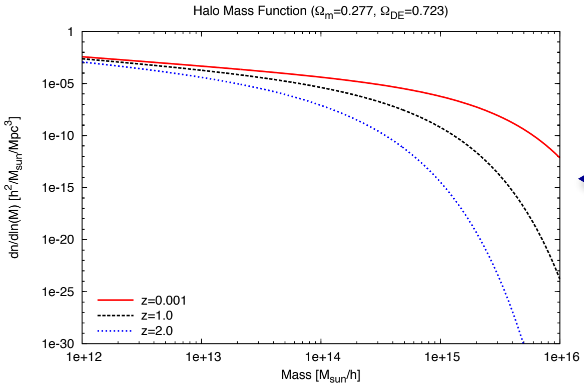
Cosmological implications from the eROSITA all-sky survey

Katharina Borm

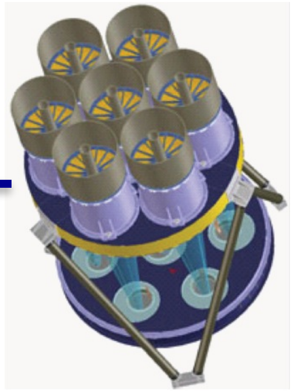
University of Bonn
Supervisor: Prof. Reiprich

Dark
Energy ???

galaxy clusters



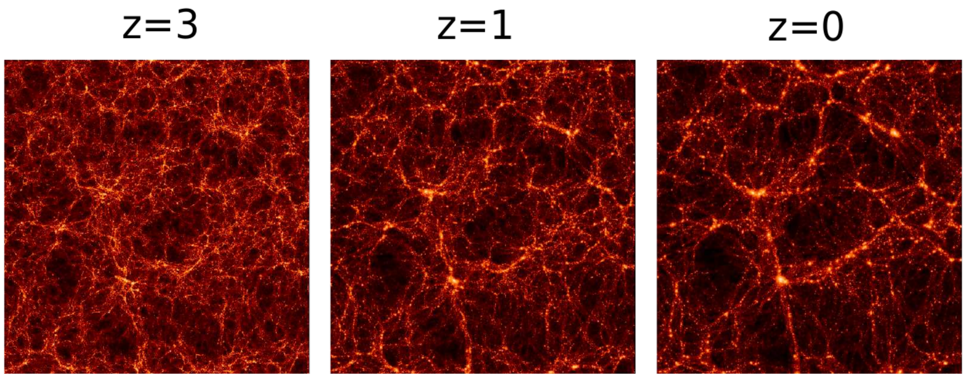
halo mass function



eROSITA

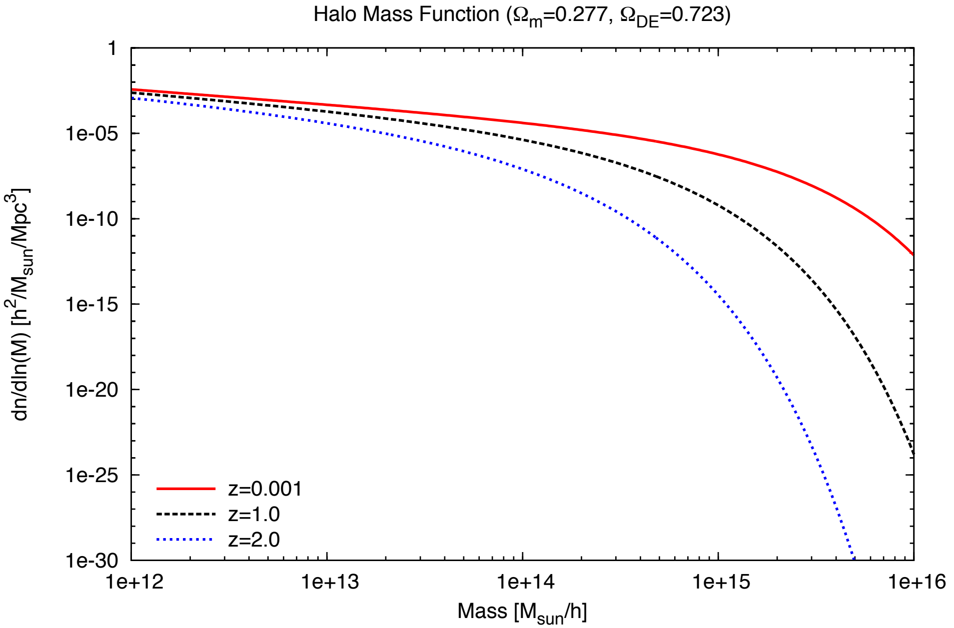
Cosmology: From galaxy clusters to dark energy

