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LoCuSS
Local Cluster Substructure Survey

Weak Lensing Mass – IR Luminosity Scaling Relation for Galaxy Clusters

Herschel Symposium 2013

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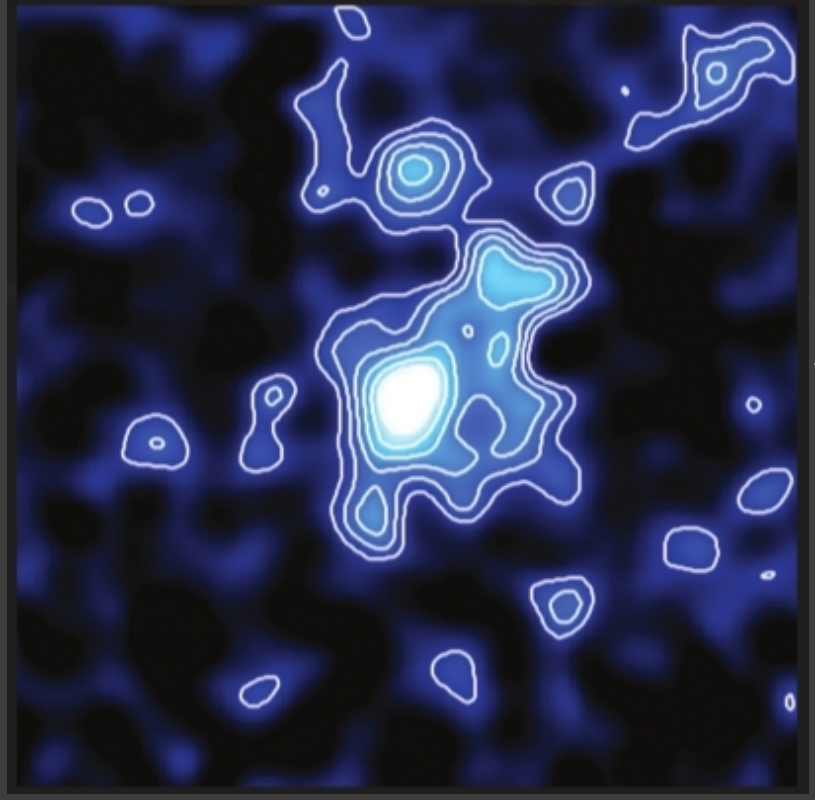
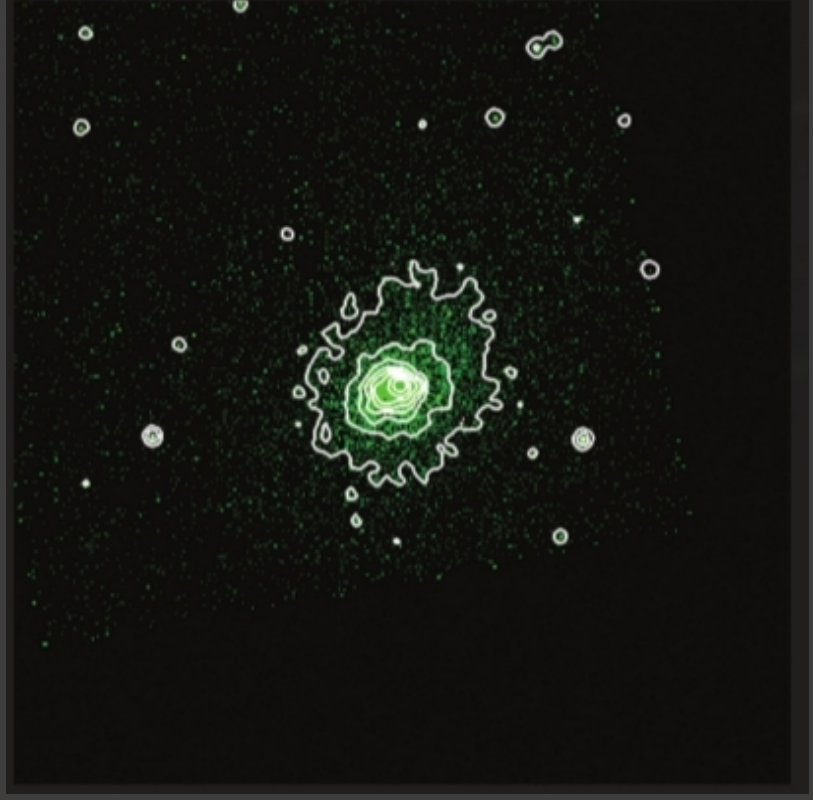
Overview

- Cluster Physics and Motivations
- LoCuSS, Sample and Data
- IR luminosity calculation
- Results
- Plans for the future

