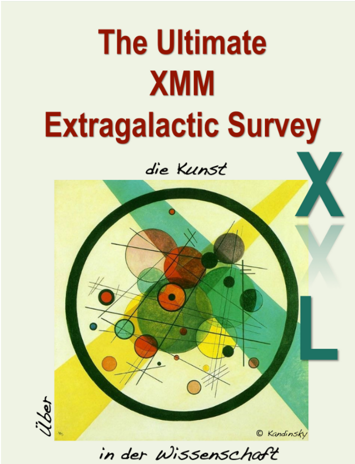
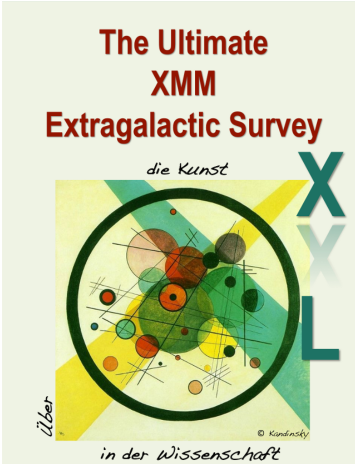
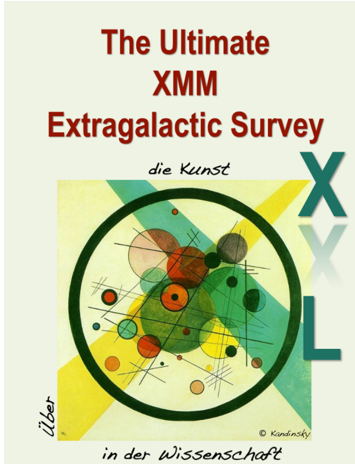
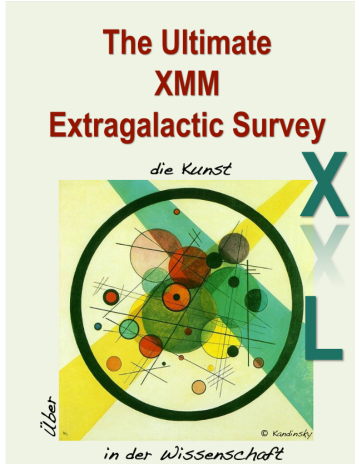
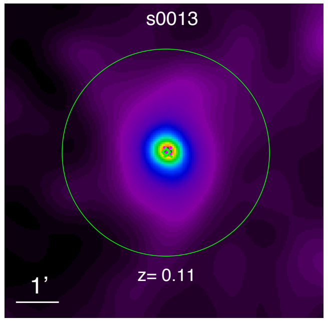


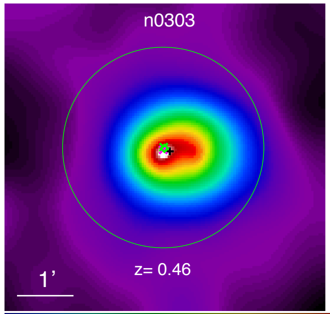


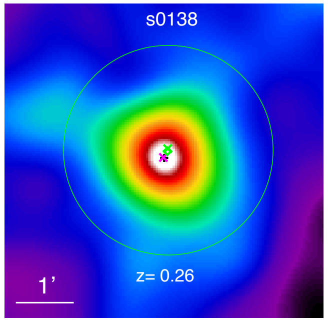


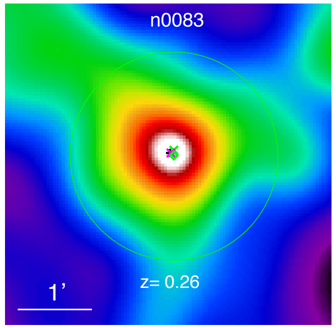


The 100 XXL brightest clusters : morphological study









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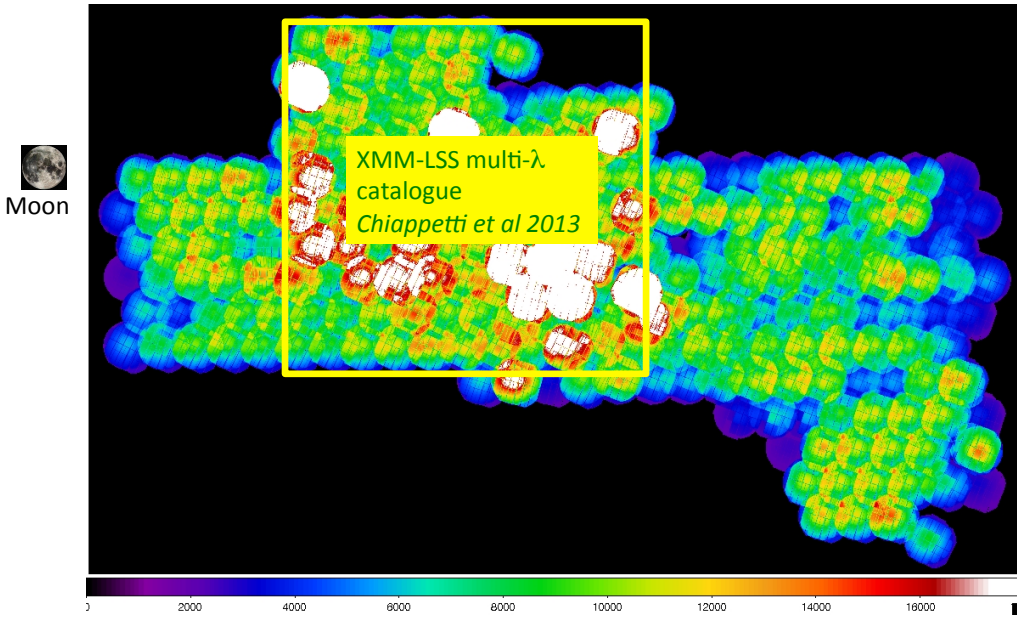
Content

- XXL survey - very large XMM survey
- Dynamical state/physics proxies
  - Centroid-shift
  - Surface brightness
  - BCG/X-ray peak/X-ray centroid offset
- Preliminary comparison with cosmological simulations
- Conclusions

XXL survey overview

25 deg^2 in CFHTLS-W1 2h23 -5d00

(extension of the XMM-LSS field)

