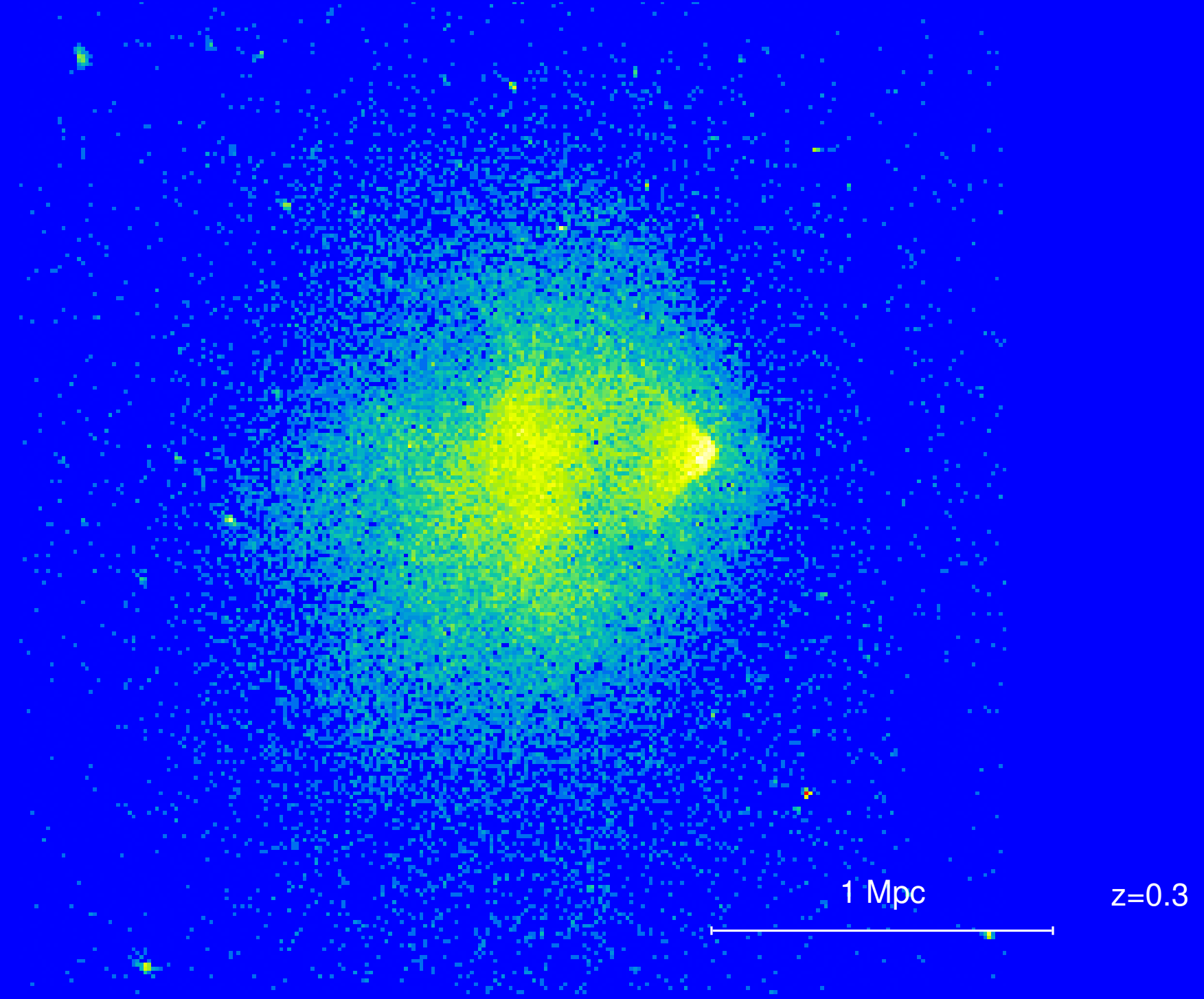


Highlights of ACIS cluster science

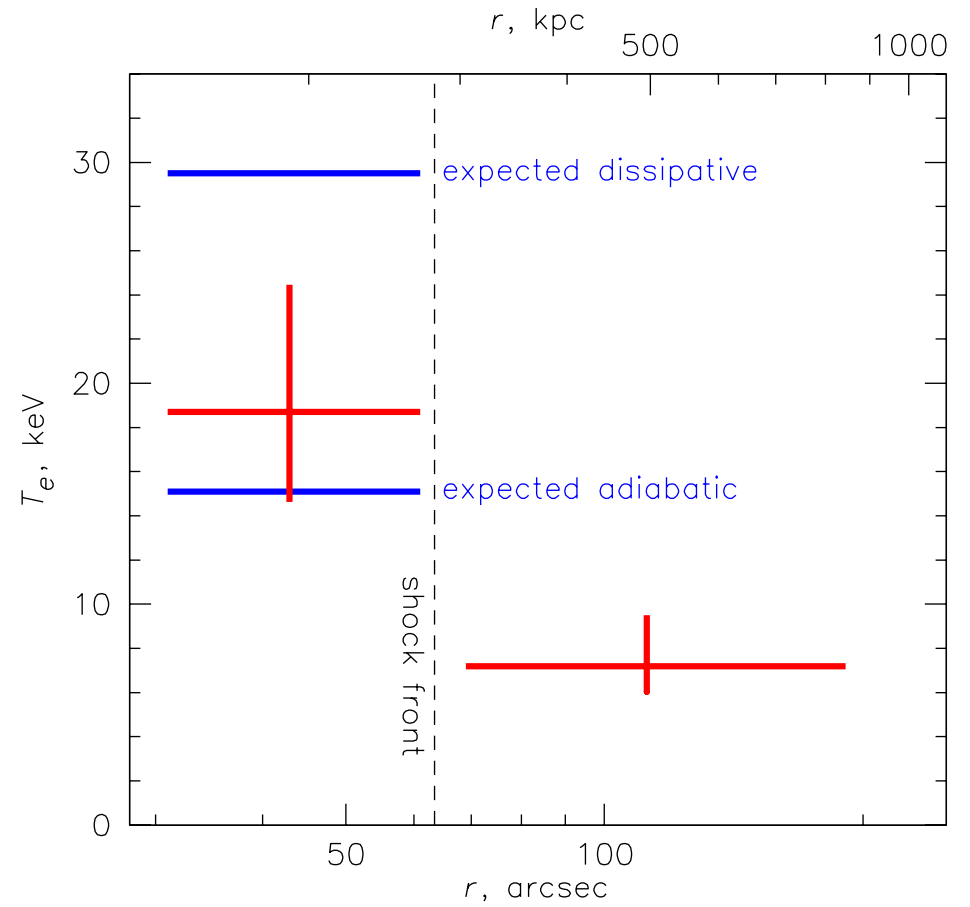
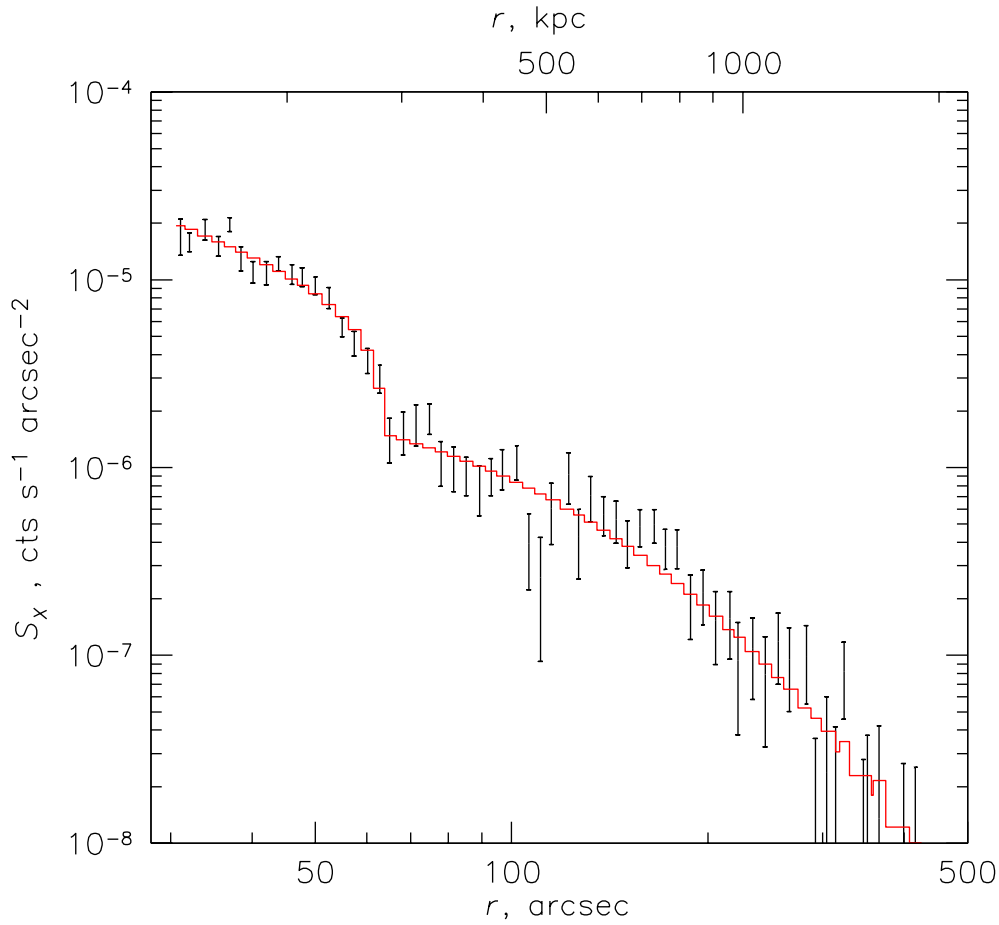
Maxim Markevitch

