

Chandra & JVLA Observations of the Frontier Cluster MACS J0717.5+3745



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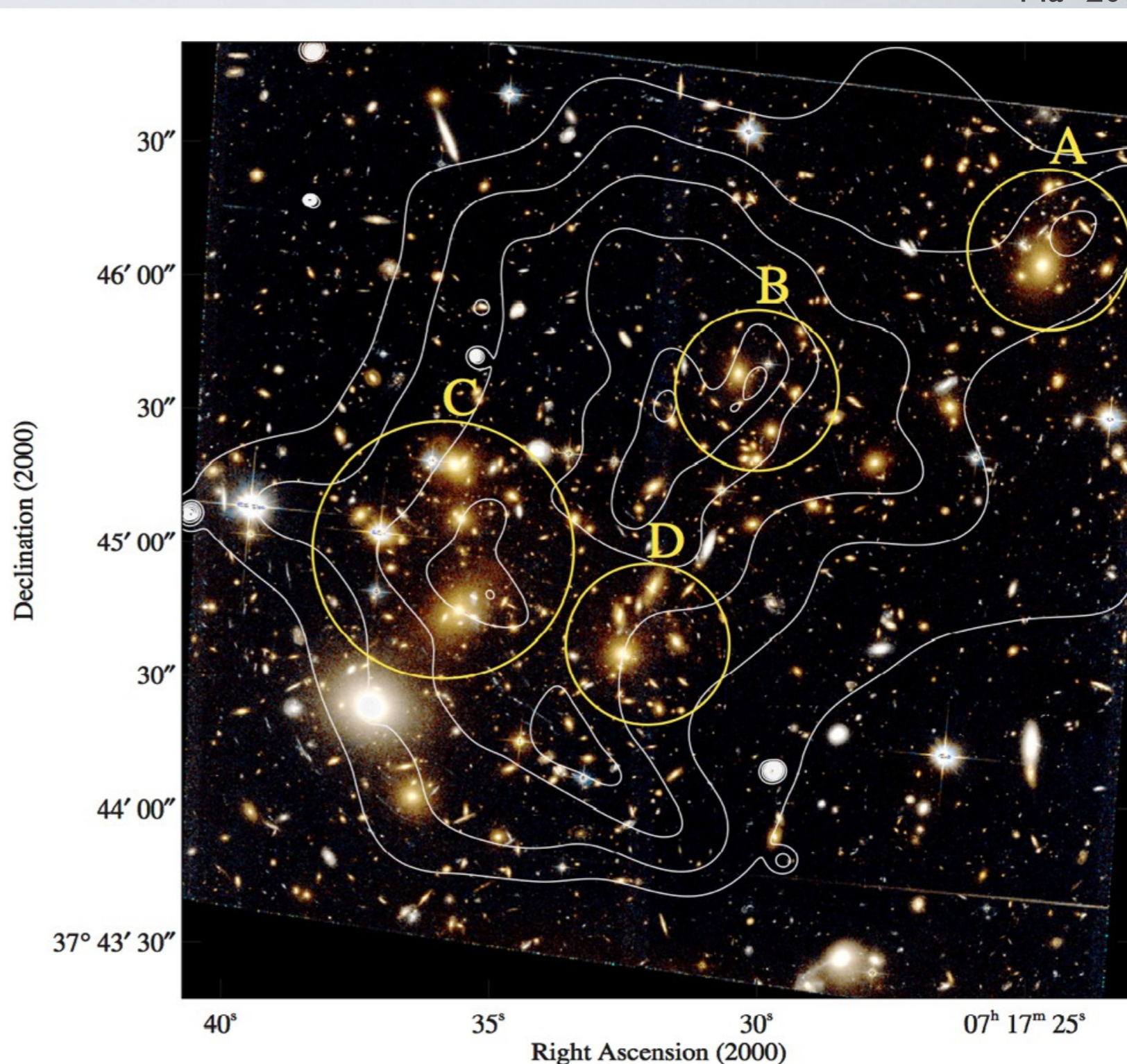
MACS J0717.5+3745

Previous work:

