The smaller the better:
X-ray groups as cosmic laboratories

First results from the XMM-CFHTLS survey

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Why are galaxy groups important?

- Building blocks of massive clusters
- Constitute large part of the large scale structure
- Galaxy pre-processing
- Gravitational energy ~ non-gravitational energy.
- Crucial mass range to constrain scaling relations

XMM survey on the CFHT Legacy Survey fields

Combine X-ray and weak lensing measurements on a large area (150 sq degs on CFHTLS) to constrain weak lensing calibrated scaling relations at the group regime.

The CFHT Lensing Survey (CFHTLenS)

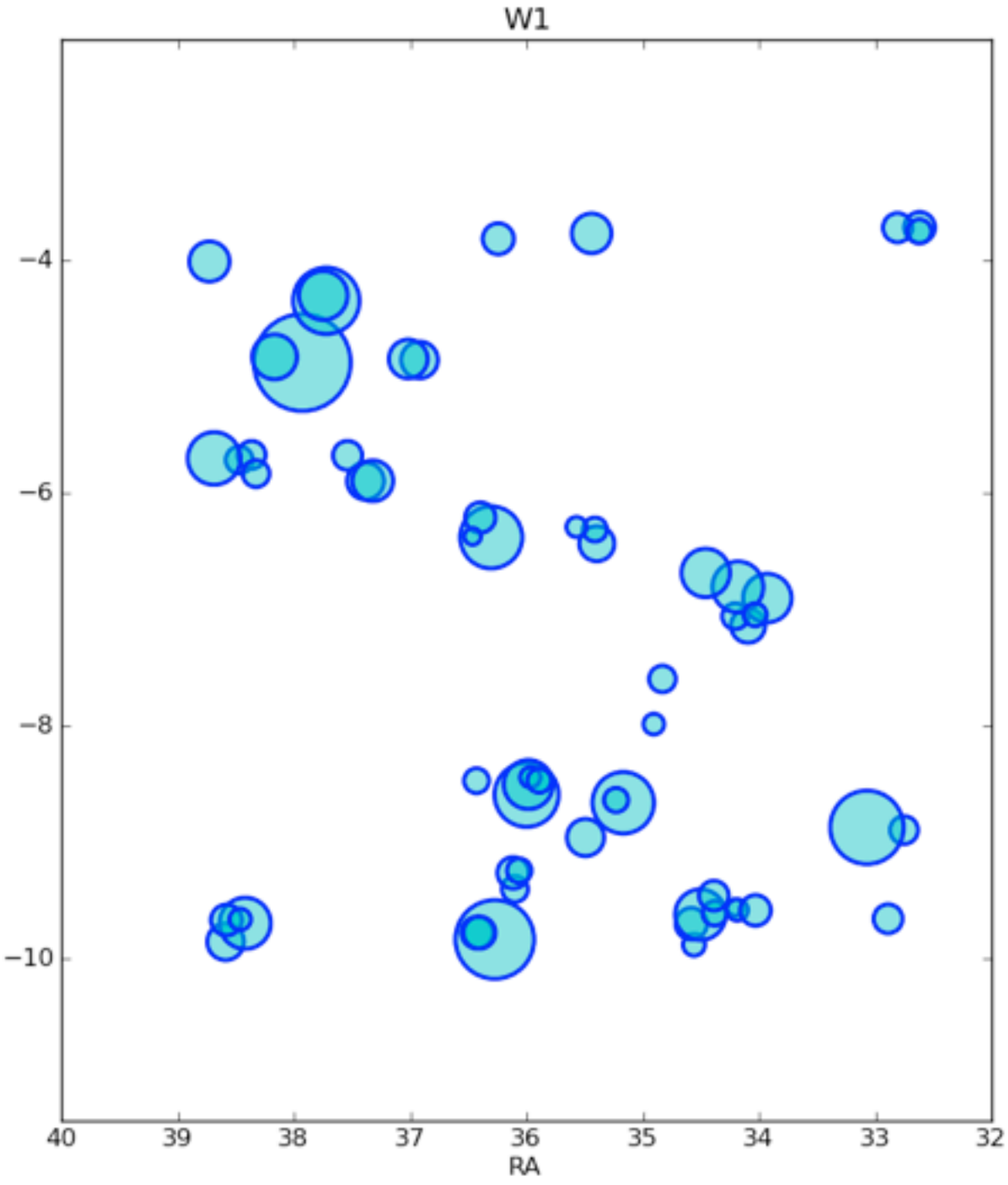
Team of 20 people focused on cosmic shear analysis (coordinators: Heymans & van Waerbeke)