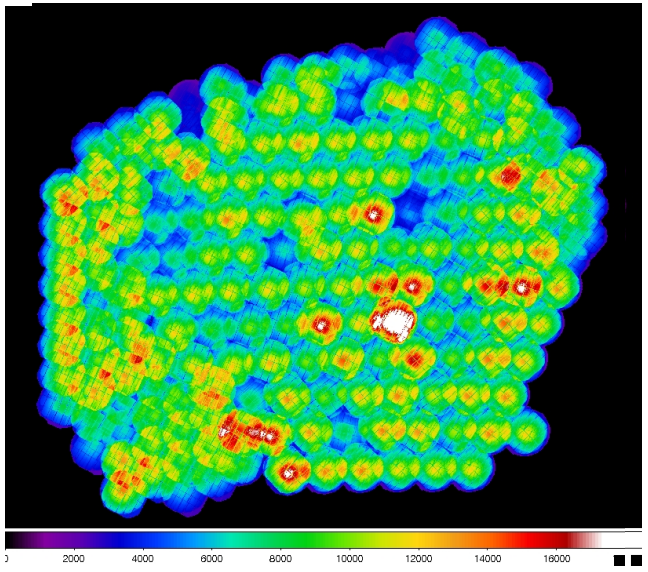


Moon

$\Delta\alpha = \Delta\delta = 20'$ everywhere

25 deg^2 in BCS 23h30 -55d00

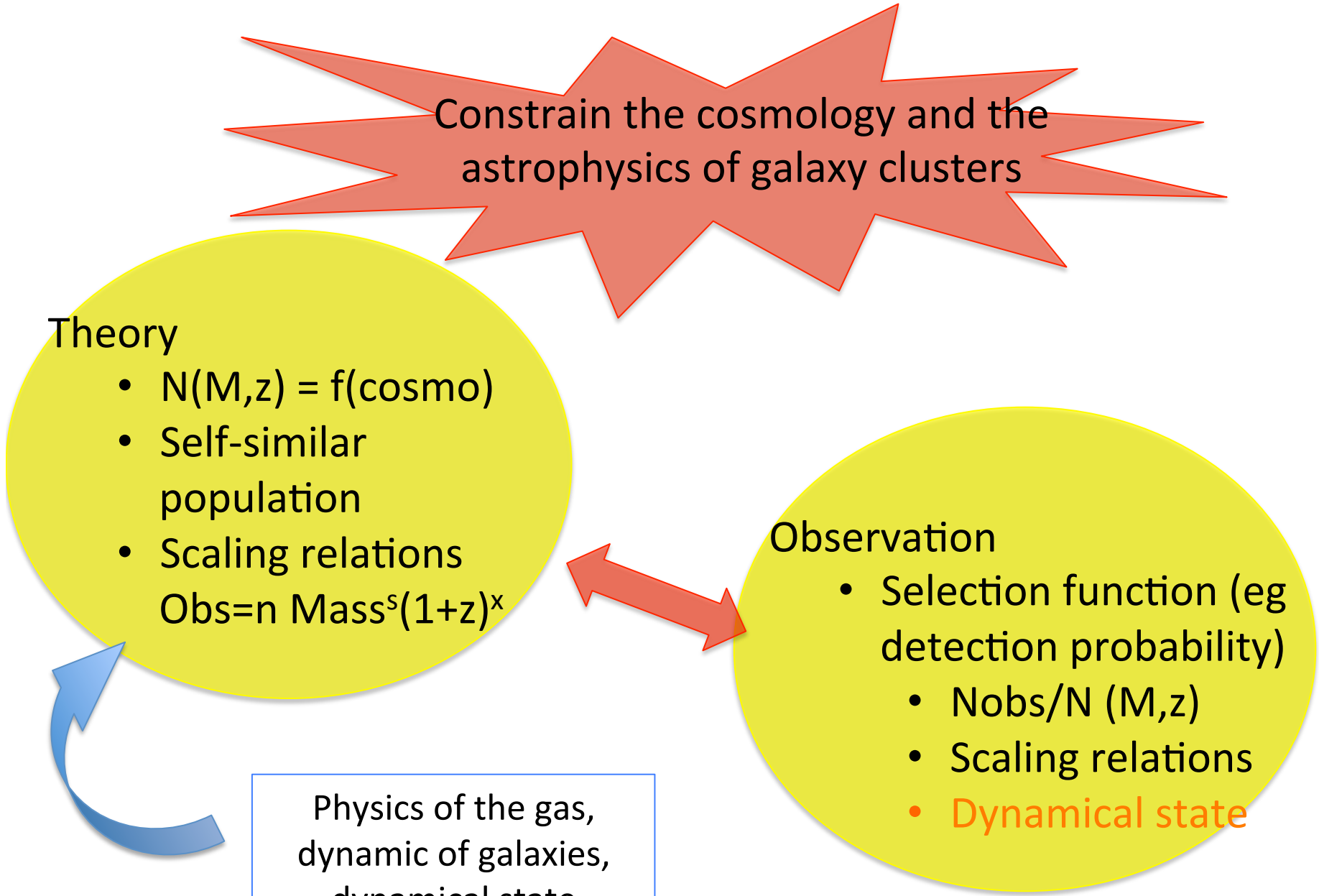
(extension of the XMM-BCS field)



$\Delta\alpha = \Delta\delta = 20'$ ($\Delta\alpha = \Delta\delta = 23'$ in the initial central survey)

- XXL : 2x25deg2 contiguous 10ks XMM pointings (~6.8Ms of XMM time)
- Blind detection of extended (cluster/group) and point sources
- The 100 brightest clusters ($0.04 \leq z \leq 1.$, $10^{13} \leq M \leq 10^{15}$Msun) (cf Paul Giles' talk)
- Astrophysics + cosmology (cf Marguerite Pierre's talk)

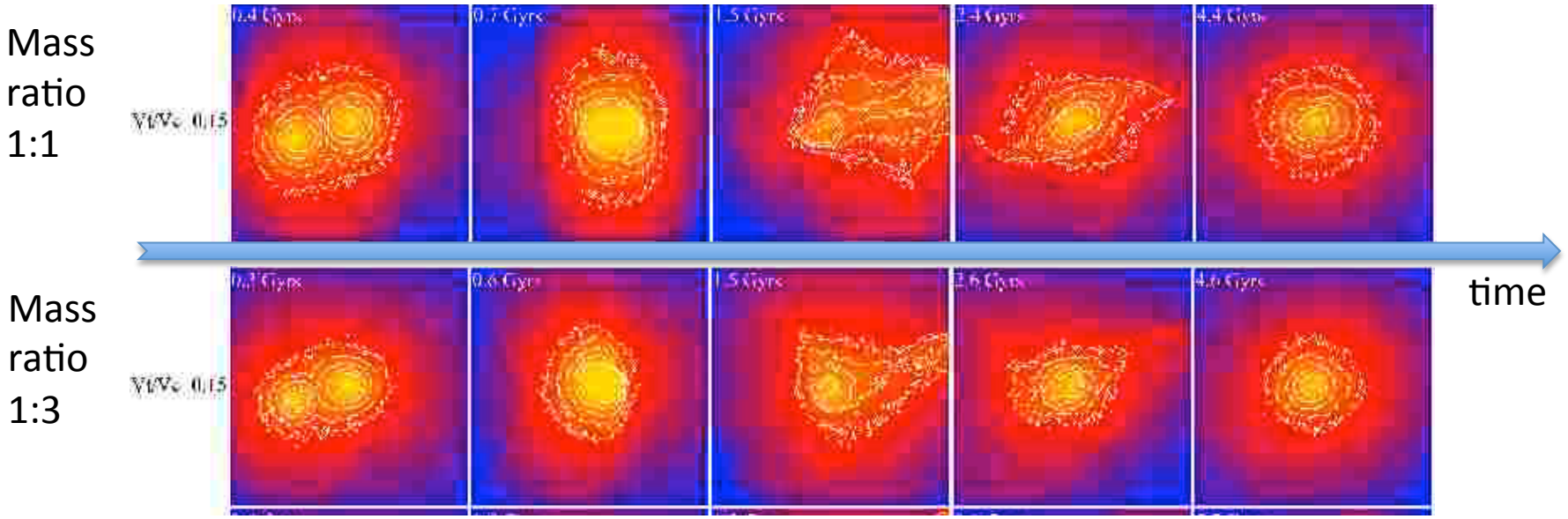
Morphological study - why ?