October 2003

1E 0657–56: the most interesting cluster in the Universe

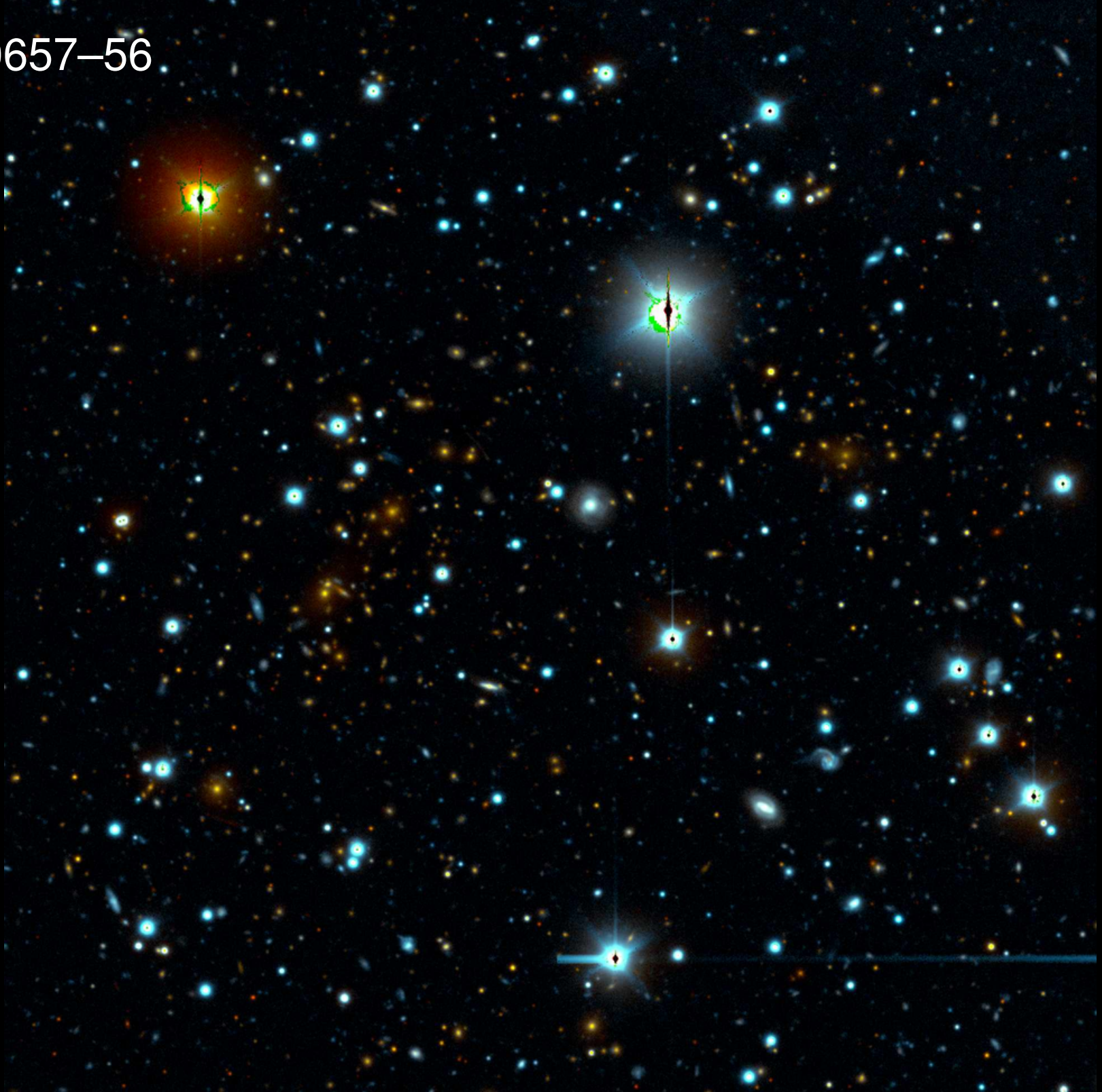


1E 0657-56: shock front

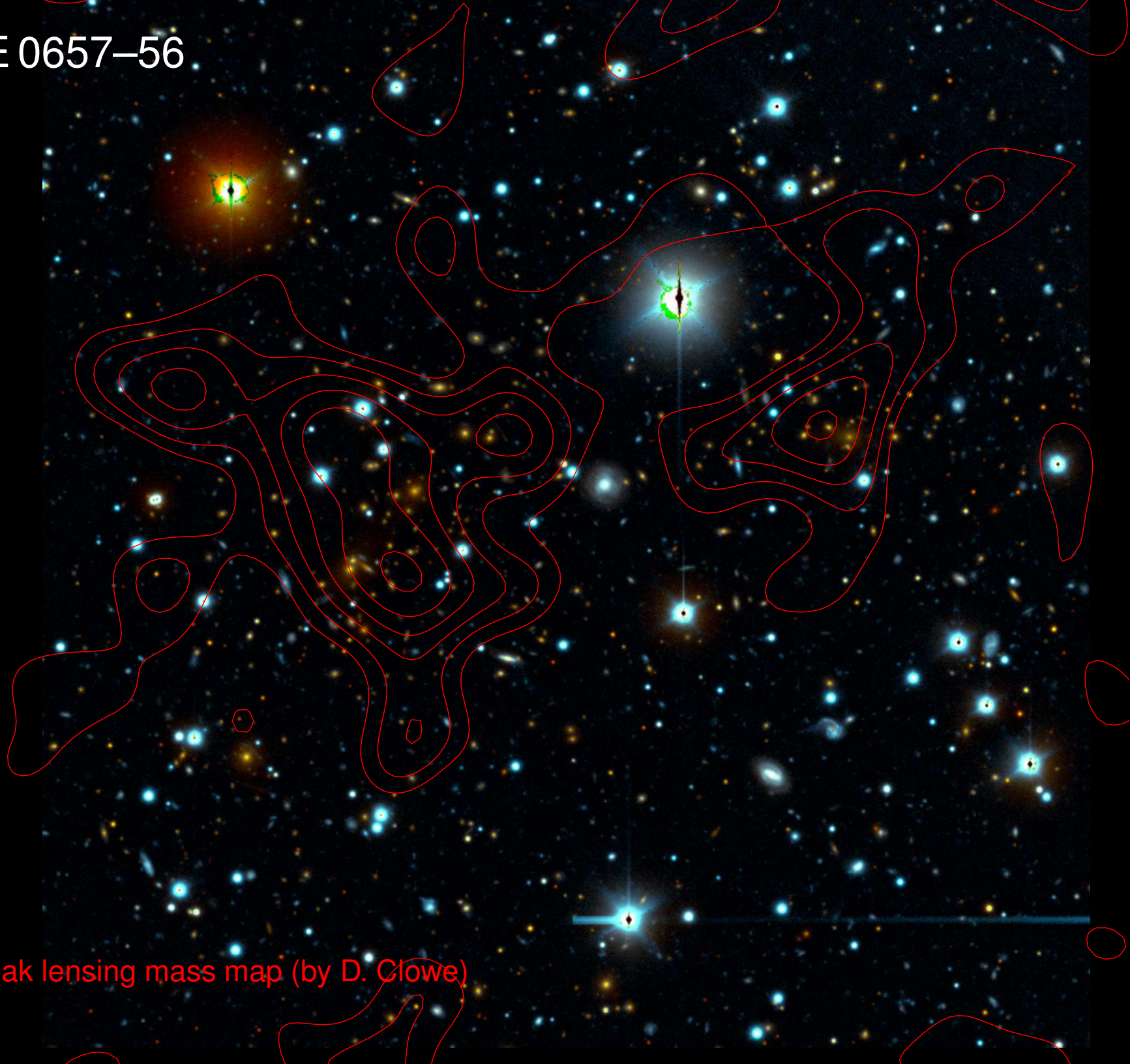


- from density jump, $M = 3.2 \pm 0.7$

1E 0657-56

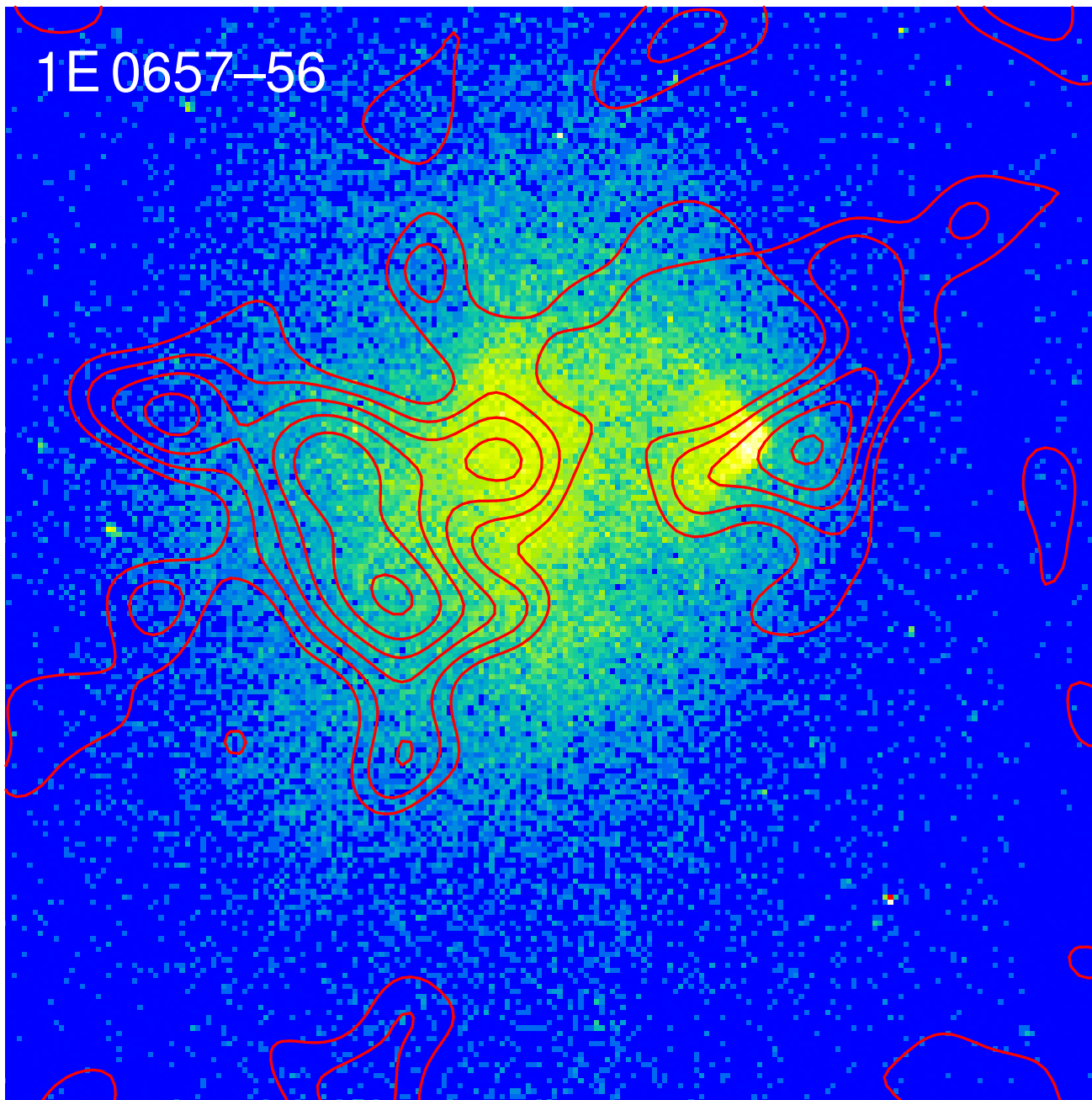


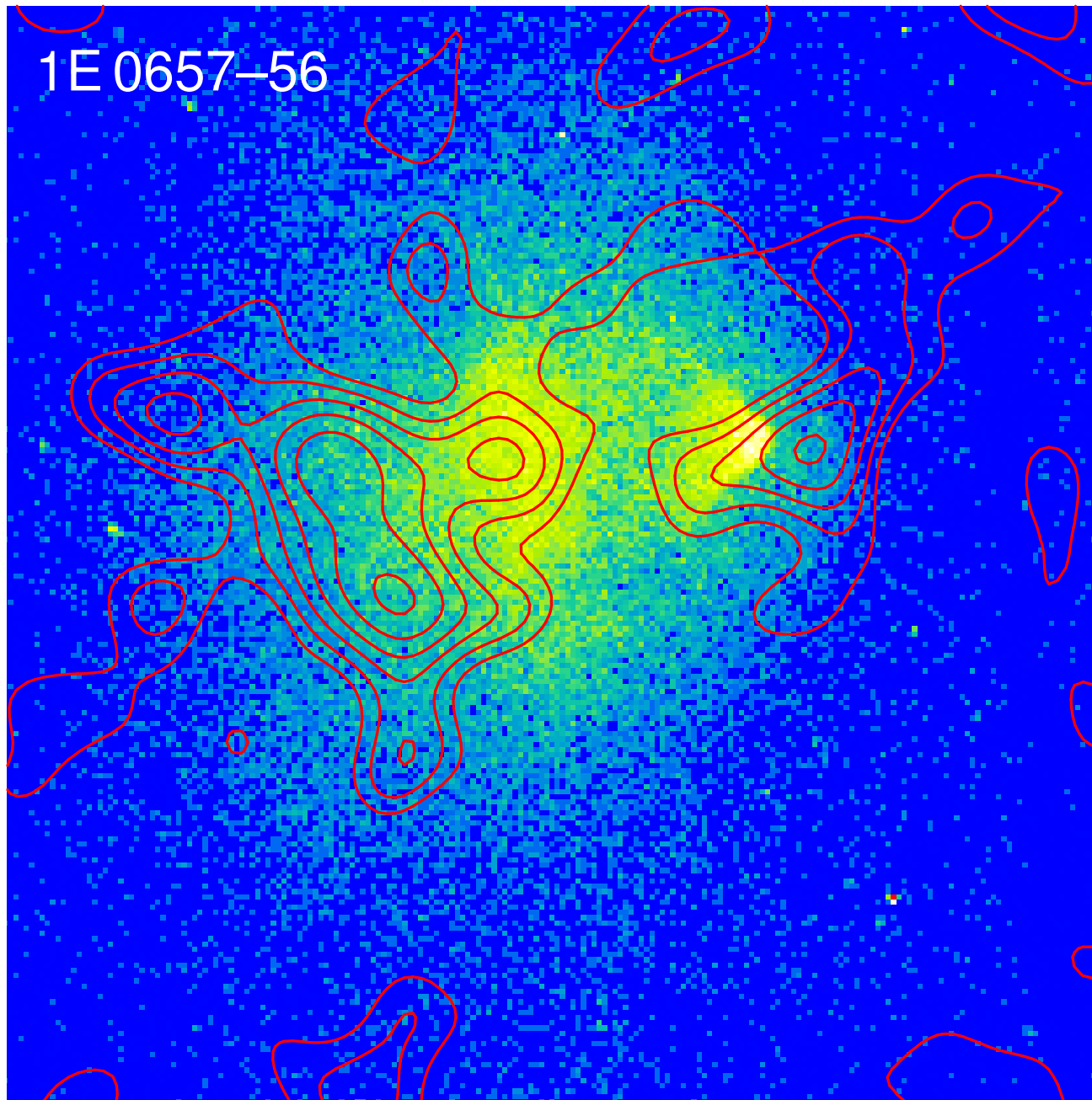
