

# Representative samples of galaxy clusters: recent results & future prospects

G.W. Pratt

$L_x$

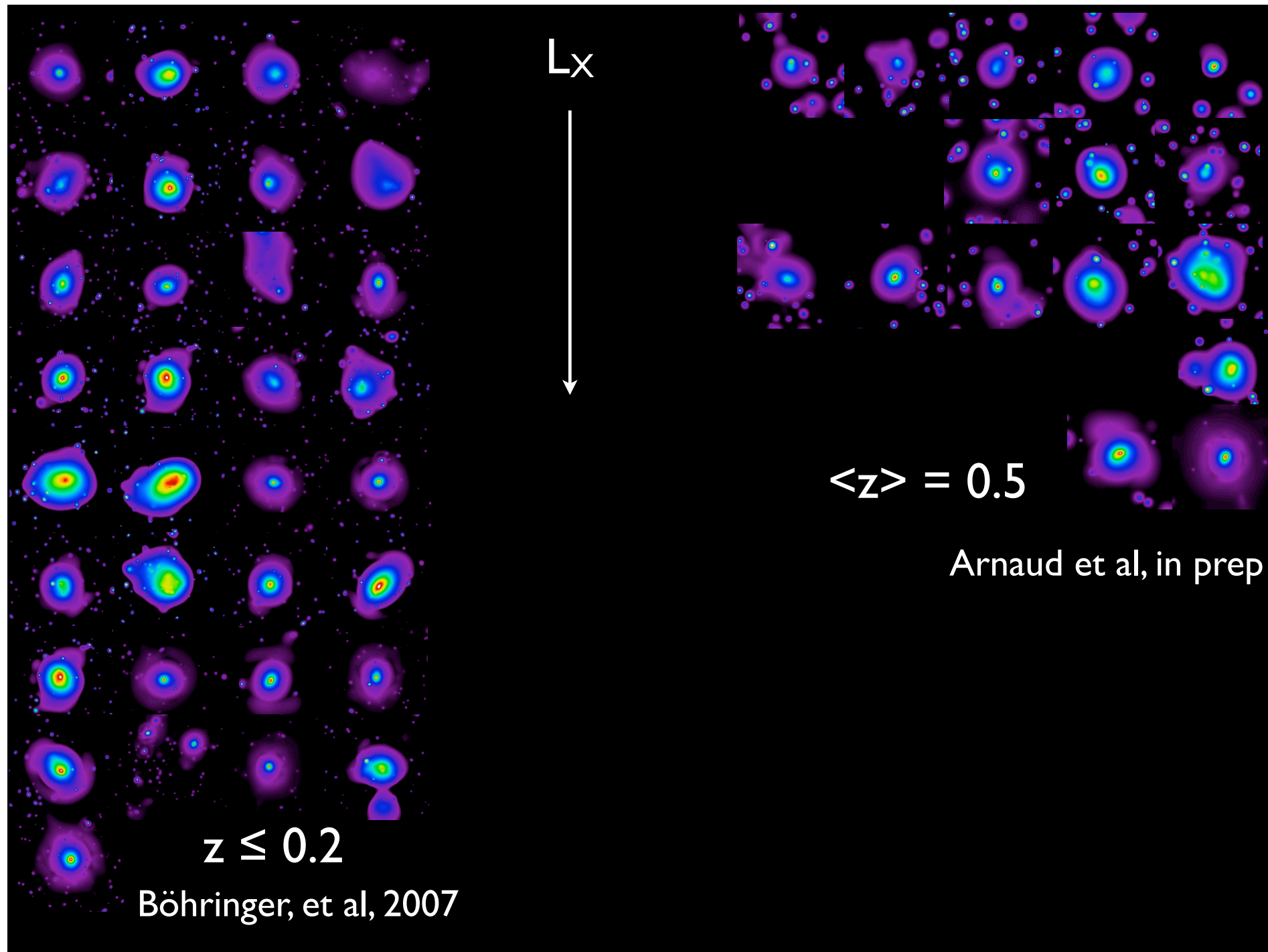


$\langle z \rangle = 0.5$

Arnaud et al, in prep

$z \leq 0.2$

Böhringer, et al, 2007



# Motivation

Test models of structure formation

Test effects of hierarchical structure buildup on ICM

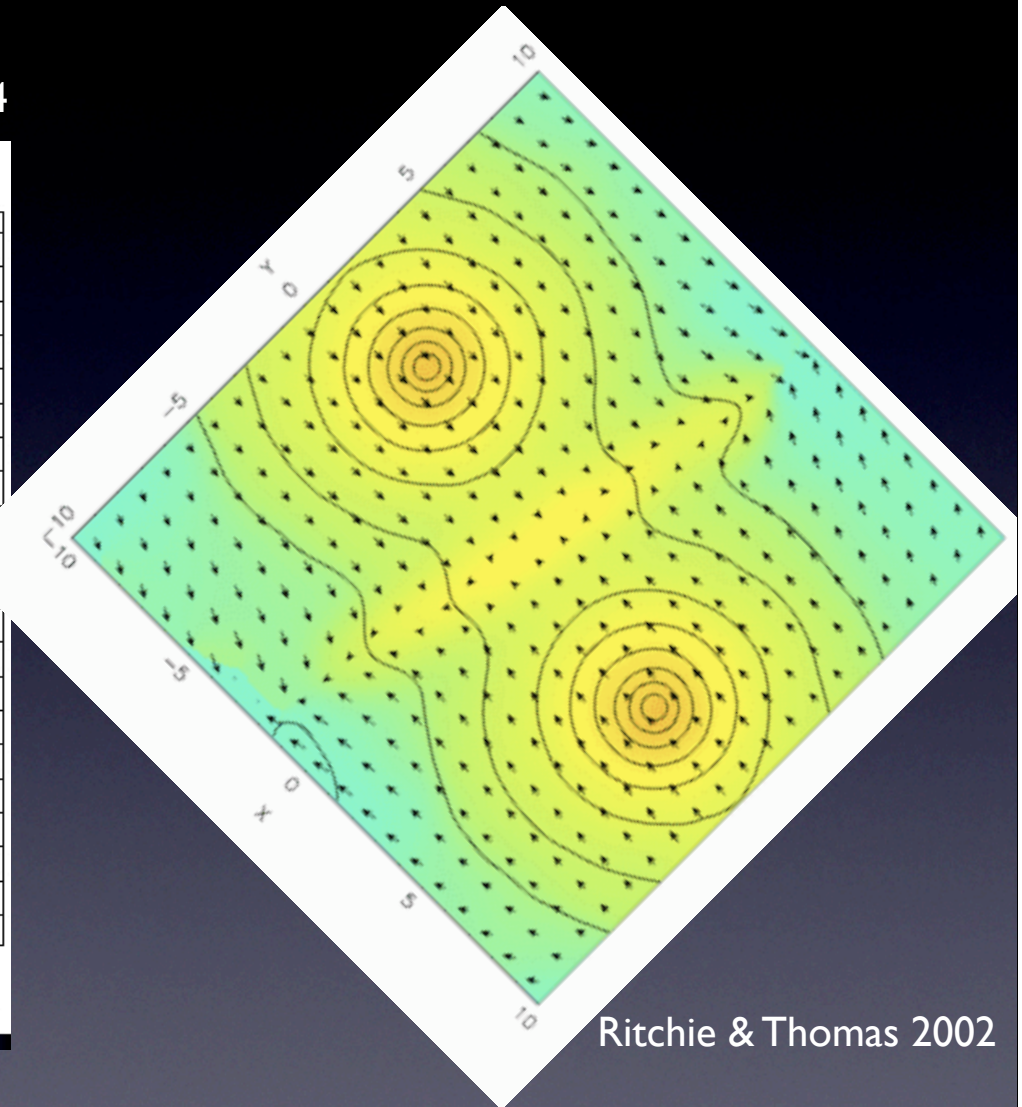
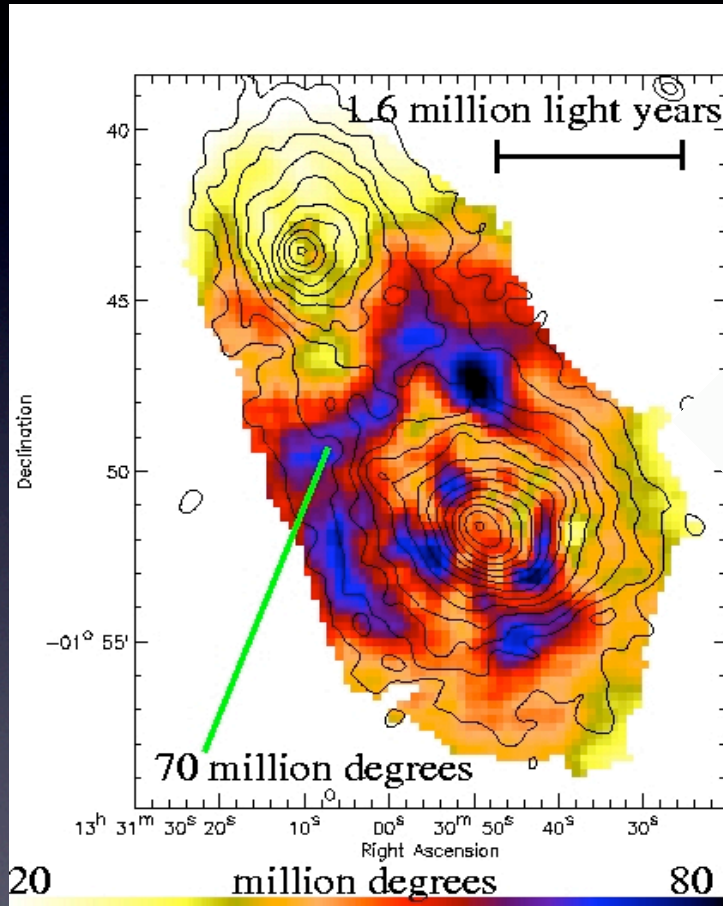
Test effects of galaxy formation on ICM