Morphological study, why ?
The cluster dynamical state

- How do we probe the cluster dynamical state ?

Poole+2006

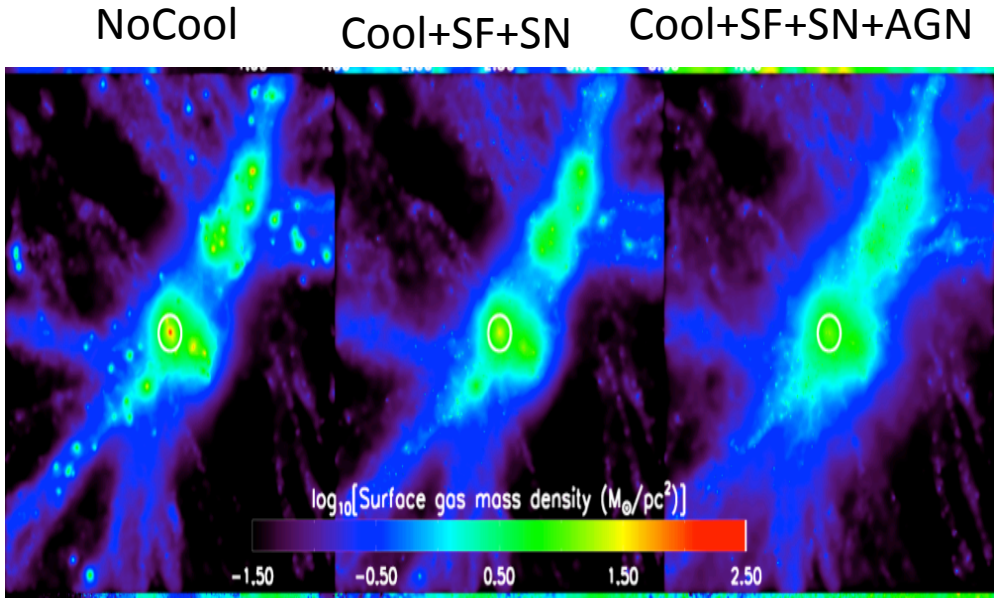


- -> comparison with the simulation
- The gas distribution probes the relaxation degree

Morphological study, why for ?
The baryon physics

Cosmo-Owls

- How do we probe the cluster dynamical state ?
- -> Comparison with the simulations
- The gas distribution probes the relaxation degree
- The gas distribution probes the physics



McCarthy+11 (see also McCarthy+10, LeBrun+14 in prep)

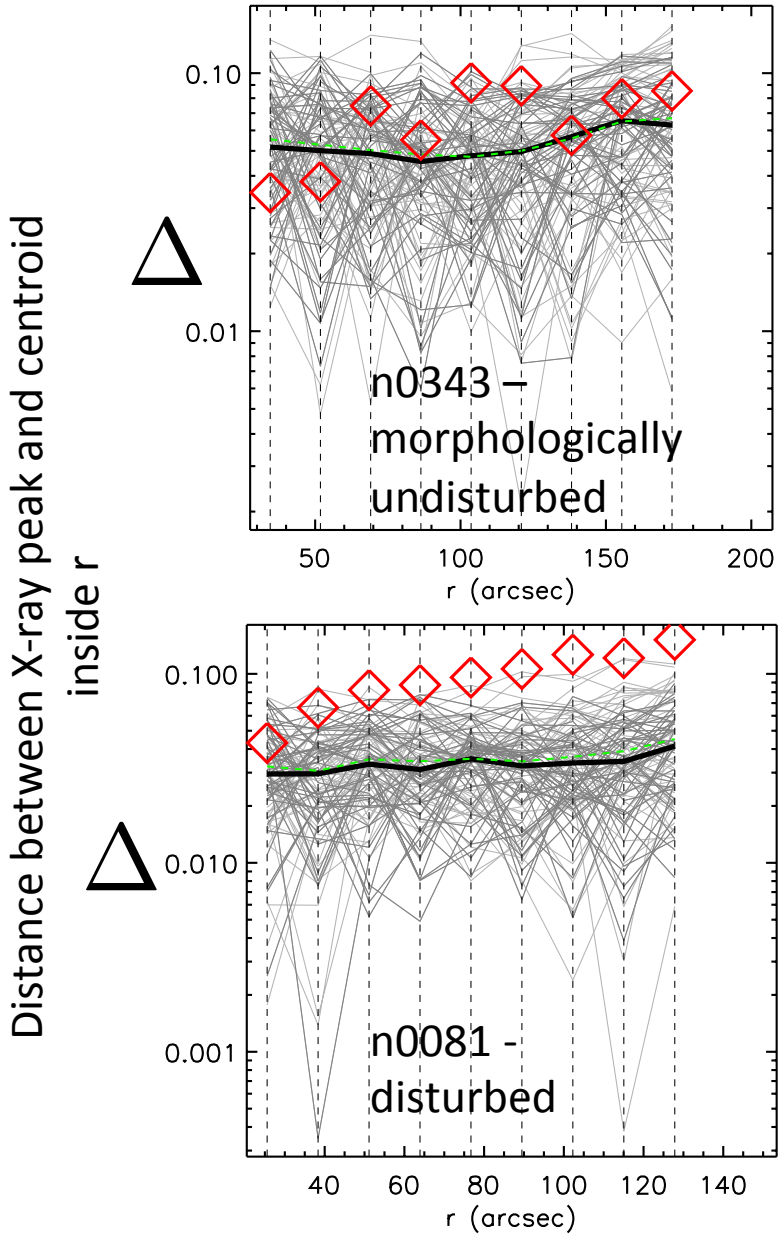
- Measure of the gas clumpiness and overall symmetry
- Compactness of the gas distribution (central density,concentration parameter…)
- Position offset

X-ray Centroid-shift

- Morphology analysis using the centroid-shift

$$w_i = \sqrt{\frac{\sum_{j \leq i} (\Delta_j - \bar{\Delta})^2}{i-1}} / R_{500}$$

