Suzaku Observations of X-ray Brightest Fossil Group ESO3060170

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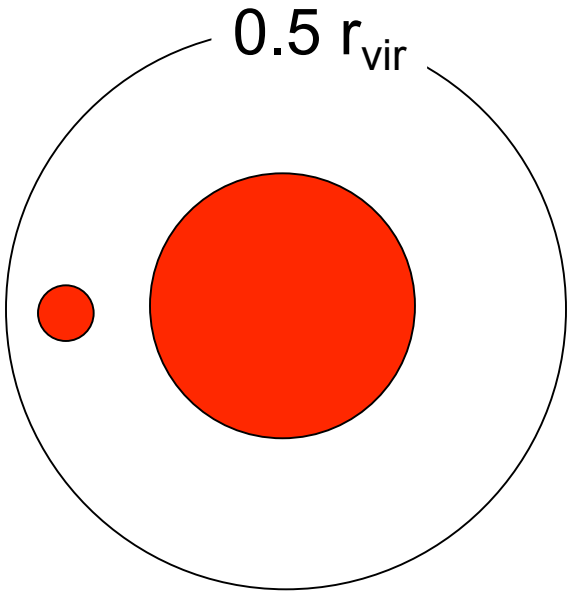
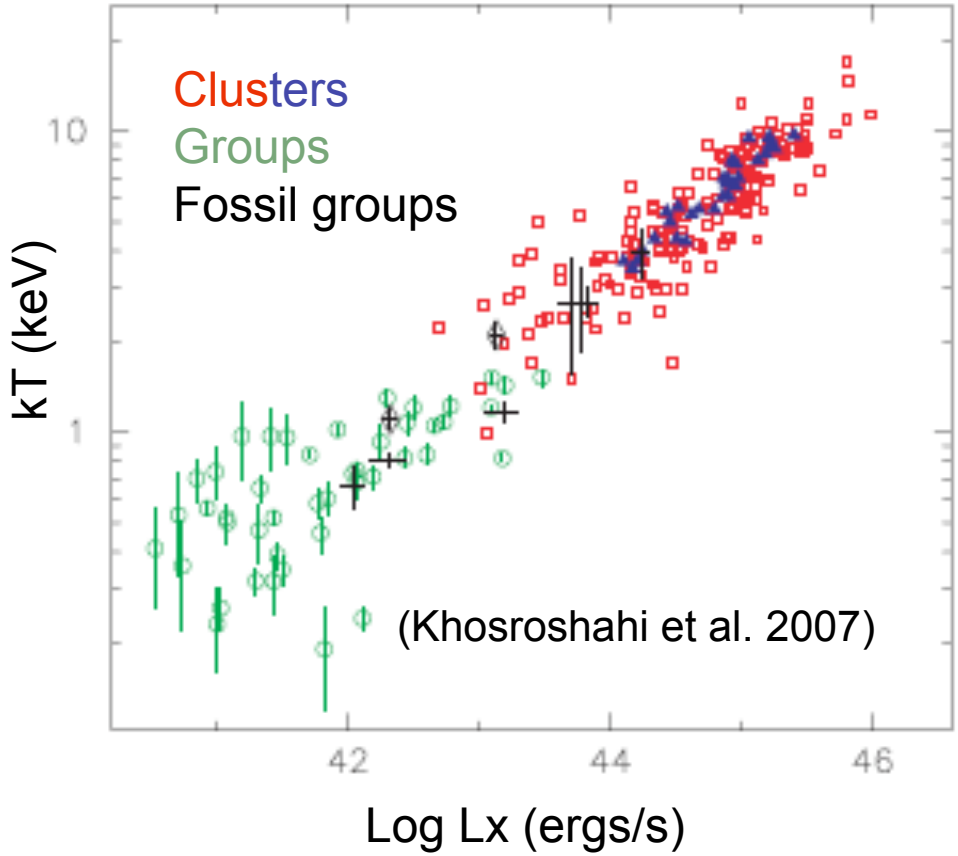
Groups ≠ Small scale clusters missing metals/baryons

Groups' shallow potential ➔ deep observations at large radii

Fossil groups: central dominant galaxy ≥ 2 R-mags brighter than 2nd brightest galaxy w/in 0.5 r_{vir} (Jones et al. 2003)





Are fossil groups old, undisturbed systems?