1E 0657-56



Weak lensing mass map (by D. Clowe)

1E 0657-56





Offsets between gas and mass peaks — Dark Matter exists! (Clowe et al. 2003)

1E 0657–56: Dark Matter self-interaction cross-section

DM collisional cross-section per unit mass can be constrained from

- offset between gas and mass
- no offset (within errors) mass and galaxies
- large velocity of the subcluster
- consistency of the subcluster's M/L ratio with the universal value

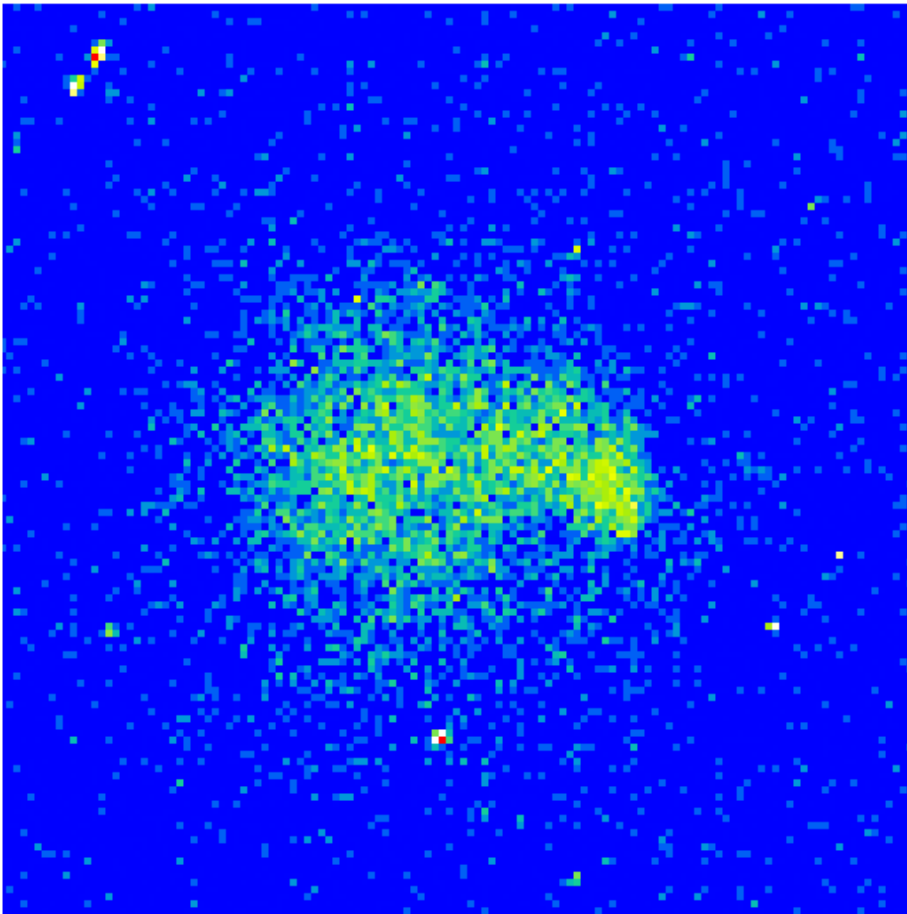
The best (order of magnitude) constraint from these methods is

$$\frac{\sigma}{m} < 1 \text{ cm}^2 \text{ g}^{-1}$$

(Markevitch et al. 2003)