Statistical properties for cosmological applications

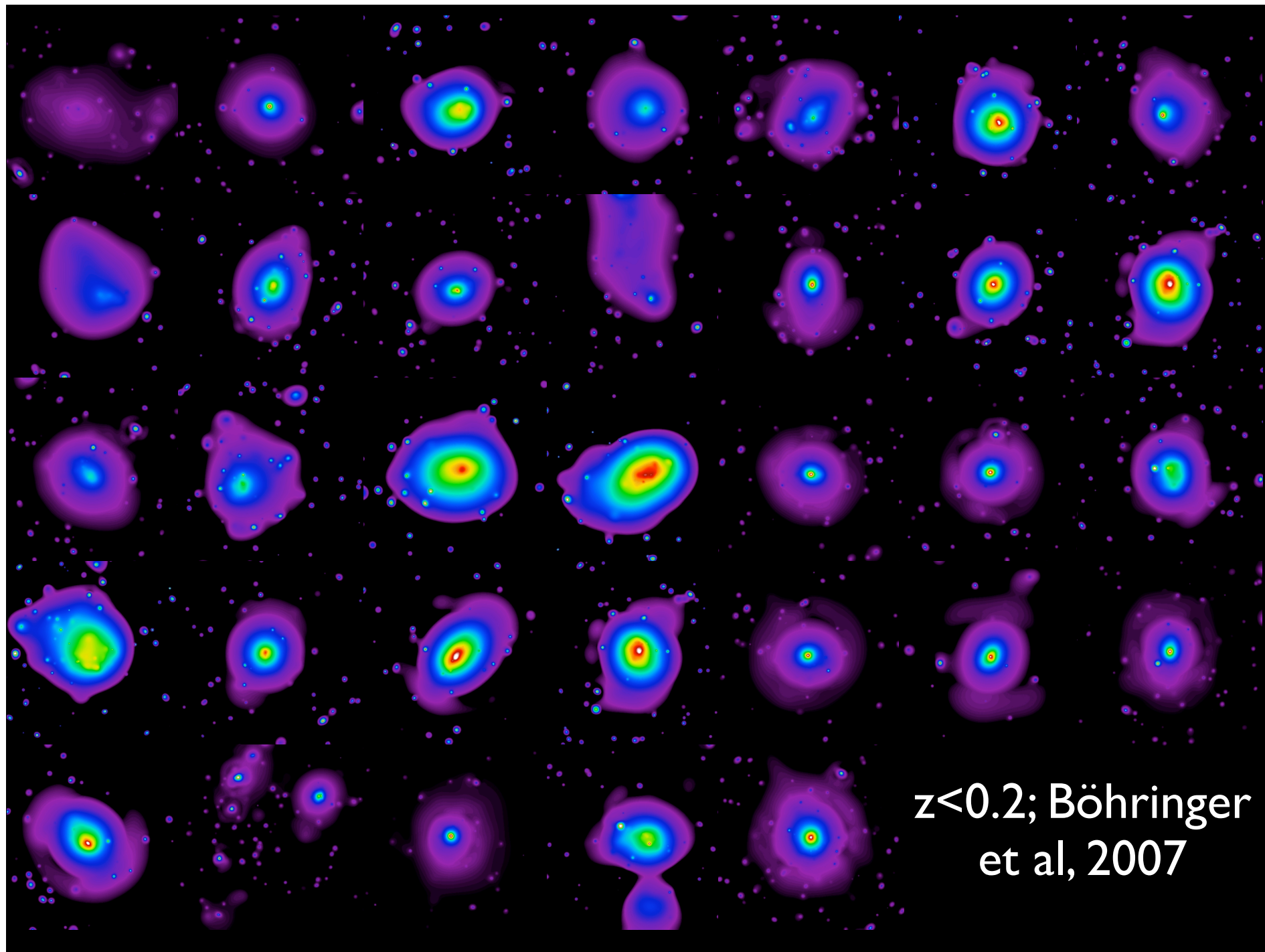


# Formation

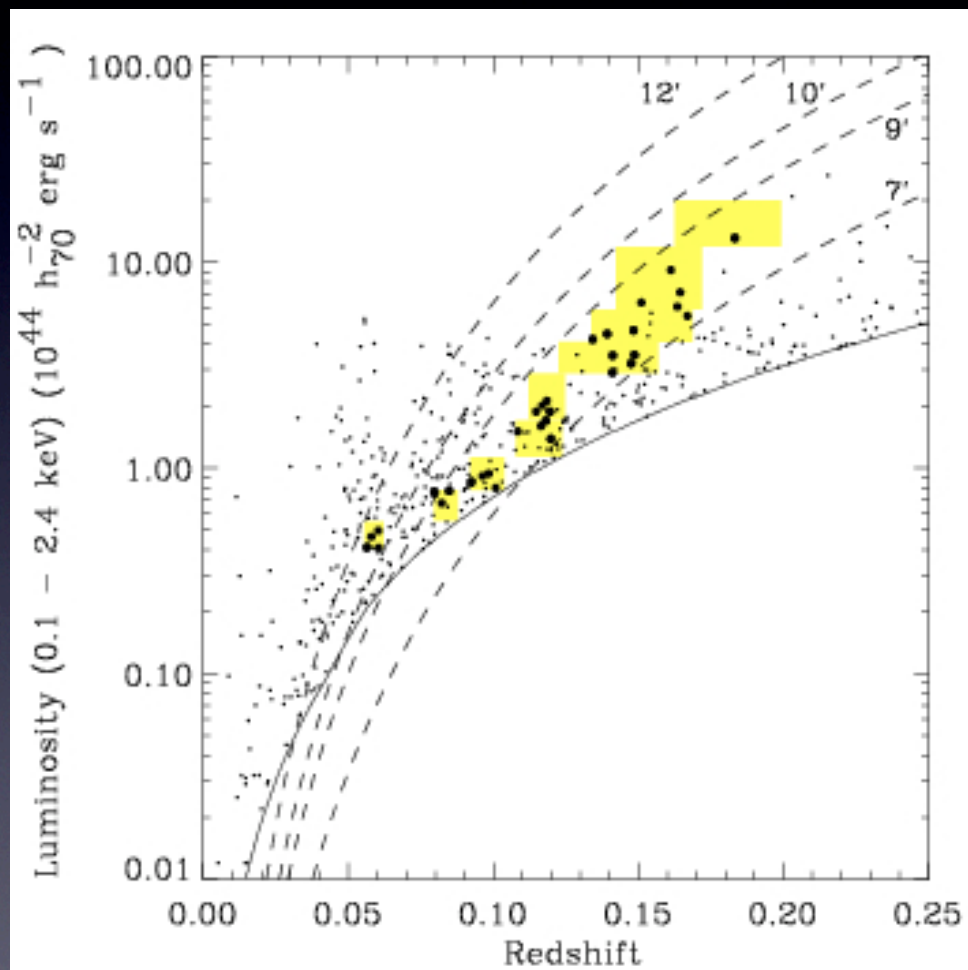
Belsole et al 2004



Ritchie & Thomas 2002



# REXCESS luminosity bins





# REXCESS: nearby LP

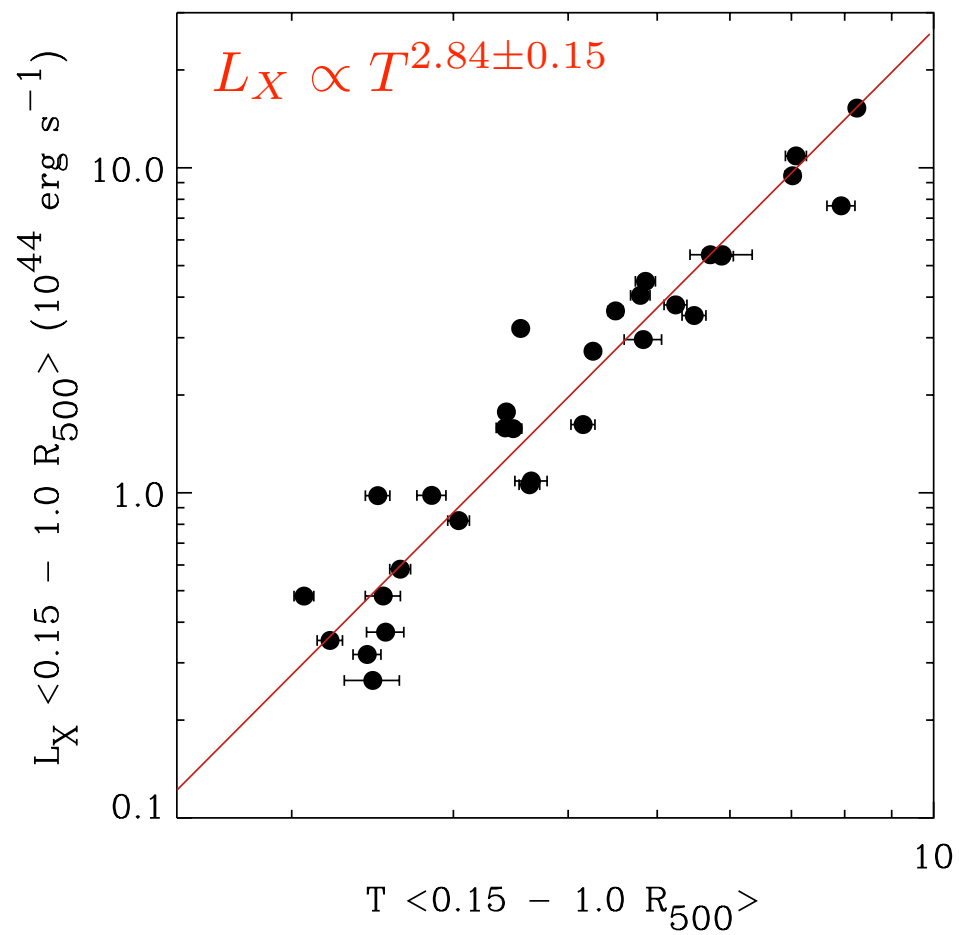
PI H. Böhringer

Analysis of 31/33 clusters (excluding A901/902 complex and RXC J2152.2-1942);  $z < 0.2$

$R_{500}$  estimated iteratively from R-T relation of Arnaud et al (2005)