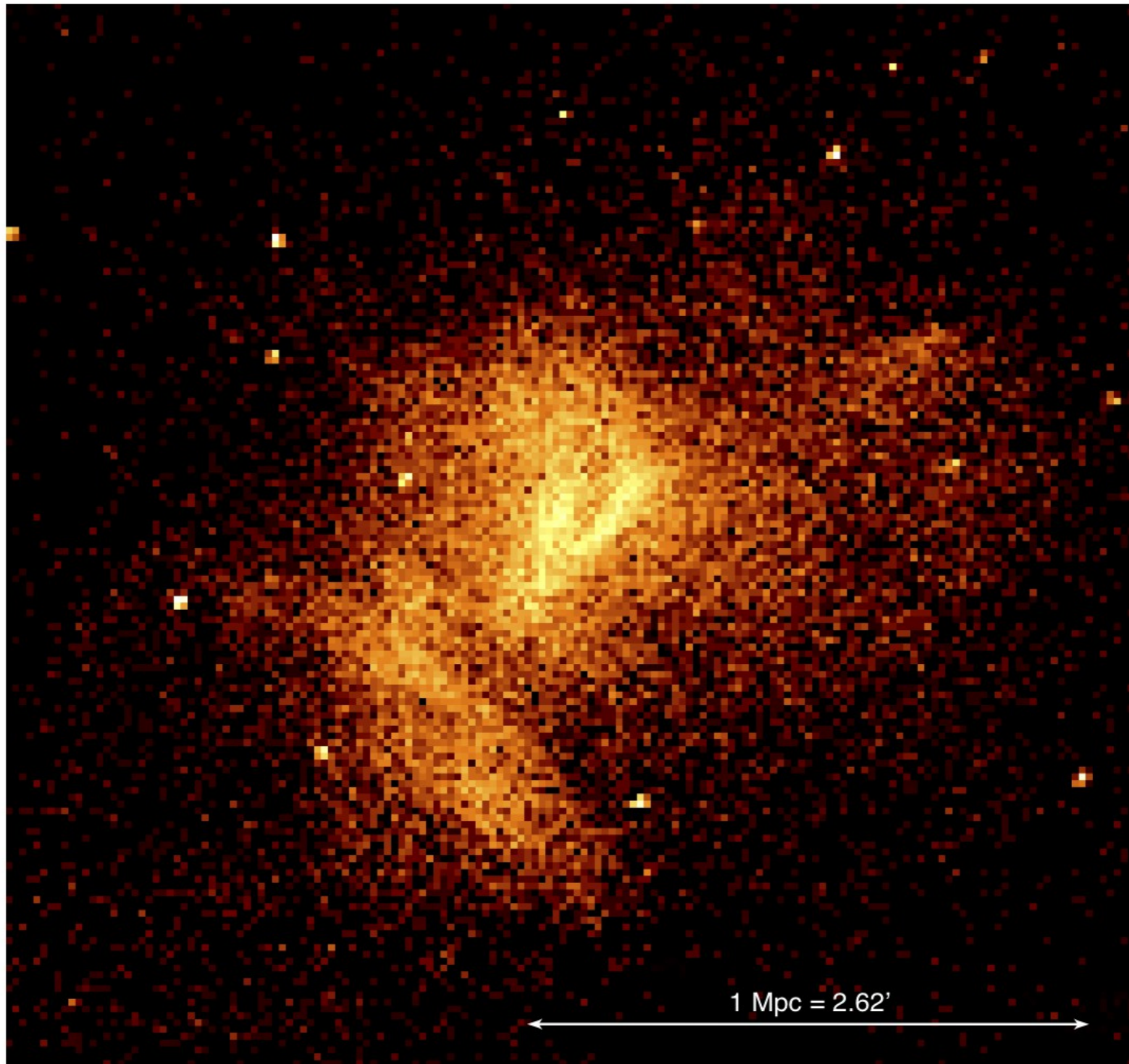
Medezinski+2013; Jauzac+2012; Ma+2009; Zitrin+2009; Ebeling+2007; Ebeling+2004; Edge+2003

Ma+2009

- $z = 0.5458$
- $L_X(0.5-2.0 \text{ keV}) = 2.5 \times 10^{45} \text{ erg s}^{-1}$
- $T = 11.6 \text{ keV}$
- $M_{\text{vir}} = 3 \times 10^{15} M_{\odot}$
- Quadruple merger event
- $\sigma_v = 660 - 1760 \text{ km s}^{-1}$ (for the subclusters)
- Hints of shock heated regions: $\sim 20+ \text{ keV}$



