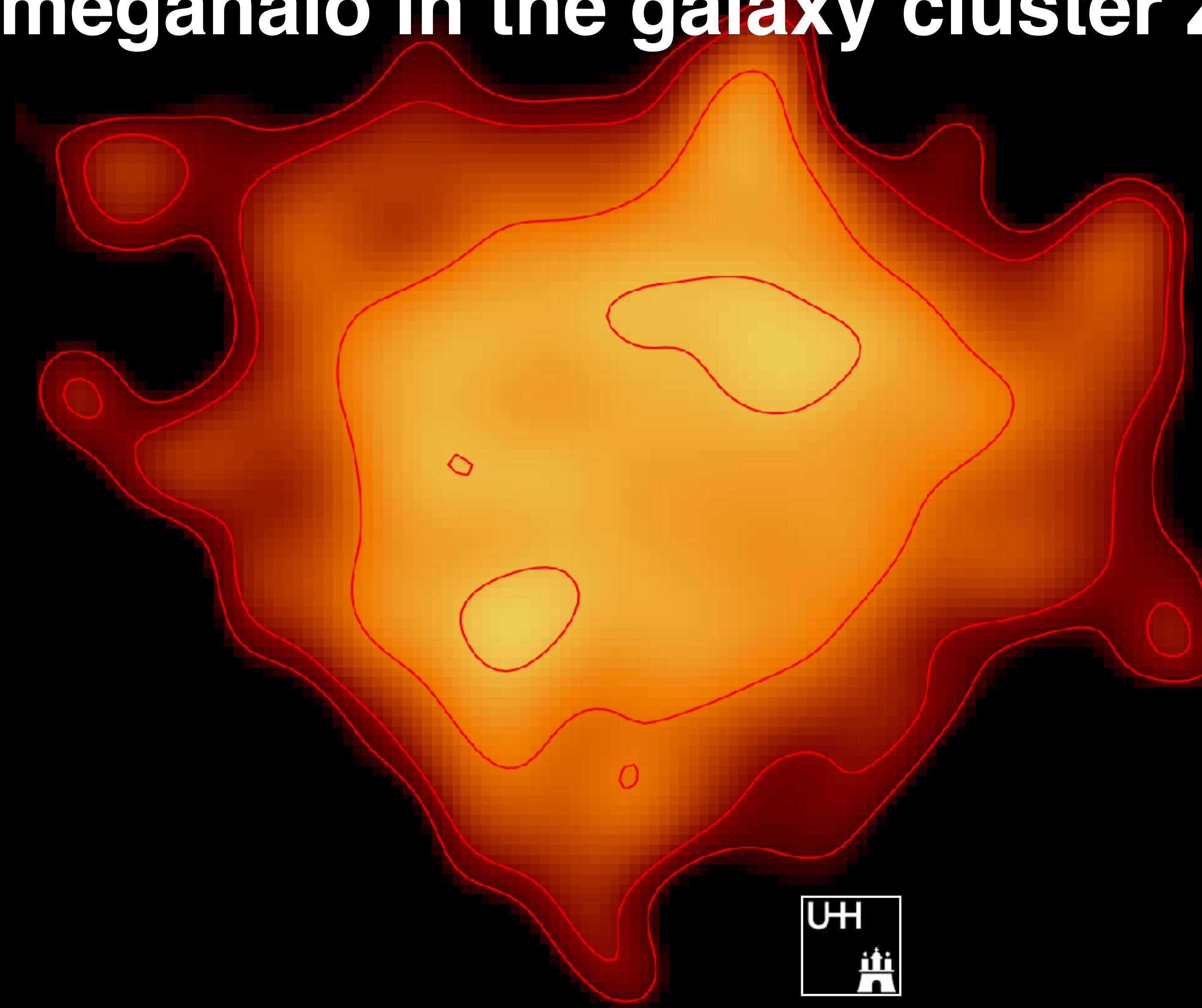


The megahalo in the galaxy cluster ZwCl 0634.1+4750



Hamburg Observatory

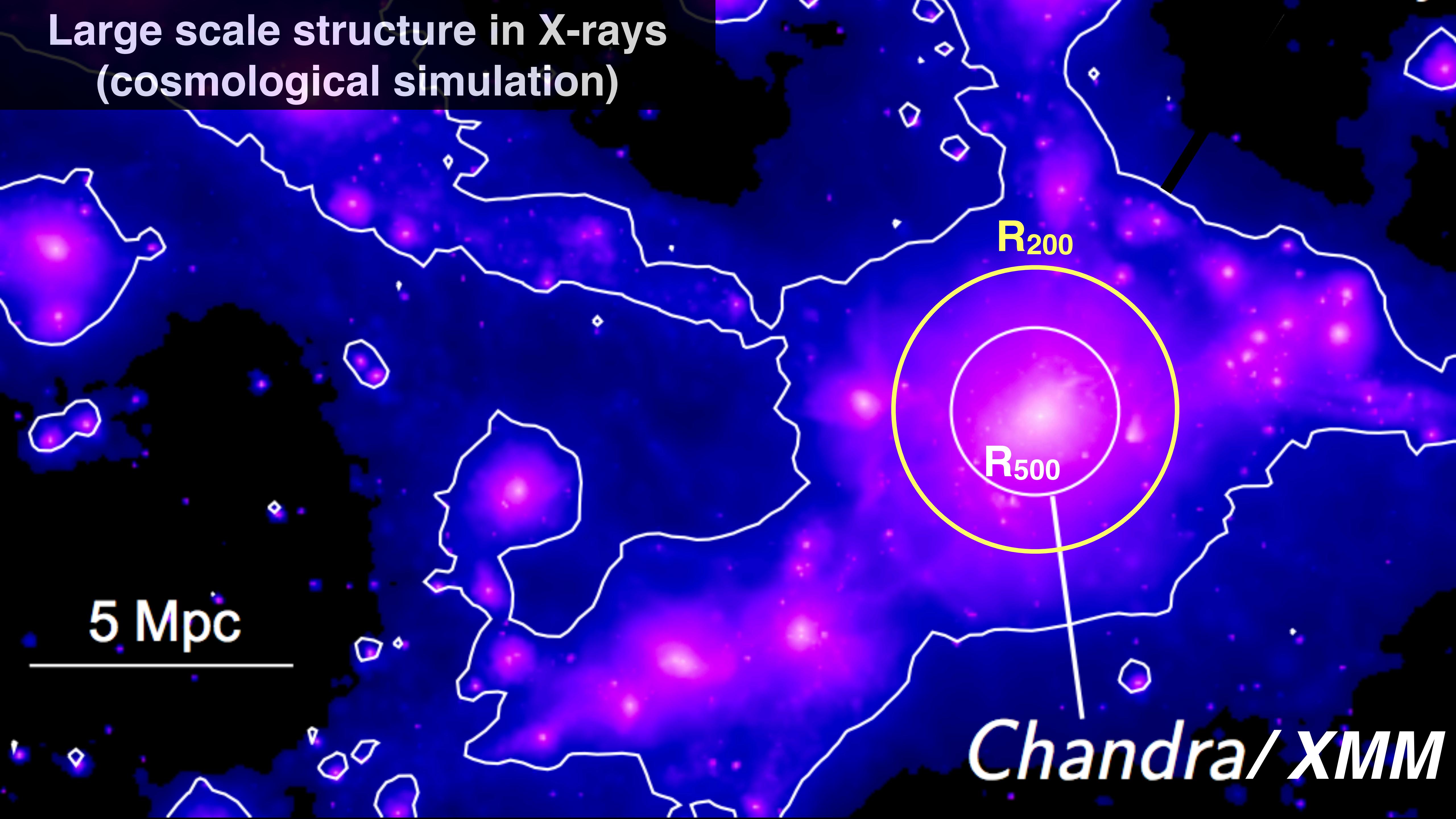
Virginia Cuciti