Global temperatures estimated in  $0.15-1.0 R_{500}$

# Preliminary $L_X - T$

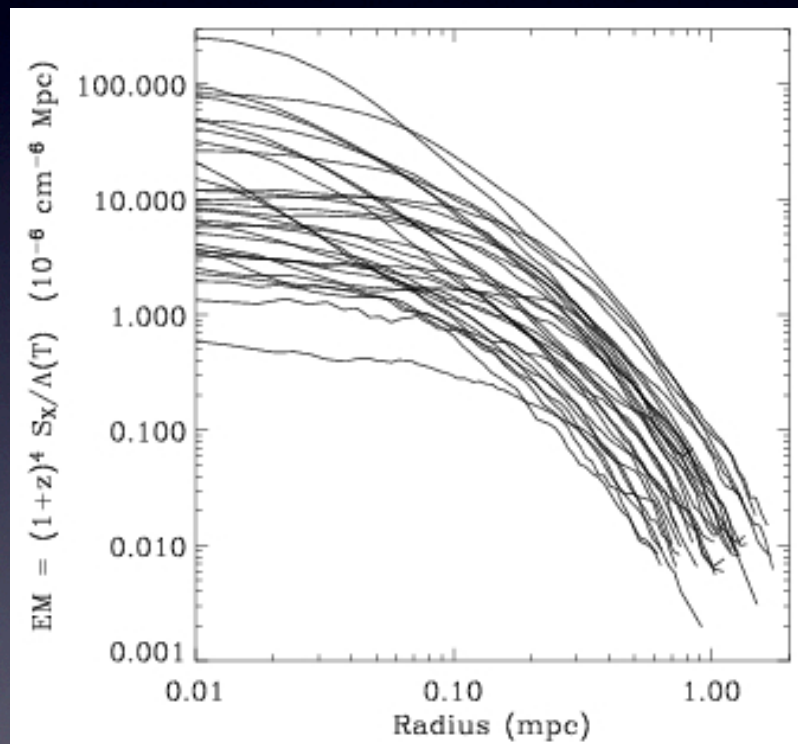




# Emission measure profiles

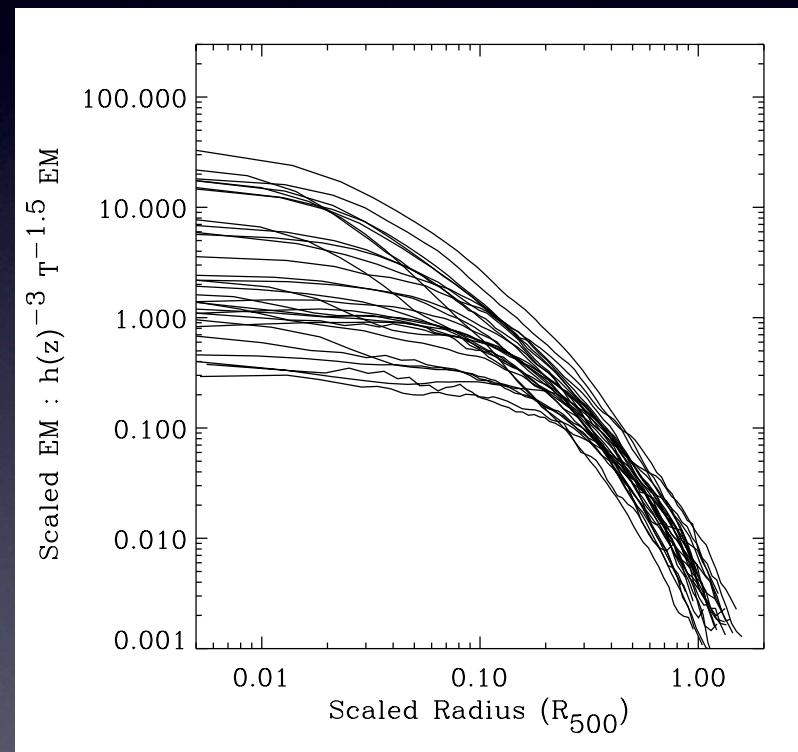
$$EM \propto \int n_e^2 dl$$

Physical units