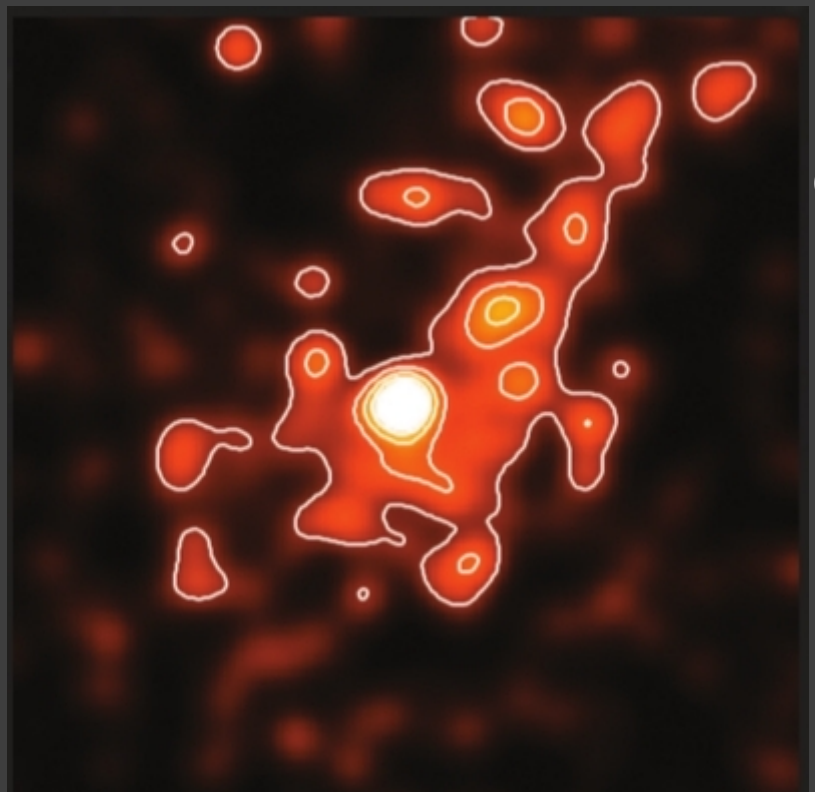
Abell 0209



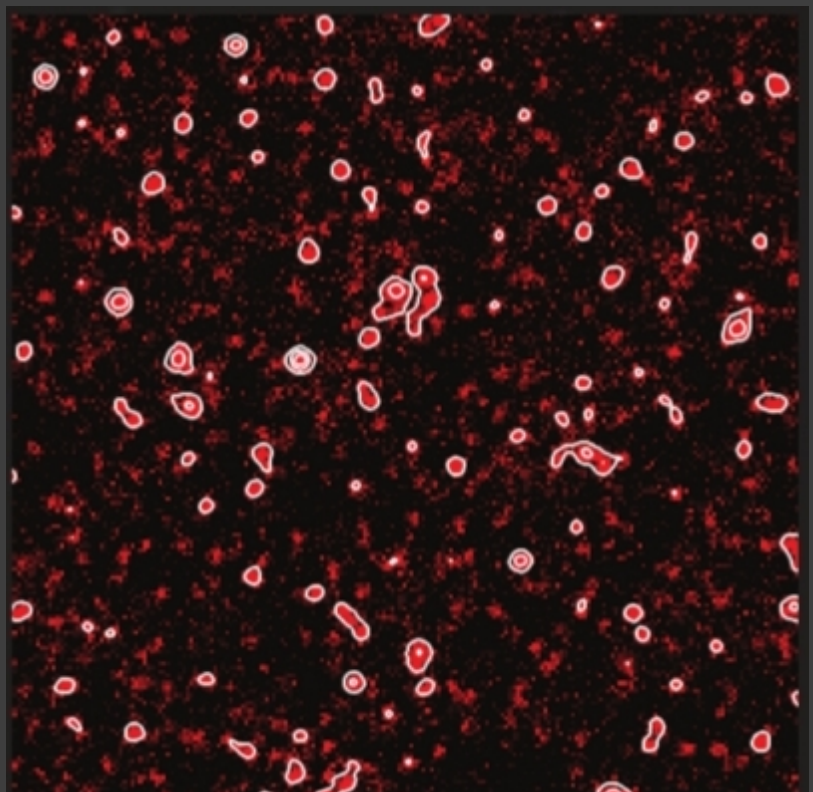
WL mass map – optical Subaru



Hot gas - X-ray Chandra

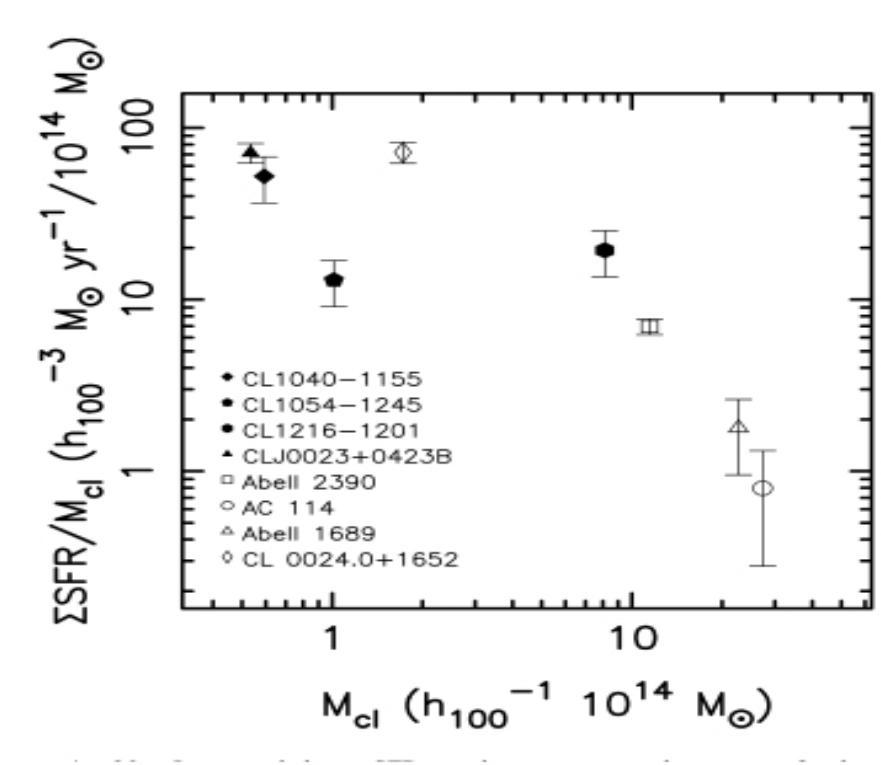


Old stars - K band UKIRT

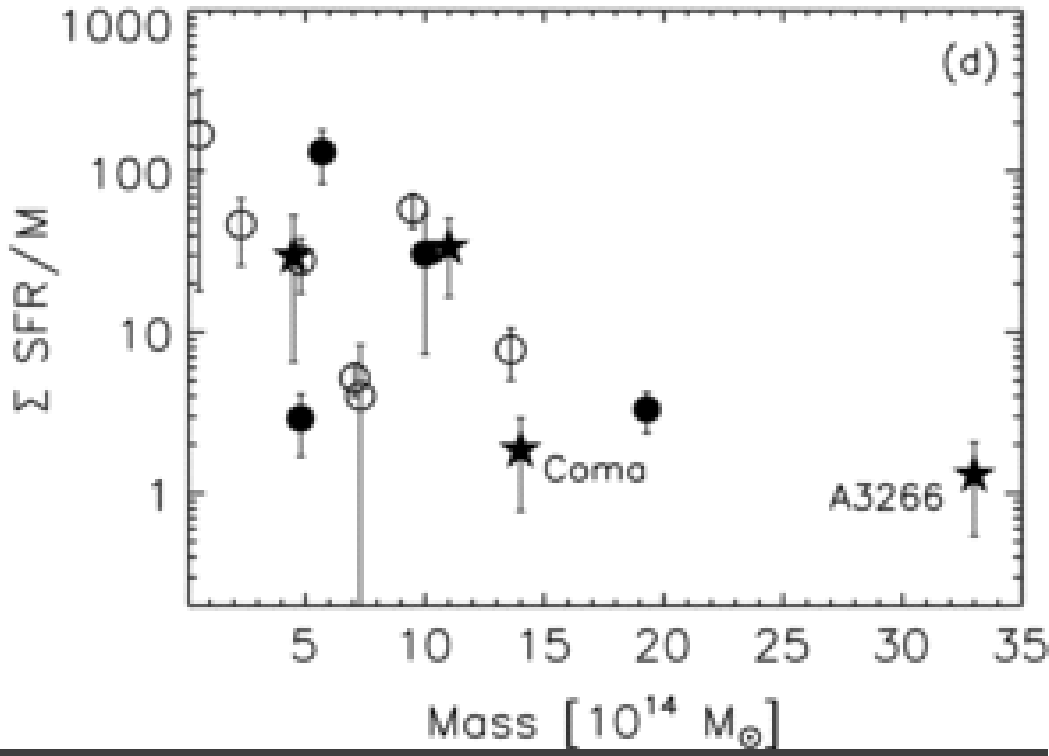