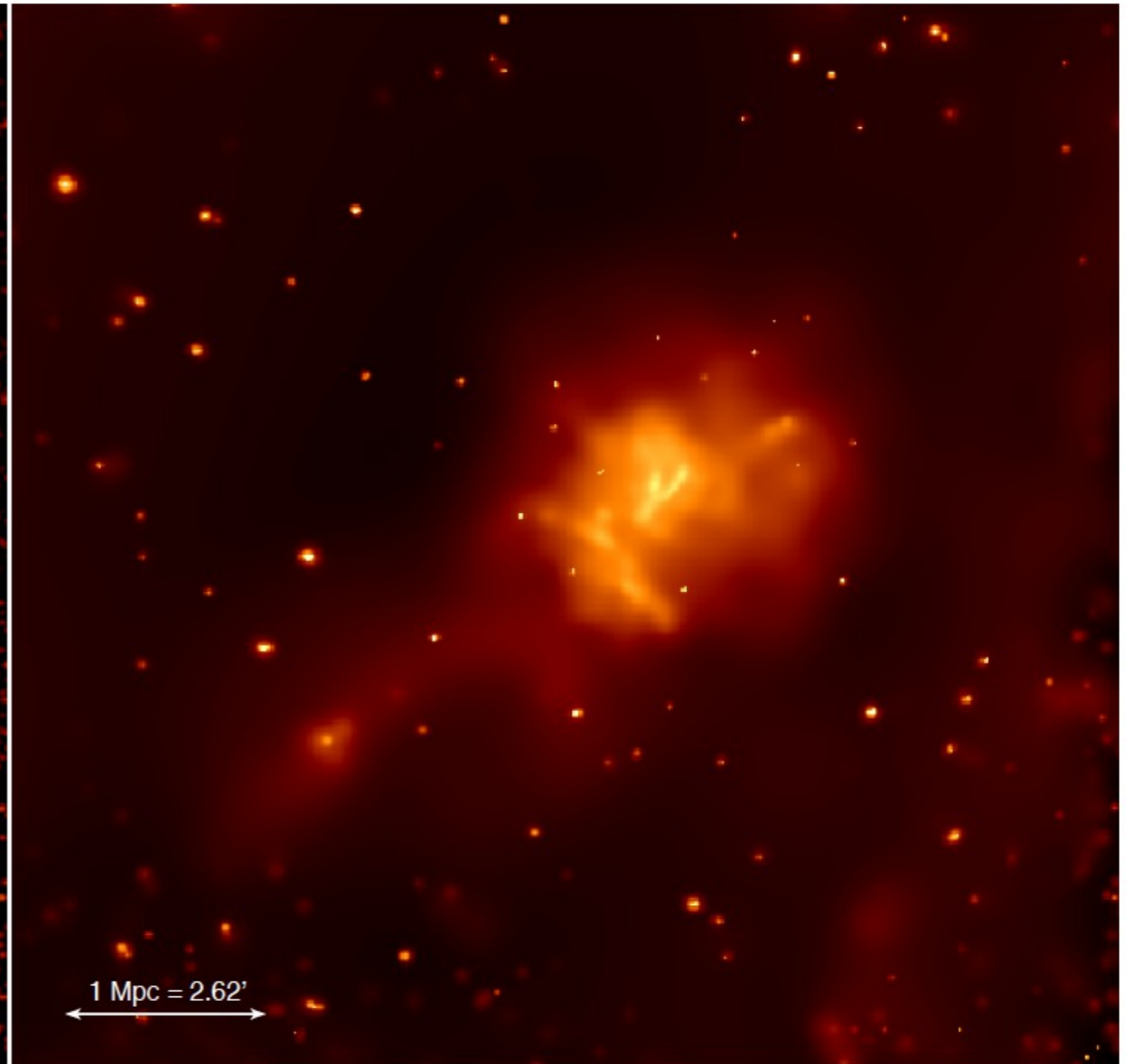