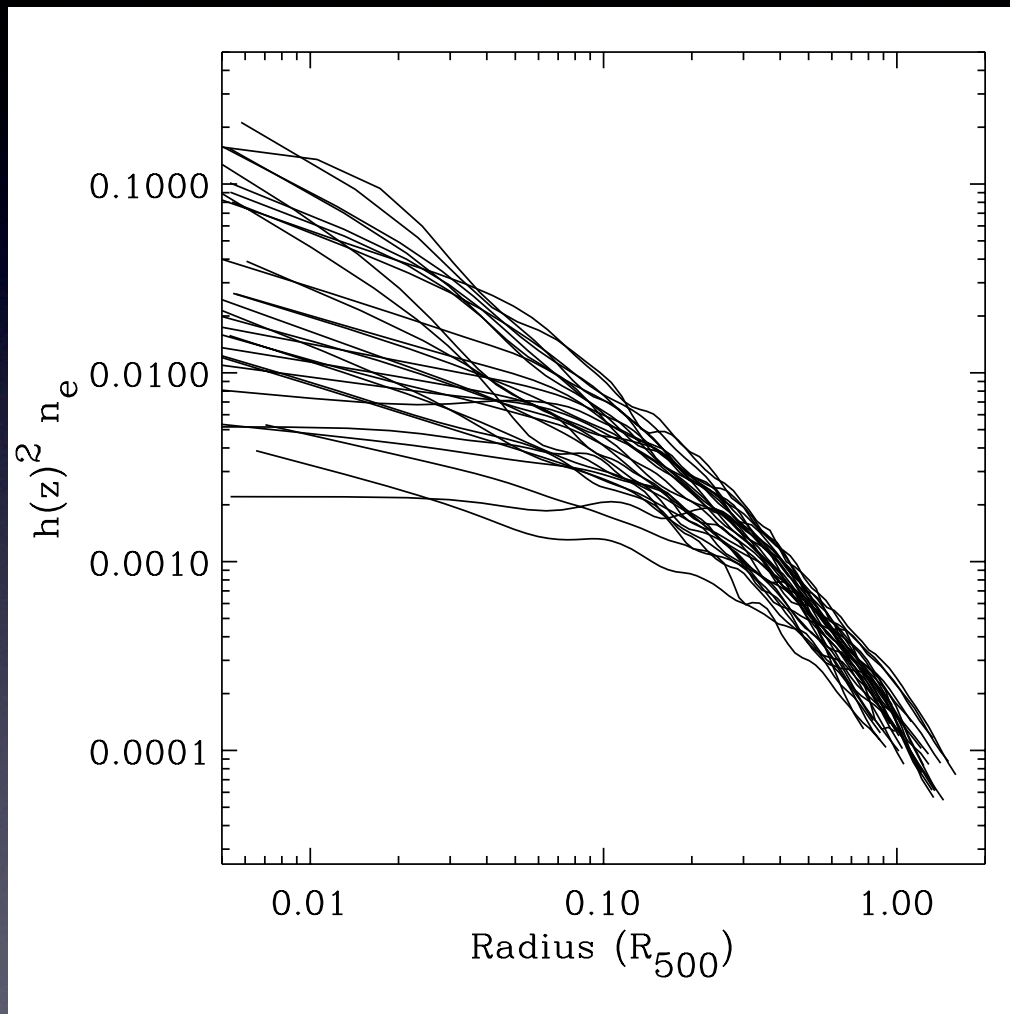
Scaled units

Croston et al, in prep

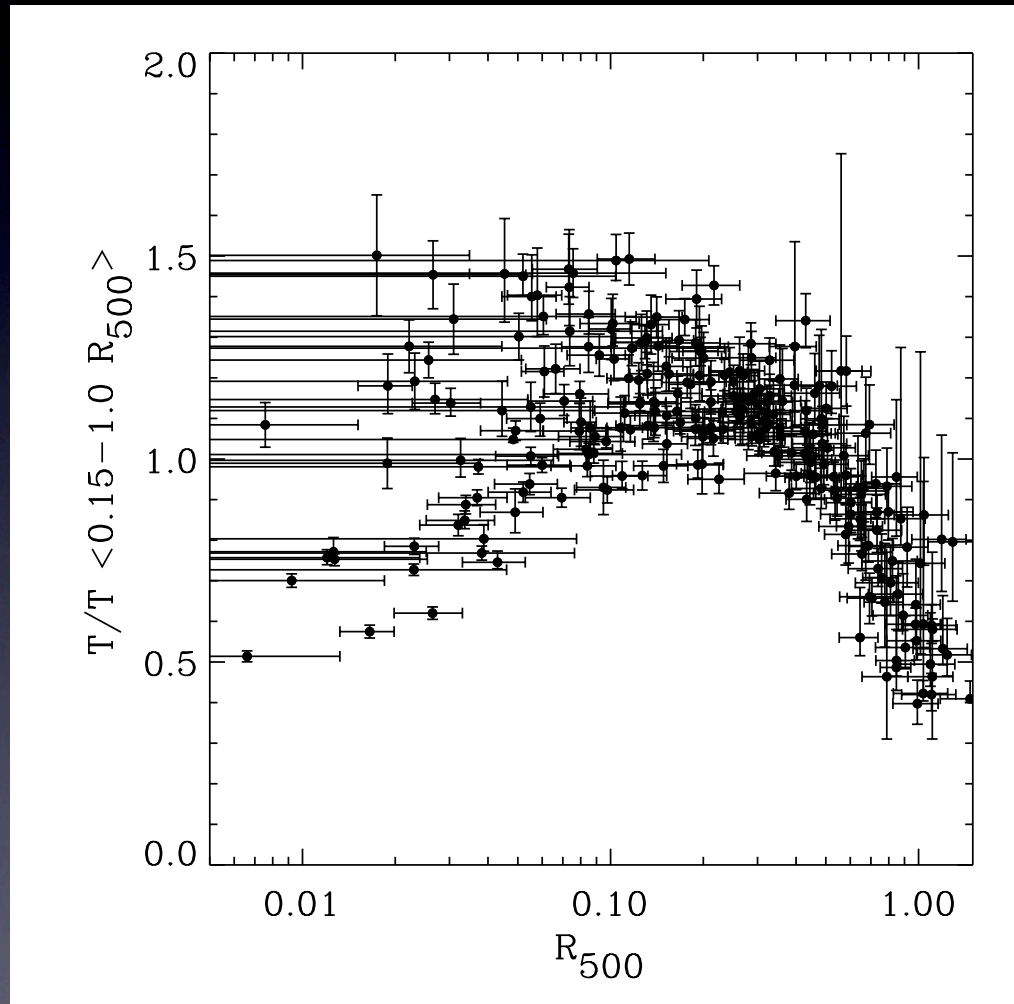


# Scaled gas density profiles

Croston et al., in prep



# Scaled (projected) temperature profiles





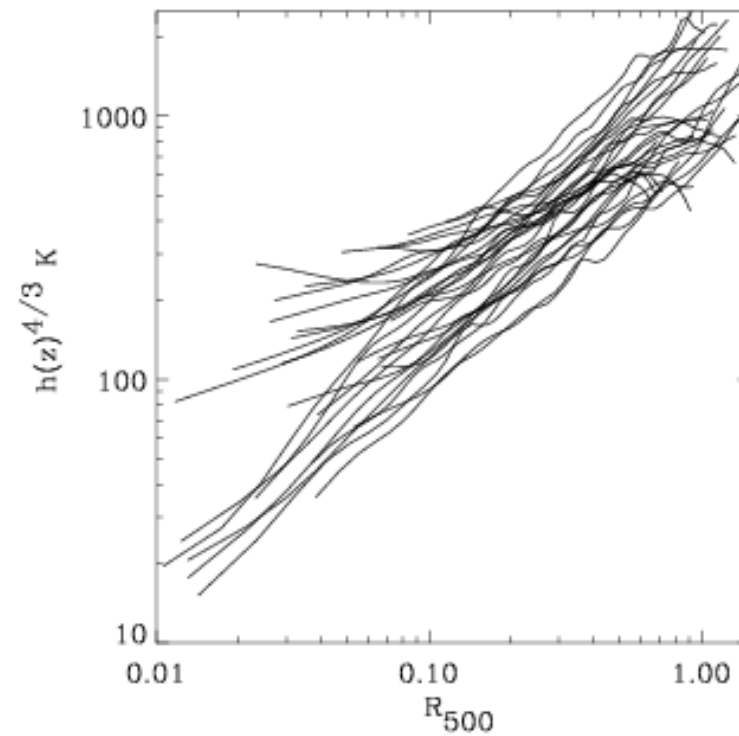
