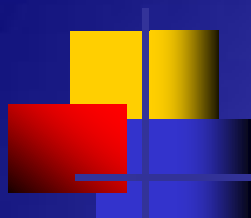


The background is a dense field of galaxies, each appearing in a different color (red, green, blue, yellow, purple). Overlaid on this field are numerous concentric, multi-colored contours in shades of purple, blue, and green, which represent X-ray emission regions or galaxy group boundaries. The contours vary in size and complexity, with some showing multiple nested rings.

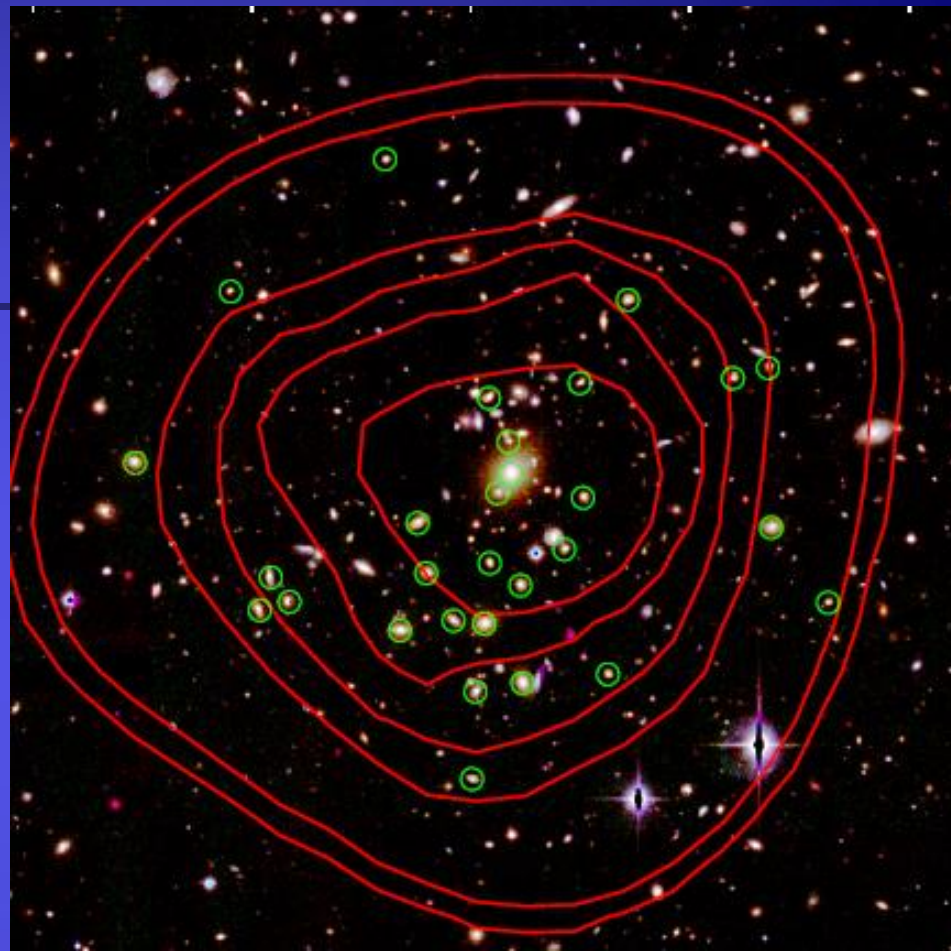
Galaxy groups in ultradeep X-ray fields

Alexis Finoguenov

Fluctuations
down to 5×10^{-17}
ergs/s/cm²

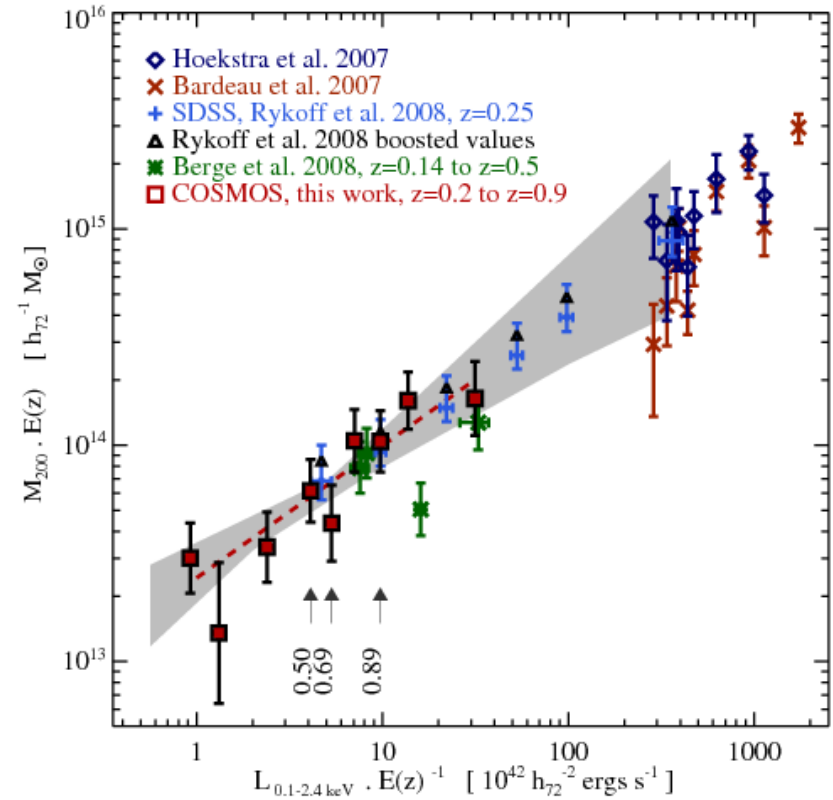
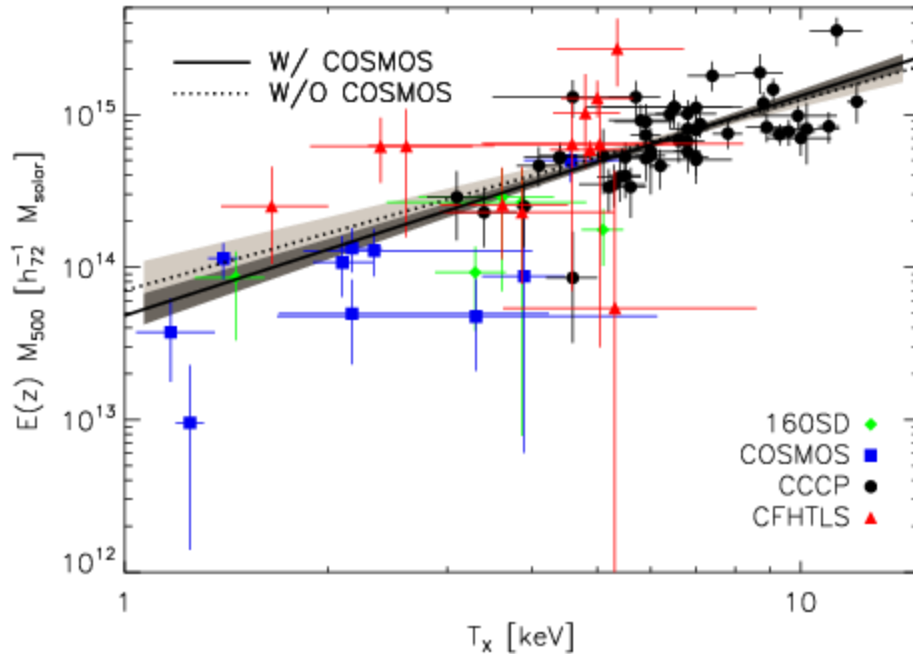


Extended X-ray emission from groups



- Selection is independent of galaxy properties
- Virialized halo with L_x tracing total mass
- Surveys are both complete and deep
- Centering and halo size – better membership