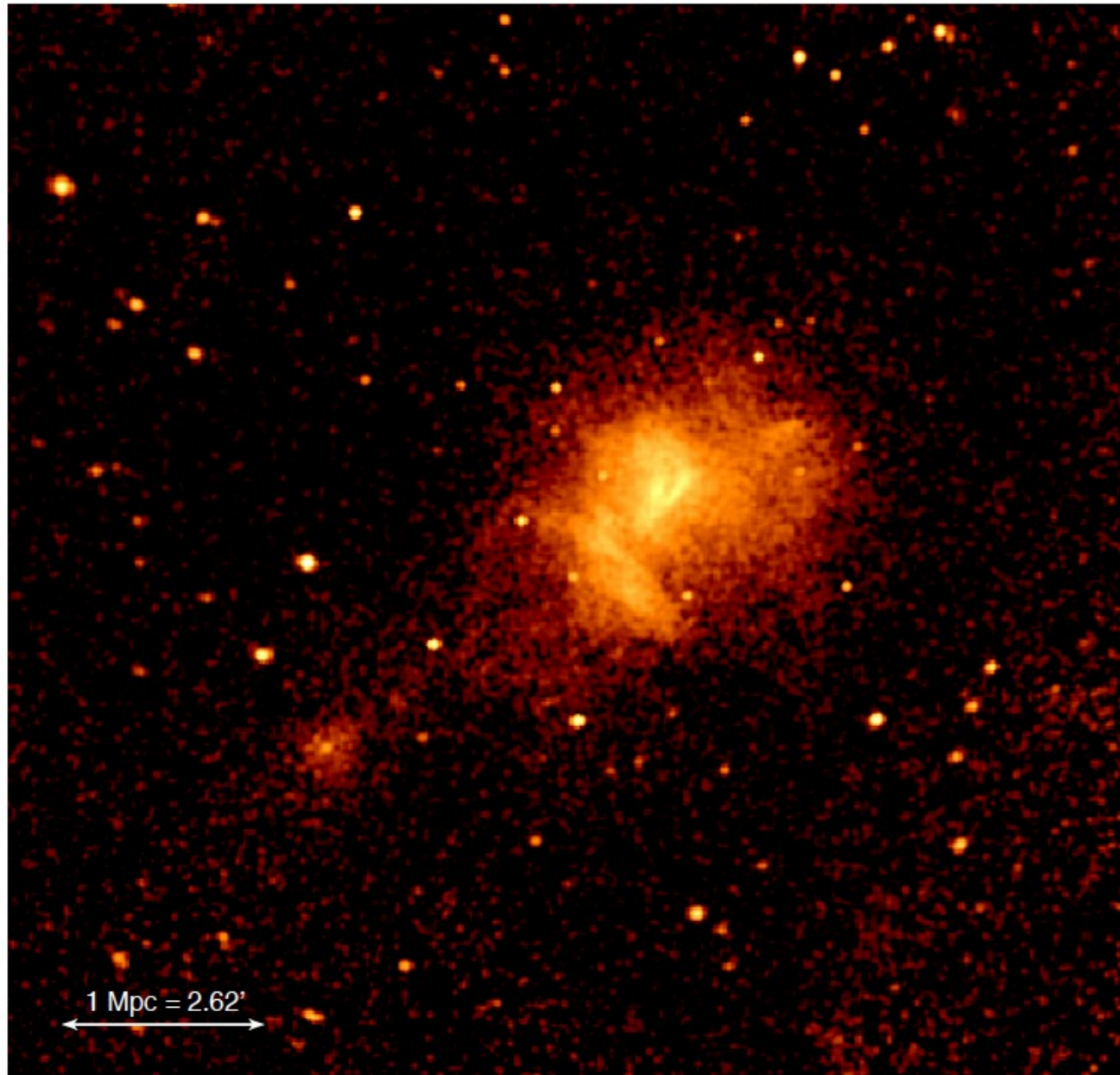
CHANDRA