# Entropy

$$K = kT/n_e^{2/3}$$

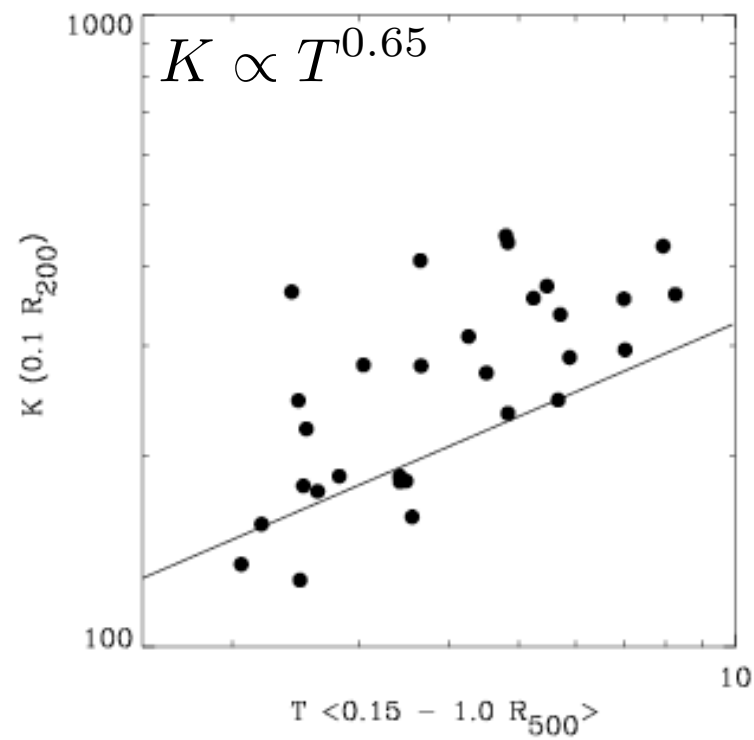
Key to the thermodynamic history of ICM

X-ray structure determined by entropy and shape of  
gravitational potential

# Entropy profiles

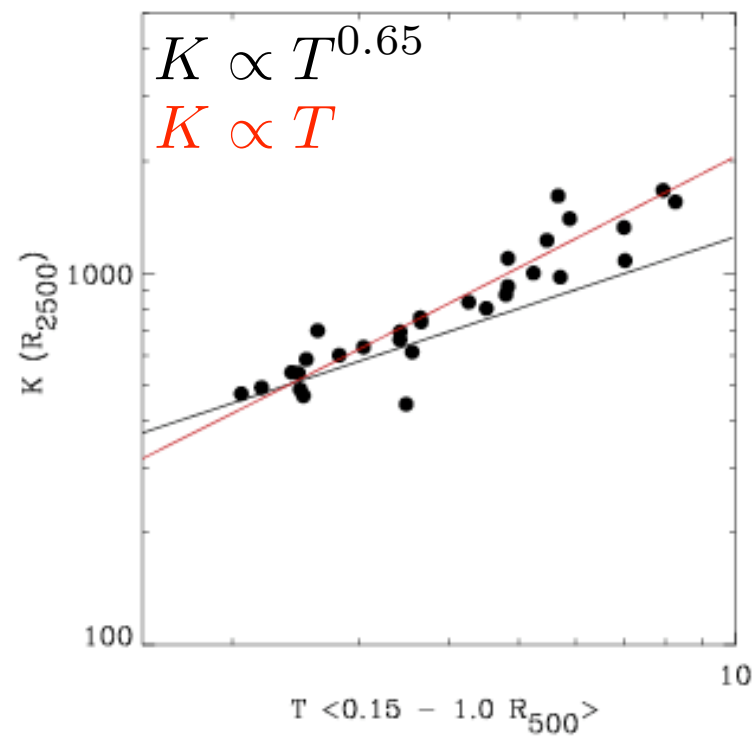