Scaling relations from weak lensing

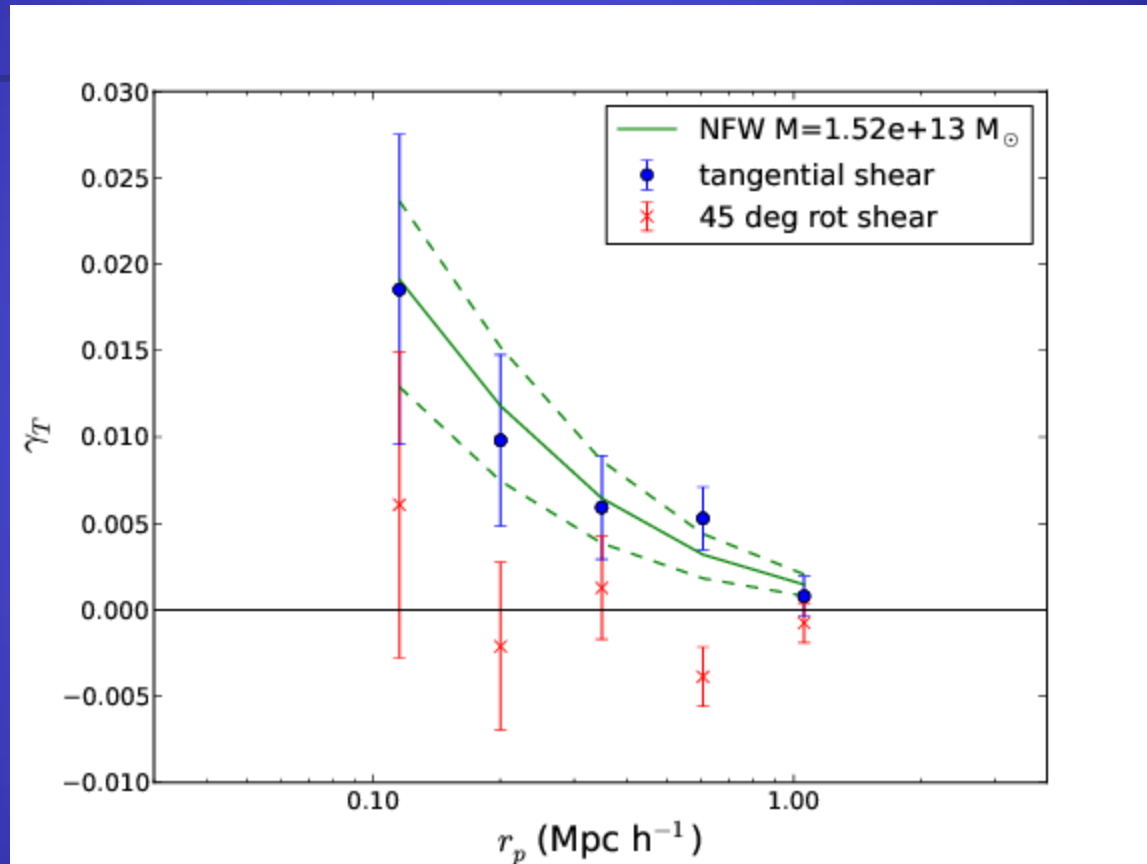


$$\frac{\langle M_{200} E(z) \rangle}{M_0} = A \left(\frac{\langle L_X E(z)^{-1} \rangle}{L_{X,0}} \right)^\alpha \quad (13)$$

where $M_0 = 10^{13.7} h_{72}^{-1} M_{\odot}$, $L_{X,0} = 10^{42.7} h_{72}^{-2} \text{ ergs s}^{-1}$, and where the function $E(z) \equiv \sqrt[2]{\Omega_m(1+z)^3 + \Omega_\Lambda}$ rep-

Alexis Finoguenov

Lx-Mass from weak lensing (GEMS)

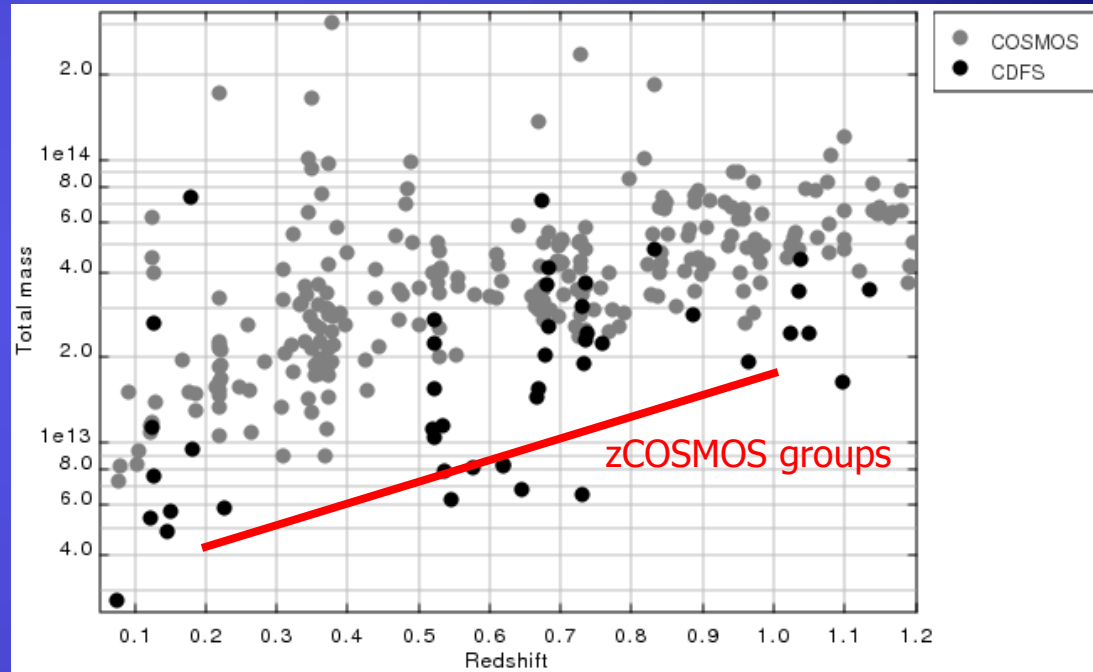
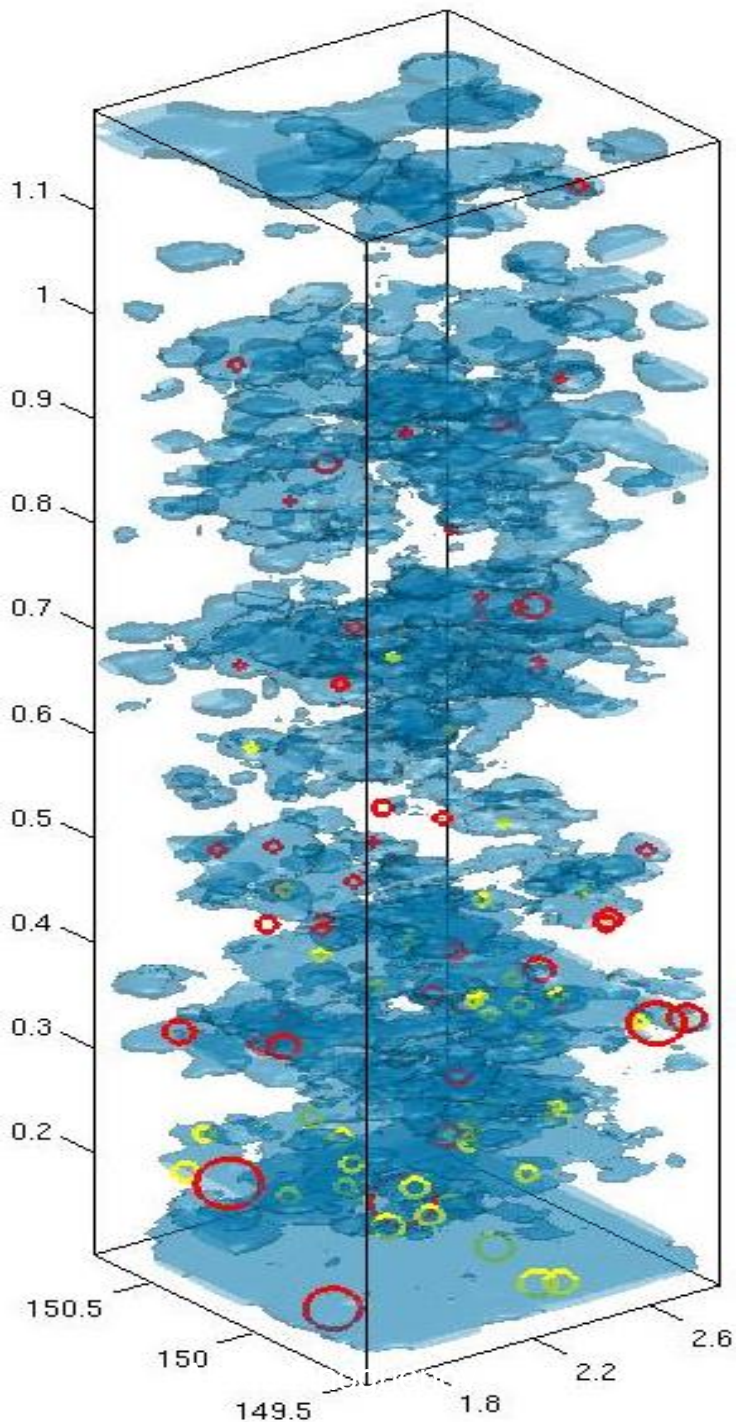