Yes

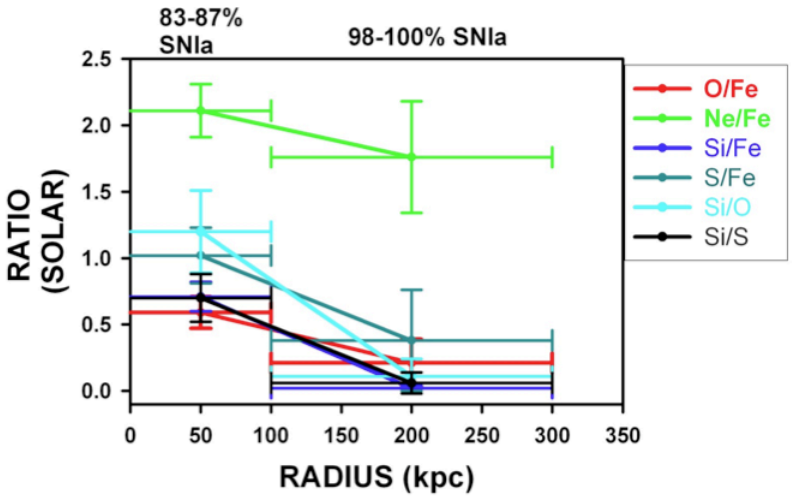
- Simulations (Navarro 95)
  X-ray observations (Khosroshahi 07) :
  ➔ concentrated dark matter

- Optical isophotes &
  X-ray atmospheres: undisturbed
  last significant mergers long ago

No

- Lack of defined cool cores:
  cores heated by recent
  mergers (Sun 04)

- Ratio of SN Ia to SN II iron
  mass fraction 99±1%(outer)
  85±2%(center) (Dupke10)