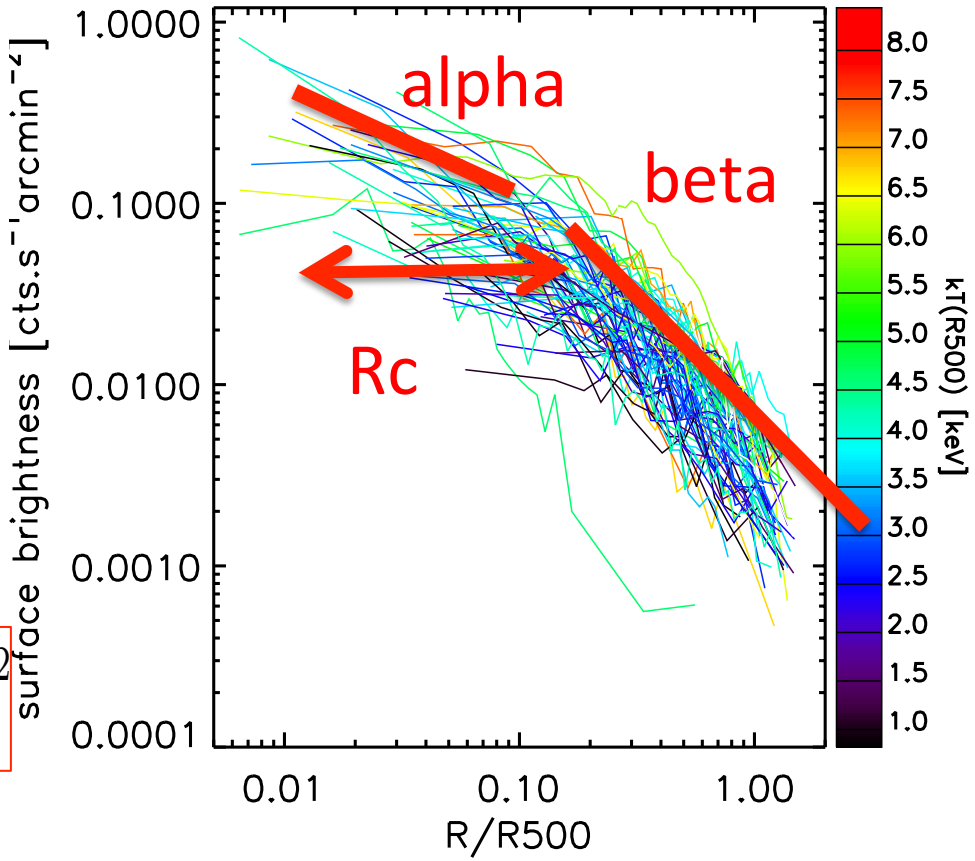
  - Errors estimated through MonteCarlo simulations
  - Contribution due to the PSF (source off-axis) and data quality (eg ncts, chip gaps…)
- $w_{cor} = w_{data} - w_{psf} - w_{stat}$



Surface brightness fitting

- Surface brightness profiles assuming spherical symmetry and centered on X-ray peak
- PSF redistribution taken into account
- Beta model + extended beta model (AB model Pratt&Arnaud 2003)

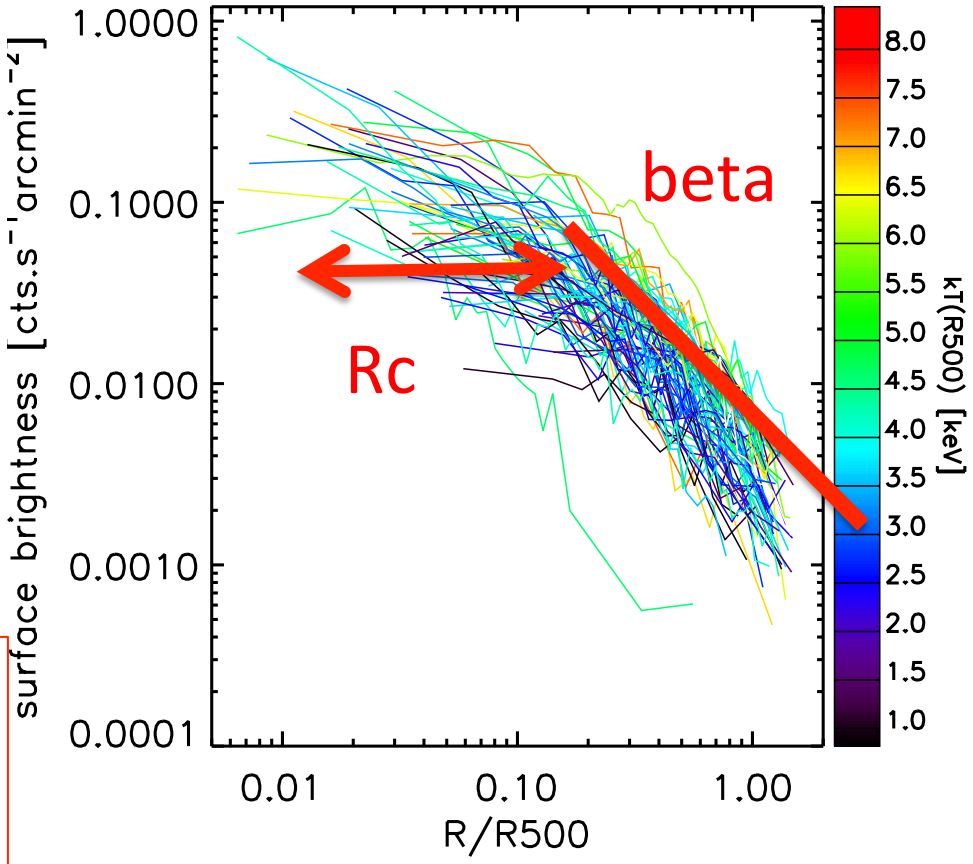
$$\rho(r) = \rho_0 \times \left[\frac{r}{r_c}\right]^{-\alpha} \times \left[1 + \left(\frac{r}{r_c}\right)^2\right]^{-3\beta/2+\alpha/2}$$