# Entropy at 0.1 R<sub>200</sub>

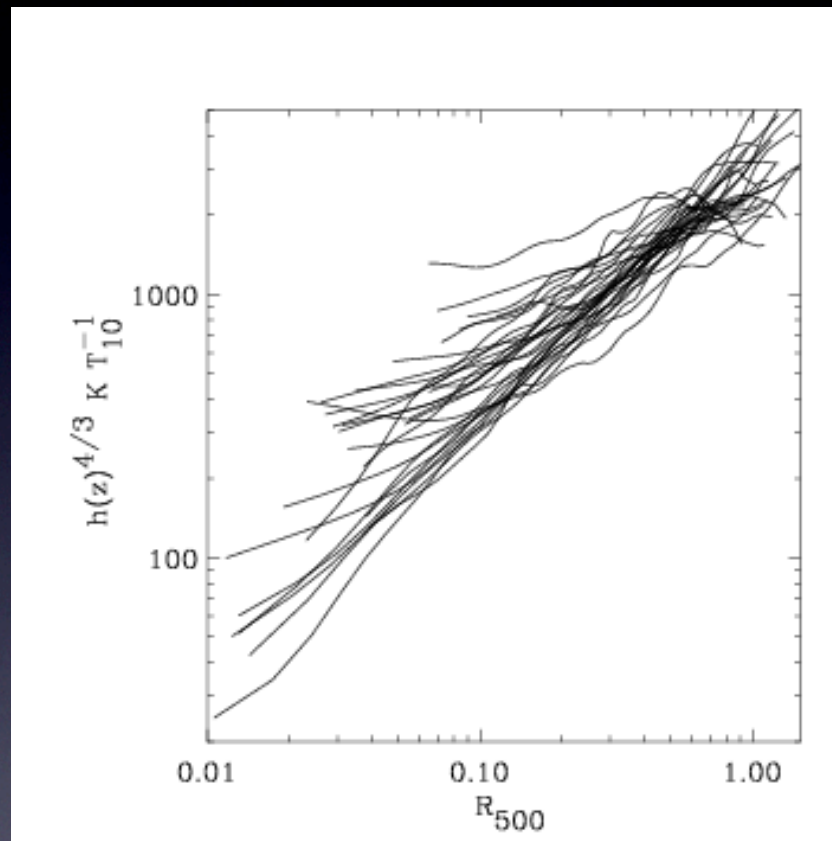


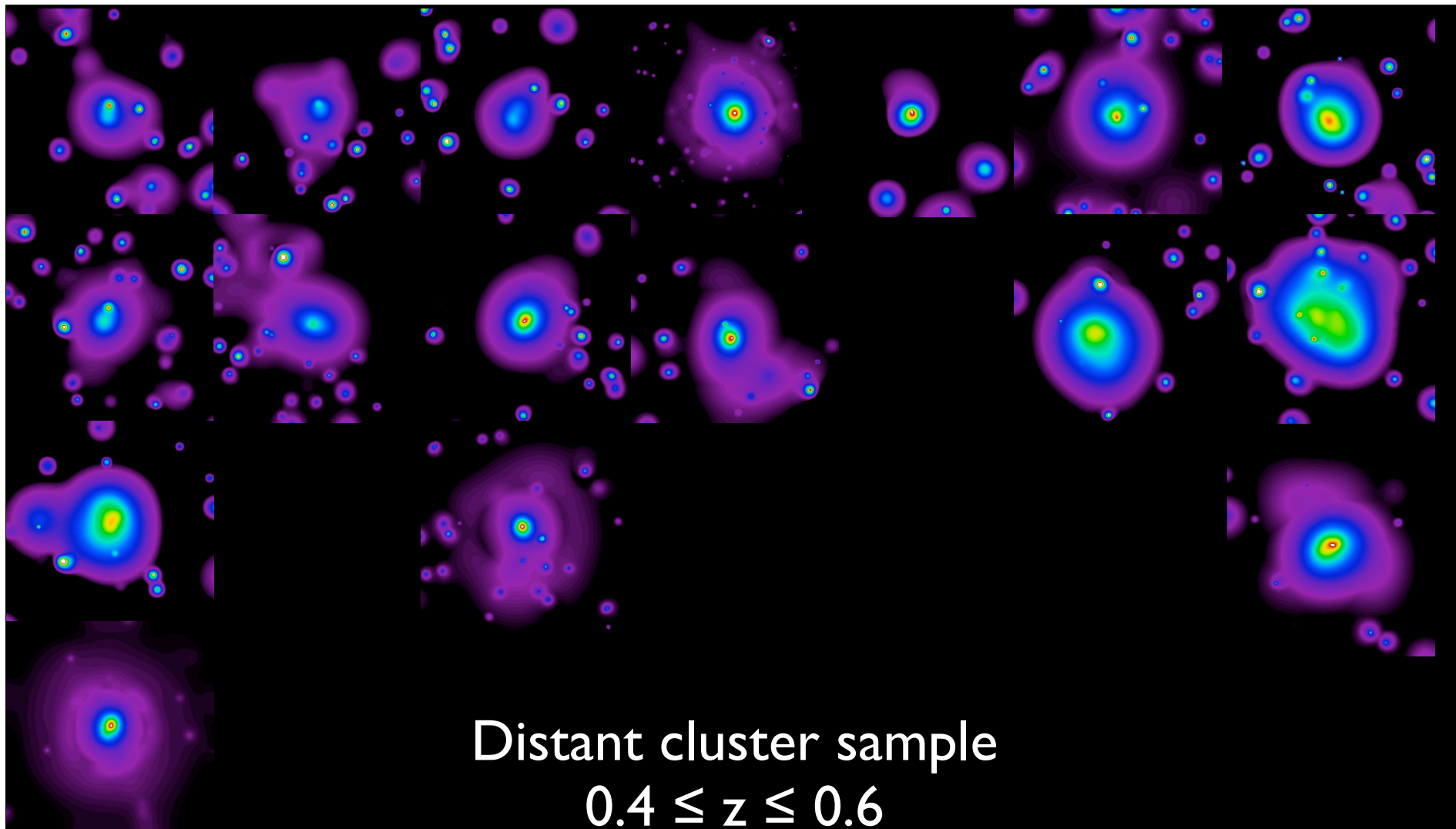


# Entropy at $R_{2500}$



# Scaled entropy profiles ( $K \propto T$ )

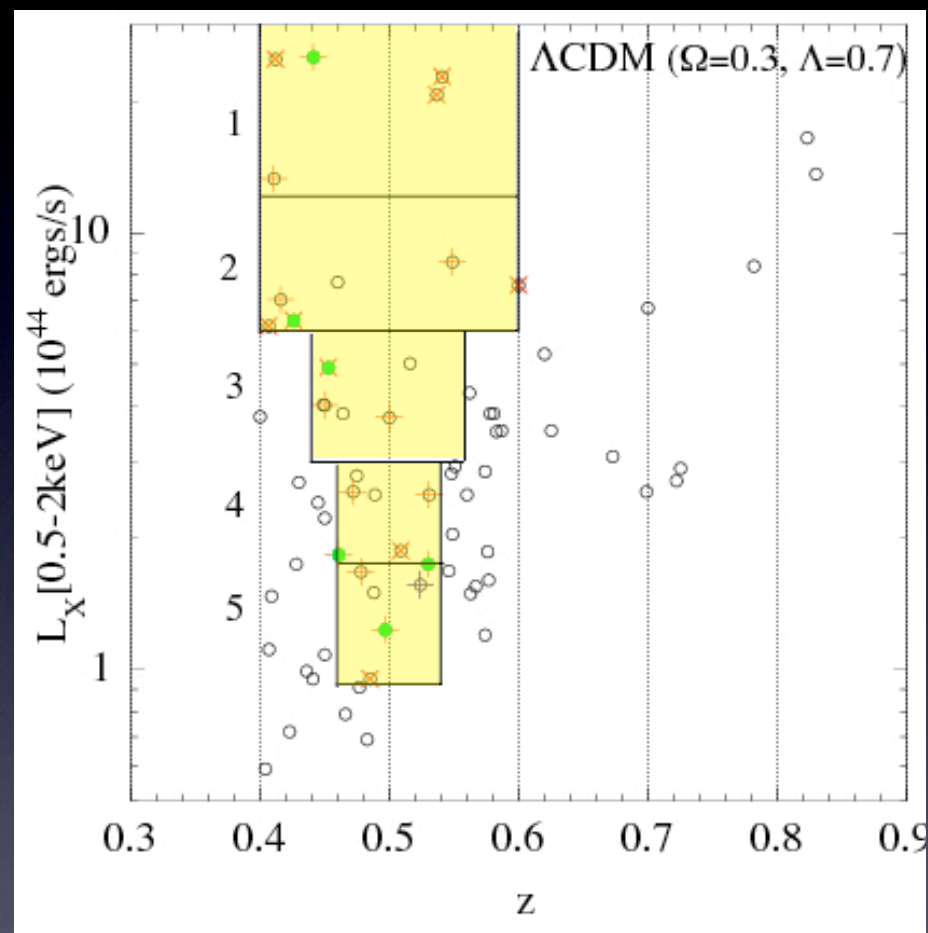




