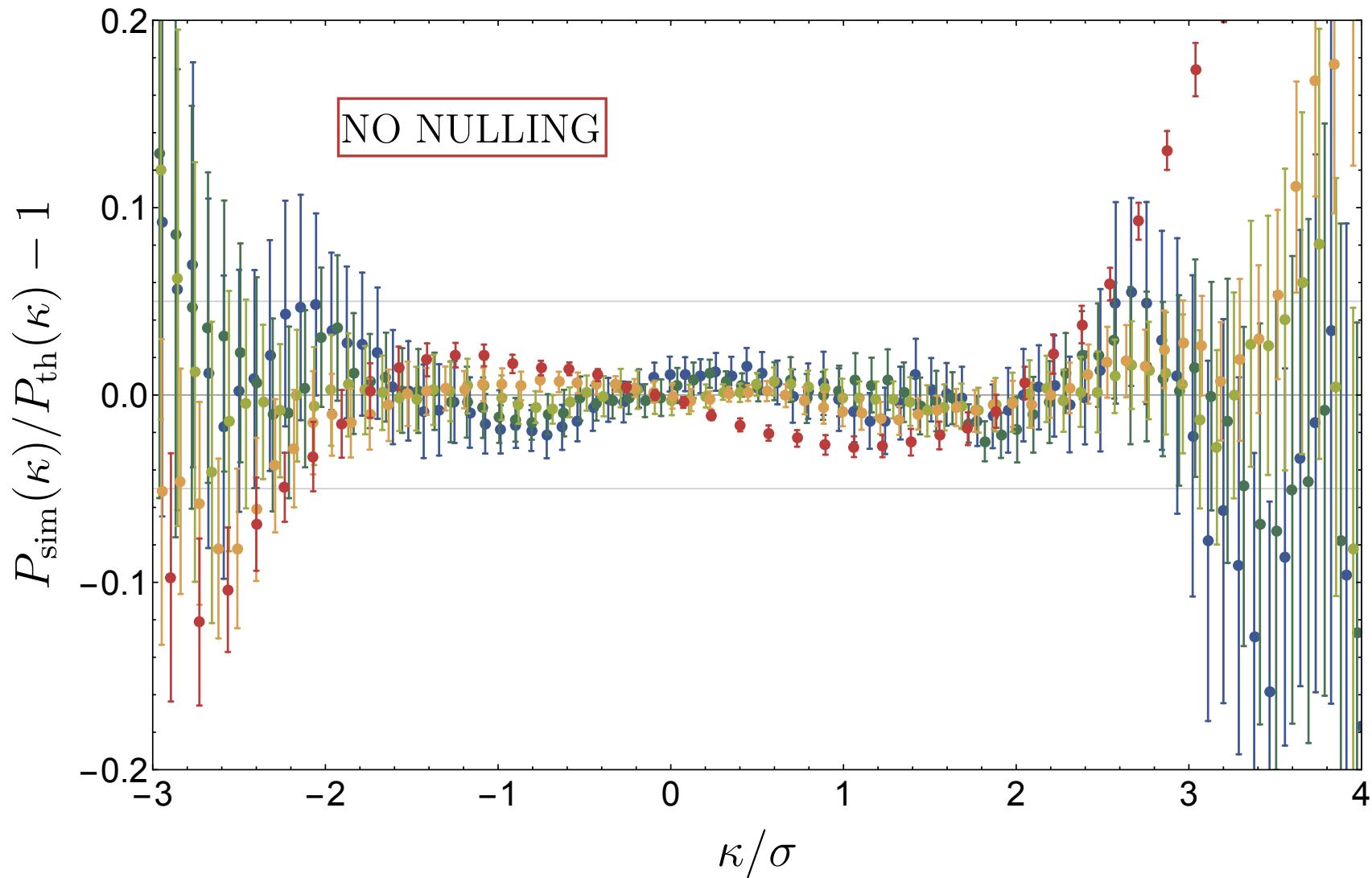
Barthelemy, Codis, **CU++ 19**

DES SV: Clerkin ++ 16



WEAK LENSING-IN-CELLS

Barthelemy, Codis, **CU++ 19**



COUNTS-IN-CELLS FUTURE

observe: tracers & weak lensing

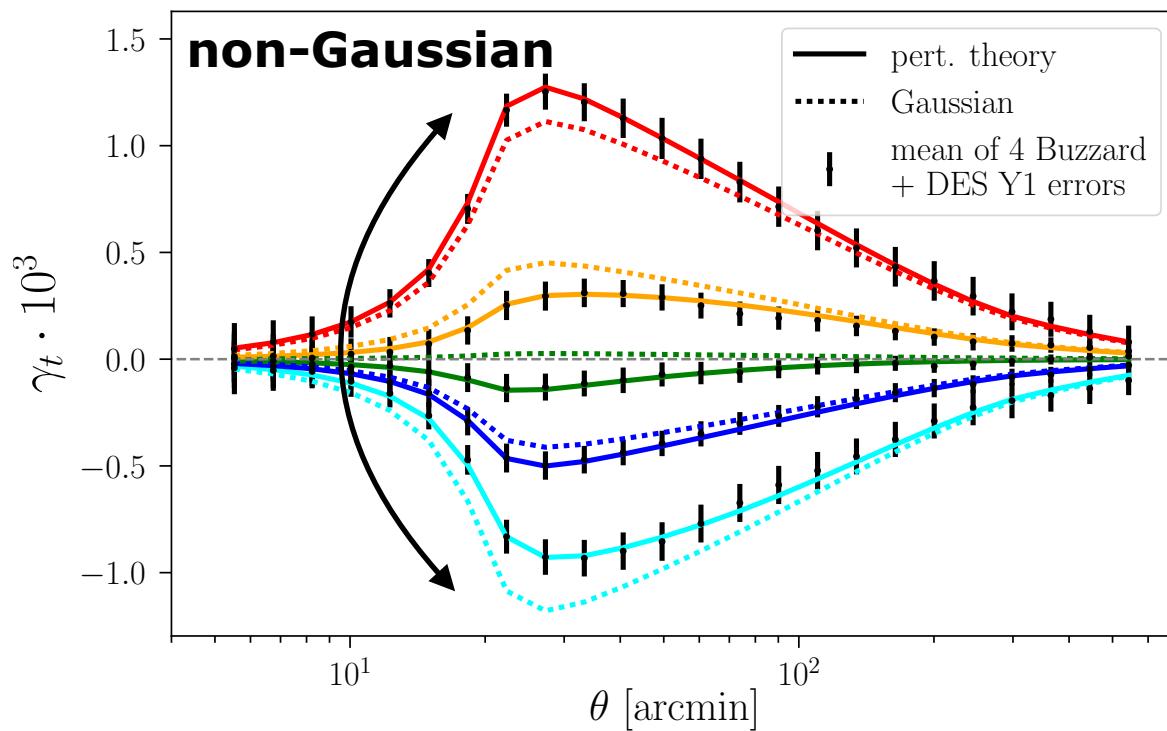
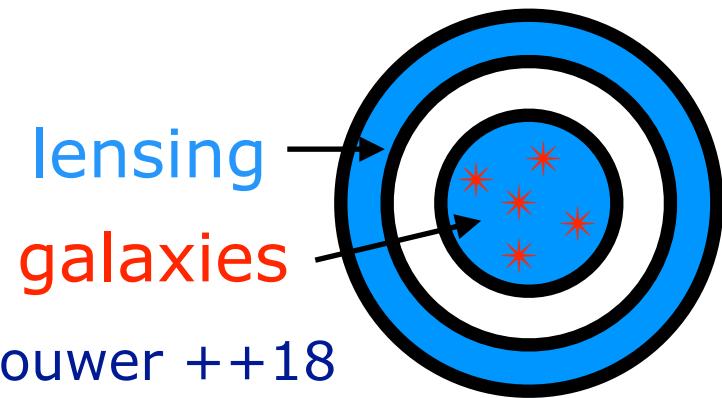


JOINT COUNTS & LENSING

density-split statistics

DESY1: 10% Euclid area
competitive with 3x2pt

Friedrich++ 18, Gruen++ 18, KiDS: Brouwer ++18

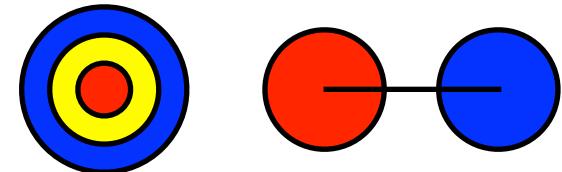


COSMO WITH COUNTS-IN-CELLS

Powerful statistics

nonGaussian, beyond PT

robust and accurate predictions



Cosmology & fundamental physics

Ω_m , σ_8 , $w_{0/1}$, f_{NL} , m_v

Observables

tracers: add mean bias

lensing: integrate over slices

