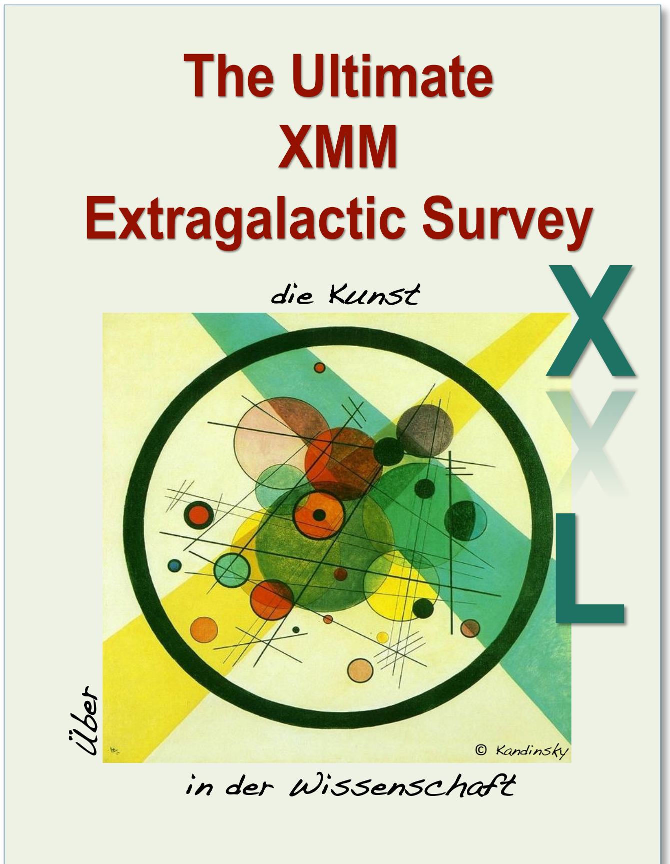
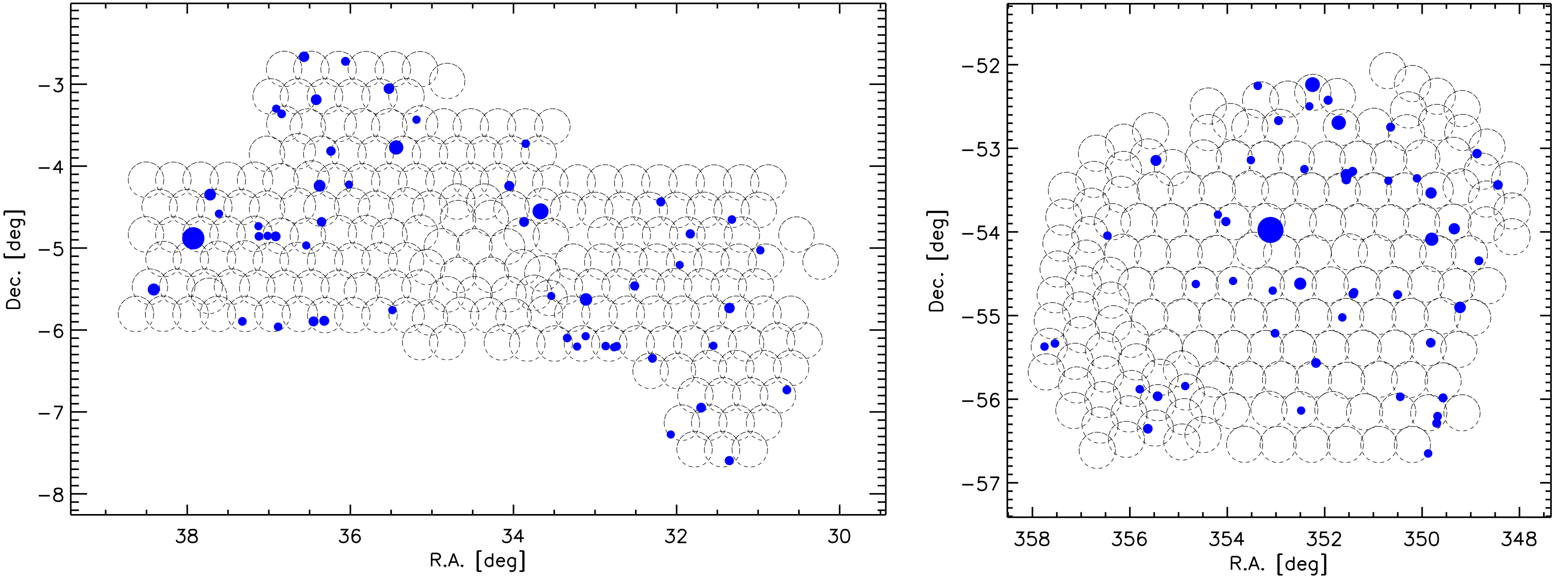
What we are learning about distant clusters in XXL

