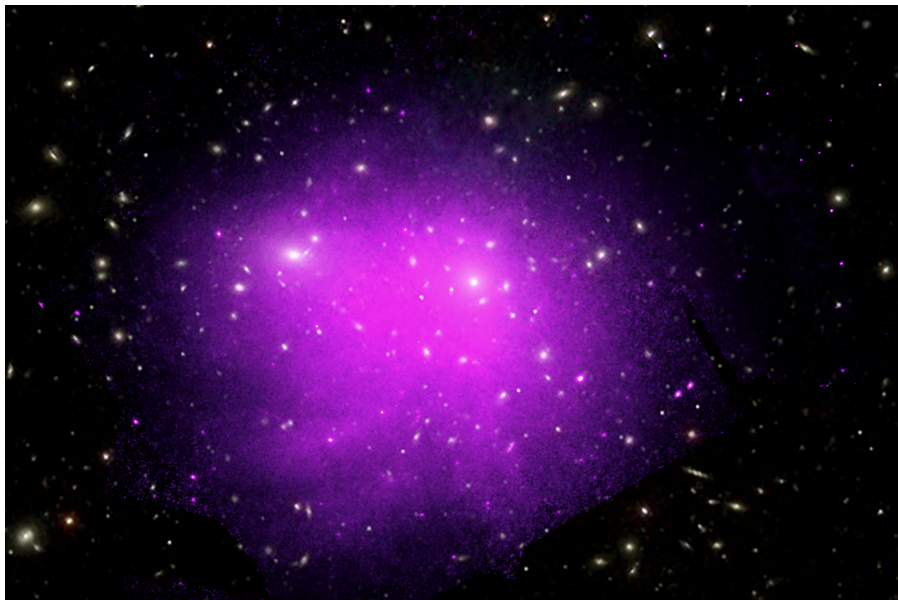

The X-ray Properties of Optically Selected Galaxy Groups

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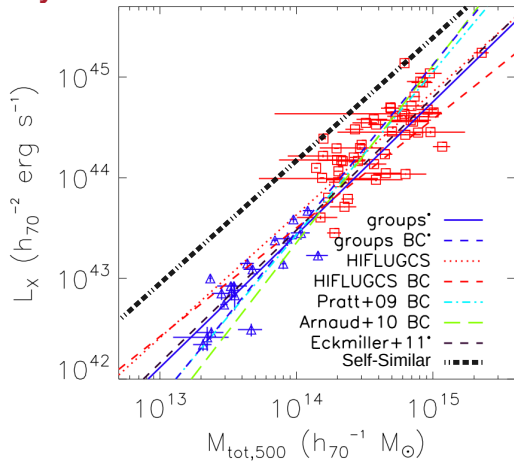
Introduction

- ✦ What are Galaxy Groups?
- ✦ Self-similarity
- ✦ GAMA & XXL surveys
- ✦ Measure X-ray Luminosity of Optically Selected Galaxy Groups
- ✦ X-Ray Luminosity Function
- ✦ Luminosity - Mass Relation