New stars – FIR Herschel

How do global cluster properties affect total SFR?



Finn et al. 2005



Bai et al. 2011

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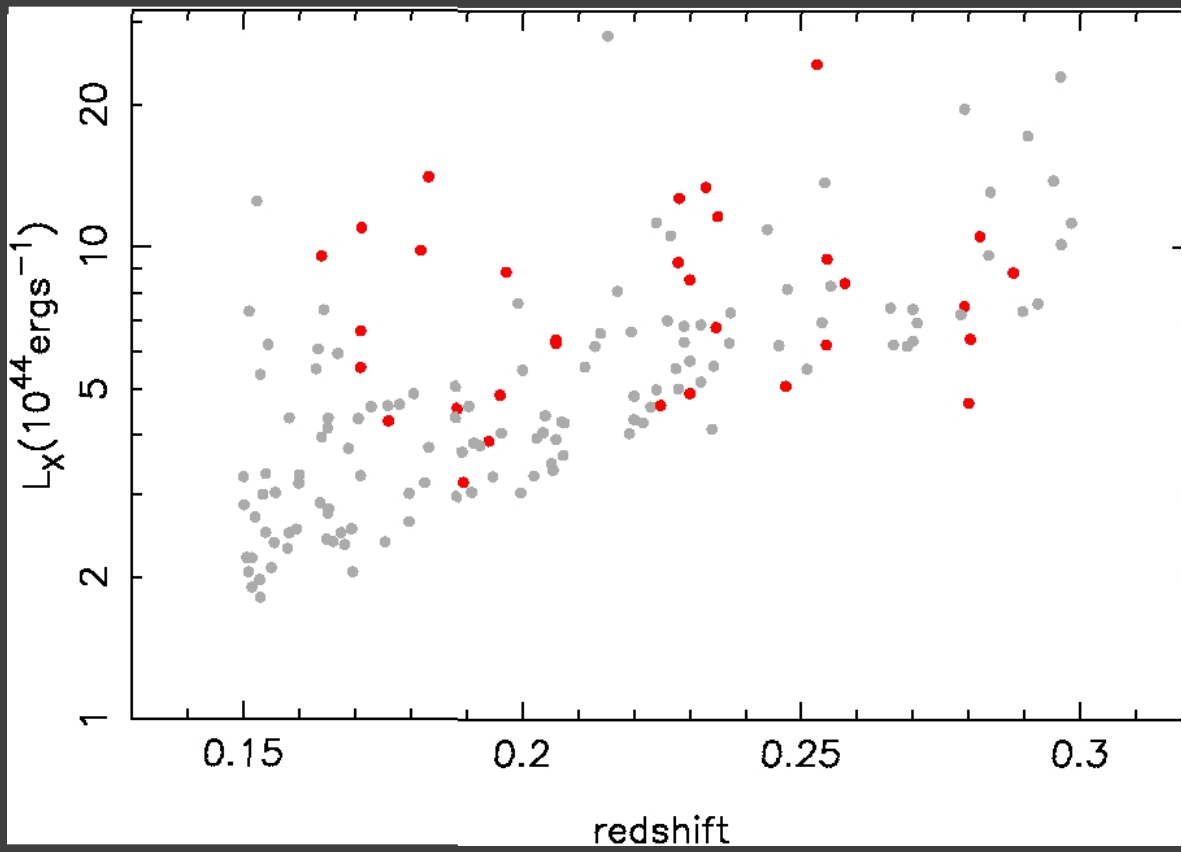
Galaxy Evolution Sample