Surface brightness fitting

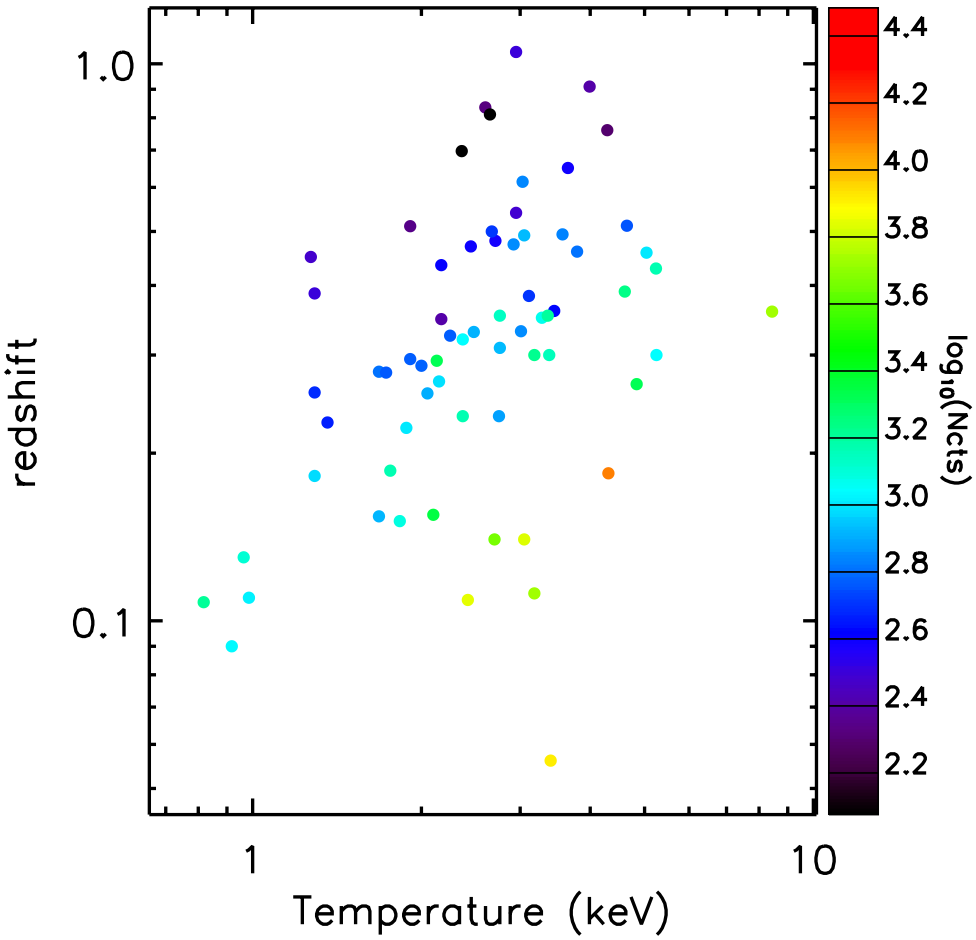
- Surface brightness profiles assuming spherical symmetry and centered on X-ray peak
- PSF redistribution taken into account
- Beta model + extended beta model (AB model Pratt&Arnaud 2003)

➢ Any trend of the shape parameters with temperature and redshift ?



The XXL 100 brightest cluster sample

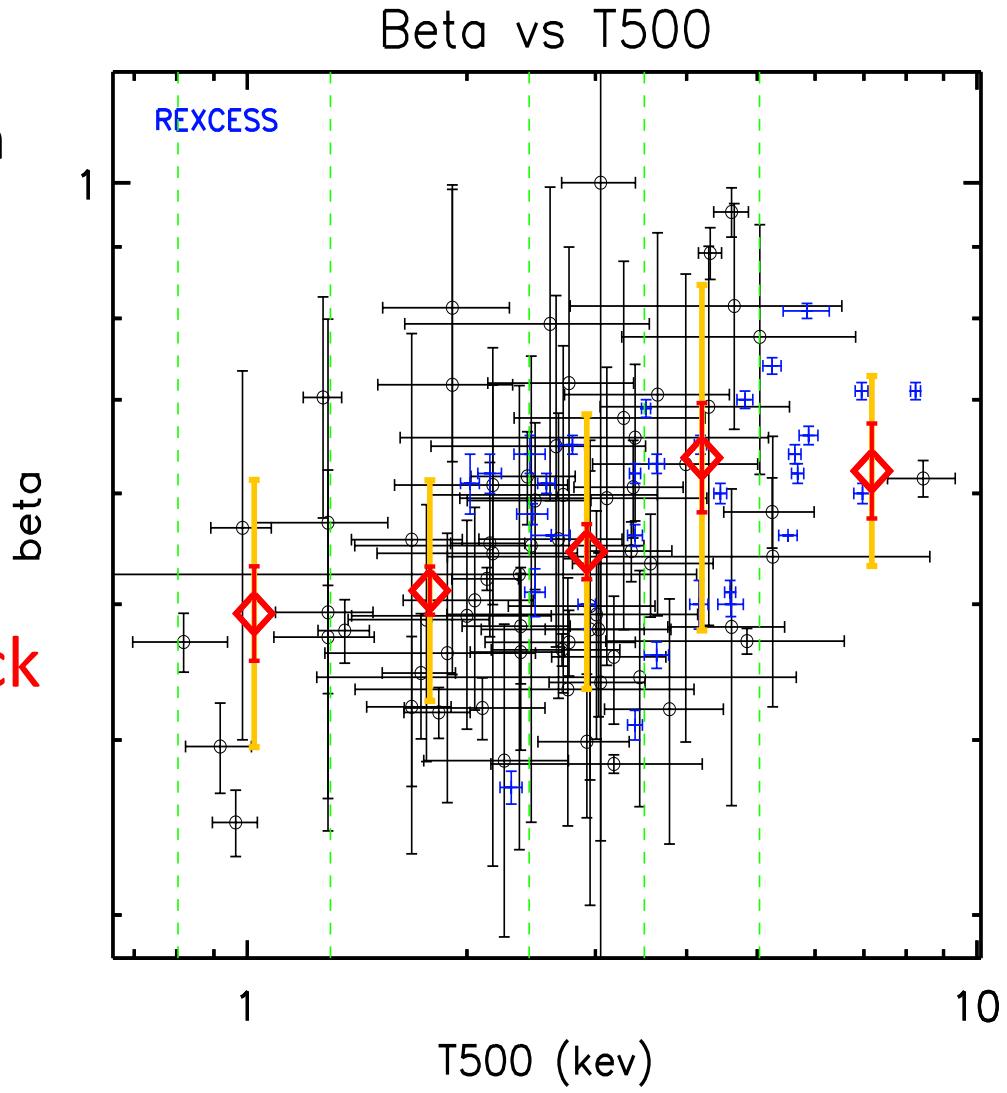
- Selection effect -> select hotter systems at high redshift
- Statistical test to disentangle between temperature and redshift



Evolution of the outer slope with temperature

- Partial correlation attributes the correlation to be due to the temperature (Spearman rank test gives a null probability of ~ 0.01)