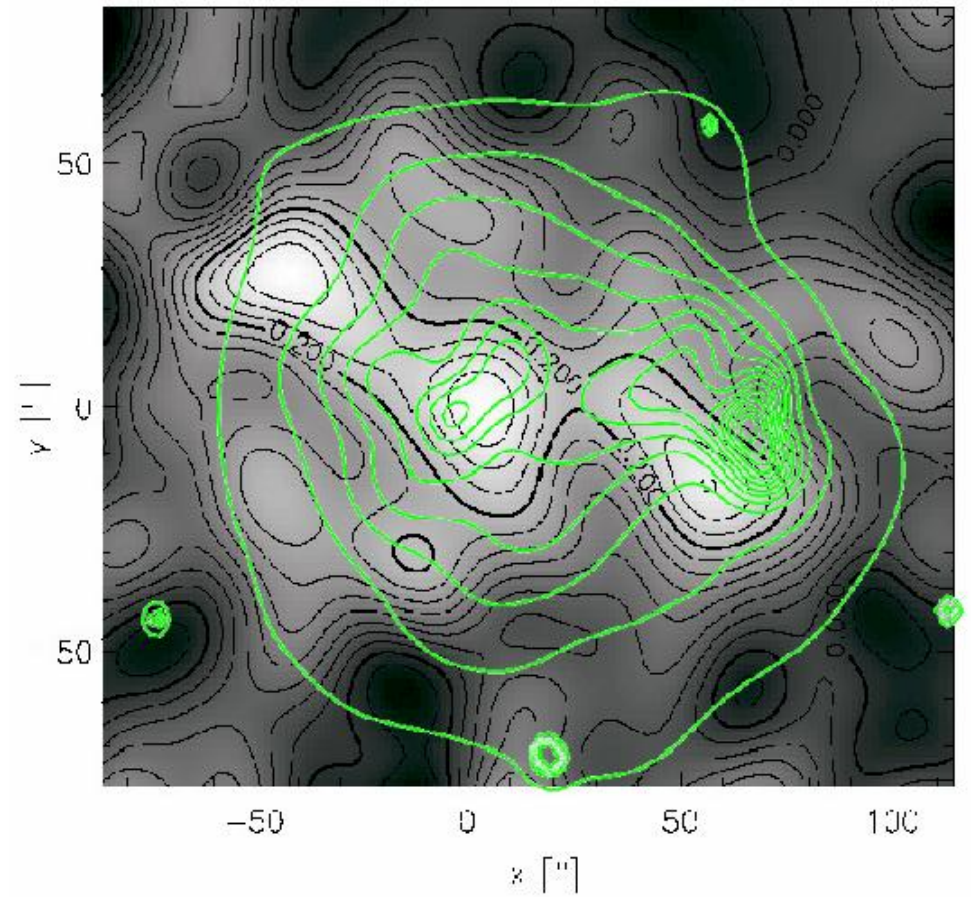
MS 1054-03

X-ray image



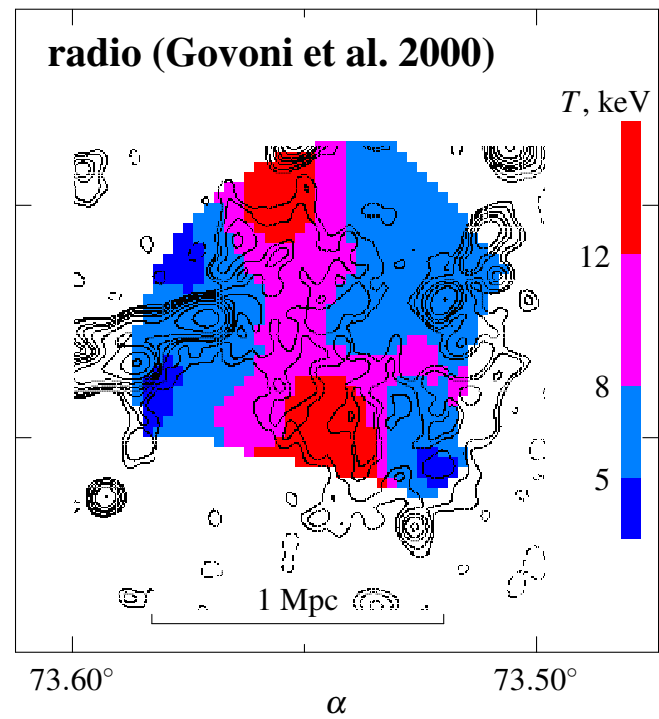
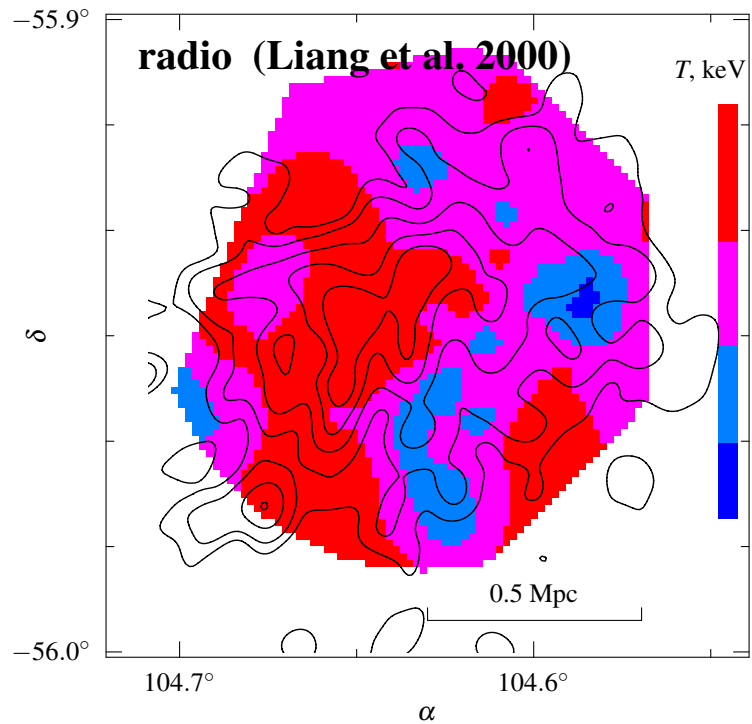
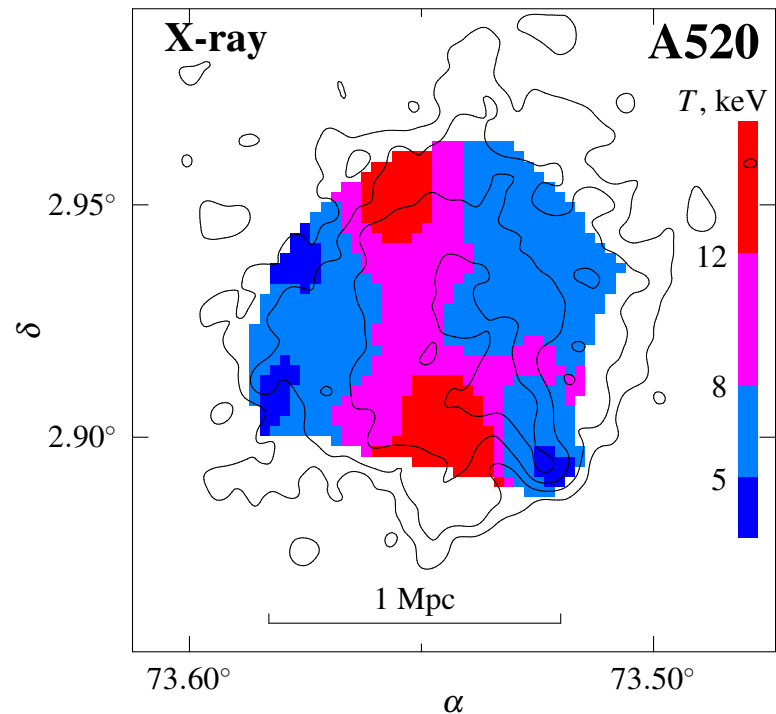
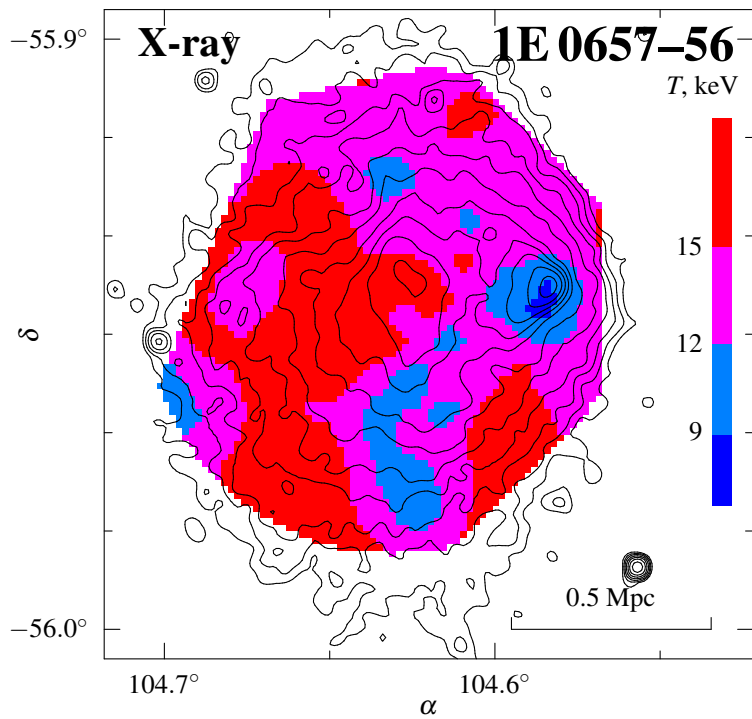
X-ray / weak lensing mass overlay

(Jetlema et al. 2001)