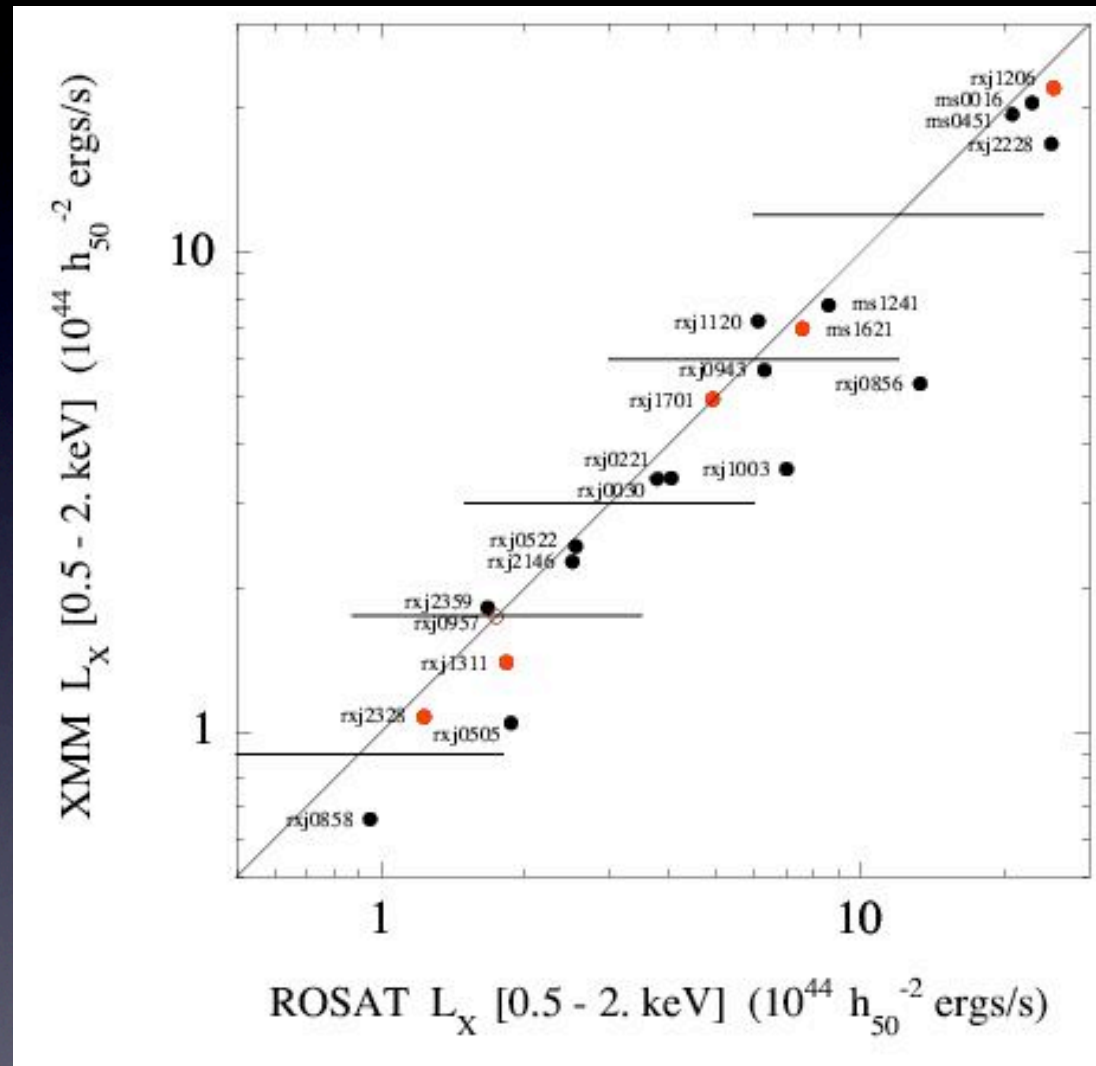
Distant cluster sample  
 $0.4 \leq z \leq 0.6$   
PI M.Arnaud



# Distant cluster sample selection

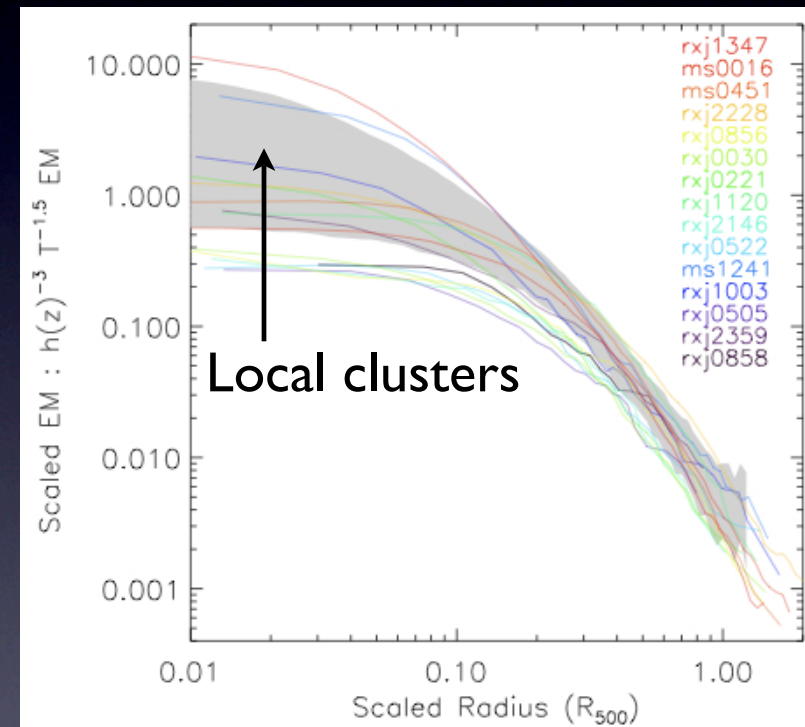
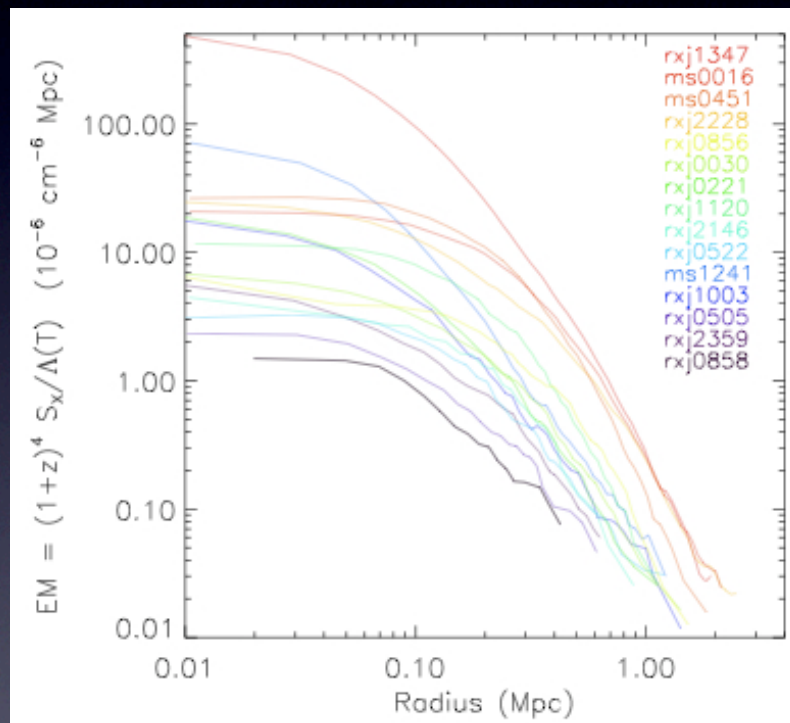