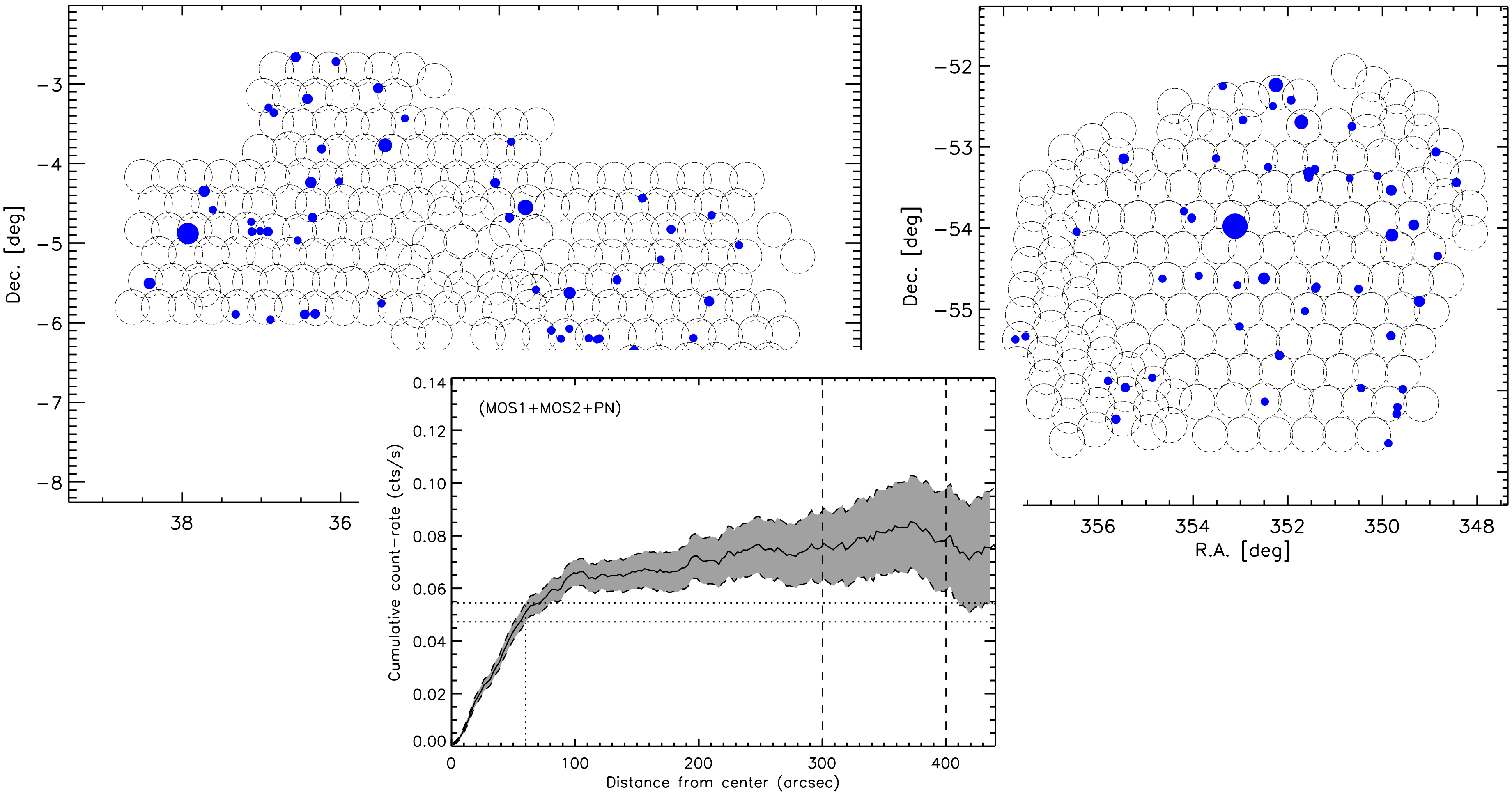


- B. Maughan (Bristol)
- F. Pacaud (Bonn)
- K. Husband (Bristol)
- J. Willis (Victoria, CA)
- M. Bremer (Bristol)
- M. Pierre (CEA Saclay)
- And many more….