CHANDRA

243 ks - 0.5-2.0 keV - 1" pixels

Smoothed Image

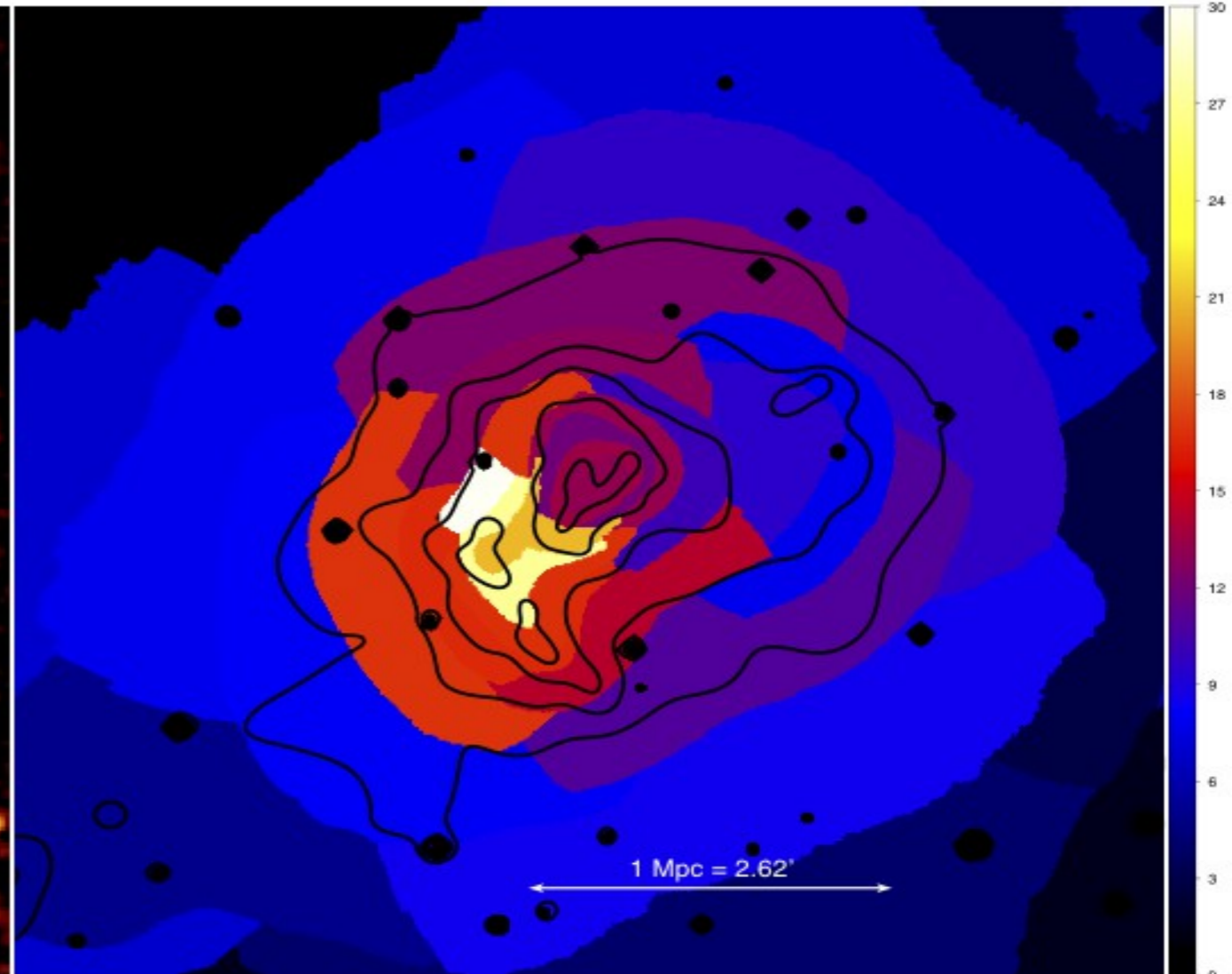
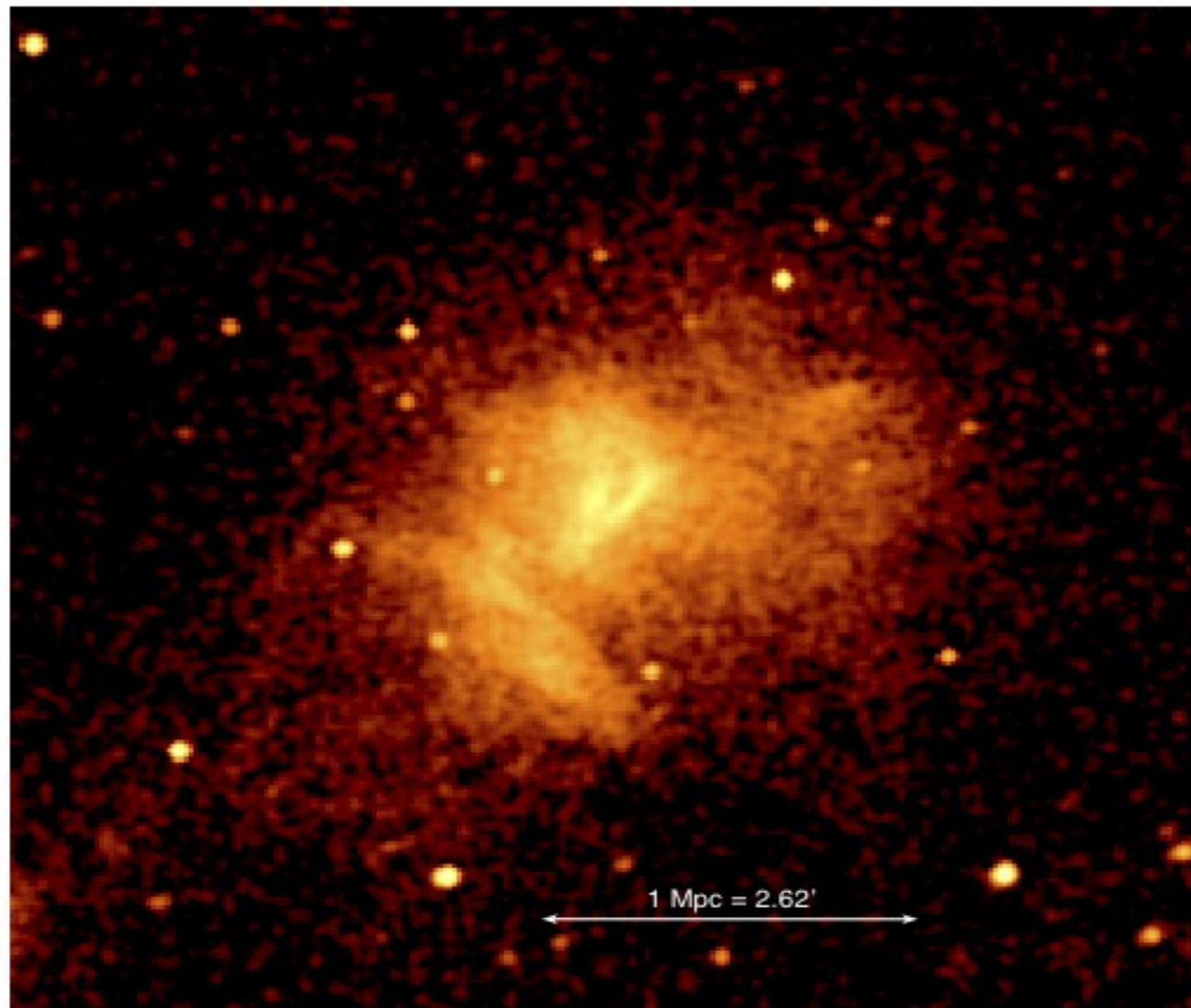