# XMM-Newton vs ROSAT luminosity



# Evolution of Emission Measure profiles standard evolution with $z$ [ $h(z)^{-3}$ ]

Arnaud et al, in prep





# Groups

Present representative samples only probe  $kT \geq 2$  keV

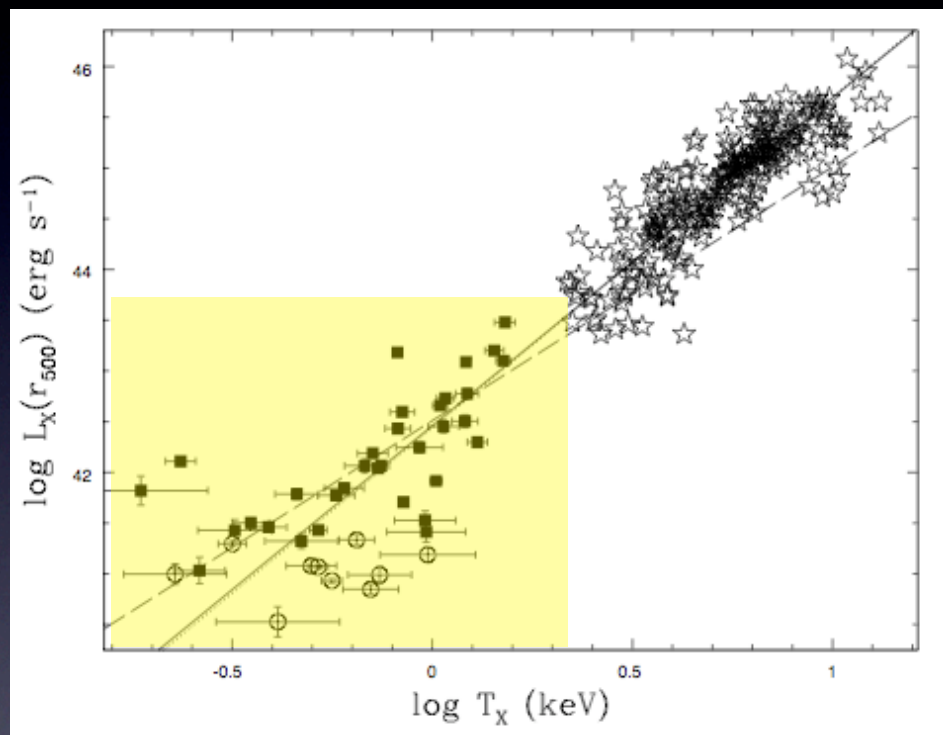
Group regime ( $\geq 0.75$  keV) is key to understanding impact of non-gravitational processes on ICM

To date no optimised ( $L_X$ -selected, FoV,  $T_{\text{exp}}$ ) group sample has been observed

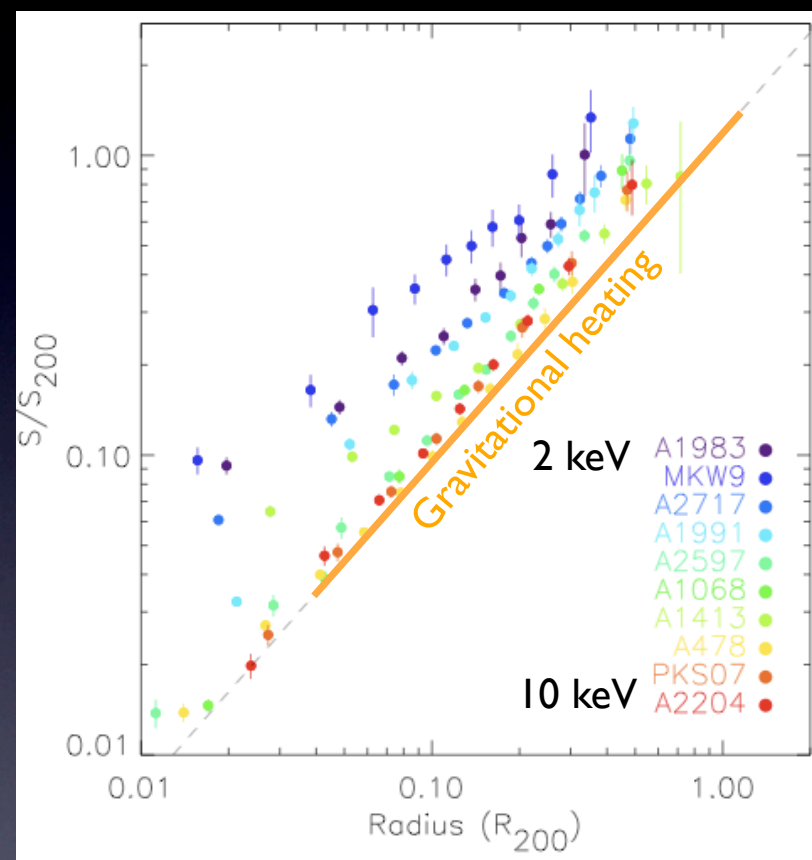
Groups do badly in TACs

It is time to devote 100ks observations to “risky” objects

# $L_X$ - $T$ , entropy excess



Osmond & Ponman 2004



GWP et al 2006

# Summary

Representative samples are key to understanding of structure formation

They are also key to unlock potential of upcoming samples of 50-100,000 clusters for precision cosmology

Current LPs are giving new insights for  $kT \geq 2$  keV

- clusters are structurally similar
- central regions are the major source of deviation from self similarity
- precise measures of scaling laws *and* scatter on horizon



Further essential insights can be gained from  
dedicated group LP with similar selection  
characteristics

Thanks

E. Pointecouteau

J. Croston

H. Böhringer

M. Arnaud

# Scaled EM profiles