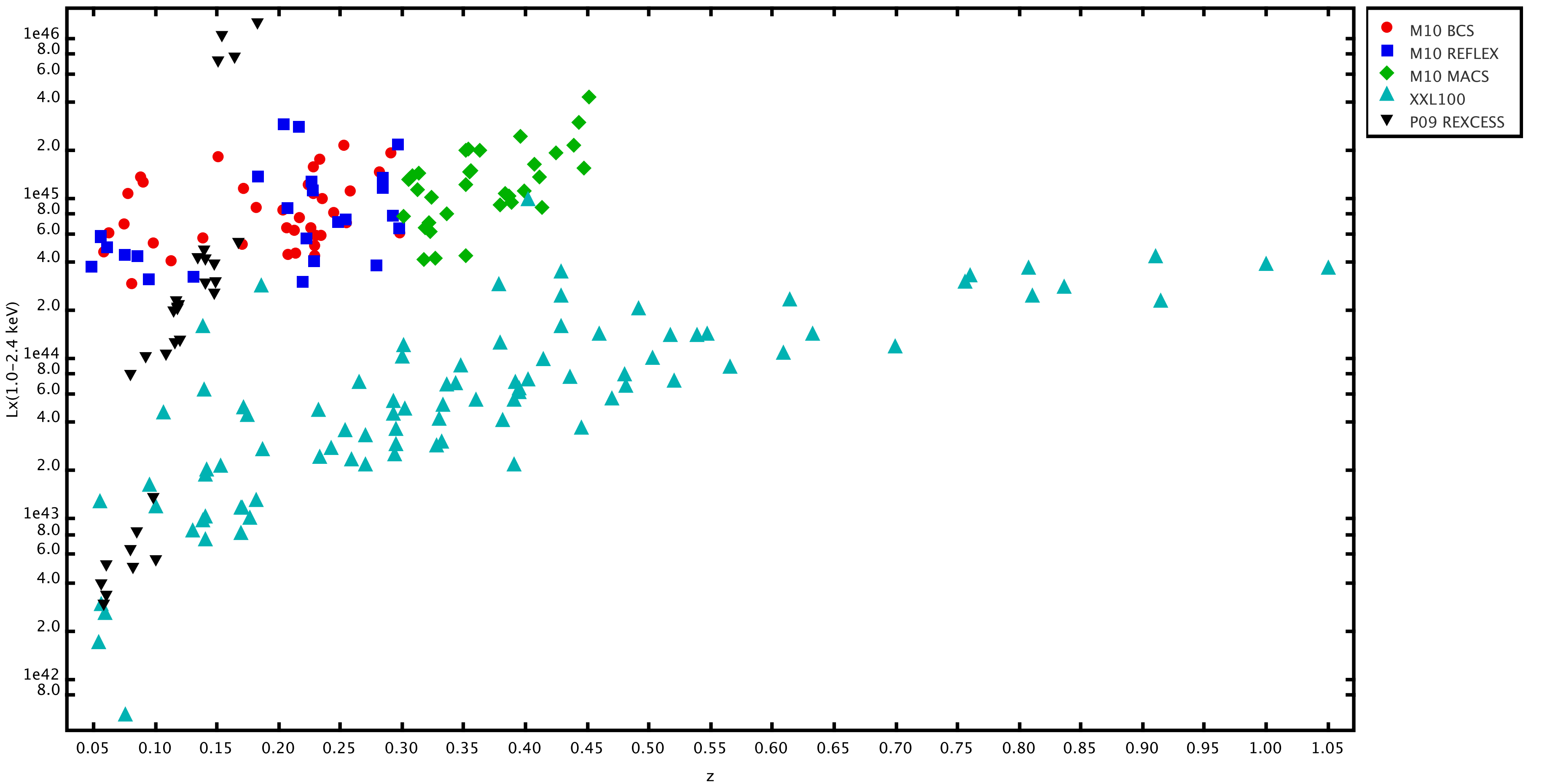
The XXL Survey



The XXL Survey



The Bright Cluster Sample



Why scaling relations?