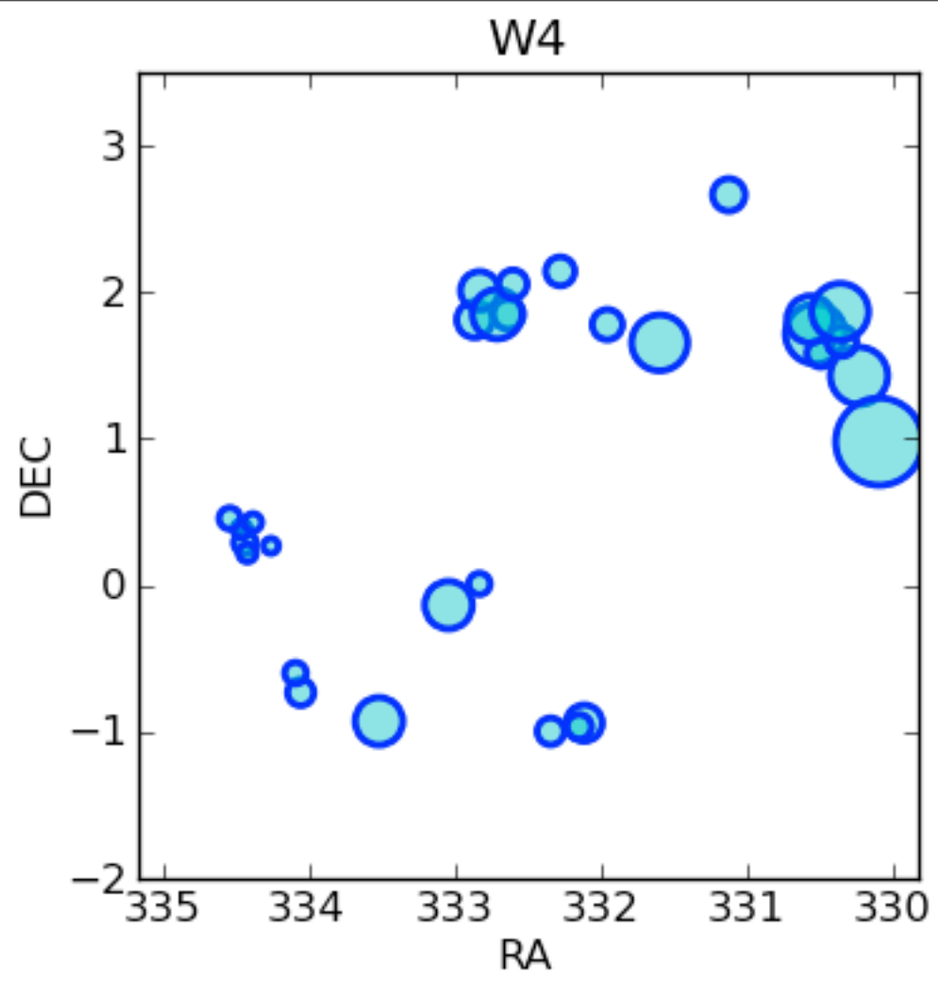
- ✦ CFHT Legacy Survey : 170 sq. degs of deep ugriz imaging
- ✦ Limiting mag i=24.5: median redshift of 0.75
- ✦ good image quality in *i*: 17 resolved galaxies per sq arcmin
- ✦ Accurate photometric redshifts (Hildebrandt et al. 2012)
- ✦ Accurate shear measurement with calibration at the sub-percent level via Bayesian model fitting (LENSFIT; Miller et al. 2007)

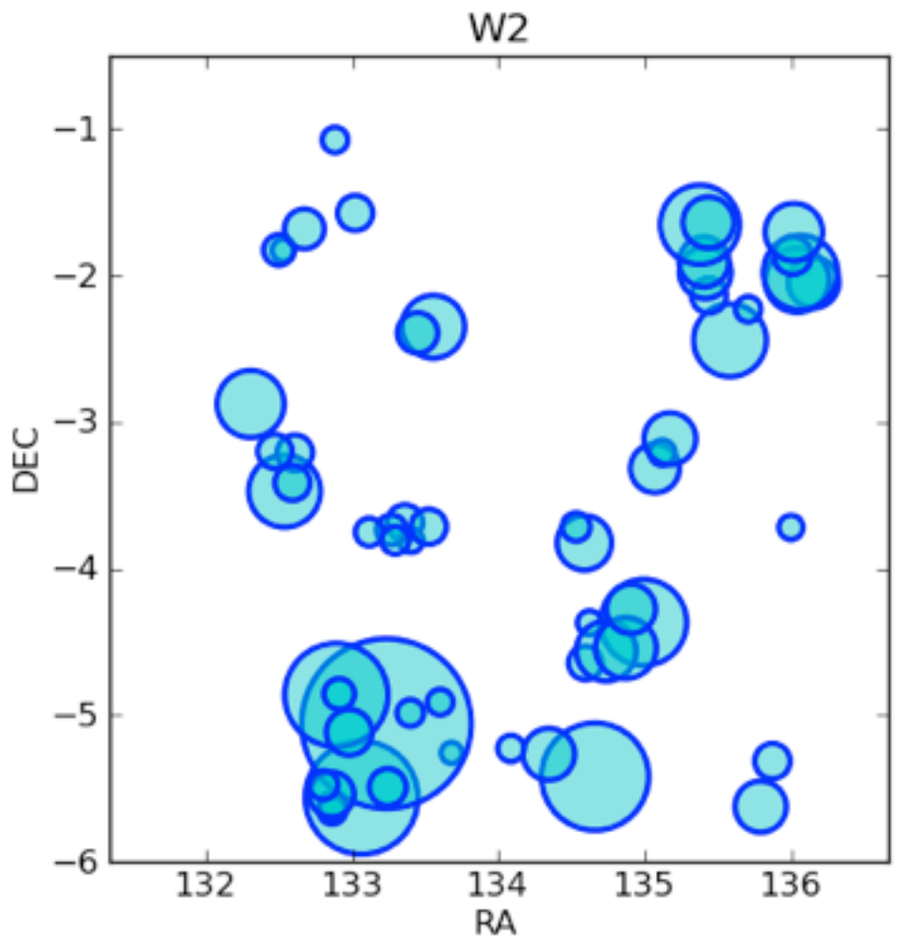
Dark Matter mass map, AAS press release, January 2012