- Multi-wavelength survey 29 galaxy clusters
- Original selection from ROSAT All Sky Survey
- $0.15 < z < 0.3$
- Massive X-ray bright clusters $L_x > 3 \times 10^{44} ergs^{-1}$
- Morphologically unbiased sample



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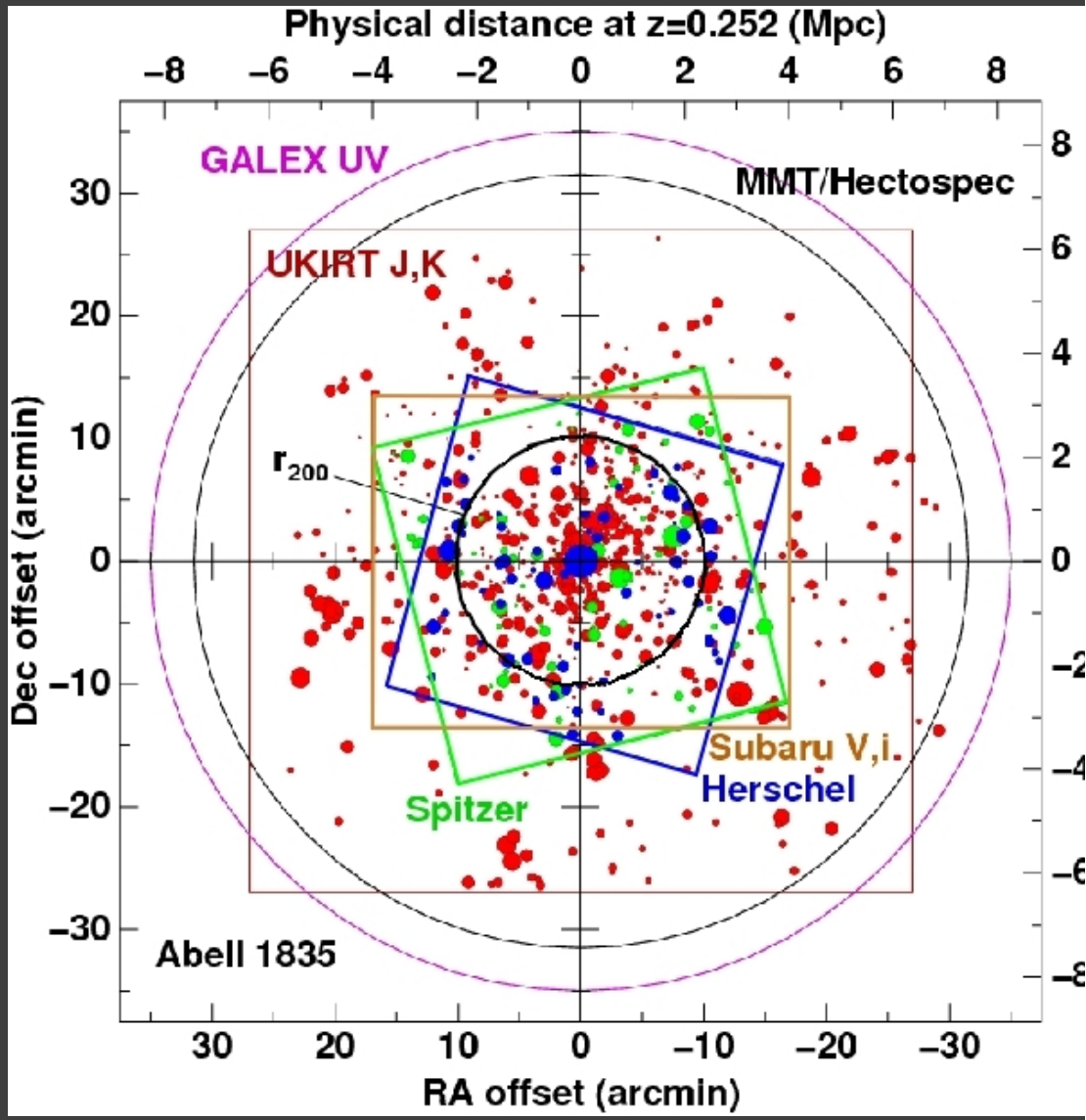
Rich Data Set