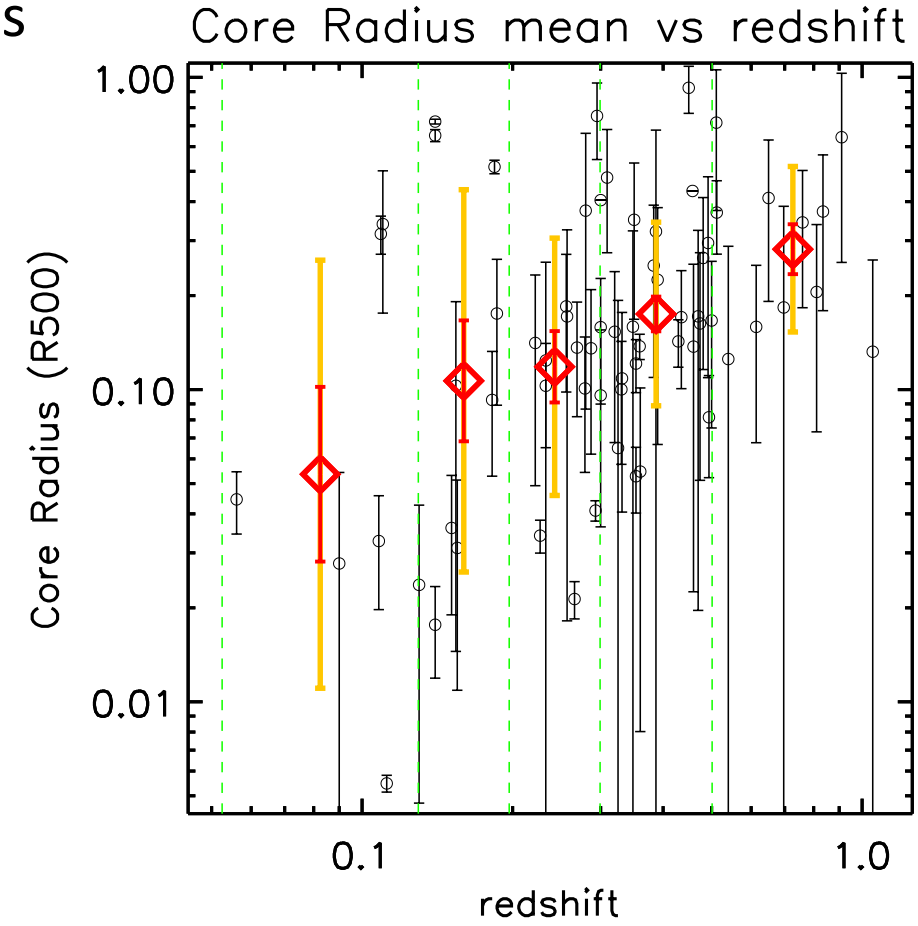
➢Effect of AGN feedback



Evolution of the core radius with redshift

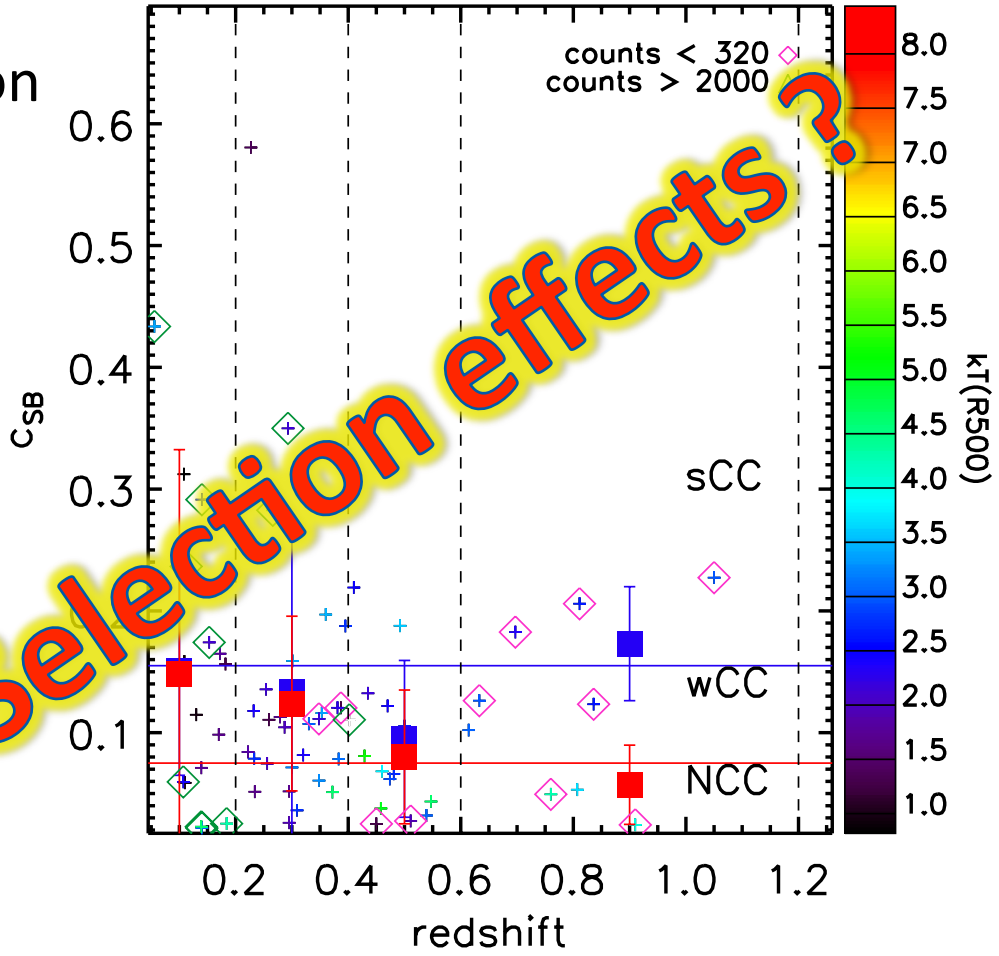
- Partial correlation attributes the correlation to the redshift with a null hypothesis given by the spearman rank test of ~0.0009

➢ Evolution of the core properties



Cool cores

- Ratio of the flux @40kpc on the flux inside 400kpc (Santos et al 2008)
- Evolution of the concentration parameter with z
- Separation
  - NCC csb < 0.075
  - wCC 0.075 < csb <0.155
  - sCC csb > 0.155