- dark energy shapes the LSS
- evolution is imprinted in the distribution of galaxy clusters



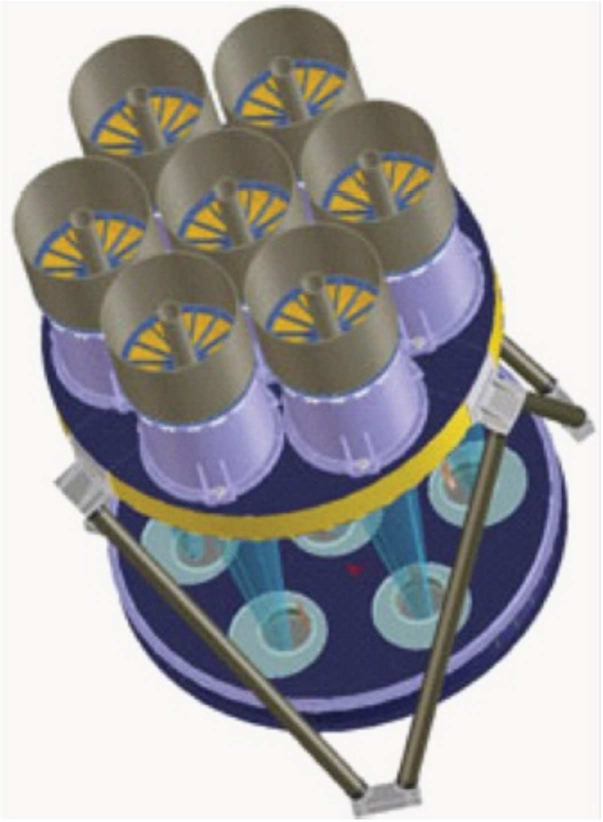
Credit: VIRGO Collaboration 1996

- LSS expressed by the *halo mass function*
- How to obtain cluster masses?
  - ➔ X-ray observations
  - ➔ hydrostatic masses
  - ➔ observe L or T and apply scaling relations



The *eROSITA* instrument

- German X-ray instrument on Russian satellite SRG
- expected launch: 2015/16 to L2
- energy range: *(0.1 - 10)* keV
- 4 years of all-sky survey
  3 years of pointed observations



Credit: Merloni et al., 2012

Science goal:

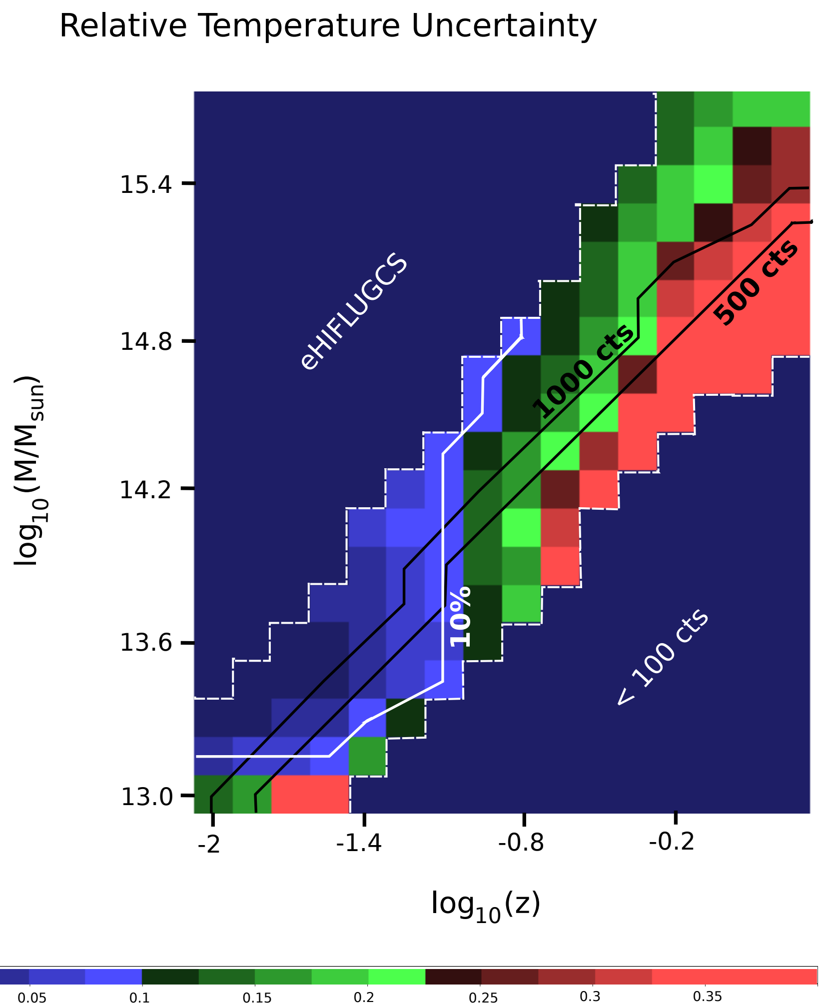
- detect ~100,000 galaxy clusters with z<1.5
- test nature of dark energy