- Herschel
  - PACS 100 160μm
  - SPIRE 250 350 500μm
- Spitzer MIPS 24μm
- Weak lensing masses
  Okabe et al. 2010
- Highly complete spectroscopic follow up from ACReS (Arizona Cluster Redshift Survey)



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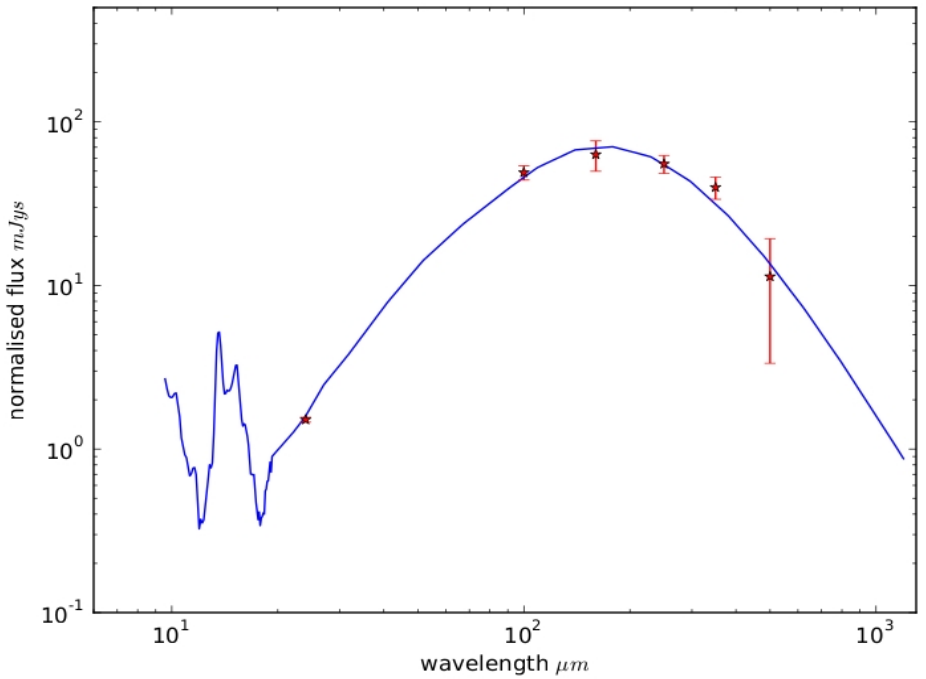
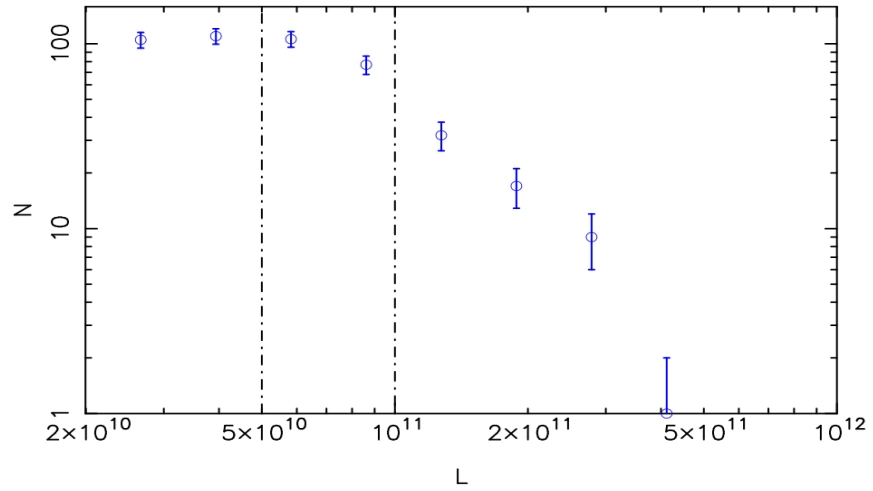
SED fitting

- Model SEDs Chary & Elbaz 2001
- Integrate over 8-1000μm
- Complete to $5x10^{10}L_{sol}$
- 313 Galaxies above Demi-LIRG limit
- Calculate L_{FIR} per cluster