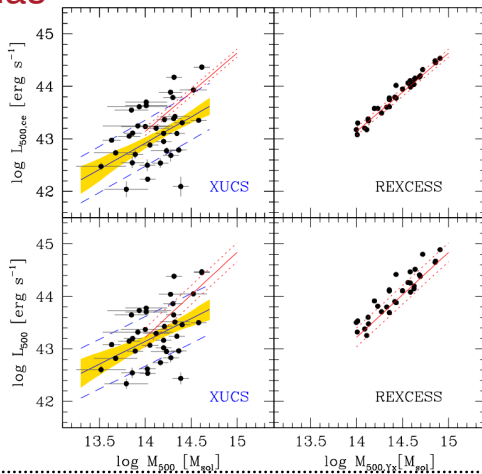


Credit: X-ray: NASA/CXC/Univ. of Chicago, I. Zhuravleva et al, Optical: SDSS

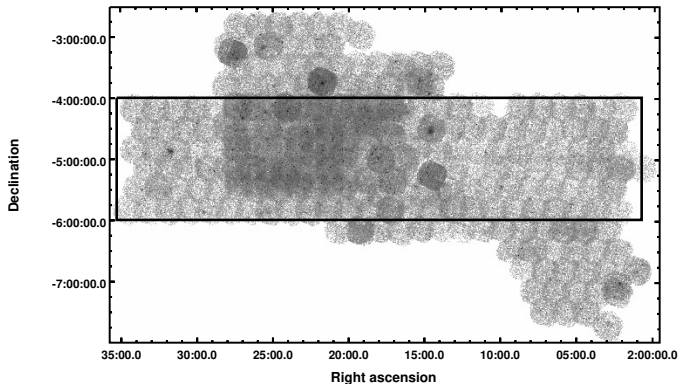
Self-Similarity



Selection bias



-
- ✦ XXL X-ray survey
 - ✦ GAMA spectroscopic survey
 - ✦ 235 GAMA groups (with 5+ members) in overlapping region

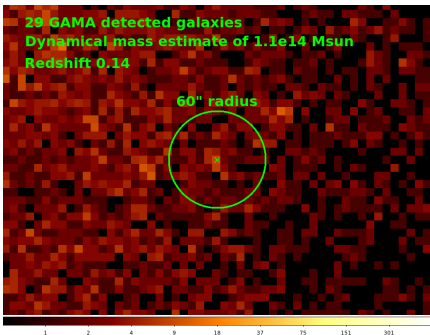
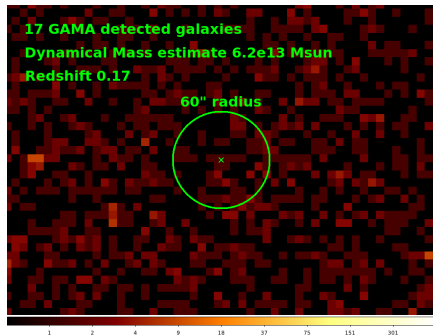


GAMA: Driver et. al (2011), XXL: Pierre et al. (2016)

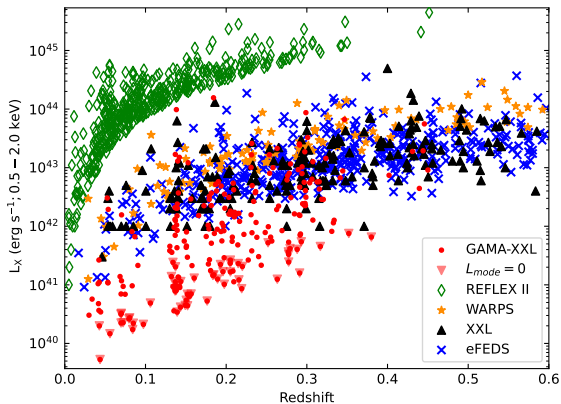
FoF Algorithm: Robotham et al. (2011)