$$\lg M = 0.6 \lg L_x + C$$

Alexis Finoguenov

Ami Choi
X-ray groups

Galaxy groups and LSS

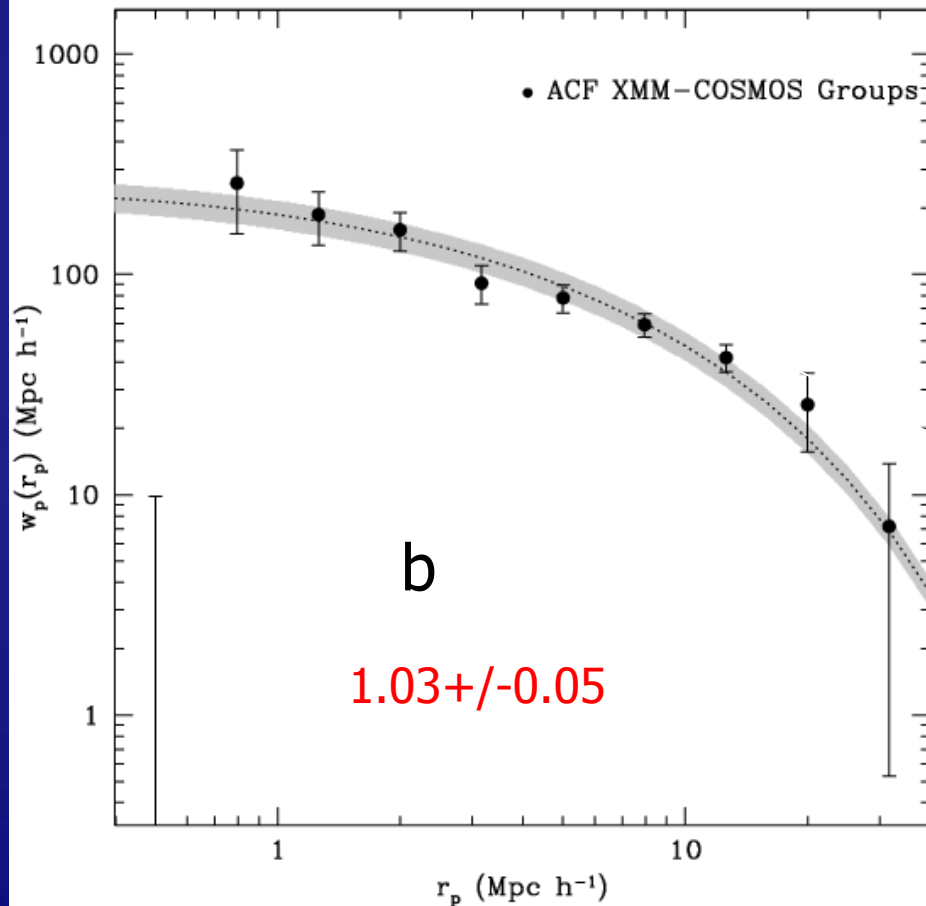
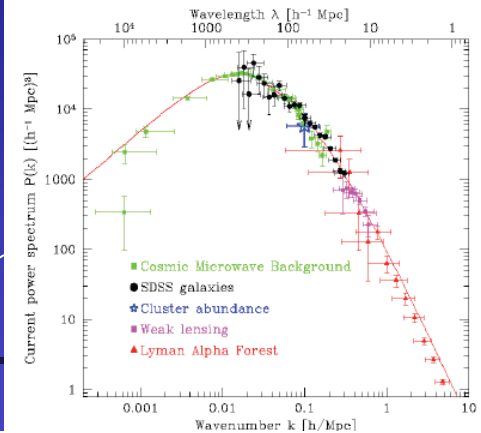


K.Kovac

LSS at 0.12, 0.22, 0.34, 0.37,
0.51, 0.73, 0.89

X-ray groups

ACF and mass

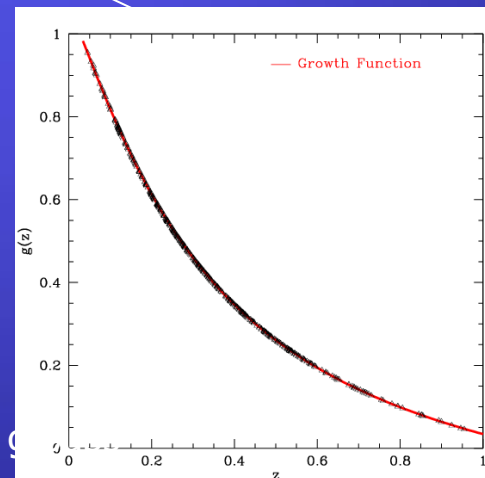


$$\bar{b}(M_0) = \sqrt{\frac{\sum_{i,j} b_i b_j g_{pair}}{N_{pair}}}$$

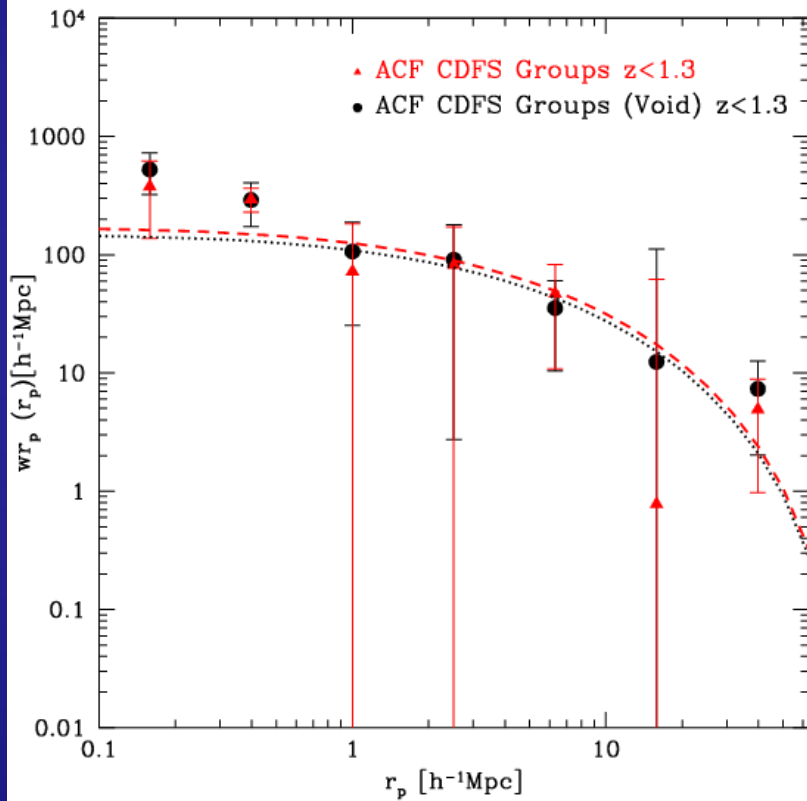
$$b_e = 1 + \frac{av^2 - 1}{\delta_e} + \frac{2p/\delta_e}{1 + (av^2)^{p+1}}$$