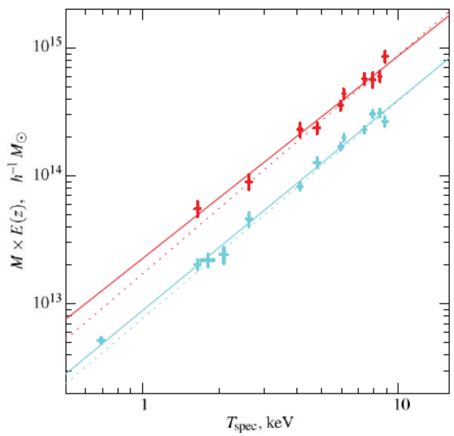
- In gravity only models, assuming clusters are self similar, simple scaling laws can be derived between various cluster properties

- Advantageous as they provide a cheap way of measuring cluster mass, important ingredient for cluster cosmology

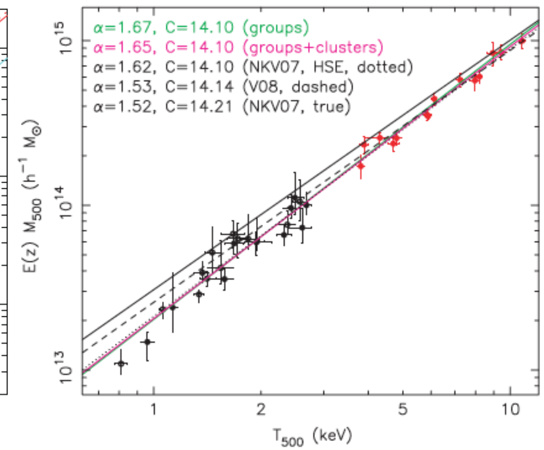
- LT relation is relatively simple to measure, provides insight into cluster formation history

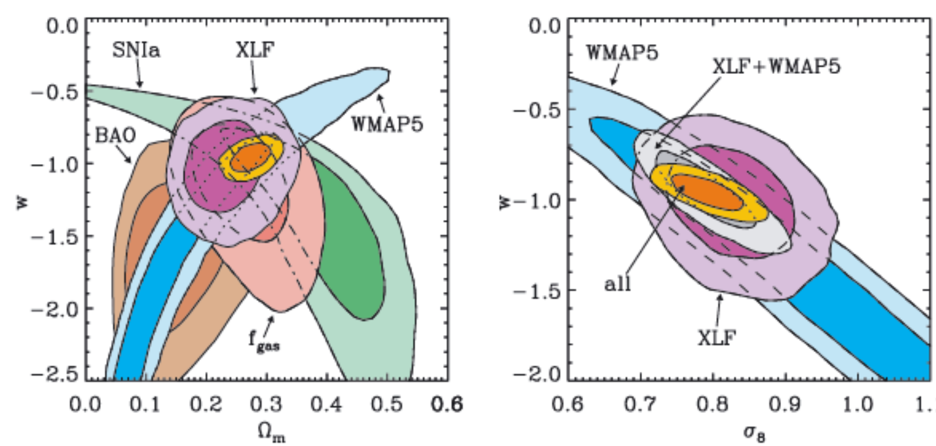
- Evolution given by $E(z)^{\gamma}$ (for SS $\gamma = 1$). Recent evidence for weaker than SS evolution (Pacaud+07, Reichert+11, Clerc +12,14, Hilton+12)