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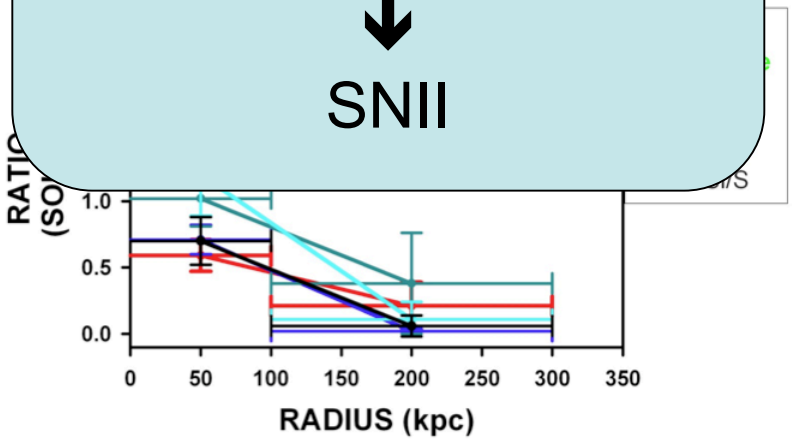
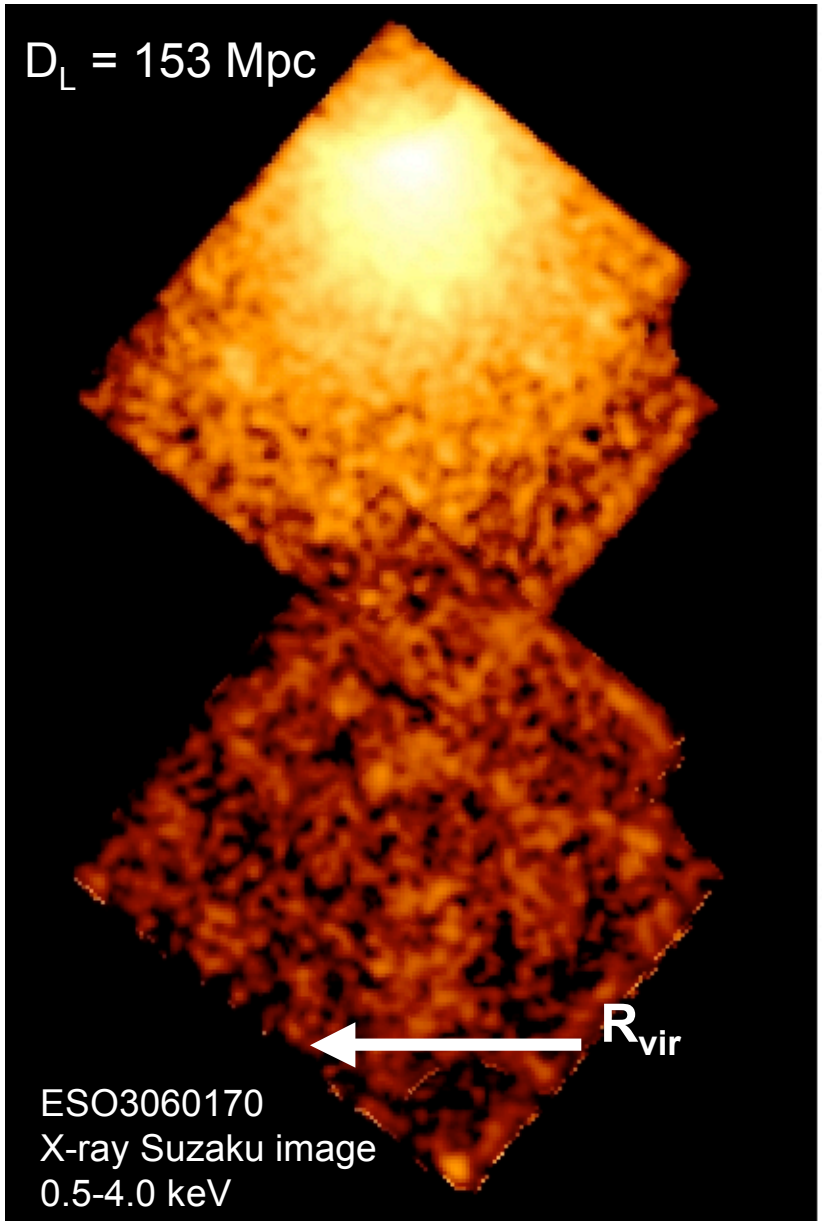
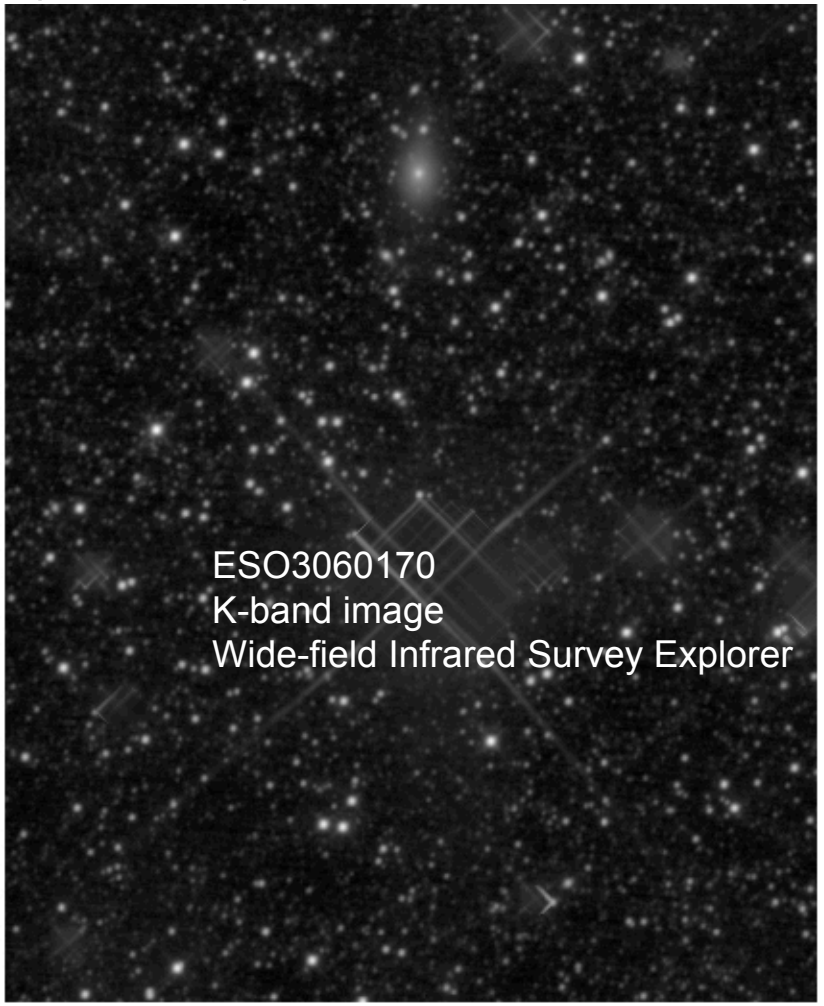
- Recent mergers
  ↓
  Star formation
  ↓
  SNII