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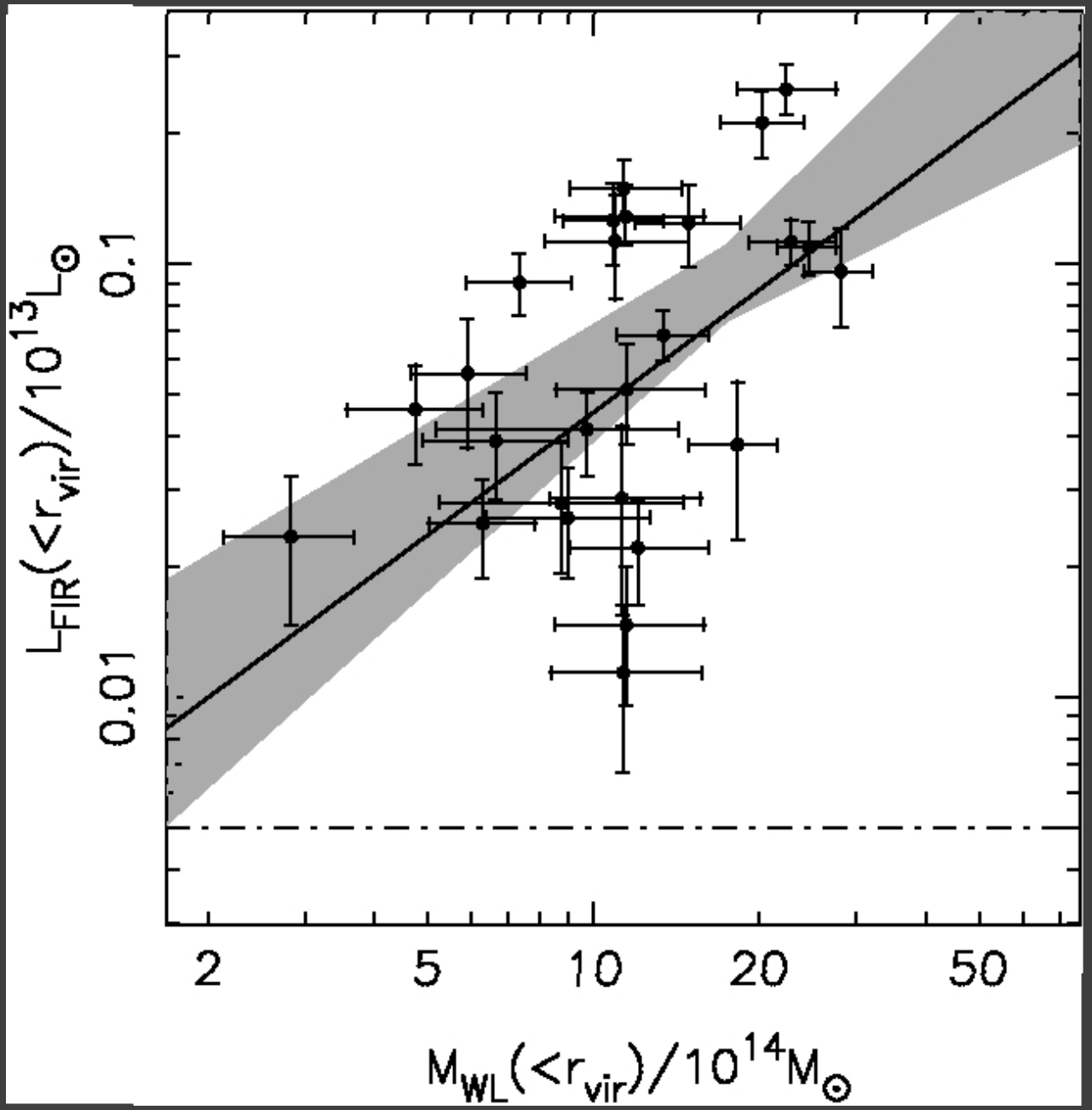
Scaling Relation