Vikhlinin+06



Sun+09





Mantz+10

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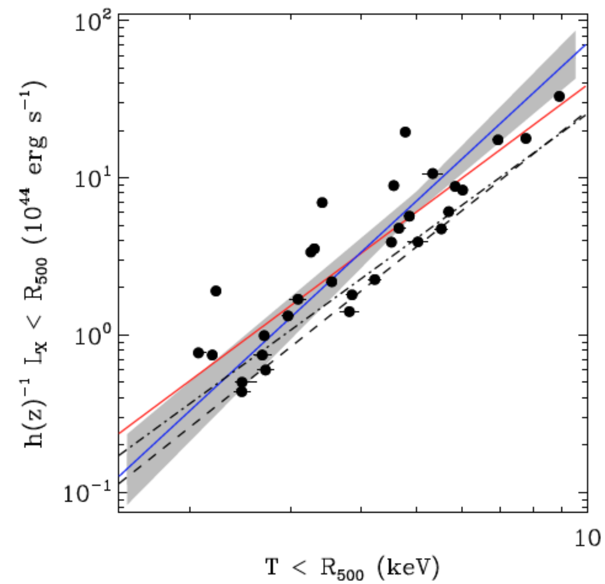
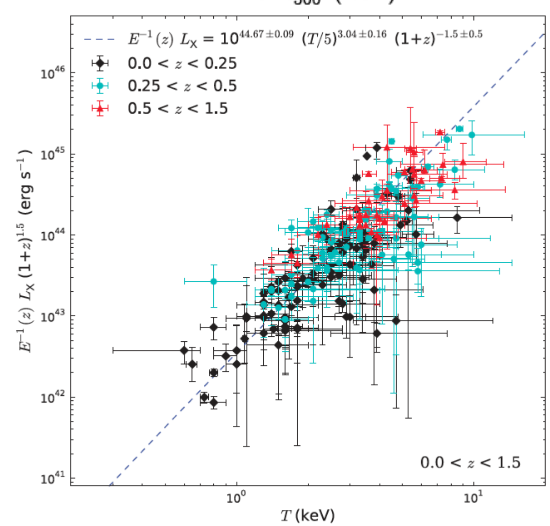
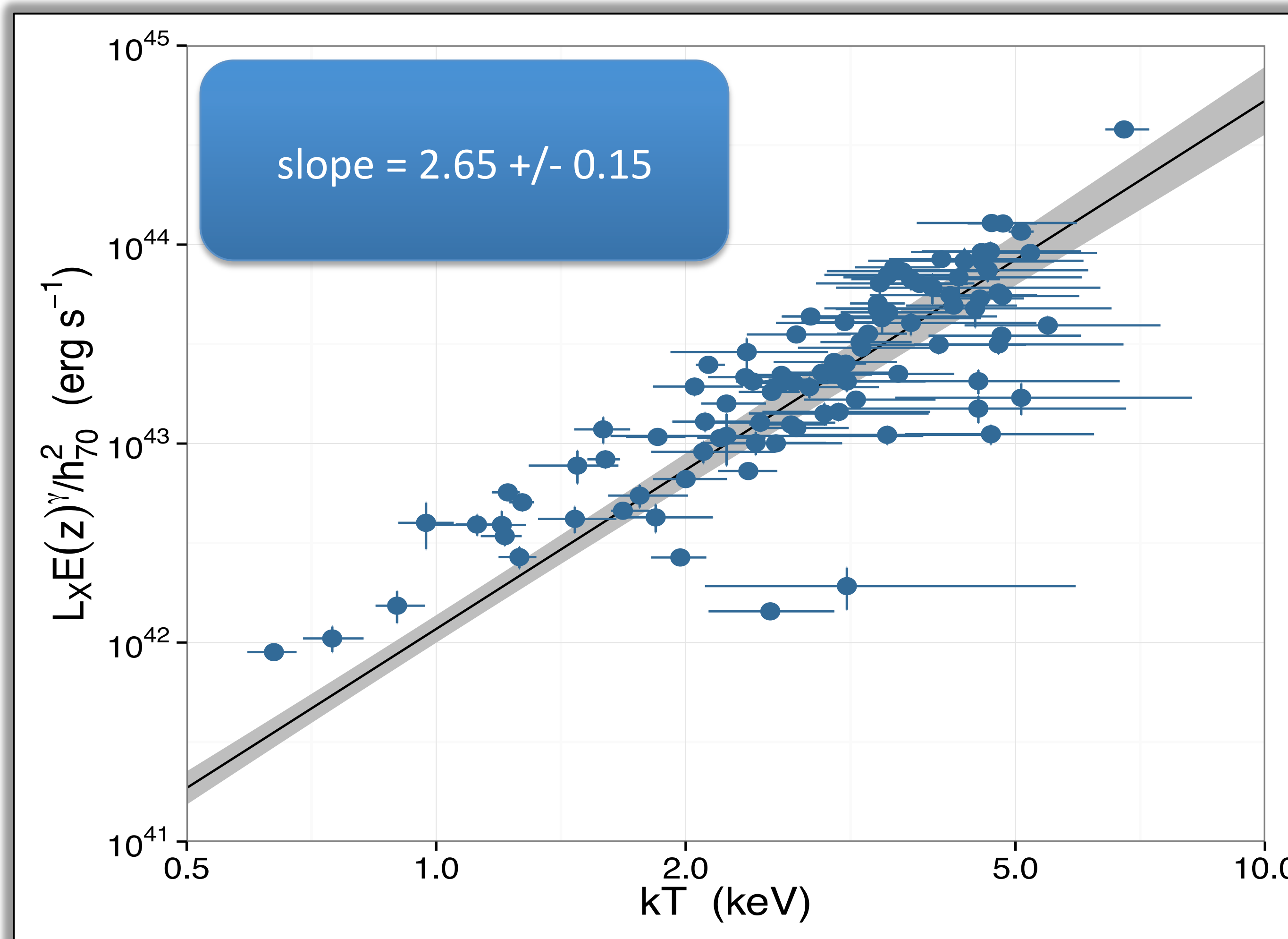