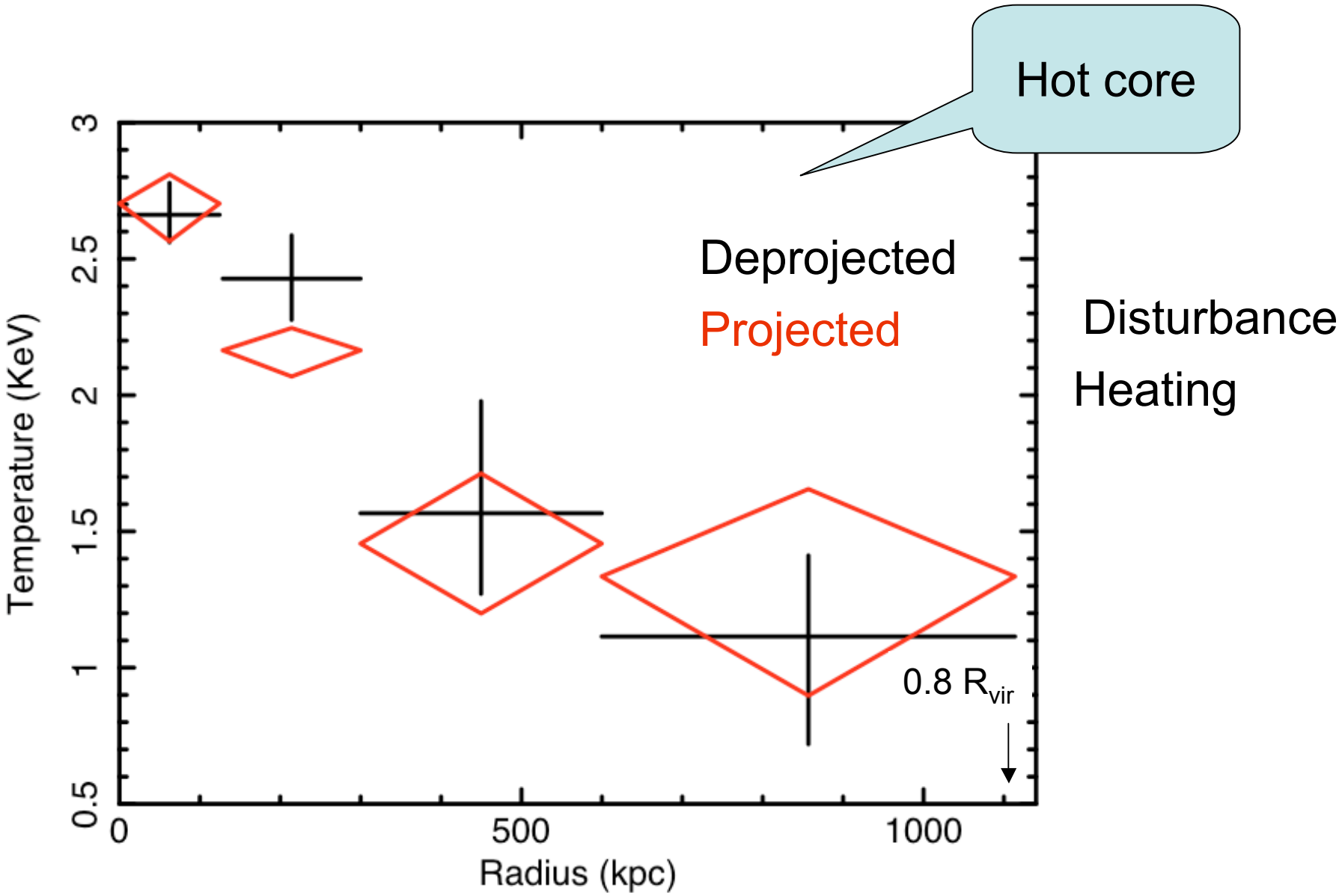
Suzaku observed brightest fossil group ESO 3060170 (PI: Y.Su)