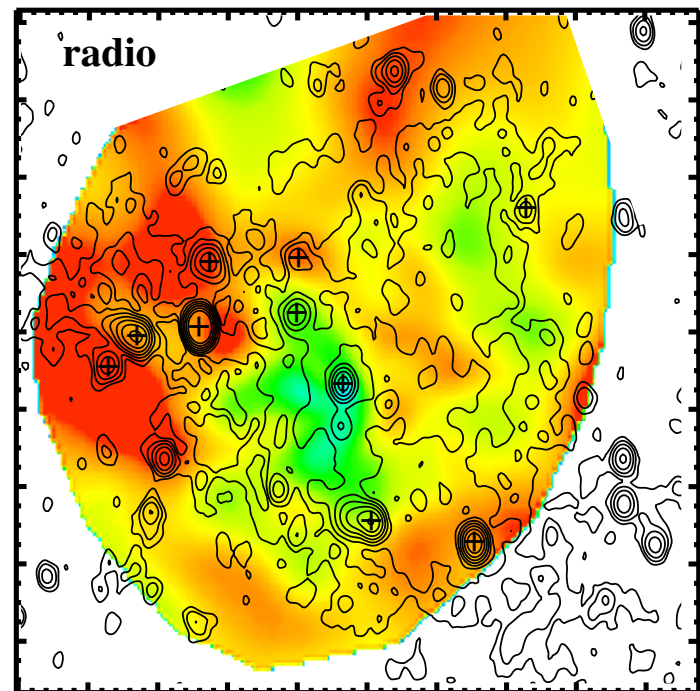
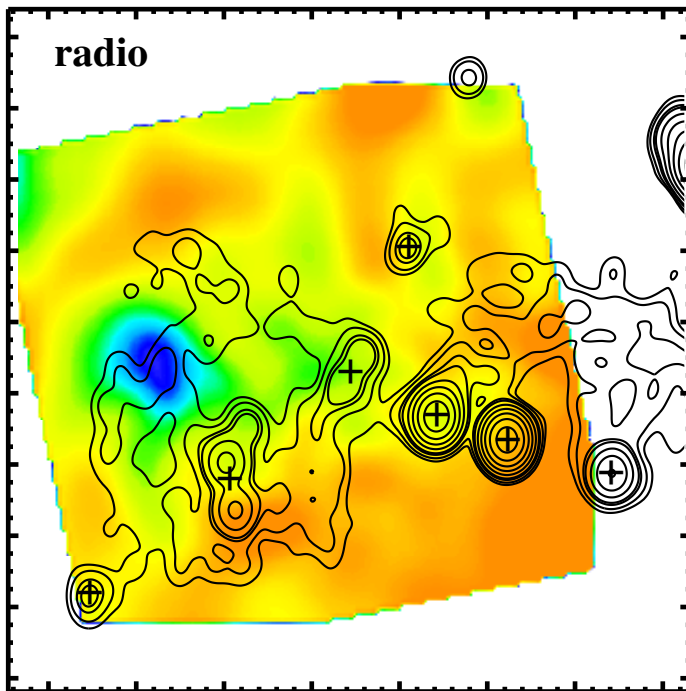
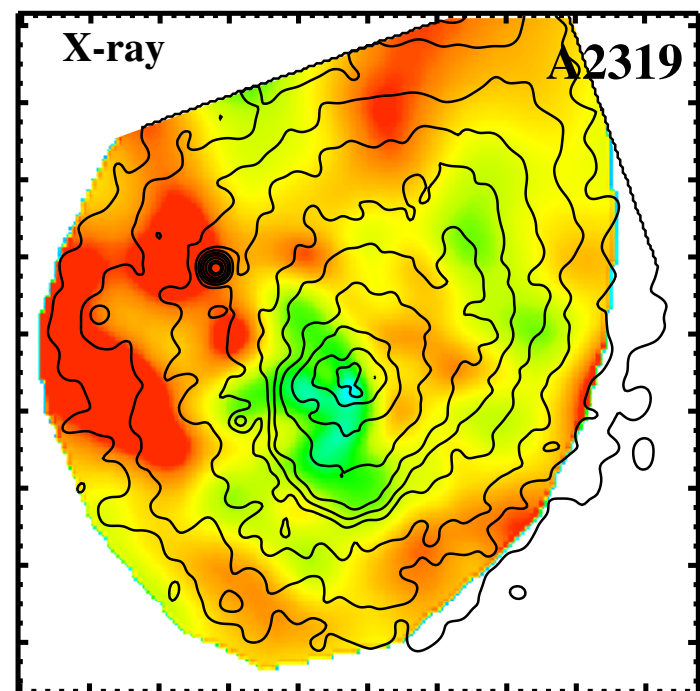
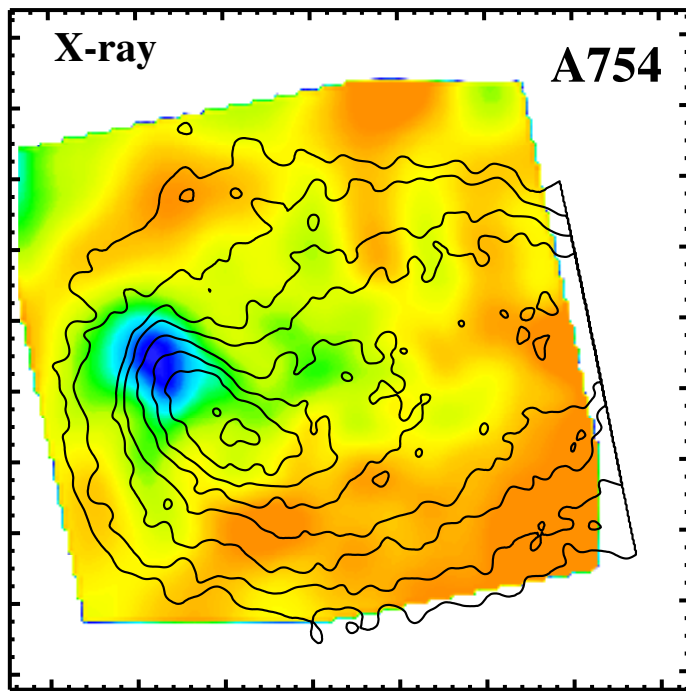


Cluster radio halos

- **Synchrotron radiation from $\gamma \sim 10^4$ electrons**
- **Very short lifetime, yet halos are very extended**
- **Most likely generated by cluster mergers — shocks or turbulence?**



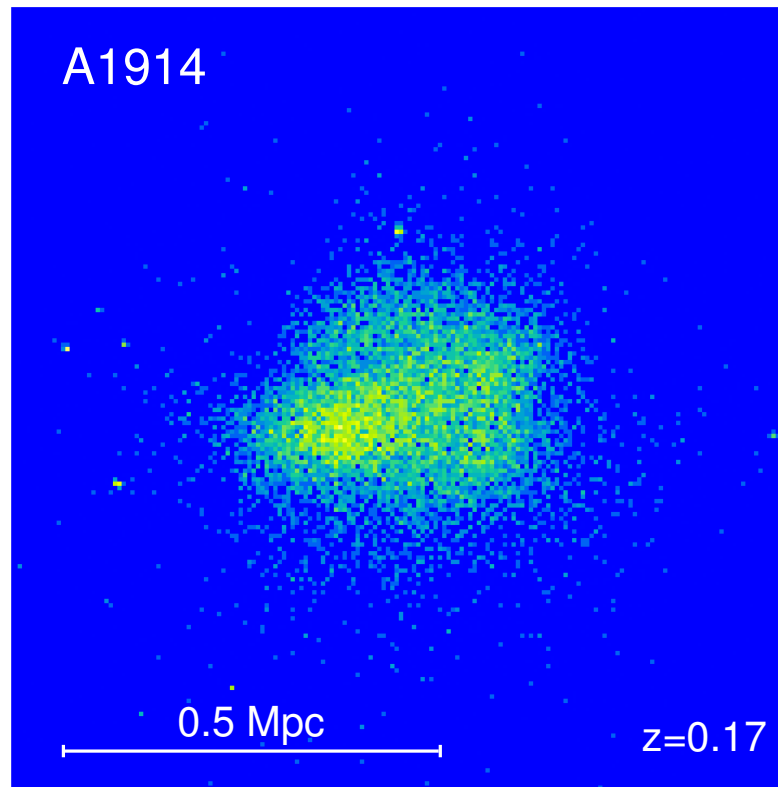
- **Radio brightness correlates with gas temperature — shock acceleration?**