Pratt+09



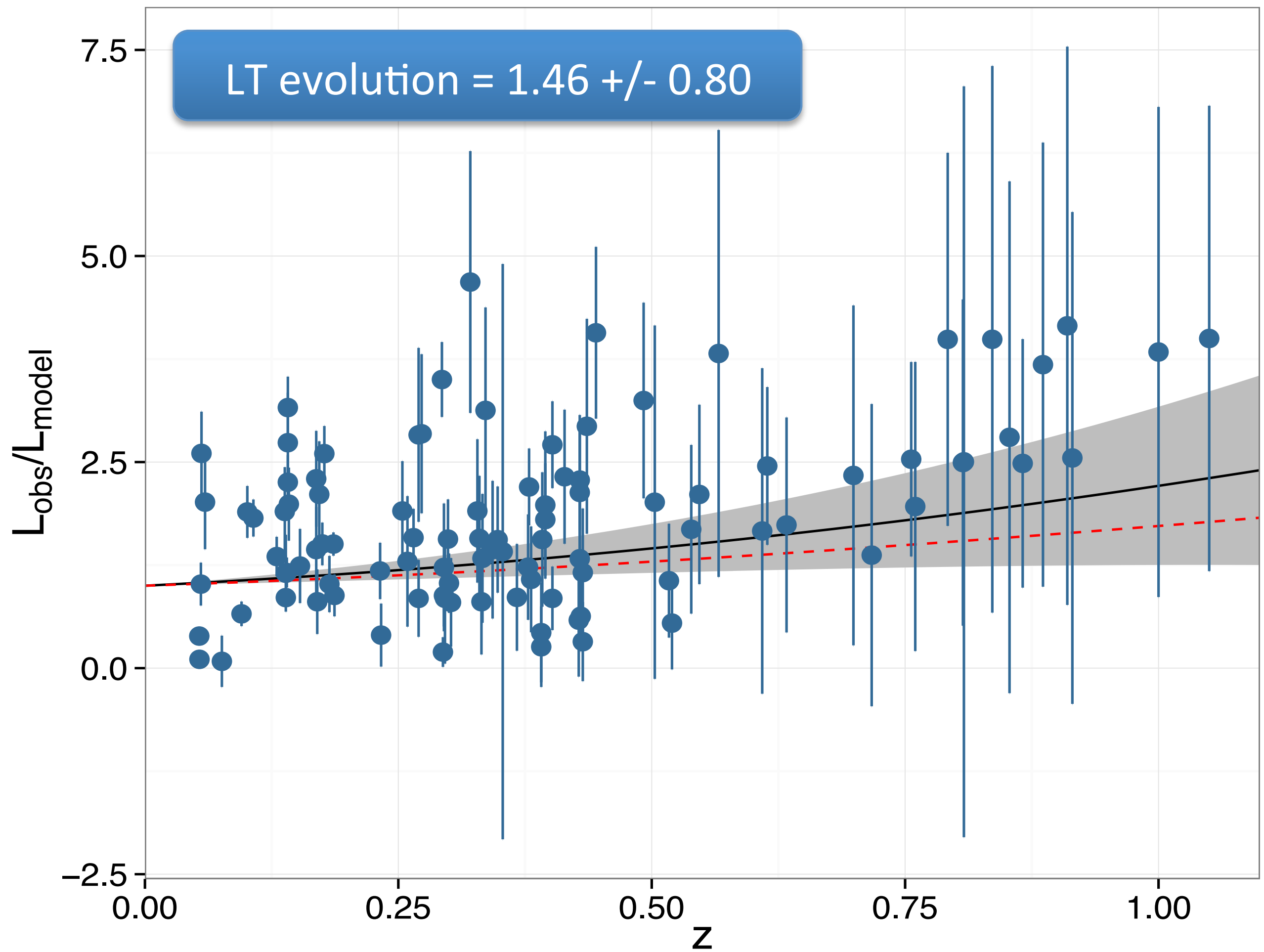
Hilton+09

L_{XXL} – T relation (bias corrected)