where $A = 0.322$, $a = 0.707$ and $p = 0.3$.

Allevato, AF, et al. 2012

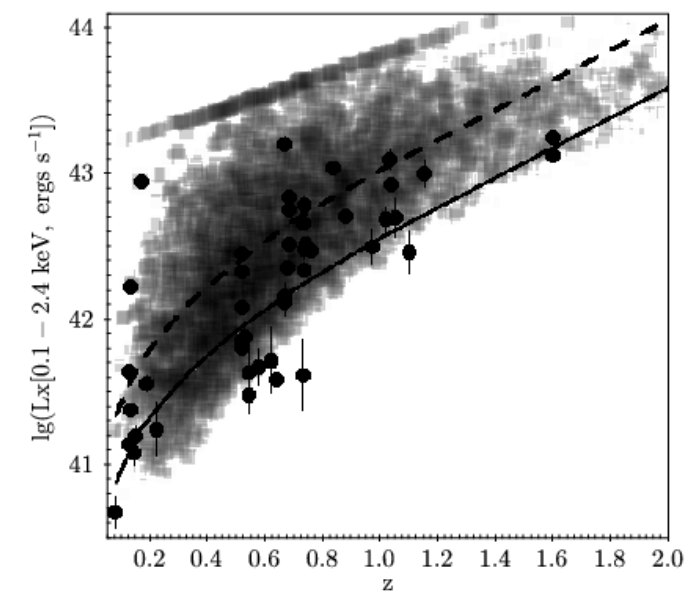
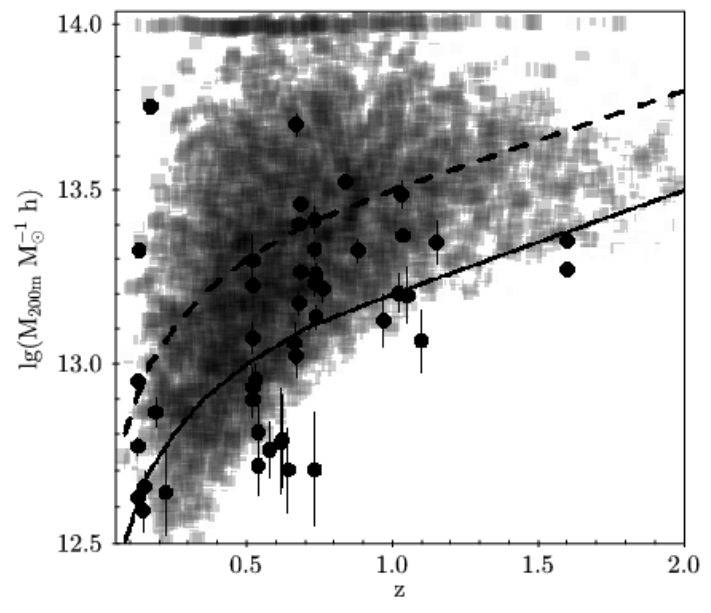
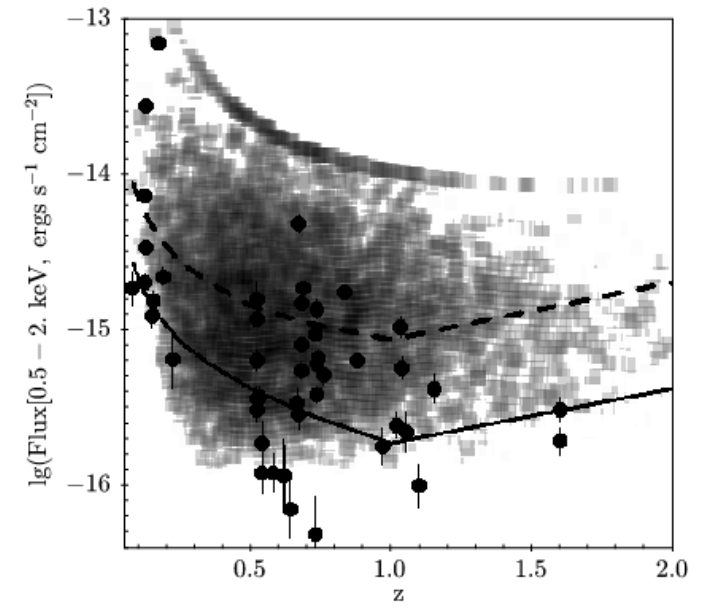
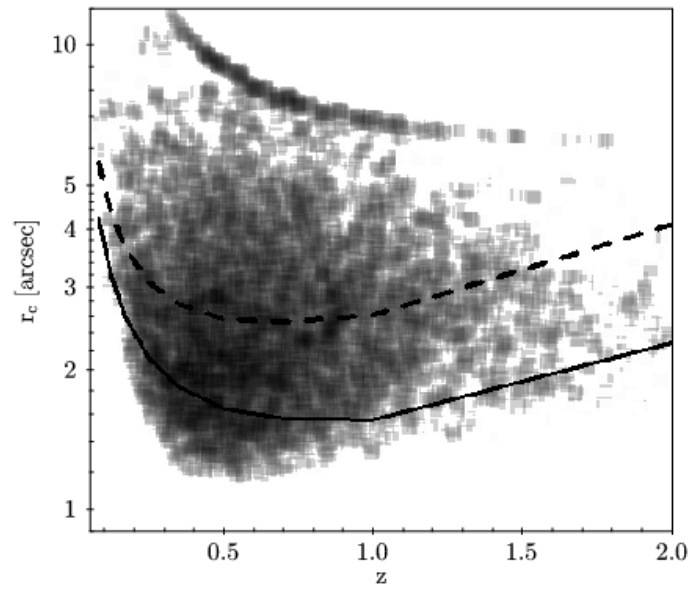
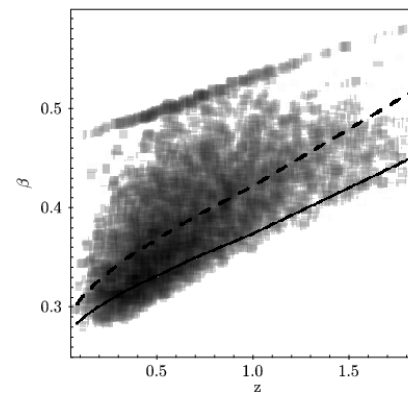