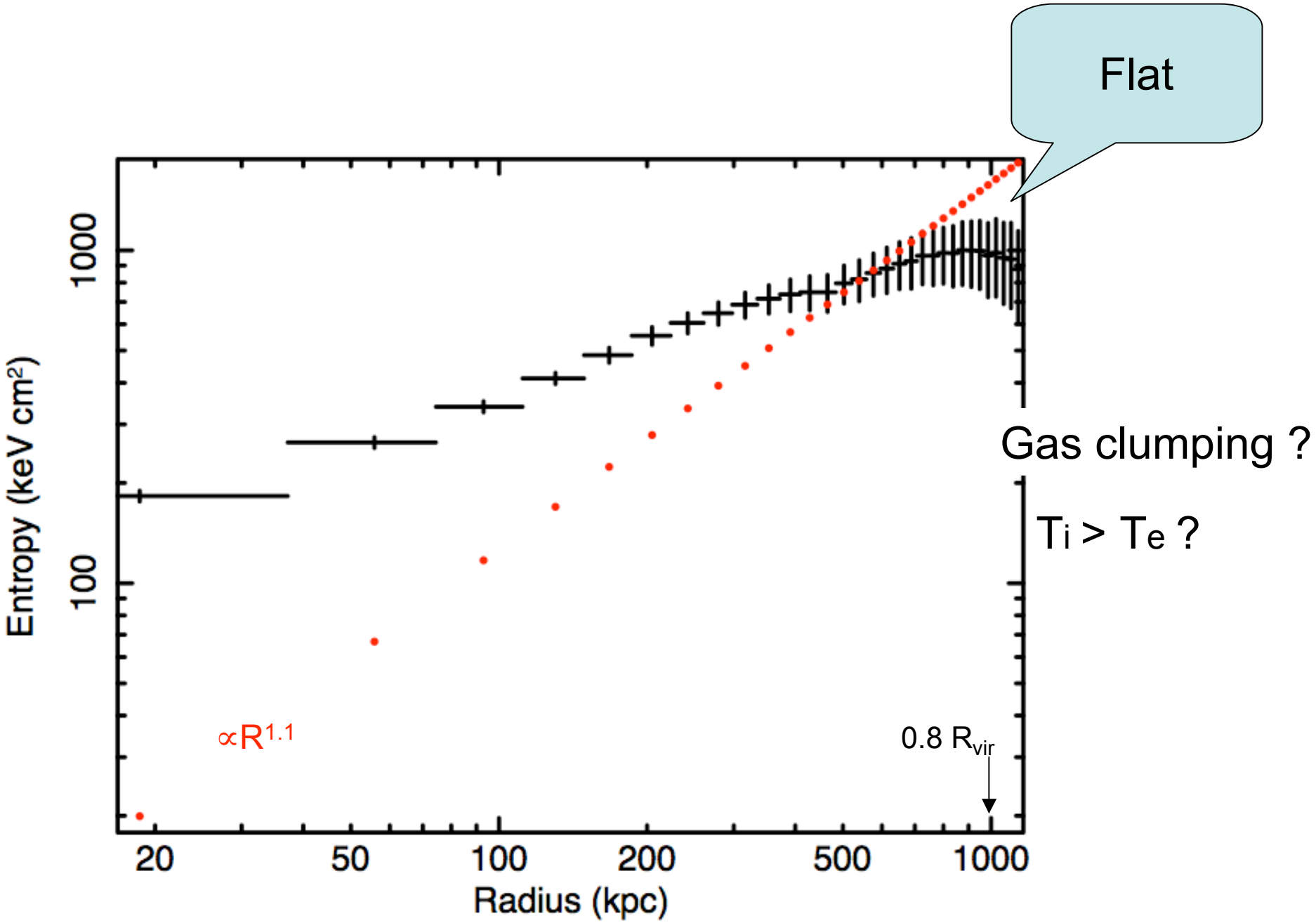


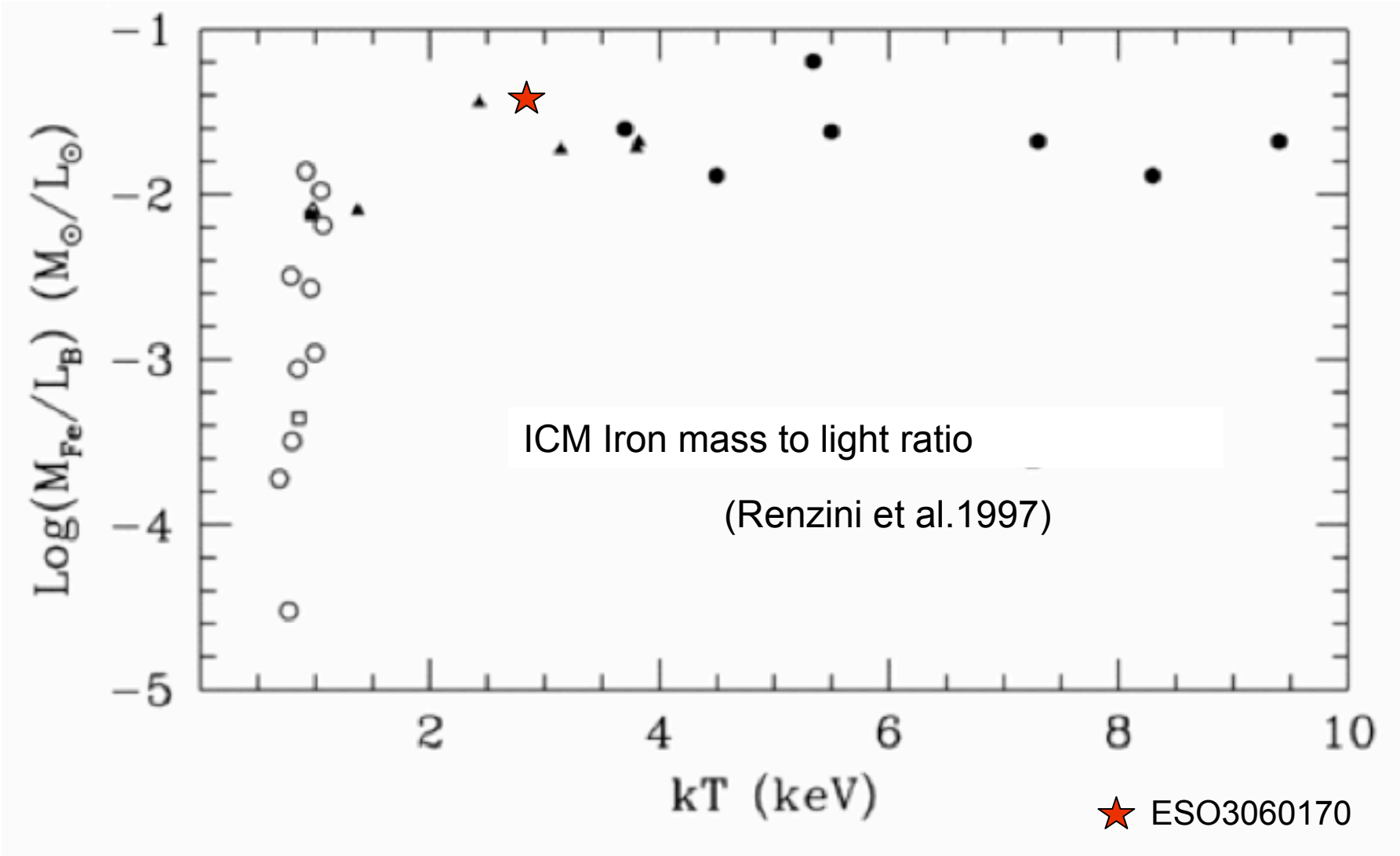


$L_X \sim 3.45 \times 