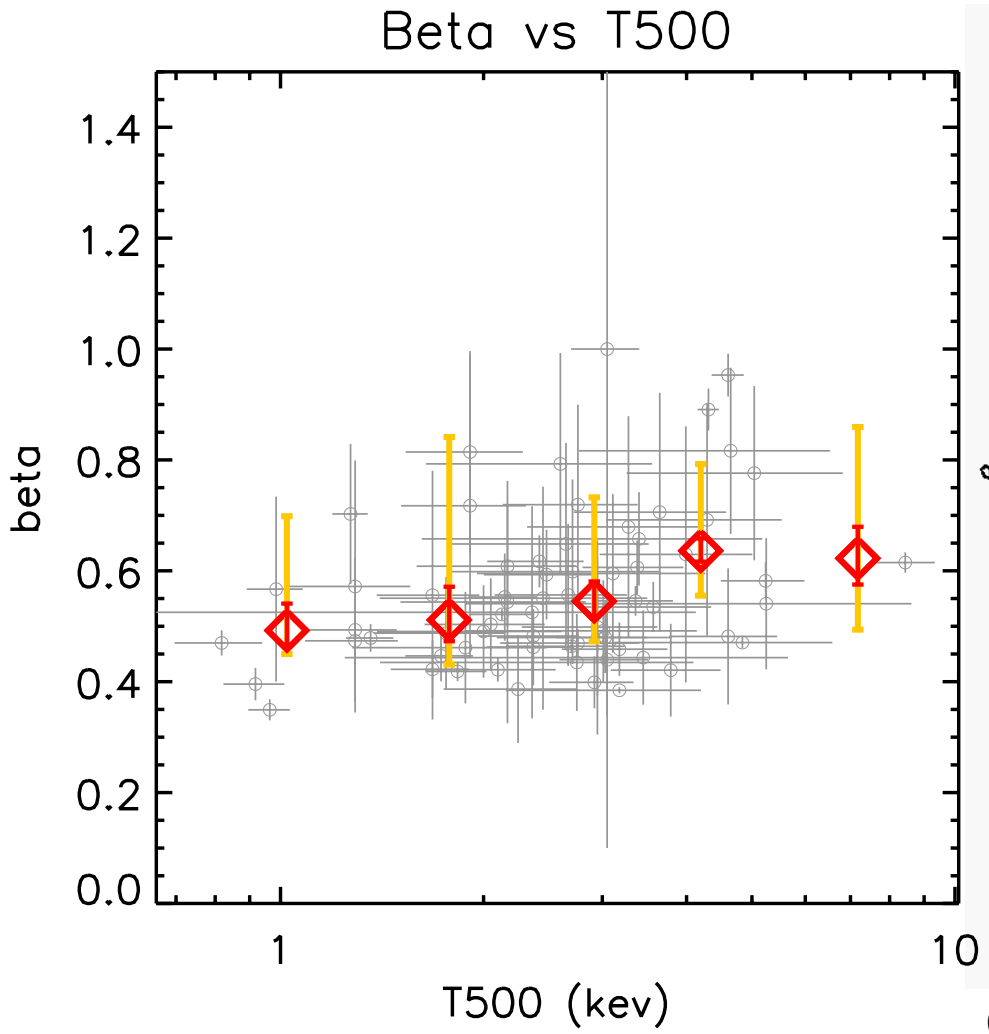


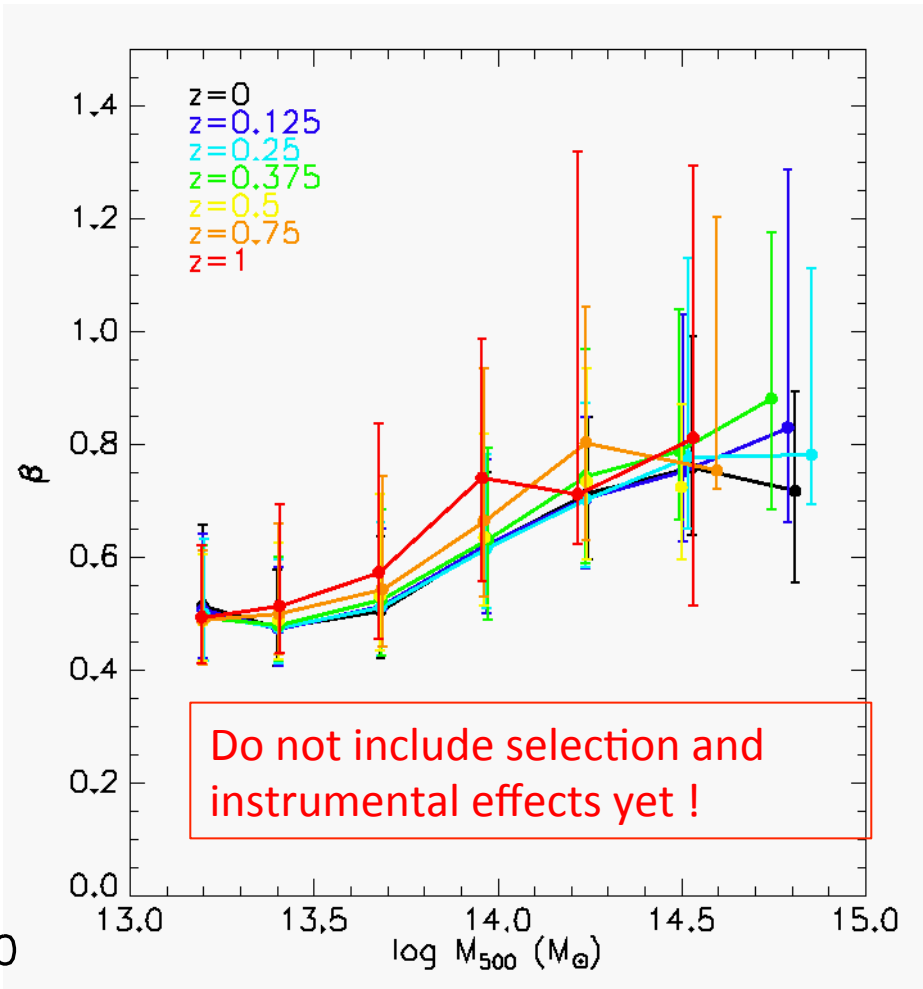
Selection effects ?

Clusters (kT>3keV

groups (kT<3keV)

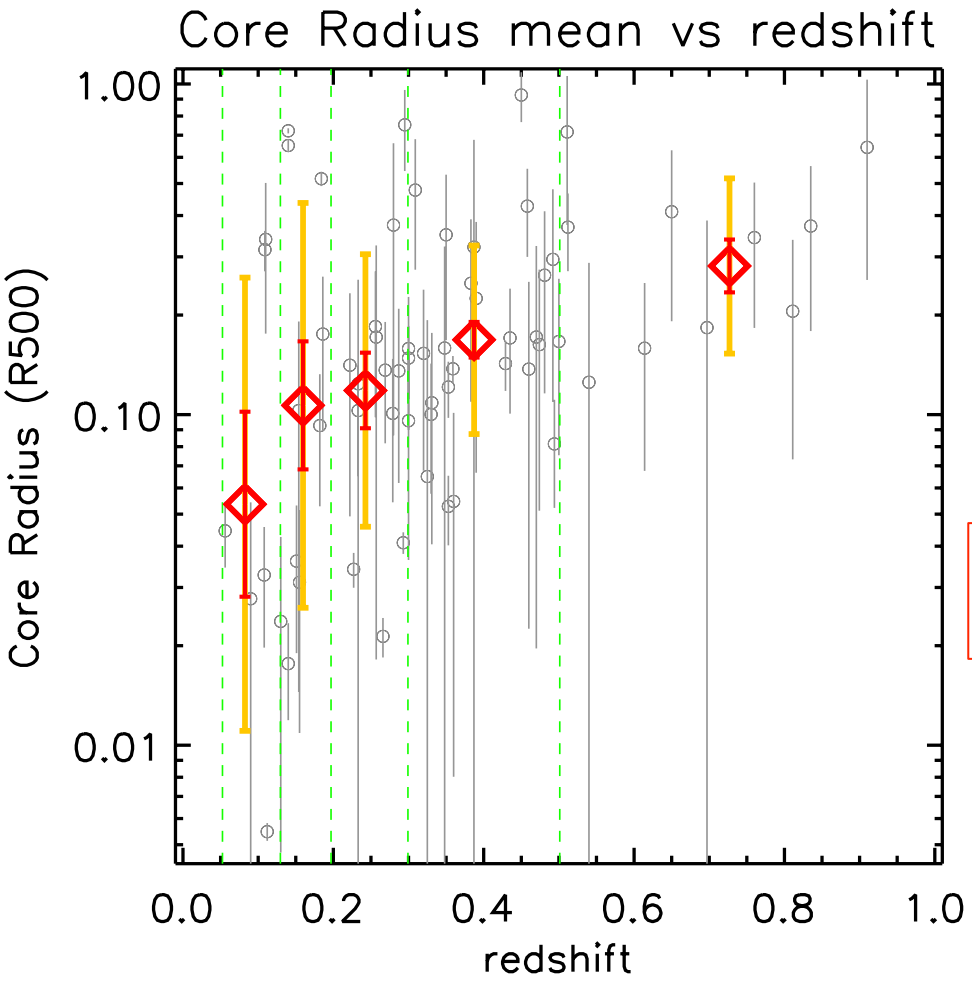
Preliminary comparison with the simulations outer slope vs temperature