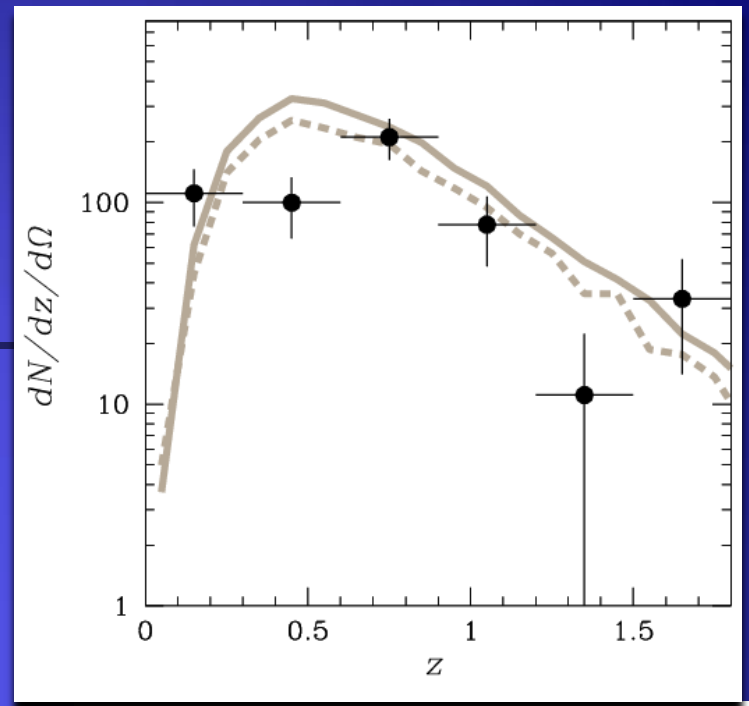
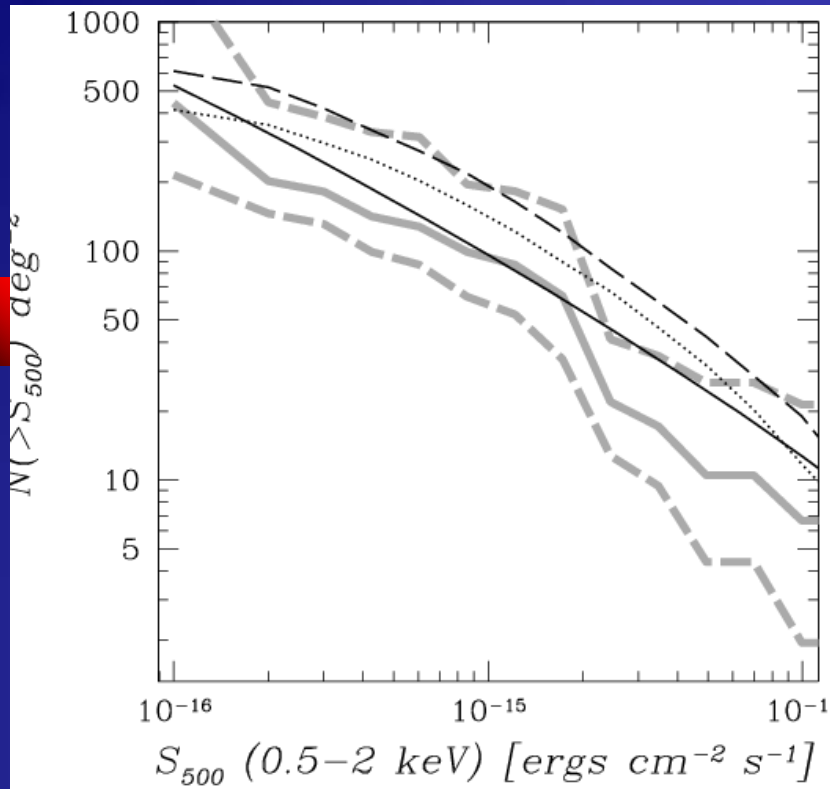
ACF of galaxy groups



$b_{\text{obs}}/b_{\text{model}} = 1.1 \pm 0.1$
This constrains the deviations from the assumed scaling relation to be $< 30\%$ in total mass.