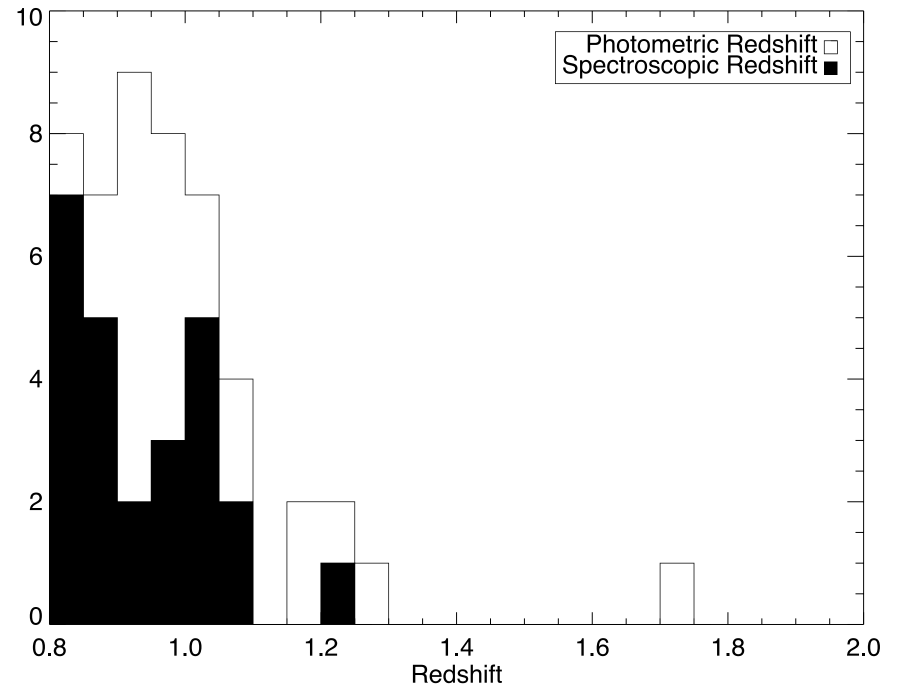
L_{XXL} – T evolution

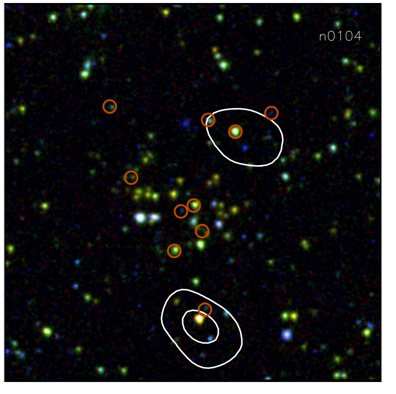
- Clerc+ 14 find γ_{LT} = -2.5 +/- 0.4, assuming relation evolves as $E(z)(1 + z)^{\gamma LT}$
- Role of cool cores
  - CC evolution
  - Survey volume
- Currently testing evolution with simulations, applying algorithm and selection function, to constrain feedback models

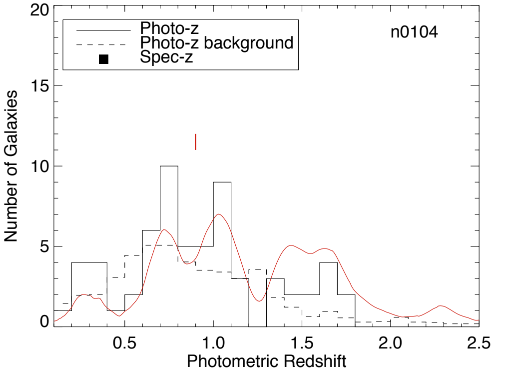


High-z clusters in XXL

- 27 confirmed z>0.8 clusters in XXL
- 33 'good' candidates at z>0.8
- Sharp drop off of confirmed clusters above z=1.1: physical, sensitivity?
- Simulations indicate many of the high-z clusters are superpositions along the line-of-sight. Supported by observations, e.g. JKCS041 (Andreon+09) at z=1.8, has foreground contamination.