Slope: 0.94 +0.35 -0.32

Scatter: 0.67 +0.14 -0.12



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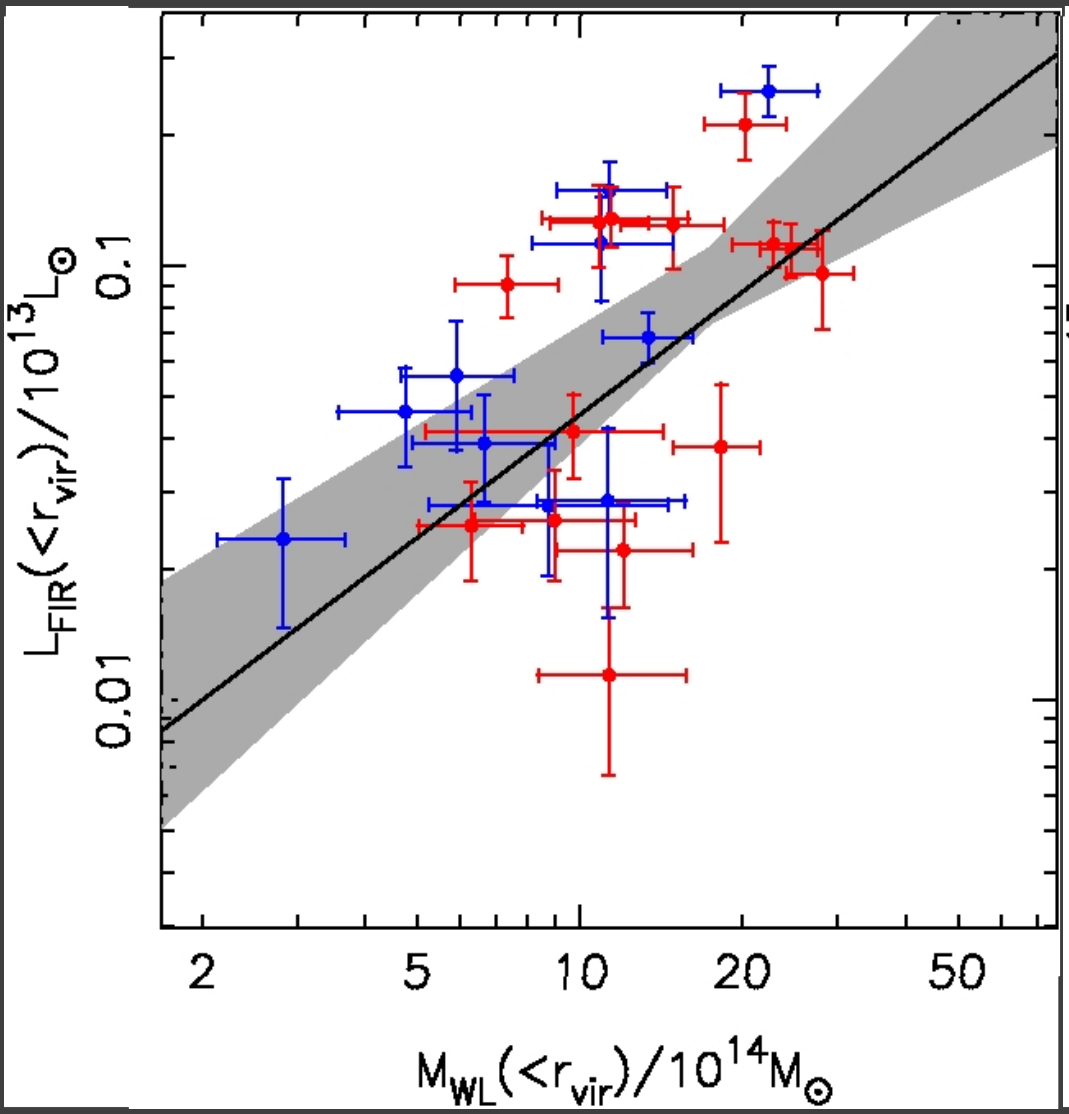
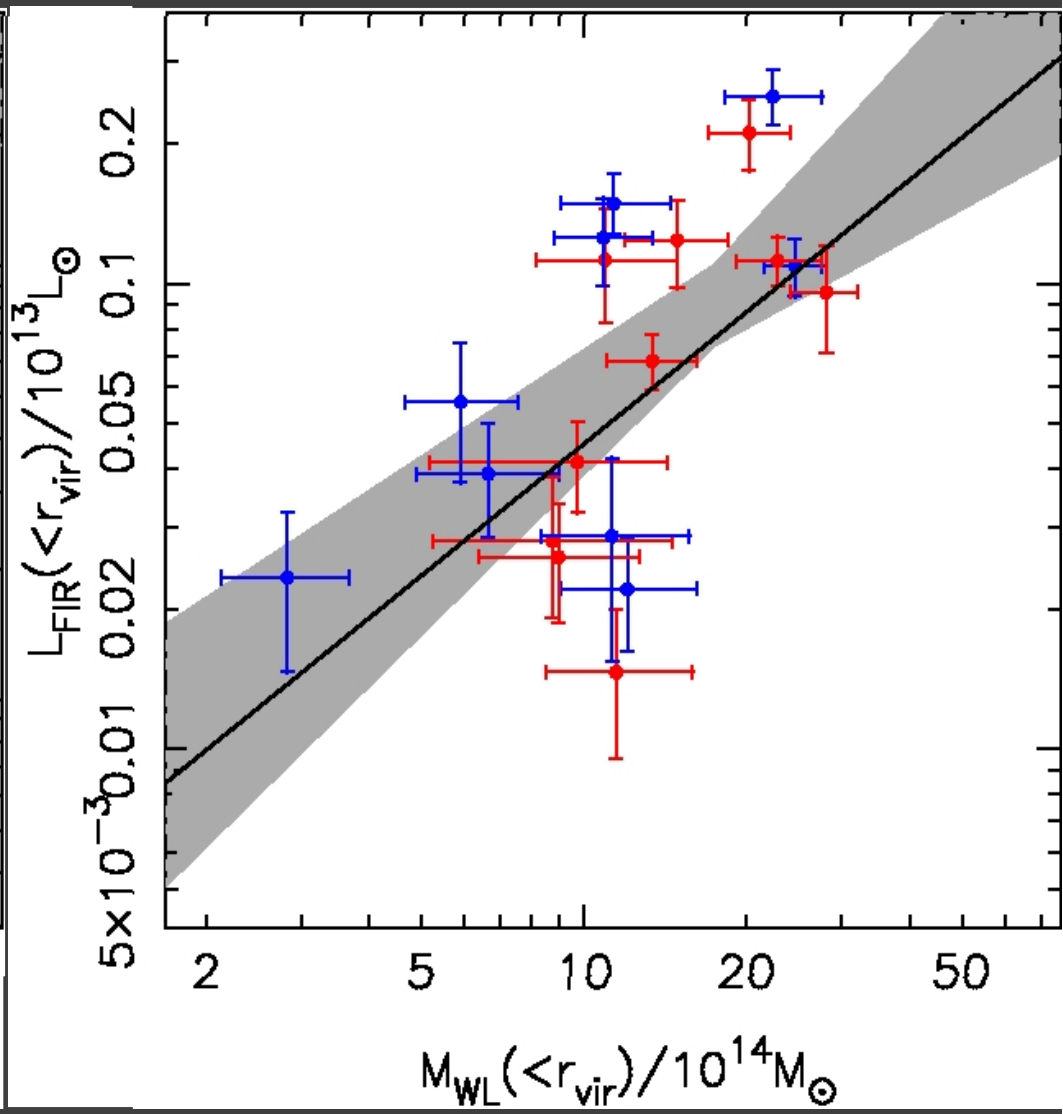
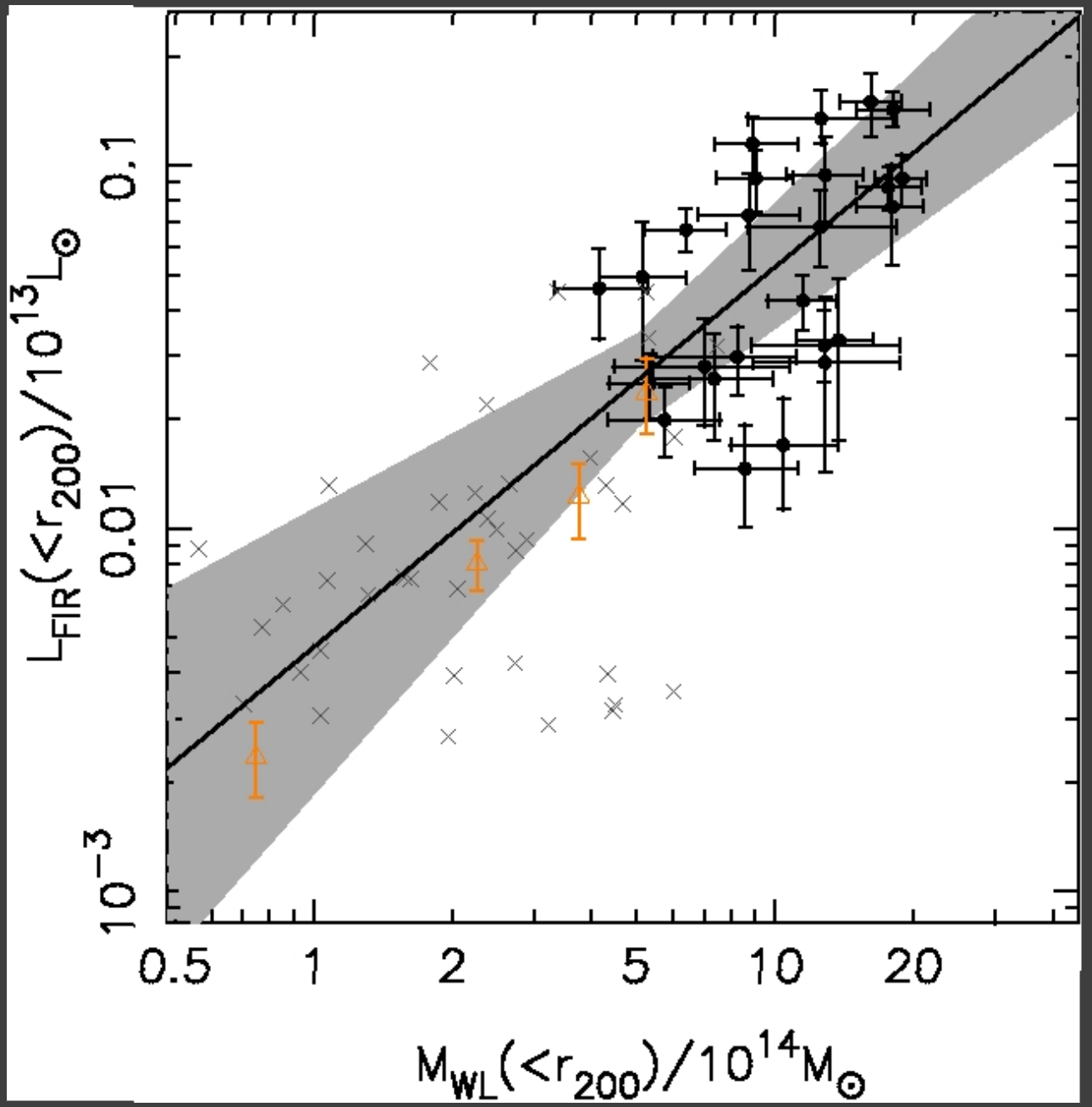
Cluster Merger State





	Cool-core (blue)	Non cool-core (red)	X-ray centroid shift: small (blue)	large (red)
M_{WL}/L_{FIR} =	1662 ± 336	2886 ± 666	2110 ± 606	2546 ± 591

Comparison with Chung et al. 2011



The Future

- Other indicators of cluster dynamical state
- Links between SFR and 'environment'
  - Making the most of the multi-wavelength data to explore where these galaxies are sitting
  - Radial trends of SFR
- Substructure within clusters
  - SFR of galaxies in in-falling groups
  - How long is group environment retained when in-falling? How quickly does cluster environment influence galaxies in group?

Conclusions

- No trend in M_{WL}/L_{FIR} ratio with cluster mass but very high scatter
  - Slope: 0.94 +0.35 -0.32
  - Scatter: 0.67 +0.14 -0.12
- Mechanisms that scale with cluster mass do not have significant impact on the evolution of star formation in these clusters
- Evidence for merger state of cluster having small impact on mean M_{WL}/L_{FIR}
- Lower mass and lower redshift samples are consistent with our results