XMM-CFHTLS

Targeted follow-up of faint RASS sources confirmed by red sequence cluster-finding with 2 ks snapshot
(total of 220 ksec, PI: Finoguenov)

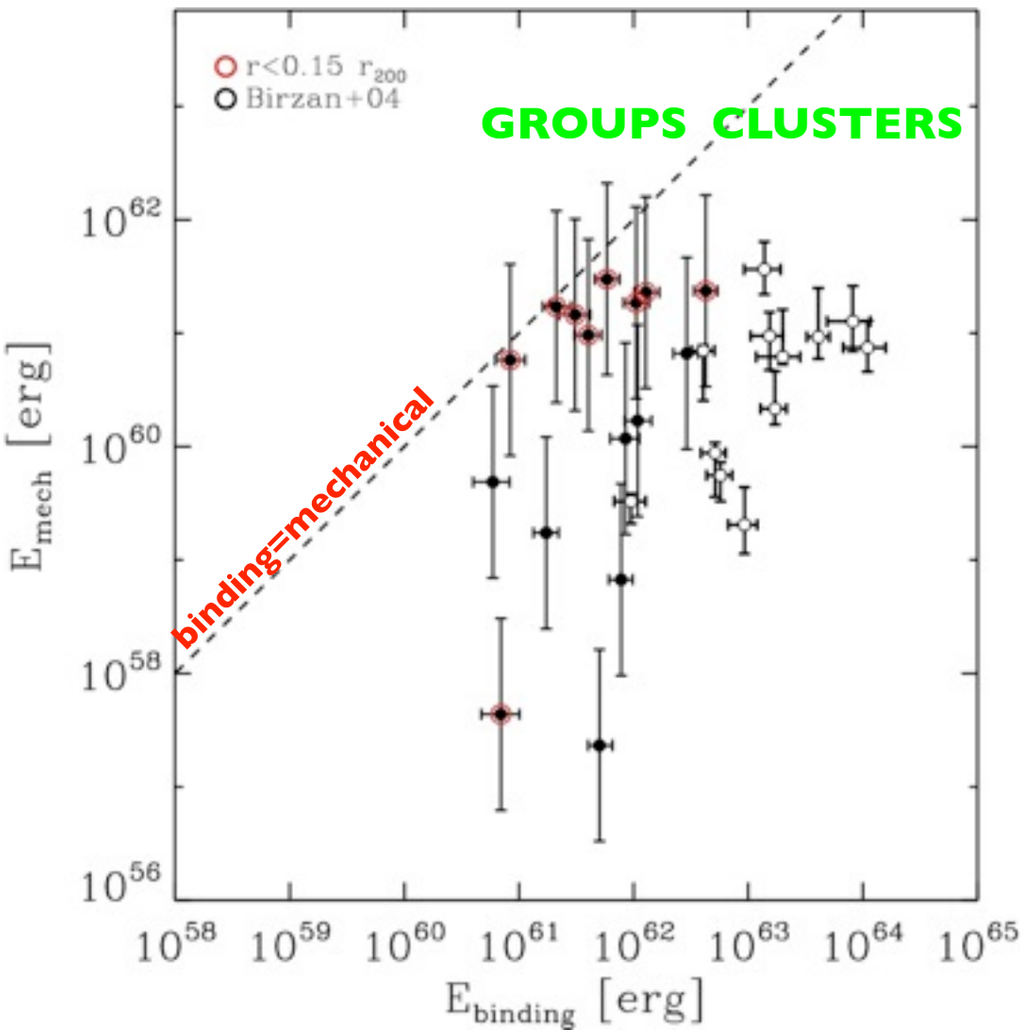


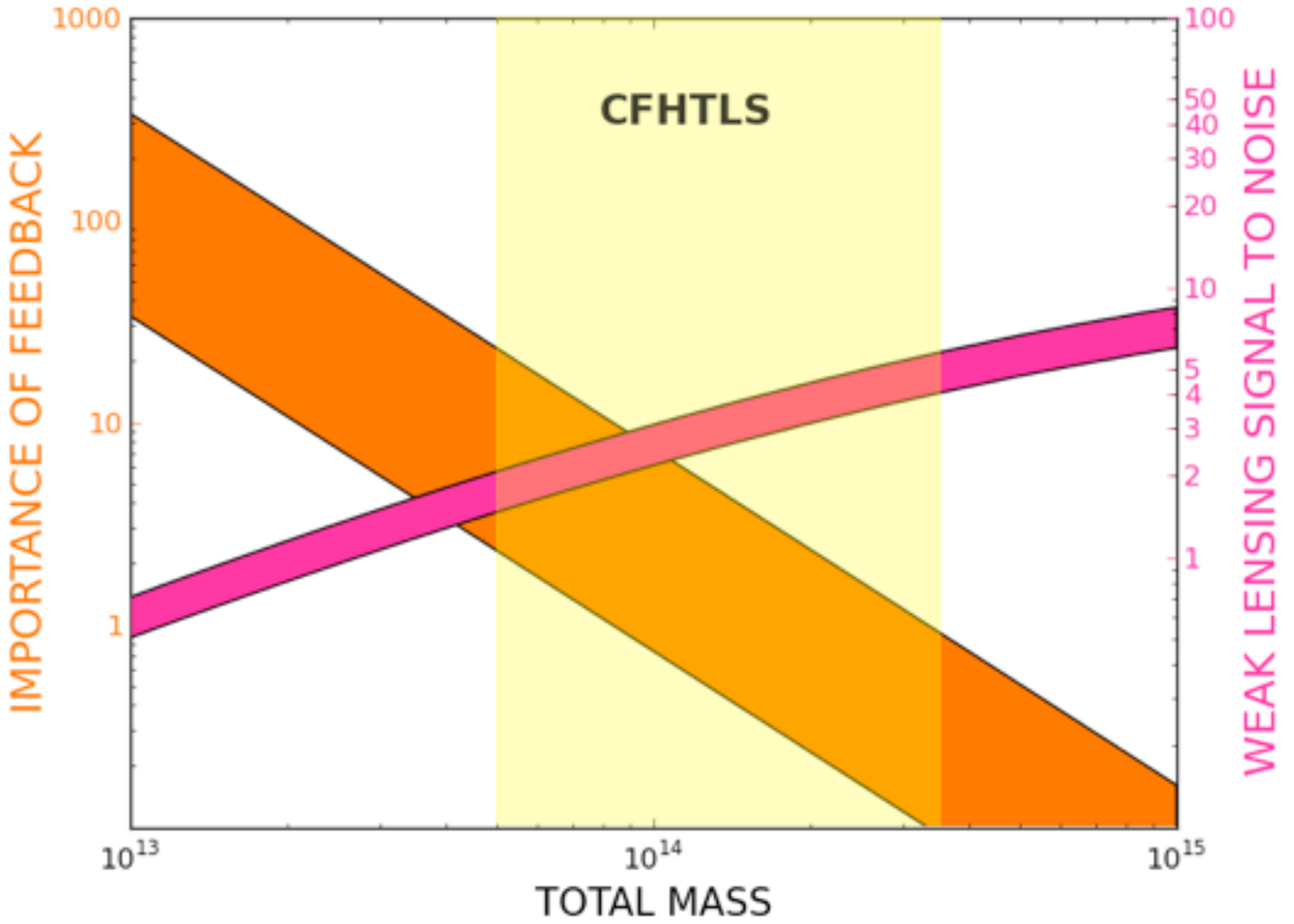




The most interesting systems are the most difficult to study.
Deep X-ray observation and a robust measure of the mass are needed.