10^{43}$ erg s^{-1}

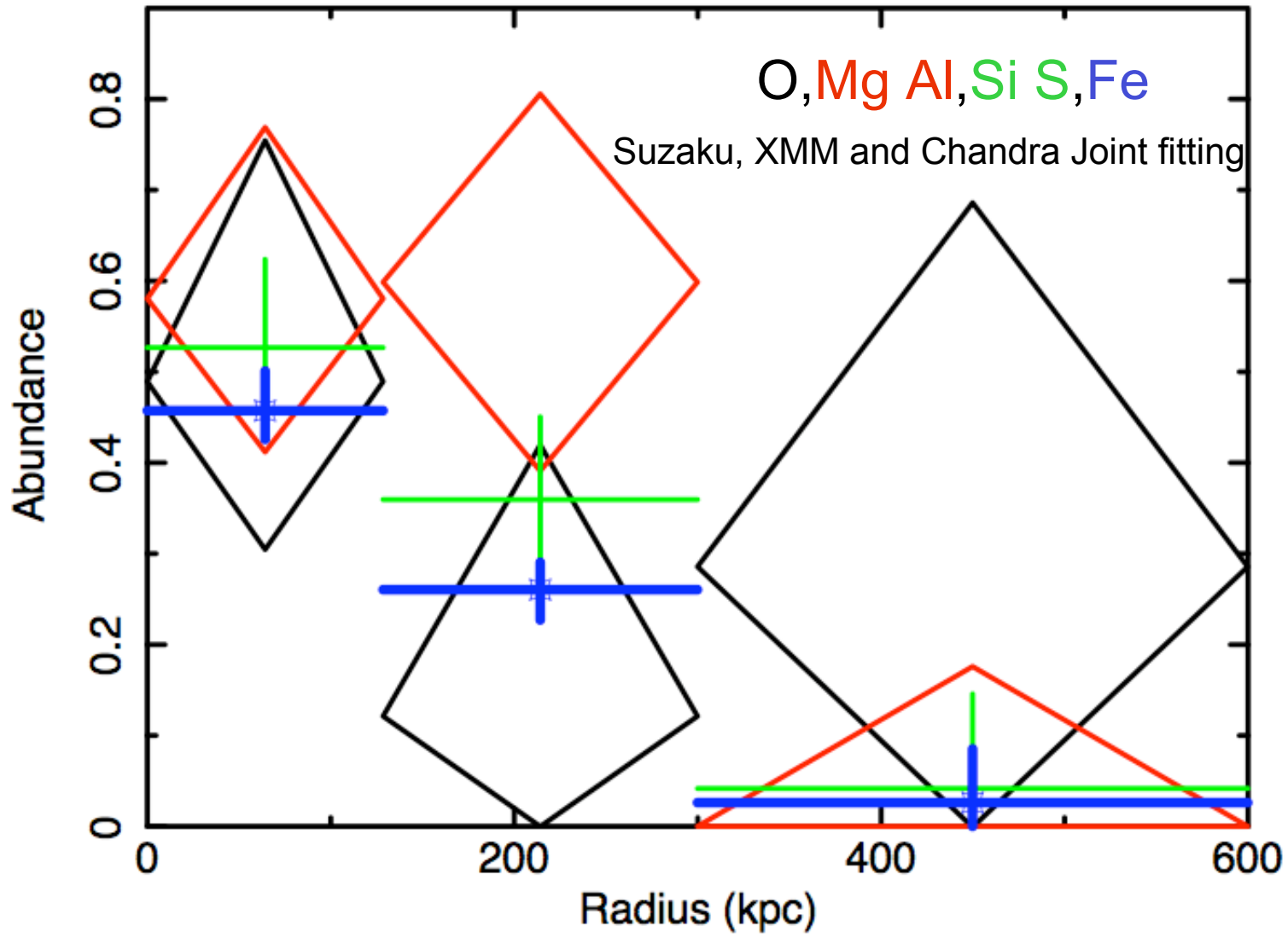
$L_R \sim 3.28 \times 10^{11}\ L_{R\odot}$