- Very disturbed morphology
- Filament extending to the south-east

TEMPERATURE MAP

X-ray

kT



- Very hot cluster: $kT > 20$ keV in the merger region!

MACS J0717.5+3745: NON-THERMAL EMISSION

van Weeren+ 2009; Bonafede+2009; Pandey-Pommier+2013

GMRT 610 MHz

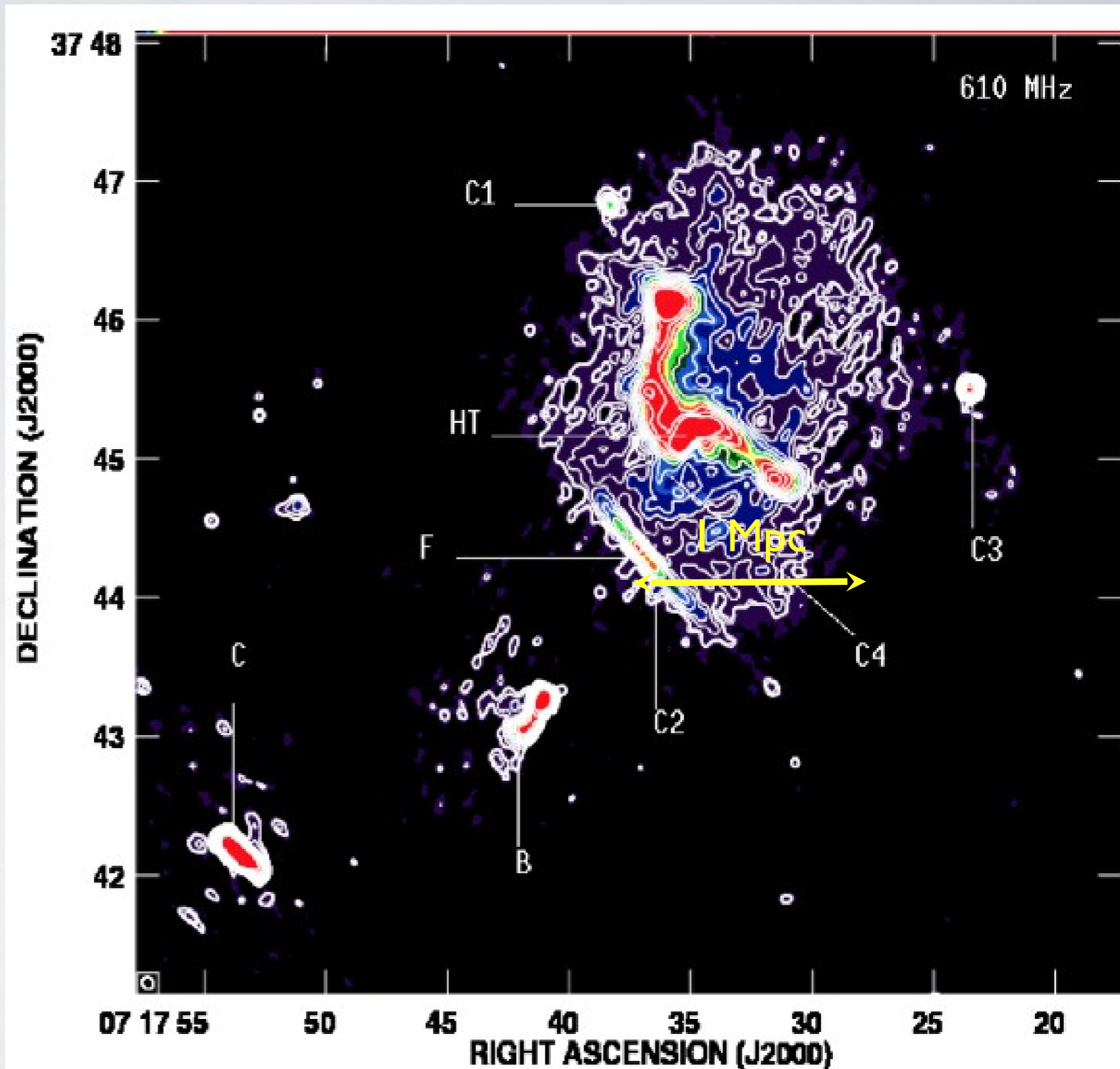
What is the origin of the non-thermal component?

Radio observations:

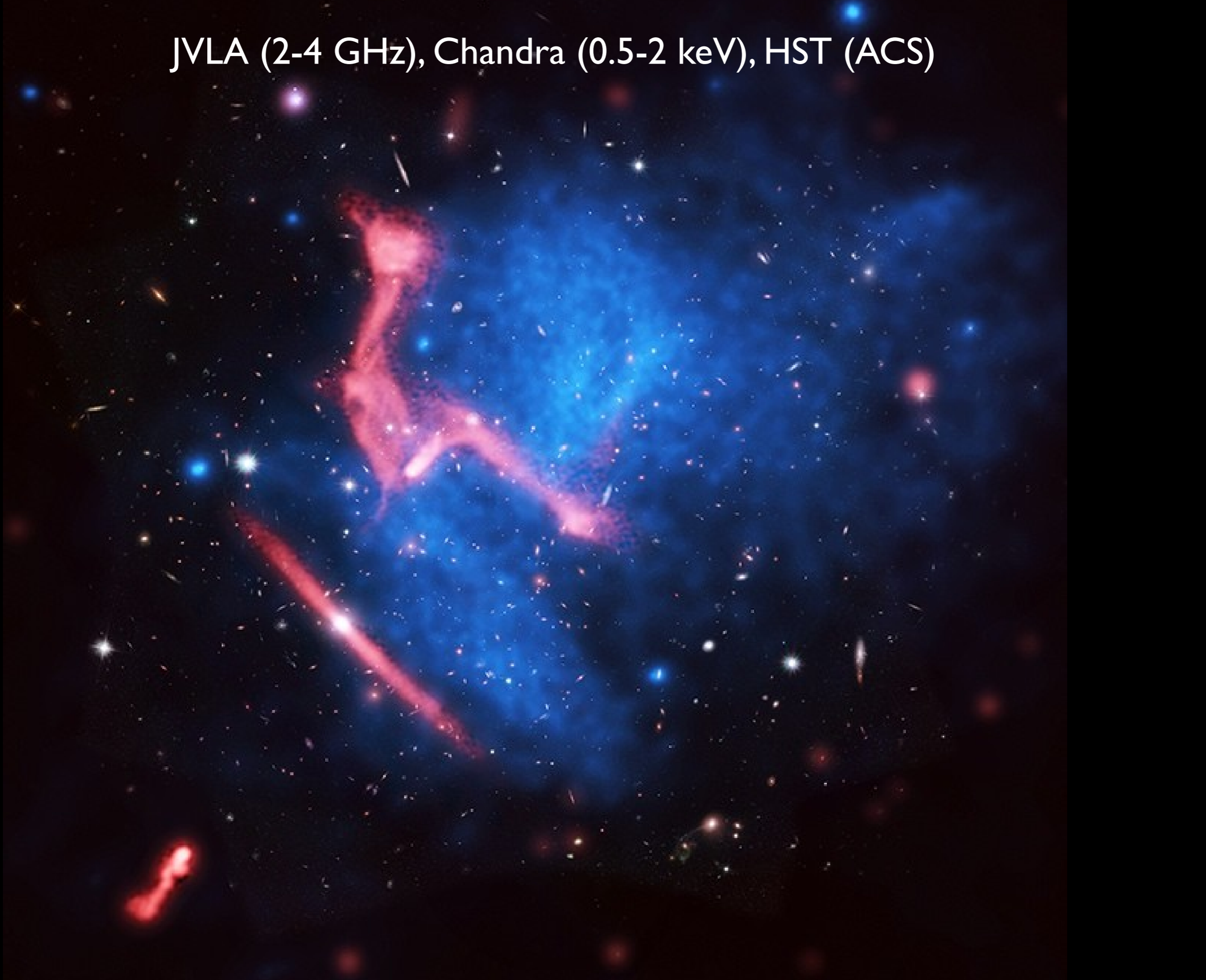
- 850 kpc radio relic
- 1.5 Mpc radio halo

implies: cluster-wide population of cosmic rays and magnetic fields

Most luminous radio source (halo + relic) in the sky



JVLA (2-4 GHz), Chandra (0.5-2 keV), HST (ACS)



JVLA (2-4 GHz), Chandra (0.5-2 keV), HST (ACS)

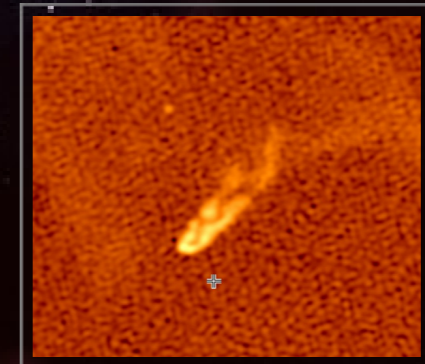
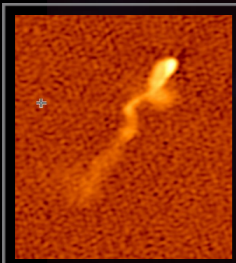
Radio Relic

Radio Relic

foreground FRI source
($z=0.15$)

Narrow Angle Tail (NAT)
galaxy (in cluster)

NAT galaxy (falling into the
cluster along a filament)



Summary

- Very disturbed morphology, indicative of several mergers
- Extremely hot ICM ($kT > 20$ keV) due to the merger
- Morphology suggests a connection between relic and NAT source
- Relic traces shock heated ICM
- Supports shock re-acceleration scenario