Giodini et al. 2010

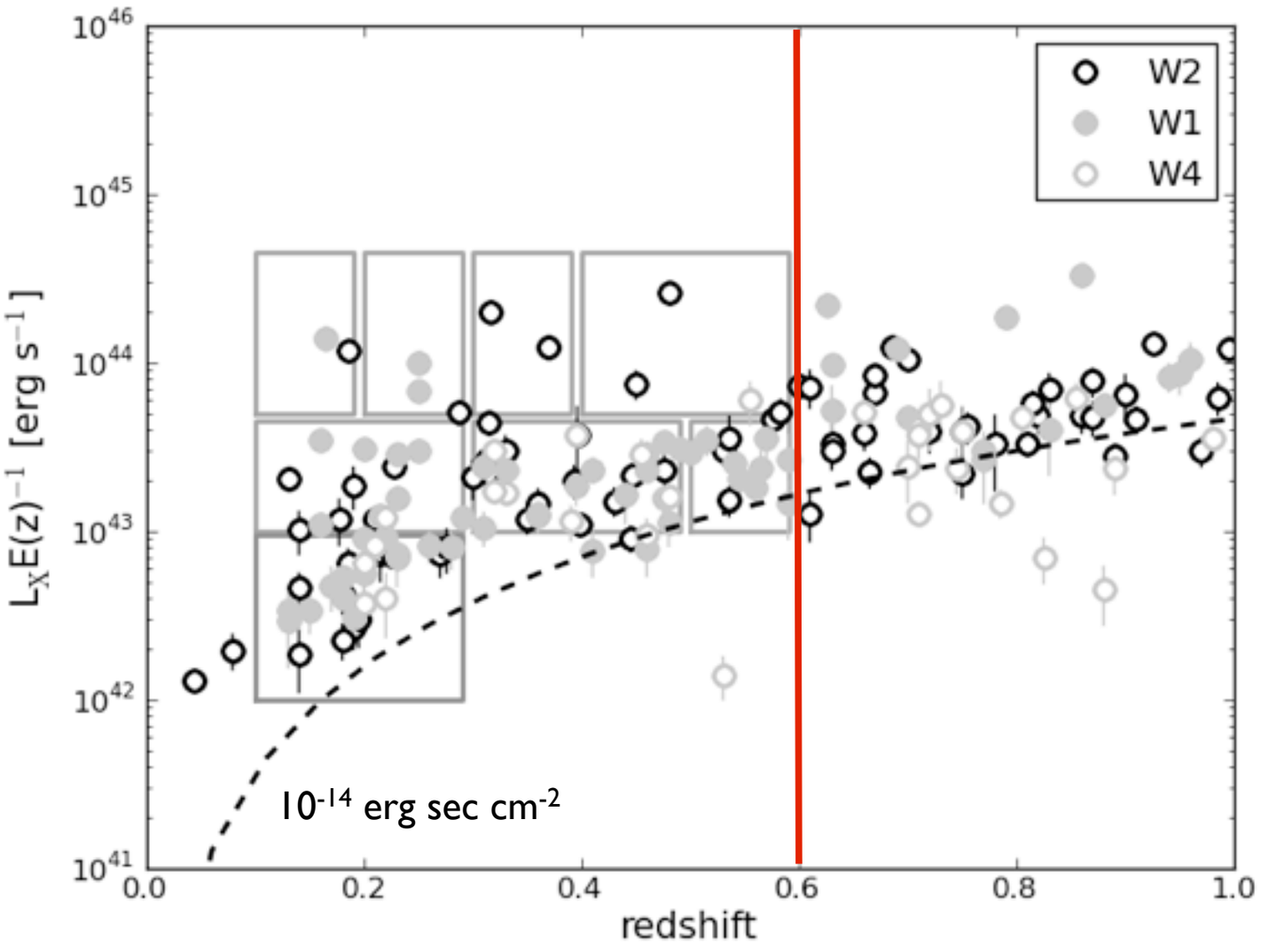




XMM-CFHTLS focuses on systems that are affected by non-gravitational physics but are also massive enough to have a good weak lensing mass measurement.