Hot core
Deprojected
Projected
Disturbance
Heating
0.8 R_vir
Temperature (KeV)
Radius (kpc)
0.5
1
1.5
2
2.5
3
0
500
1000


Flat
Gas clumping ?
Ti > Te ?
Entropy (keV cm²)
1000
100
∝R^1.1
0.8 R_vir
20
50
100
200
500
1000
Radius (kpc)



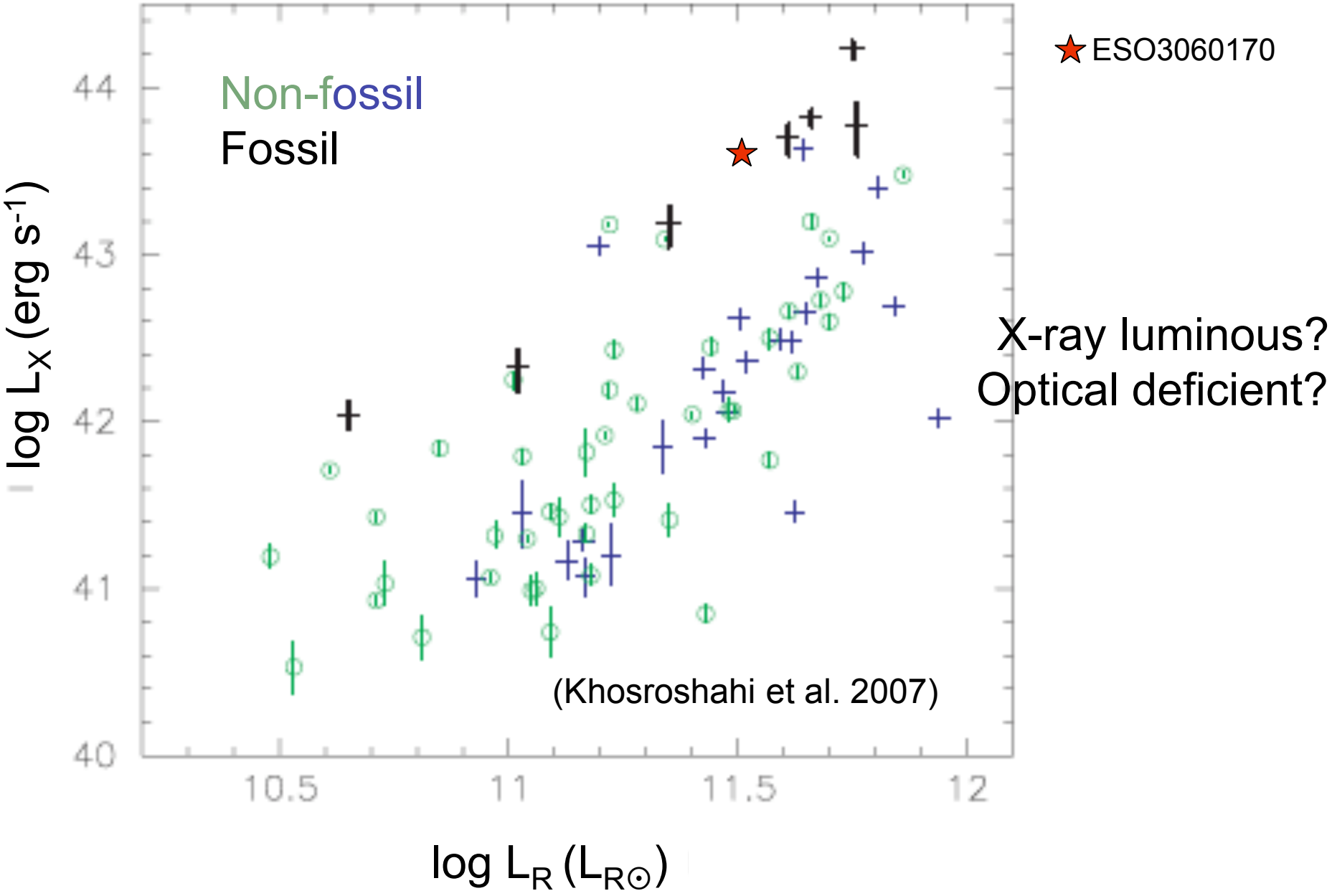
Iron mass to light ratio reaches cluster level