X-ray Undetected Groups

- 77% are not detected as clusters by XXL
- Use luminosity posterior

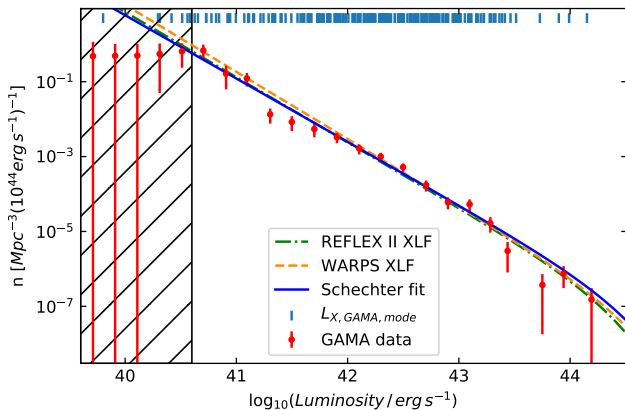


Luminosity - Redshift Space

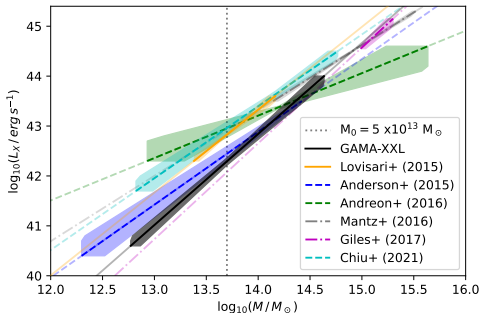
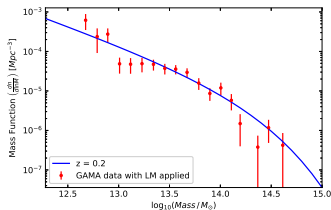
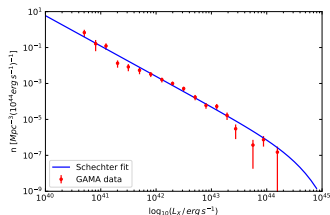


REFLEX II: Böhringer et al. (2014), WARPS: Koens et al. (2013), bristol.ac.uk
XXL: Pacaud et al. (2016), eFEDS: Liu et al. (2021)

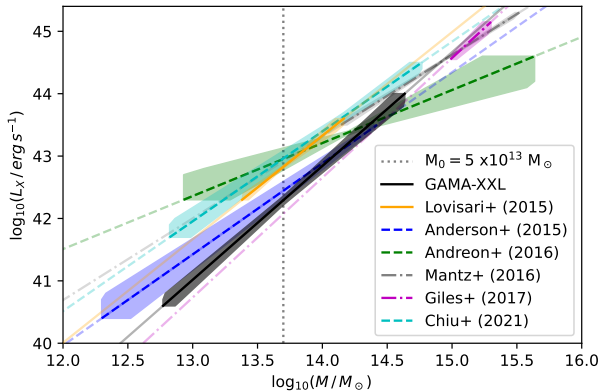
X-ray Luminosity Function



Luminosity - Mass Relation

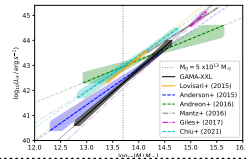
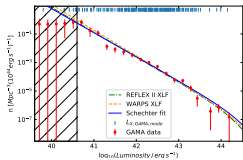
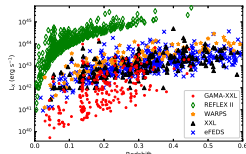


Luminosity - Mass Relation



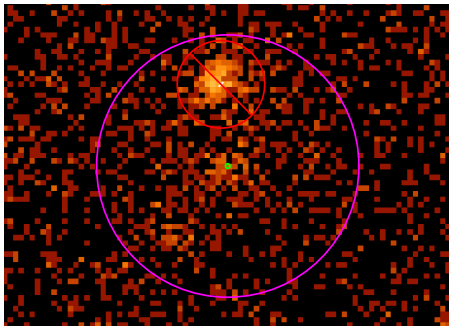
Summary

- ✂ Measured X-ray luminosities of optically selected galaxy group sample
- ✂ Observed X-ray luminosity function and inferred luminosity-mass relation shape
- ✂ Inclusion of non-detections allowed exploration of low luminosity regime
- ✂ Results suggest feedback and X-ray selection bias present
- ✂ Project can be expanded using eROSITA and Euclid surveys



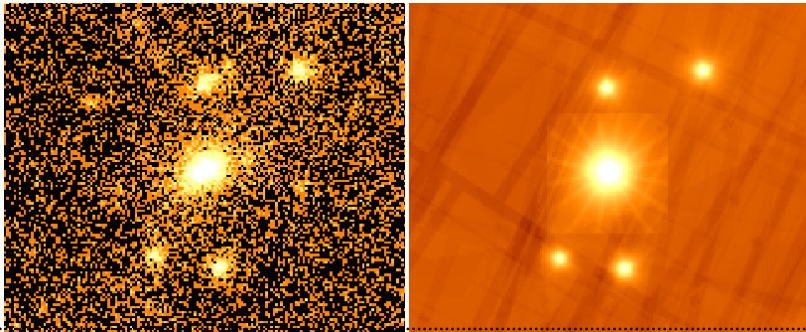
Excluding Non-Central Point Sources

For point sources located between 30" and 110" away from the group location, the point source region was masked and remaining flux in the aperture modelled and subtracted.