XMM-CFHTLS: our subsample

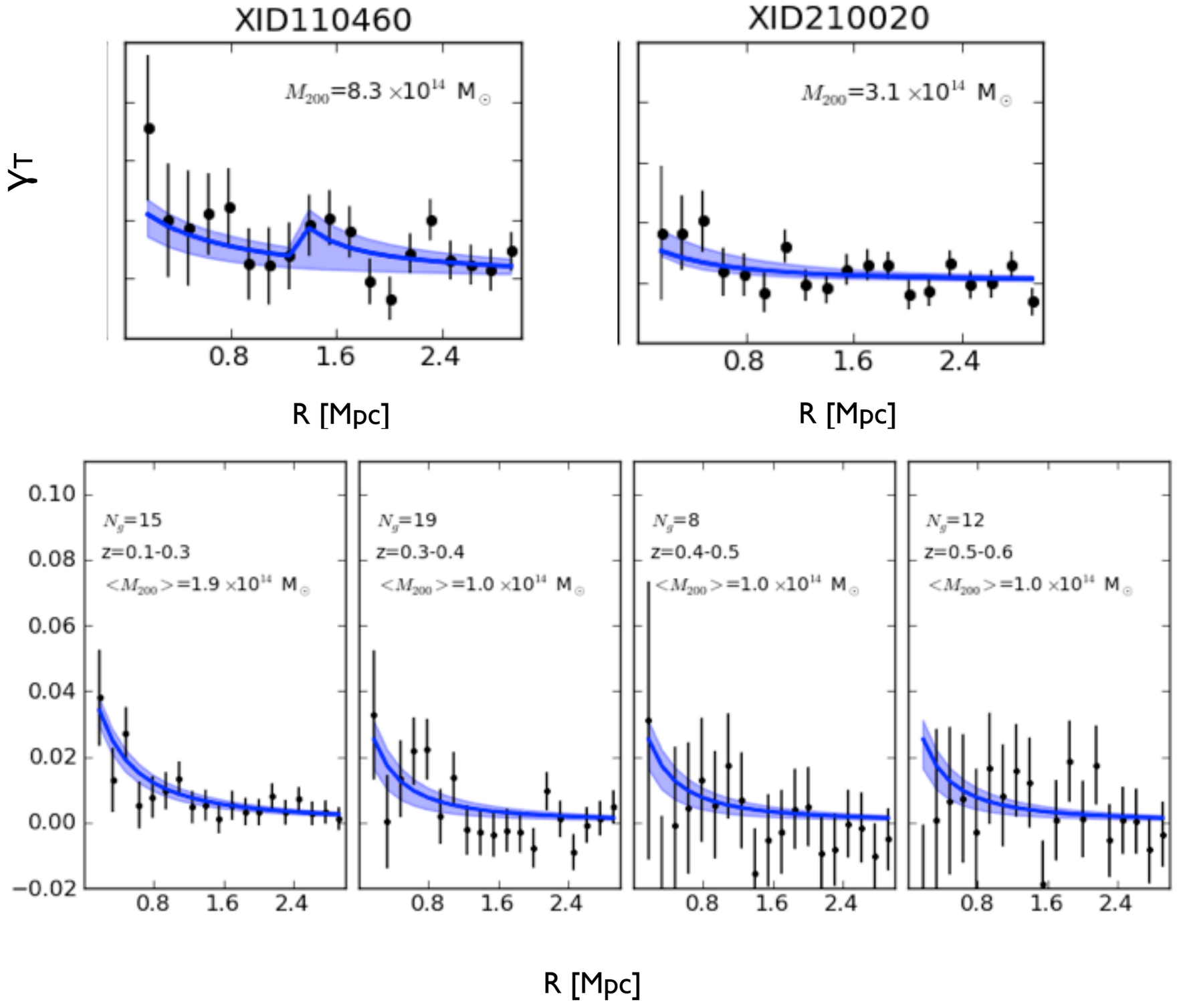
z<0.6 for weak lensing analysis



92 systems $L_x=10^{42}$-$5x10^{45}$erg sec^{-1}

9 bins in redshift and L_x