SNIa/SNII ratio is consistent over 0-130 and 130-300 kpc

No central enhancement of SN Ia ejecta

Comparisons with other fossil groups



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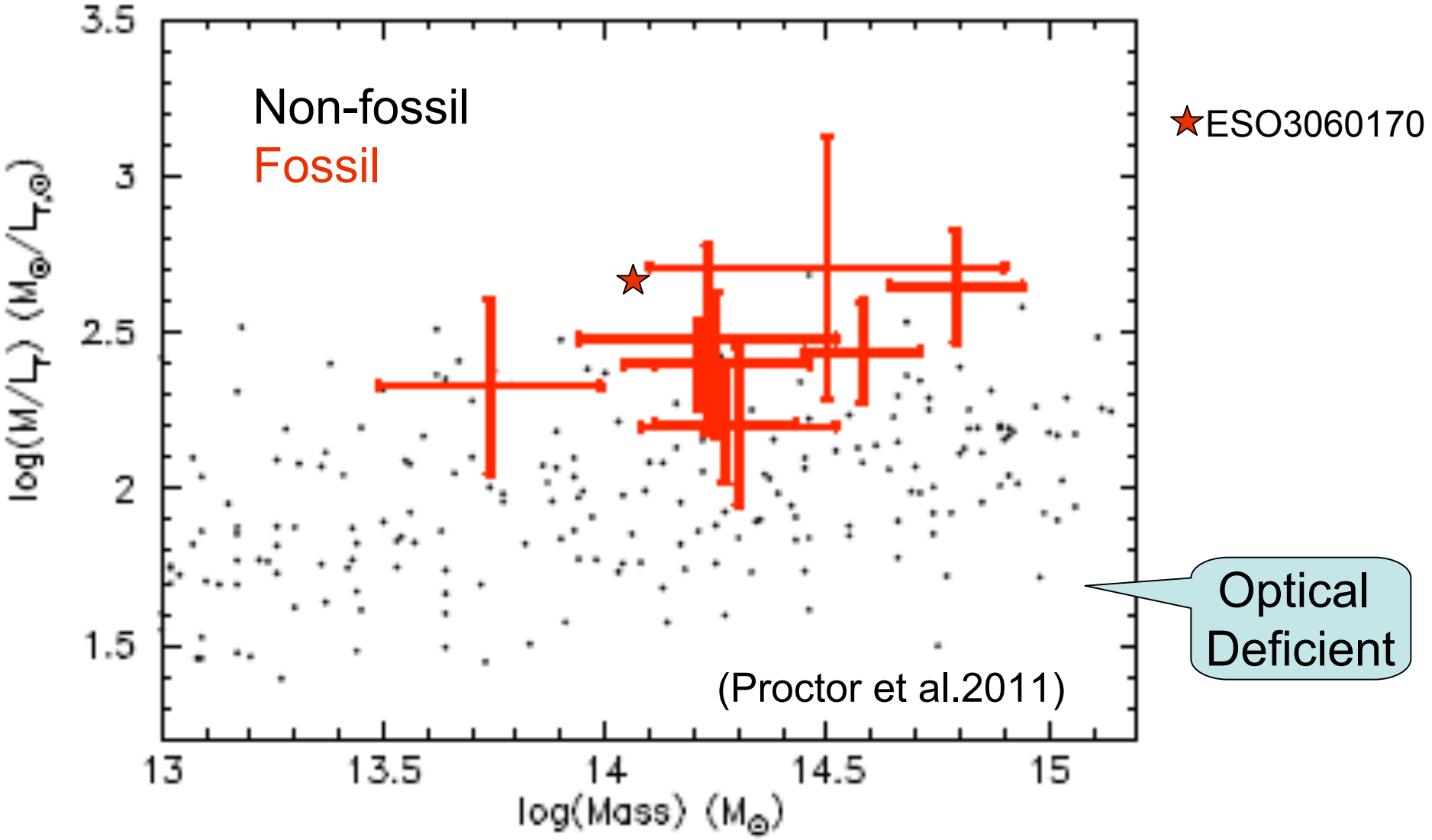

At 0.3 Rvir, ESO3060170 f_b~0.06 (Sun+2004), RXJ 1559 f_b~0.1 (Humphrey+2011)

Conclusions

- Hot core; Entropy is flat at large radii
- Iron mass to light ratio consistent with clusters

- Low optical luminosity at given L_x or M_{total}
  → deficiency in star/galaxy formation
- X-rays much more extended than optical

- Fossil group diversity: baryon fraction, abundance ratios, etc. (formation sequence)
  → Heterogeneous population

Ongoing work: XMM observations of fossil groups (PI: R.Dupke)