**AF+'15
Statistics &
Modelling**



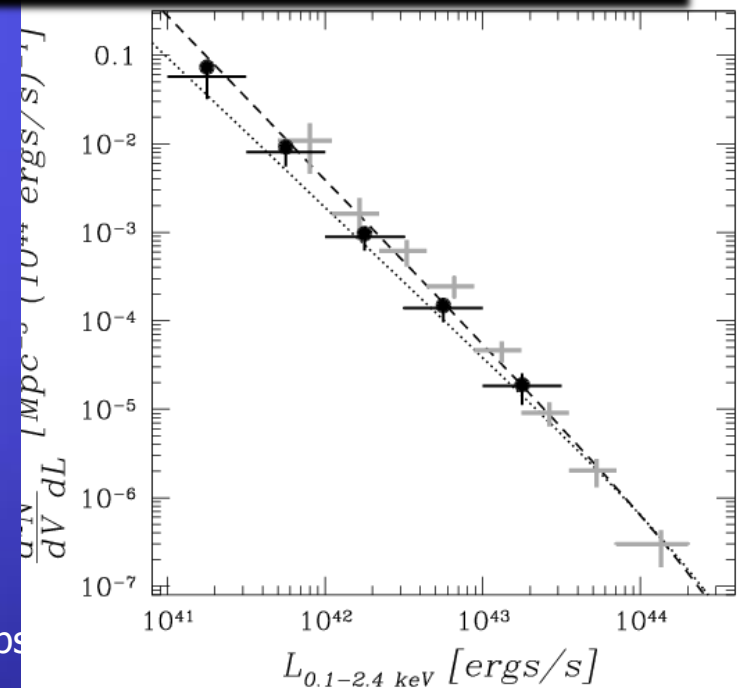


Groups vs LCDM

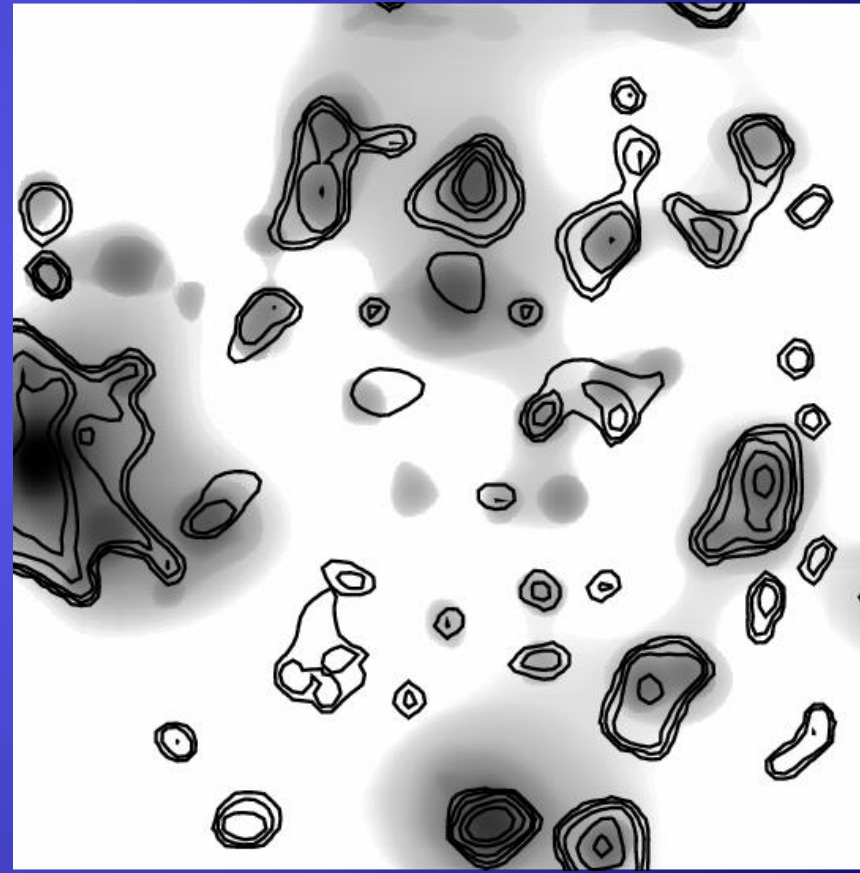
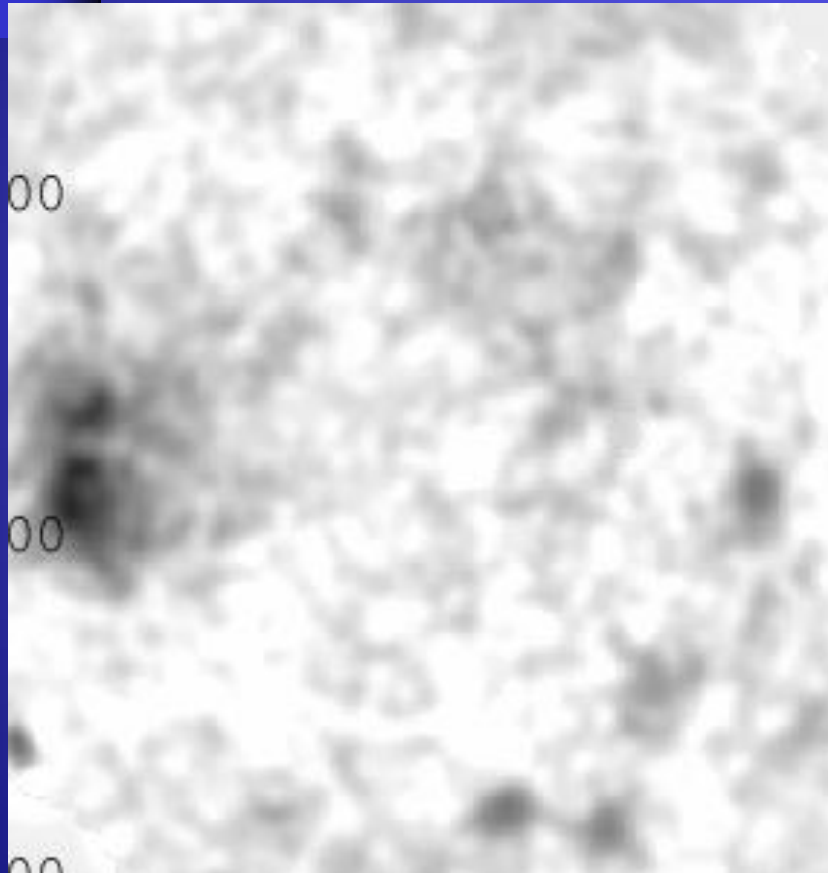
Finoguenov et al. 2015

Alexis Finoguenov

X-ray groups



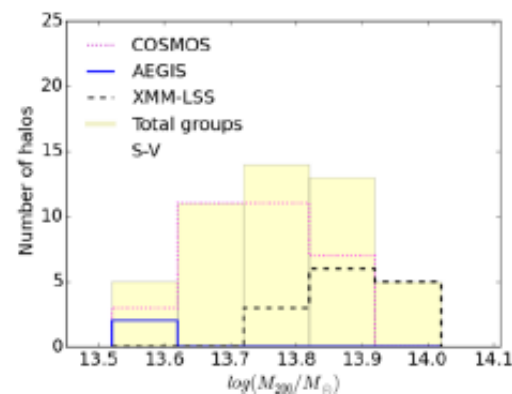
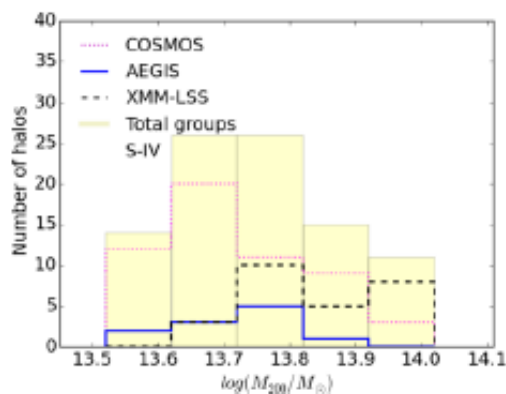
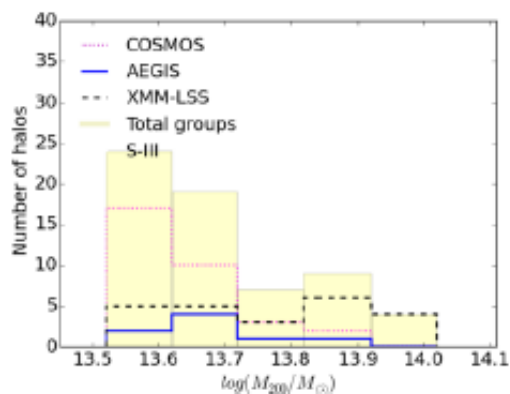
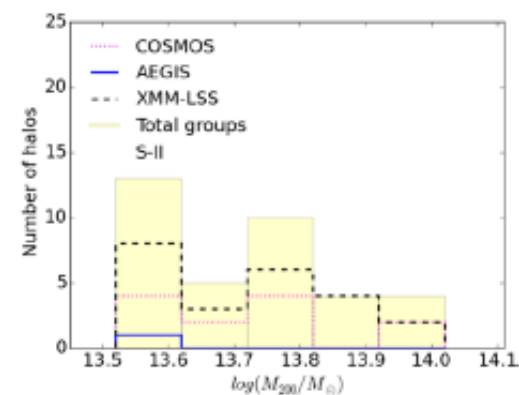
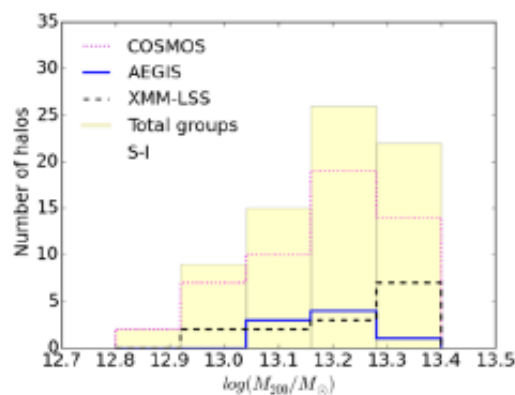
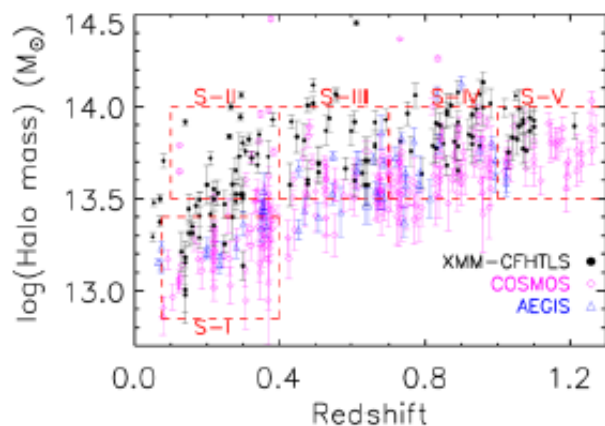
Reproducing the observed emission