- **Counterexamples — exclude shocks (at least weak ones) as acceleration mechanism (Govoni et al. 2003)**

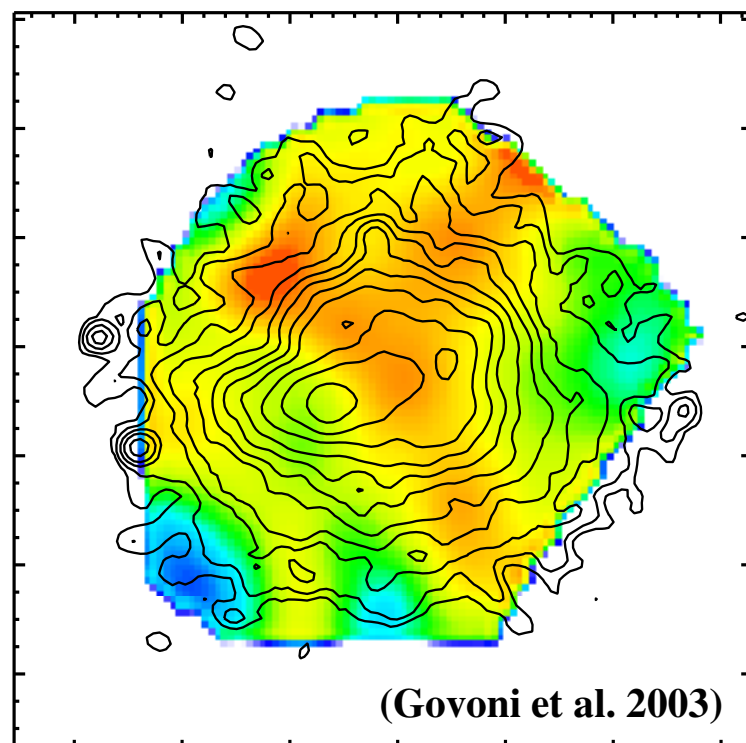
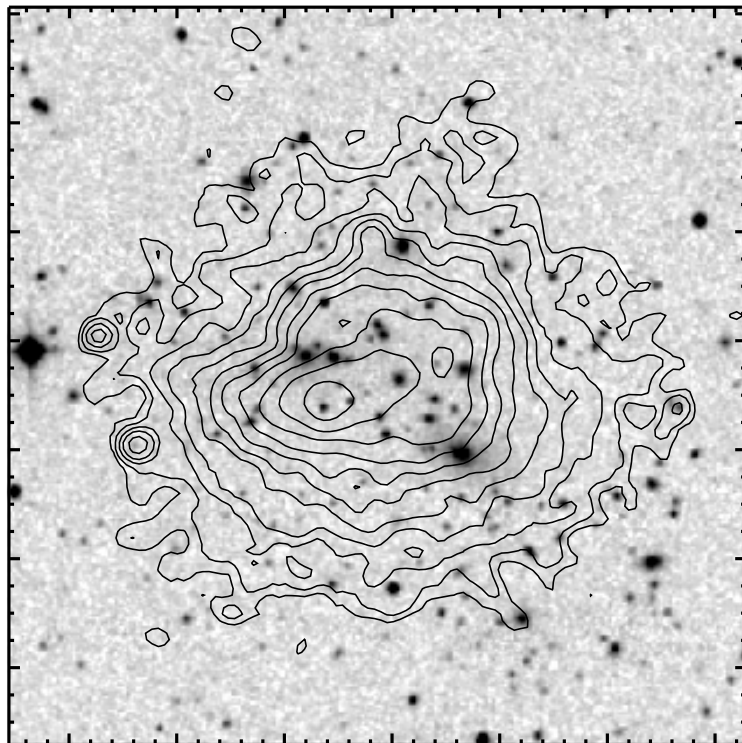
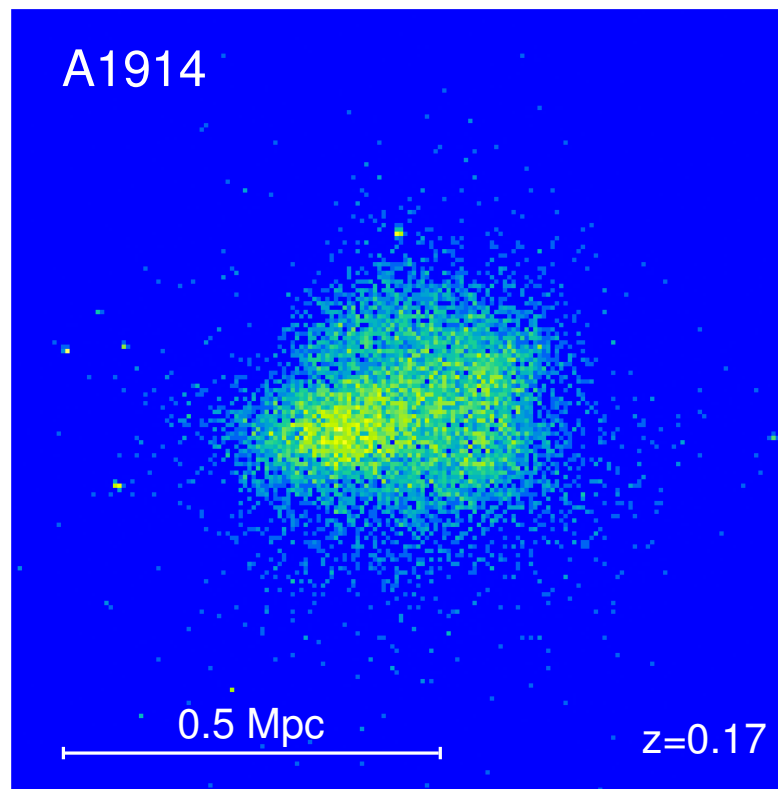
Cluster zoo