Cosmological forecasts: (Pillepich et al., 2012)

$\Delta w_0 = 0.026$ for $w_a = 0$

$\Delta w_a = 0.206$

Galaxy cluster properties



Credit: Borm et al., 2014

„Cosmological“ Observables:

- photon counts η, z, L
- T for some clusters

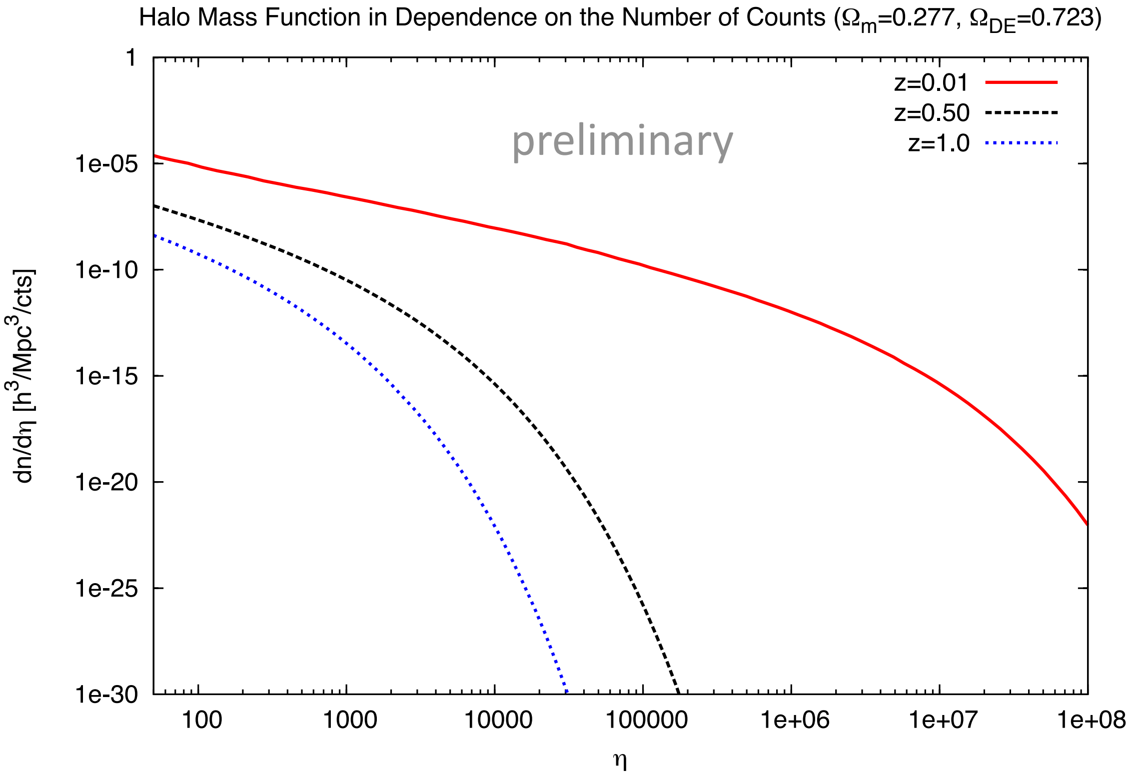
Simulation Results:

- clusters with $F < 9 \times 10^{-12}$ erg/s, but $\eta > 100$
- precise T for clusters at $z < 0.08$
- precise T for 1,700 new clusters
  → ~1.5% of all observed *eROSITA* clusters

The halo mass function

Translate HMF into an observable function: $$\frac{\mathrm{d}n}{\mathrm{d}\ln(M)}(M,z) \quad \rightarrow \quad \frac{\mathrm{d}n}{\mathrm{d}\eta}(\eta,z)$$

in theory: $$(M,z) \quad \overrightarrow{\text{scaling relations}} \quad (T,L) \quad \rightarrow \quad \text{cluster spectrum} \quad \rightarrow \quad \eta$$



Ongoing work

Apply halo mass function for cosmological simulations (CosmoMC):

- reproduce former results
- What precision is required for the cluster redshifts?
- implement further mass proxies:
  - ➔ eROSITA temperatures
  - ➔ SPT weak lensing masses