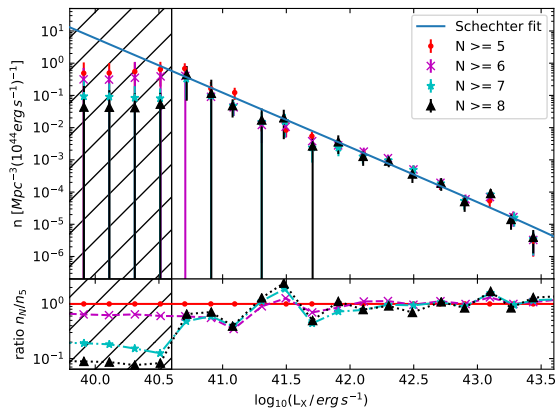


Modelling Central Point Sources

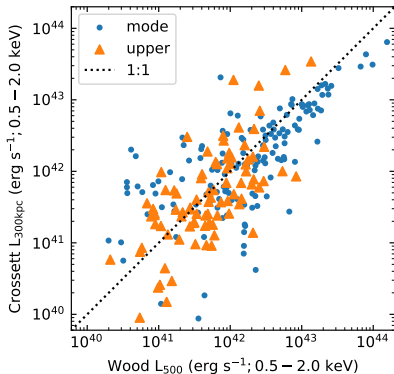
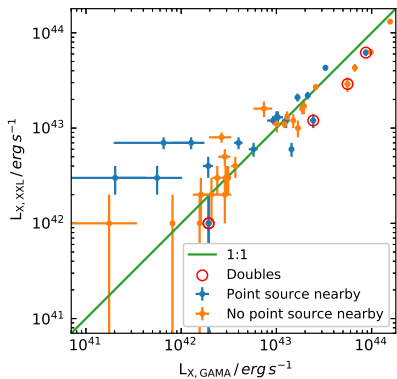
In cases where the point source was closer, the point source and group emission were modelled using the PSF and a beta model, and the proportion of emission expected from the group found.



Testing $N \geq 5$ cut-off



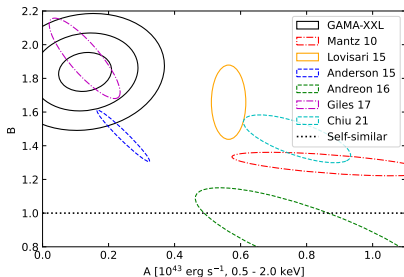
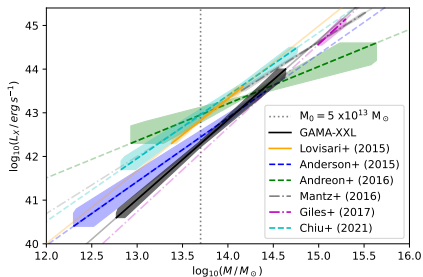
Comparing Luminosities



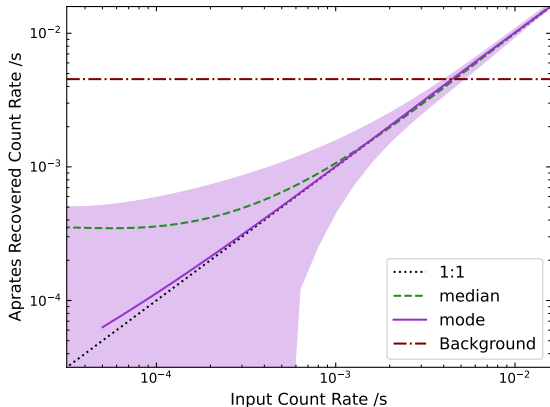
XXL: Pacaud et al. (2016)

Crossett et al. (2022)

Luminosity - Mass Relation



Recovering Low Count Rates



Euclid & eROSITA

- 🔥 DR1 / eRASS:1 overlap $\sim 1,250 \text{ deg}^2$
 - ▶ estimate 5,000 clusters
- 🔥 DR3 / eRASS:4 overlap $\sim 7,500 \text{ deg}^2$
 - ▶ estimate 60,000 clusters