Finoguenov et al. 2015

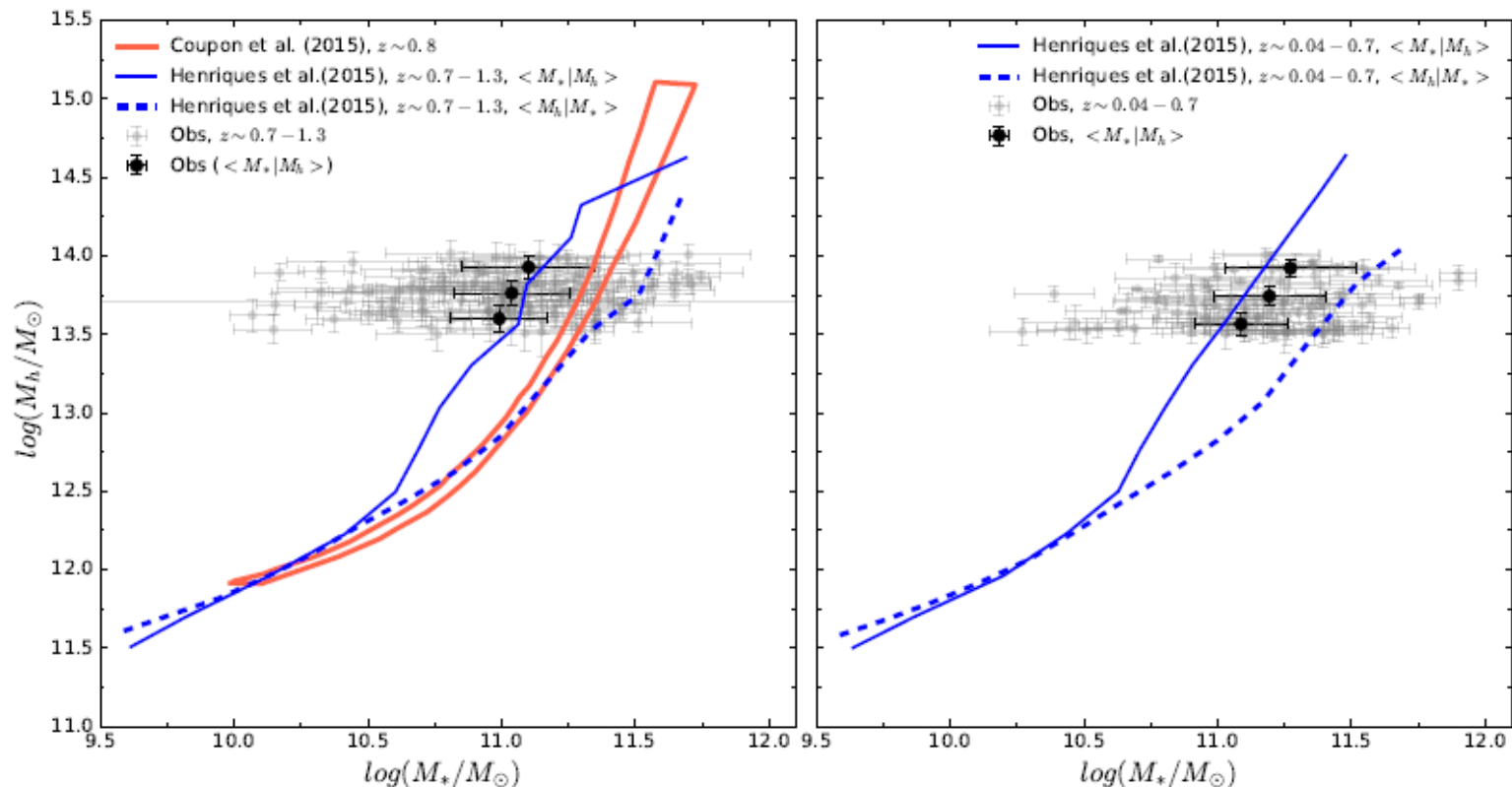
The combined sample of 450 groups

Gozaialsl, AF et al. 2015

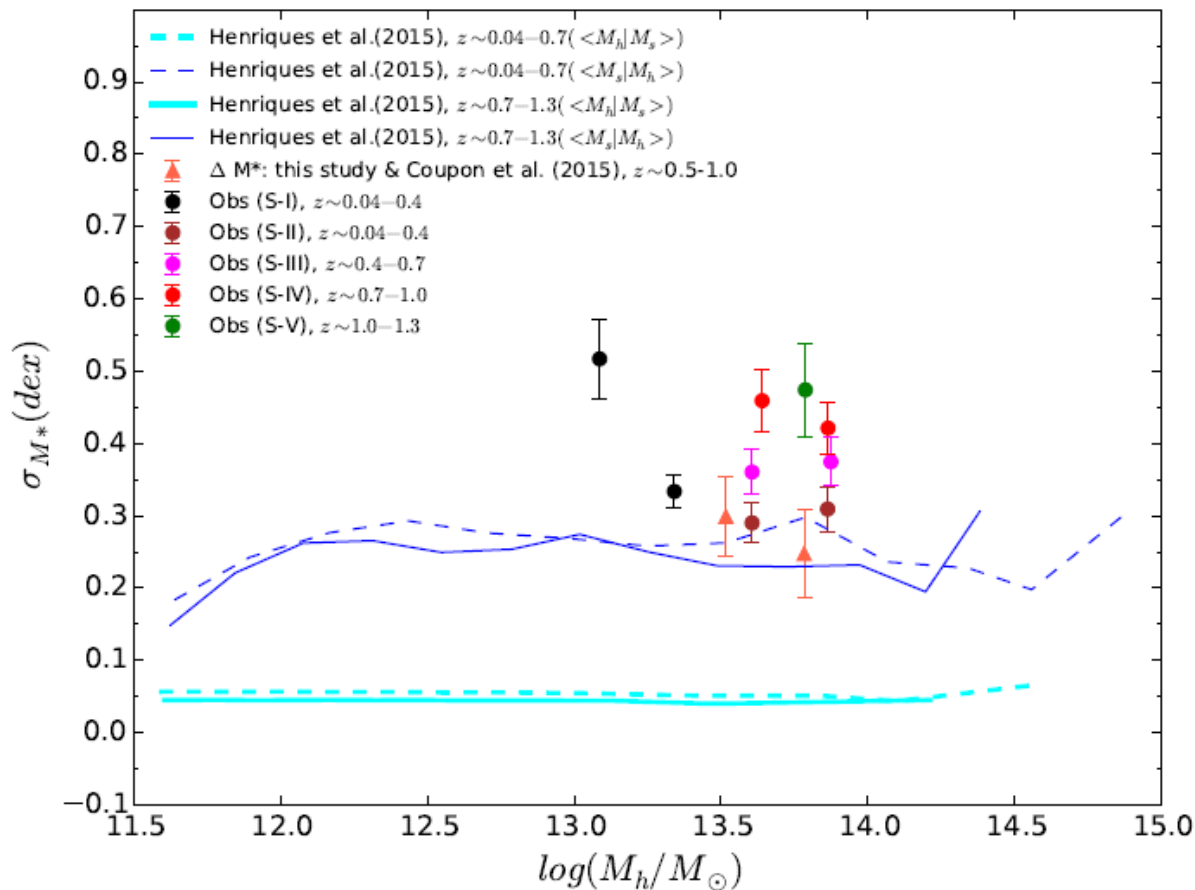


Differences in the way the stacking is done

Gozaliasi, AF,
subm.