Tangential shear profiles

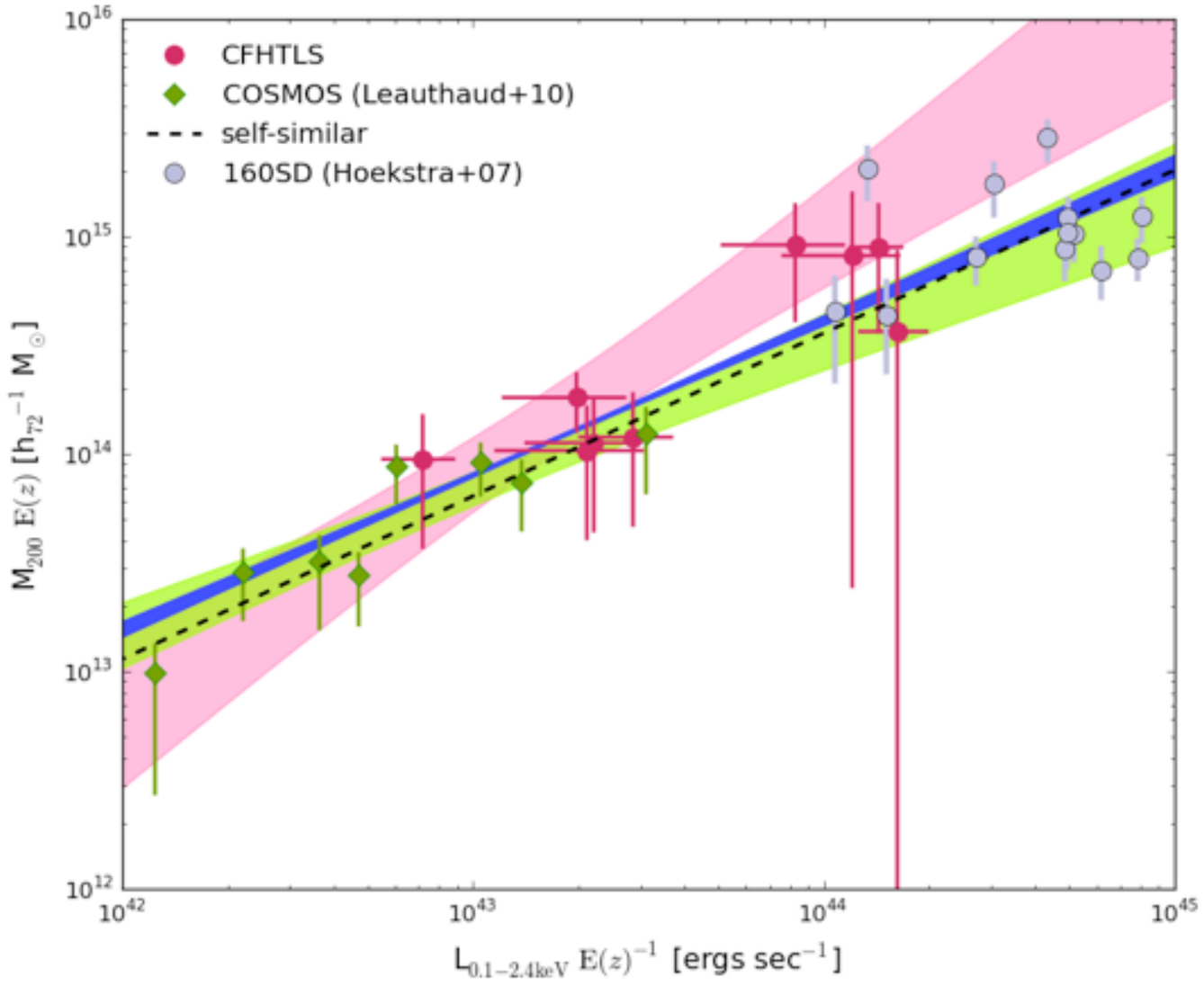


SINGLE PROFILES

STACKED PROFILES

M_{WL}-L_X RELATION

Stacked measurement in Lx bins.