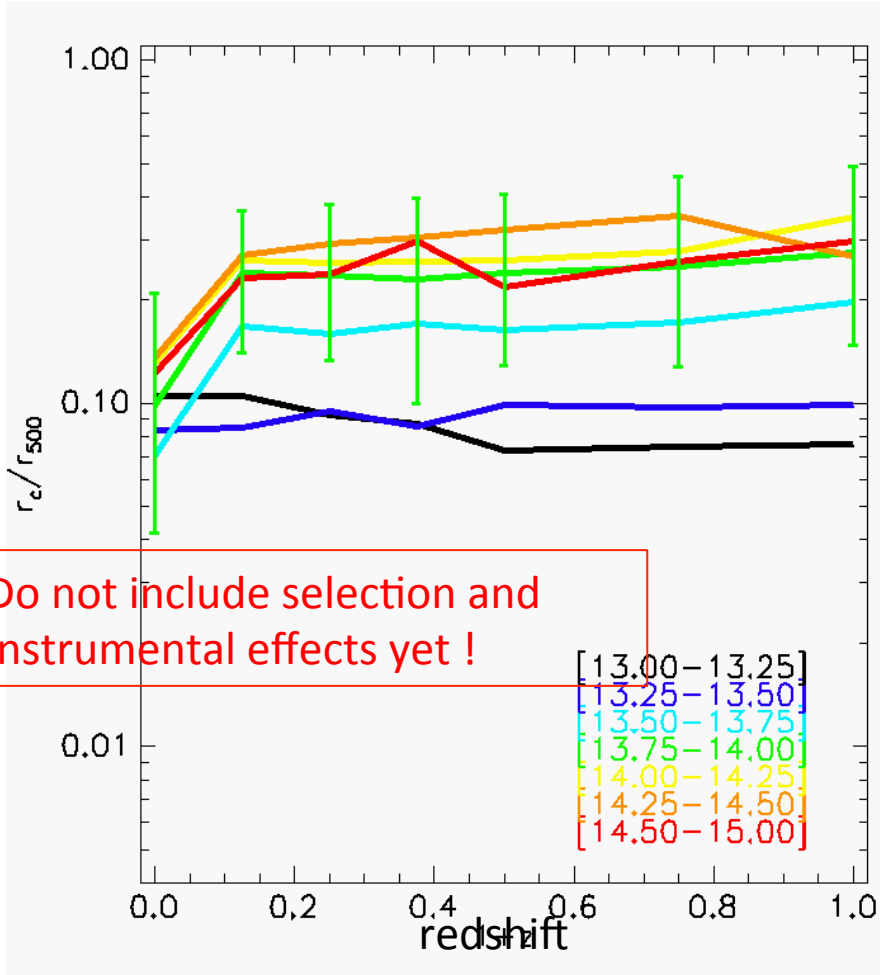




Courtesy of I. McCarthy

Preliminary comparison with the simulations
core radius vs redshift



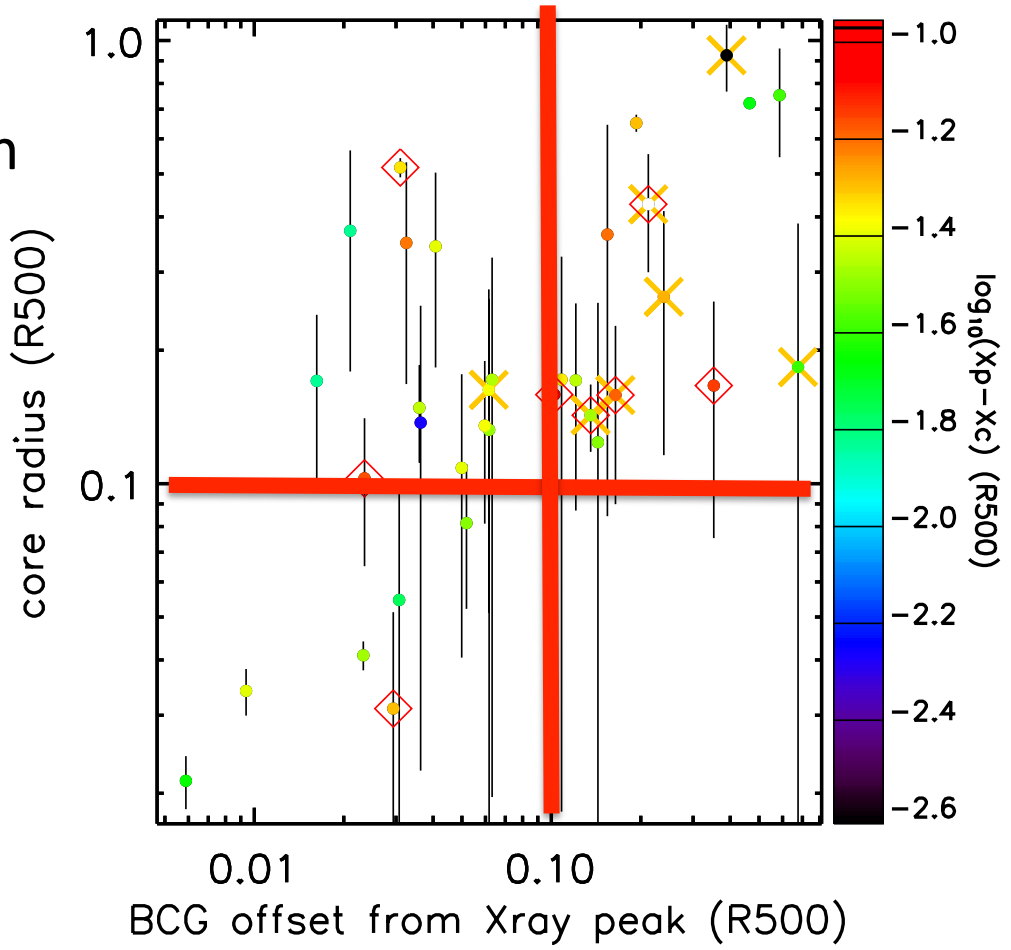


Do not include selection and instrumental effects yet !

Courtesy of I. McCarthy

BCG offset

- CFHTLS-W1 field
- BCG identification based on photoz and z-band magnitude
- Diamonds == wcor>0.0073
- X == presence of other bright galaxies



Conclusions :

- Study of the 100 brightest clusters in the XXL survey
  - $0.03<z<1$
  - $1keV < kT < 8 keV$
- 3 different dynamical state proxies
  - Preliminary evolution of core properties
  - Preliminary comparison with the simulation
- Next : comparison with a simulated XXL 100 sample + simulated cosmological sample (eg study of selection biases)