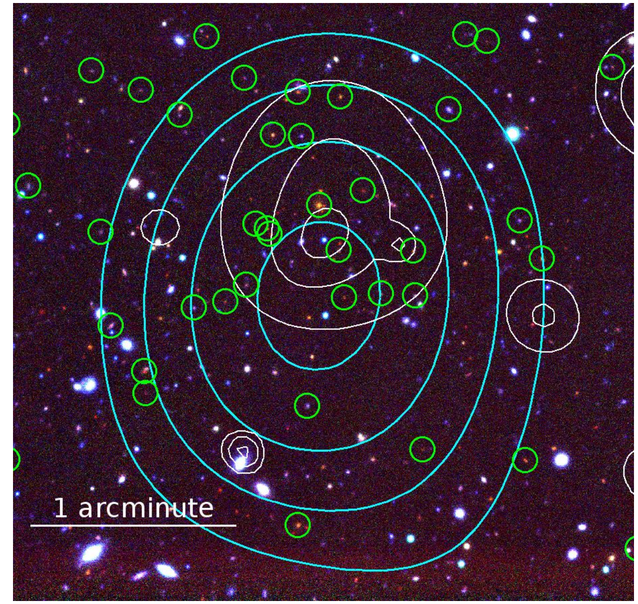


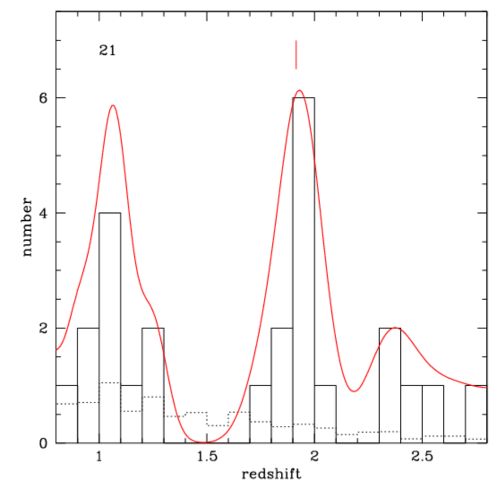


High-z clusters in XXL

- Standout cluster: XLSSU J0217-0345 (Mantz+ 14) at $z_{phot} \approx 1.9$.

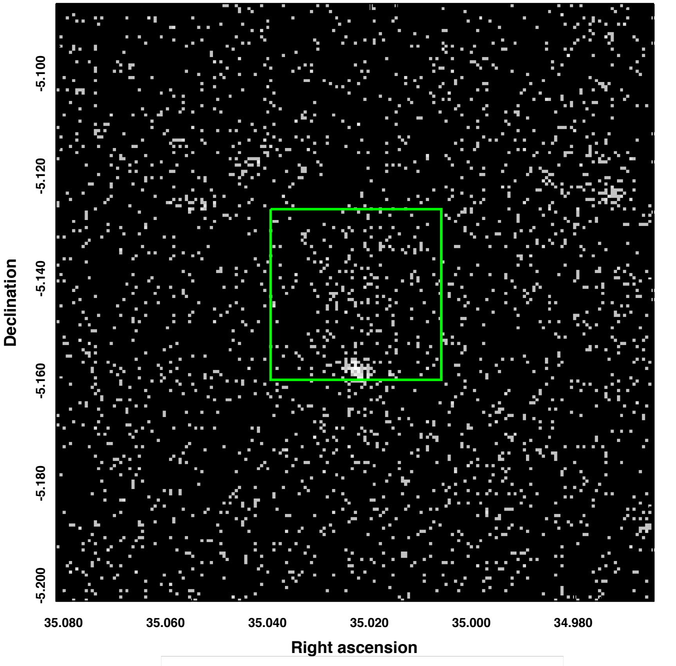
- A comparison to clusters from 21 XMM-LSS clusters (Willis+13) to SpARCS, show that distant X-ray selected clusters are a dynamically relaxed subset of the massive cluster population (Willis, in prep)

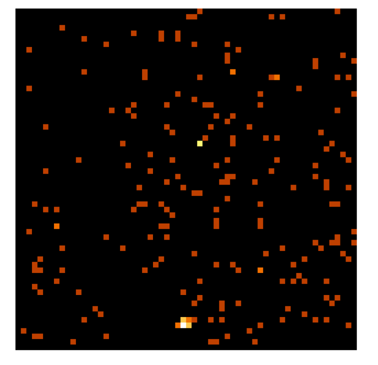




AGN contamination in high-z clusters

- Undergoing a study utilising Chandra snapshot observations of high-z (z>1.0) XXL clusters to determine AGN contamination
- Needed when Athena is launched:
  - A mission with Chandra like resolution
  - Other multi-λ methods to statistically subtract AGN contamination
  - Restrict to confirmed clusters





What have we learned…

- We find the evolution of the LT relation consistent with SS
  - Best measurement so far
  - Observer friendly evolution
- XXL survey is finding many high-z clusters
  - Sharp drop-off at z>1.1
  - Superpositions
- AGN contamination is an important issue at high-z
  - This will be a concern for ATHENA, but we are addressing this in XXL