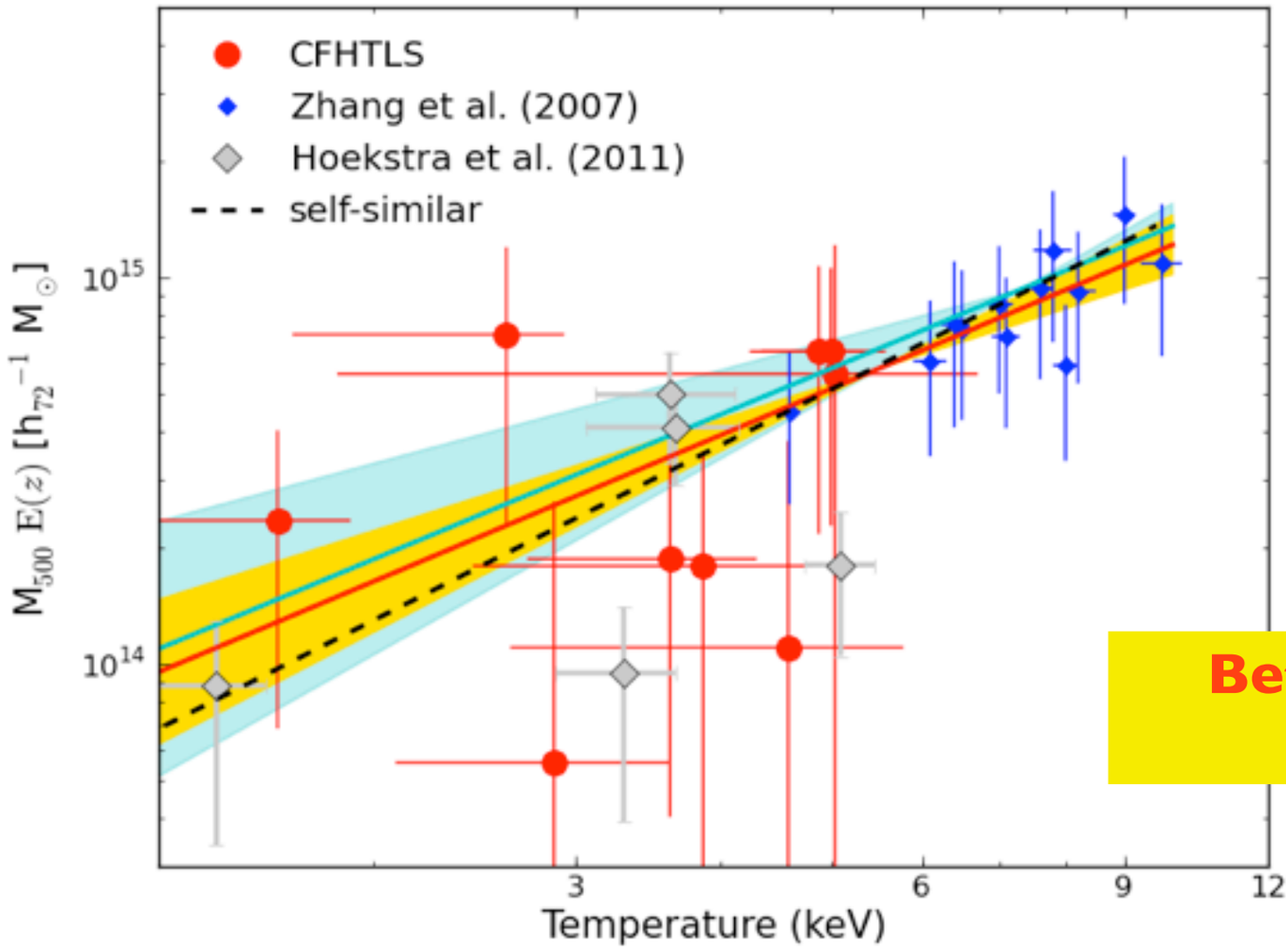


$M_{WL} \sim L^{0.71+/-0.03}$ (joint fit Leathaud+CFHTLS)

➡Adding the XMM-CFHTLS points improves the constraint.
➡Non self-similar & consistent with X-ray only measurement.

M_{WL}-T_X RELATION

Individual M_{WL} measurement for a subsample of 10 systems with >400 photons.
Core excised temperatures at $0.1R_{500}$. Single-temperature thermal plasma model fit.