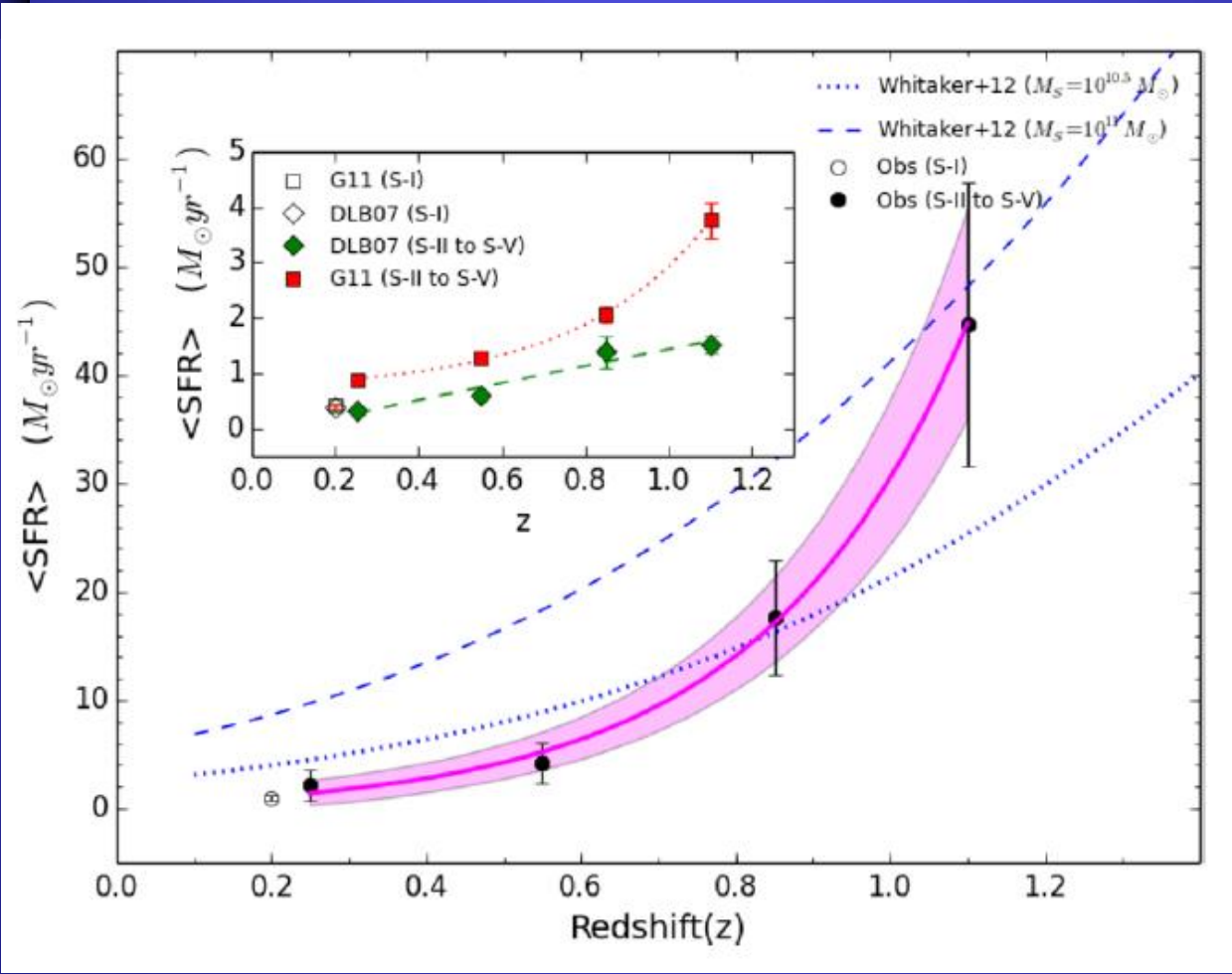


Constraining the scatter



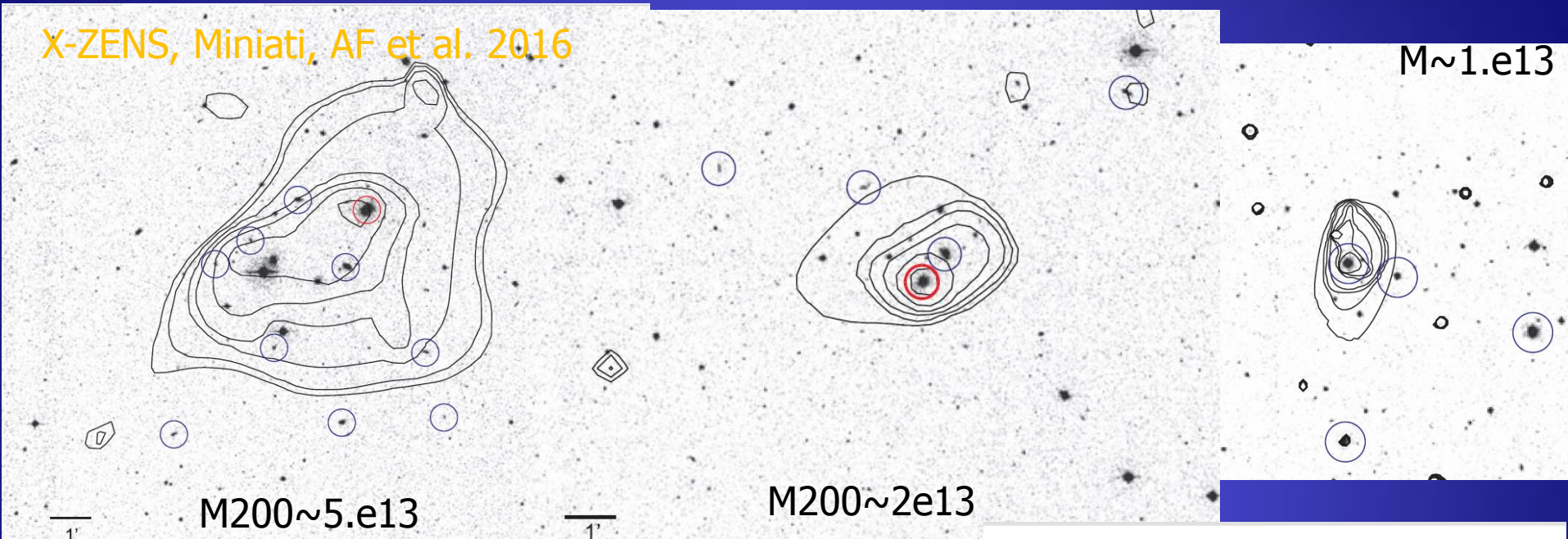
Gozaliasi, AF,
subm.

Evolution of BGG SFR

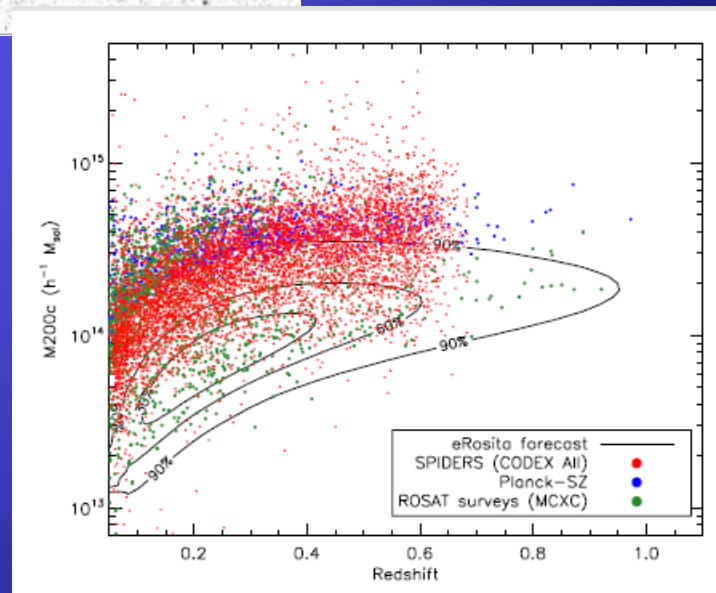


Galaxy groups with eROSITA

X-ZENS, Miniati, AF et al. 2016



- 5.e13 Msun groups to $z \sim 0.3$
- 2.e13 Msun groups to $z \sim 0.1$
- Soft X-ray response down to 0.2 keV





Summary

- Deep surveys deliver a large population of massive groups allowing detailed studies of their multiwavelength properties, including mass calibration, BCG evolution
- Ultradeep fields obtain a unique population of very low mass groups, with masses reaching below $1.e13M_{\text{sun}}$
- eROSITA will contribute to understanding the variety of X-ray properties of galaxy groups