A1914

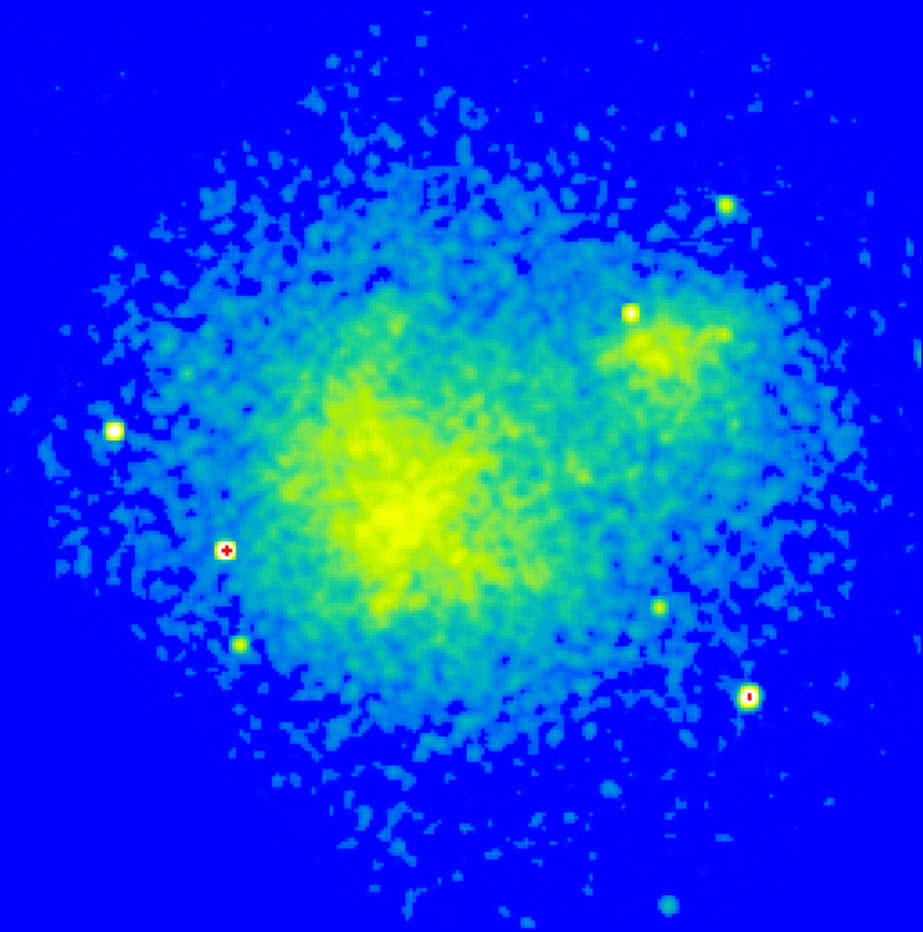


0.5 Mpc

$z=0.17$

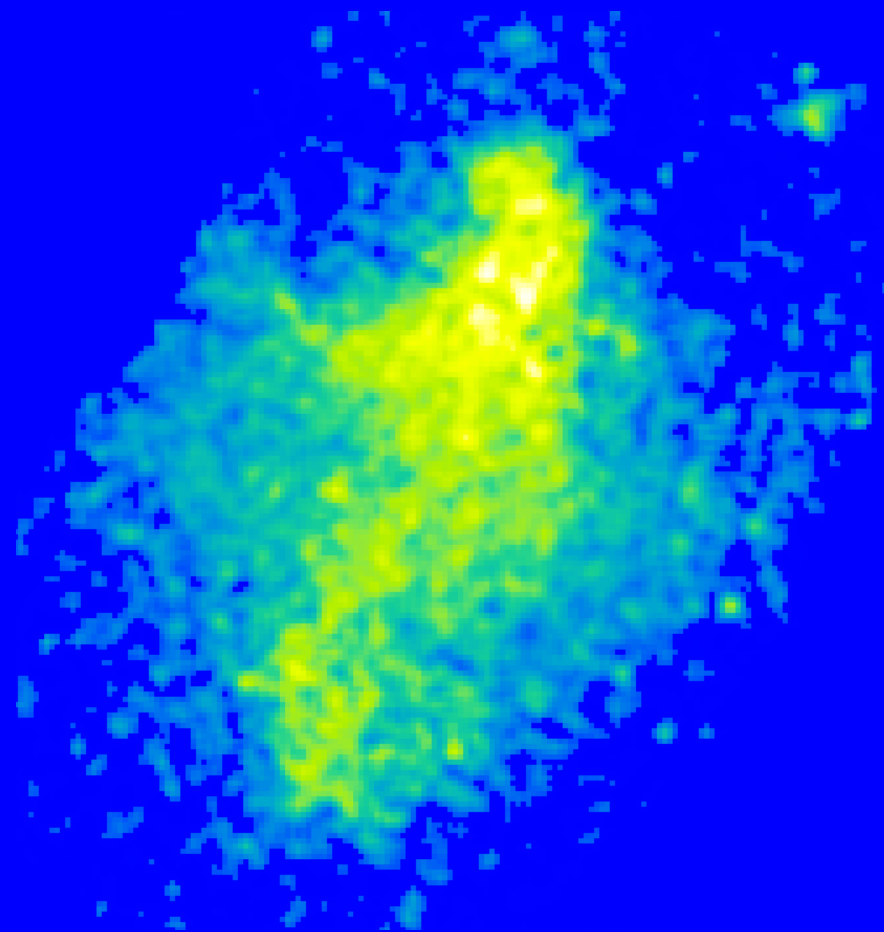


A2744



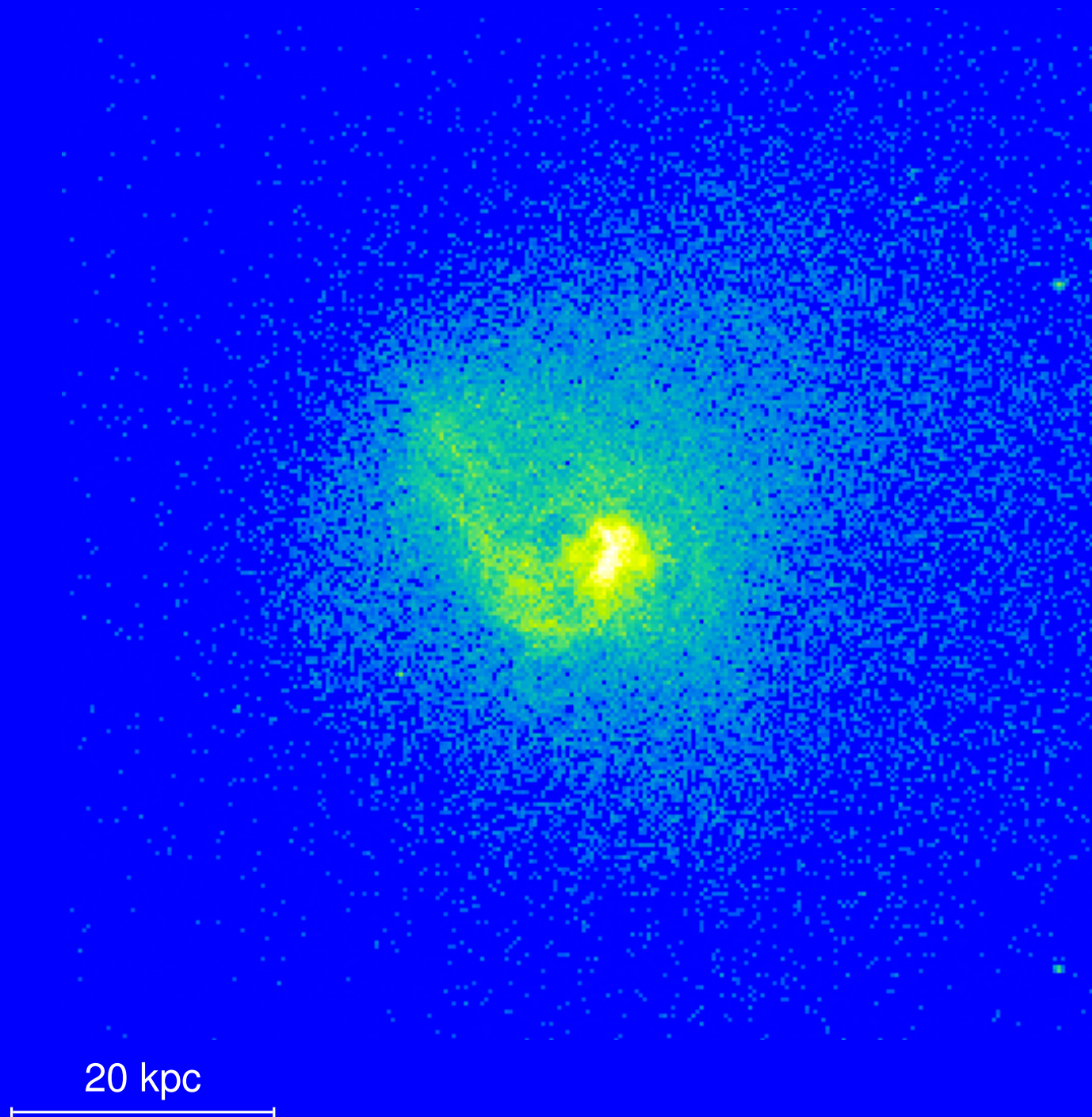
1 Mpc

A168



0.5 Mpc

Centaurus



M87

10 kpc



Perseus

50 kpc