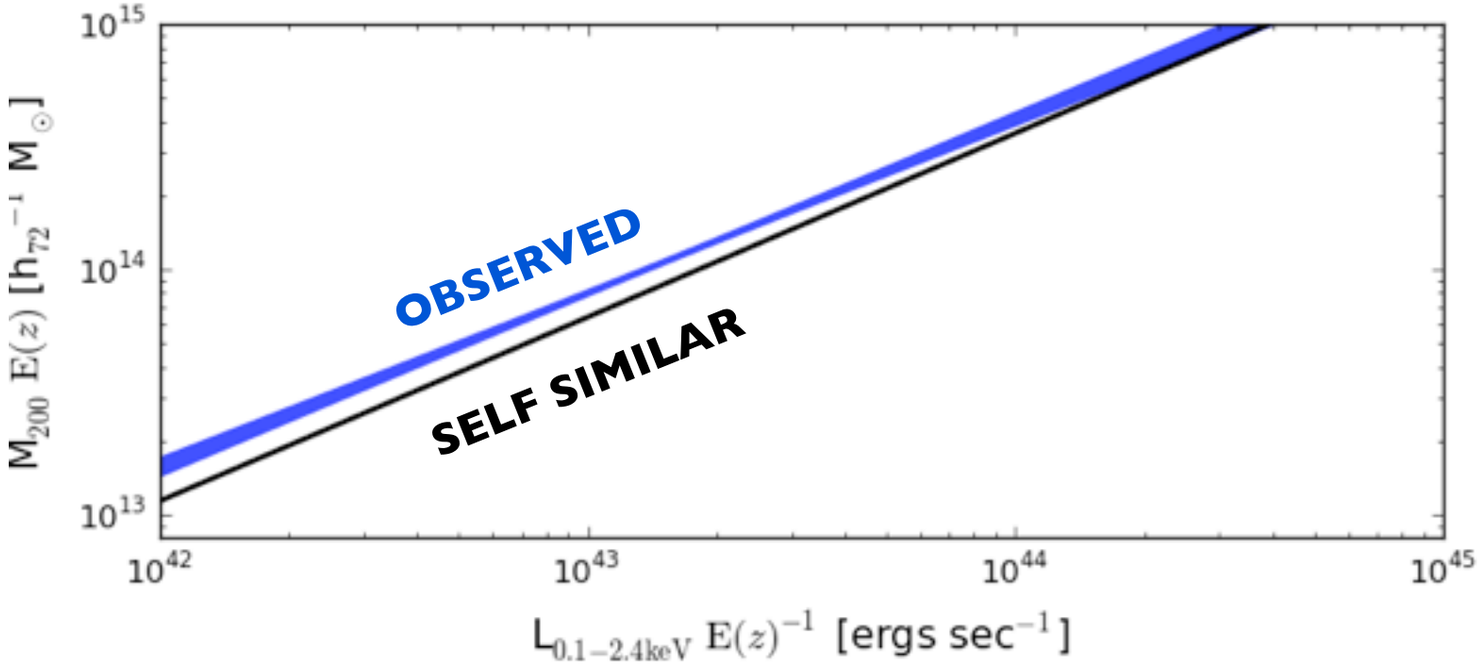


Better (HST) data needed!

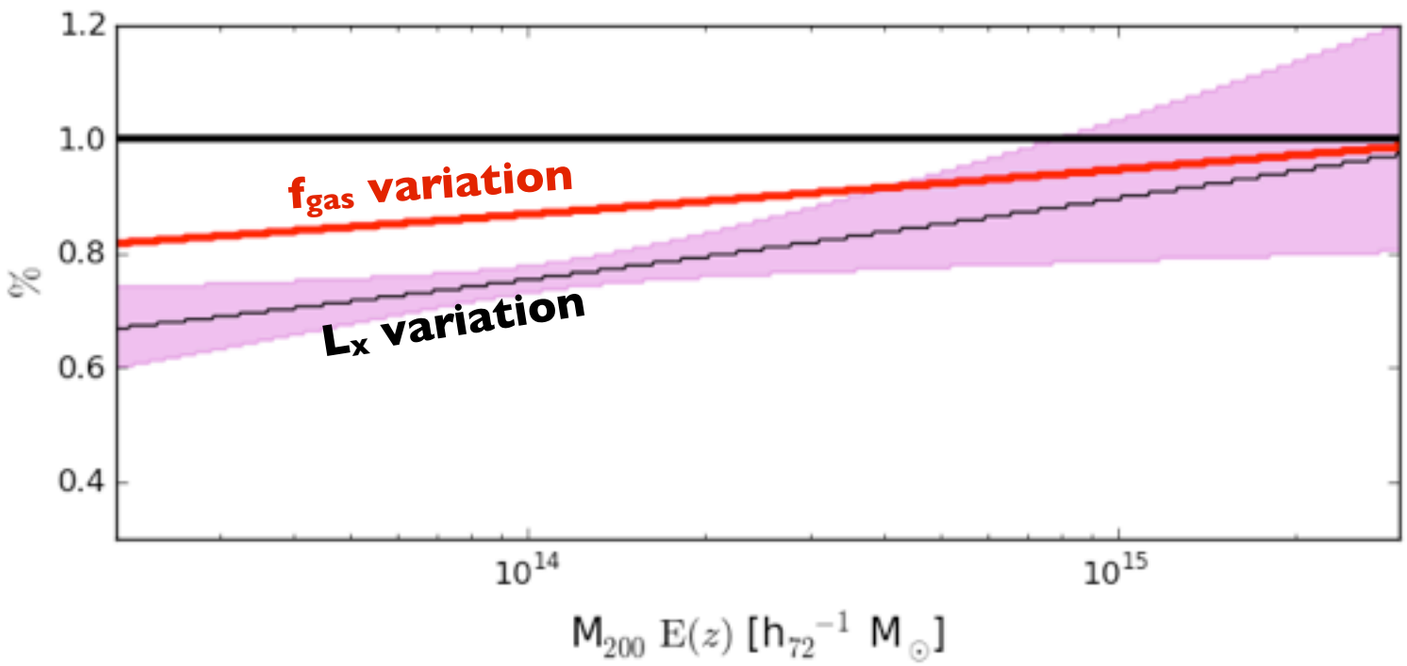
$M_{WL} \sim T^{1.25+/-0.3}$

➡...consistent with other weak-lensing calibrated studies at high mass (Zhang+07; Mahdavi's talk)
➡...flatter (but still consistent) wrt X-ray's only studies (e.g. Sun+12, Lovisari's talk)

Deviation from self similarity as a measure of f_{gas} variation



The deviation from self similarity reflects the variation in the fraction of gas for low mass systems.



$L_x \sim f_{gas}^2$ (Arnaud & Evrard 1999)

A group ~5×10^{13} has a gas fraction 20% lower than a massive cluster within R_{200}

SUMMARY

- XMM-CFHTLS is a X-ray snapshot survey on CFHTLS focused on high mass groups.
- We perform weak lensing analysis and measure (stacked) shear profiles for 92 groups at $z<0.6$.
- We constrain M_{WL}-L_X and M_{WL}-T relation improving existing constraints.
- We apply a simple model to predict the variation on the gas fraction from the observed deviation from self similarity and predict a 20% offset in f_{gas} for a 5×10^{13} M_{sun} group.
- *Results soon on astro-ph!*

& OUTLOOK

- HST snapshot data requested for individual mass measurements
- Overlap with VIPERS
- Primer for future X-ray/Weak lensing large survey: synergy between Euclid and eROSITA/SRG

Thank You!