von Humboldt fellow

F. De Gasperin, M. Brueggen, G.
Brunetti, R. Van Weeren, T. Shimwell, F.
Vazza, H. Hedler, A. Botteon...

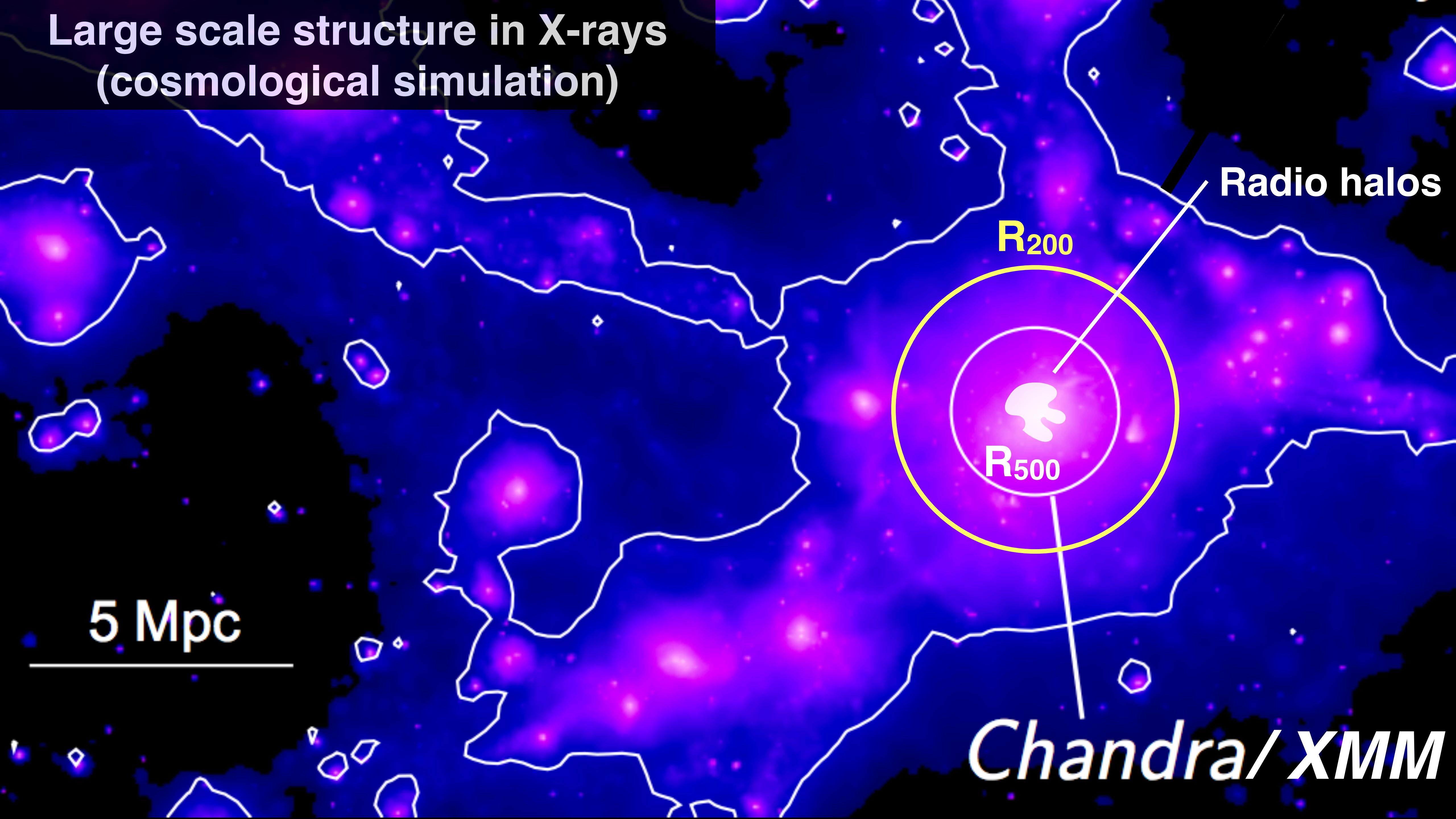
Outline

- Galaxy clusters and beyond
- Zwcl 0634.1+4750: radio galaxies and radio halo
- Megahalo: properties and possible scenarios
- Other examples of Meghalos?

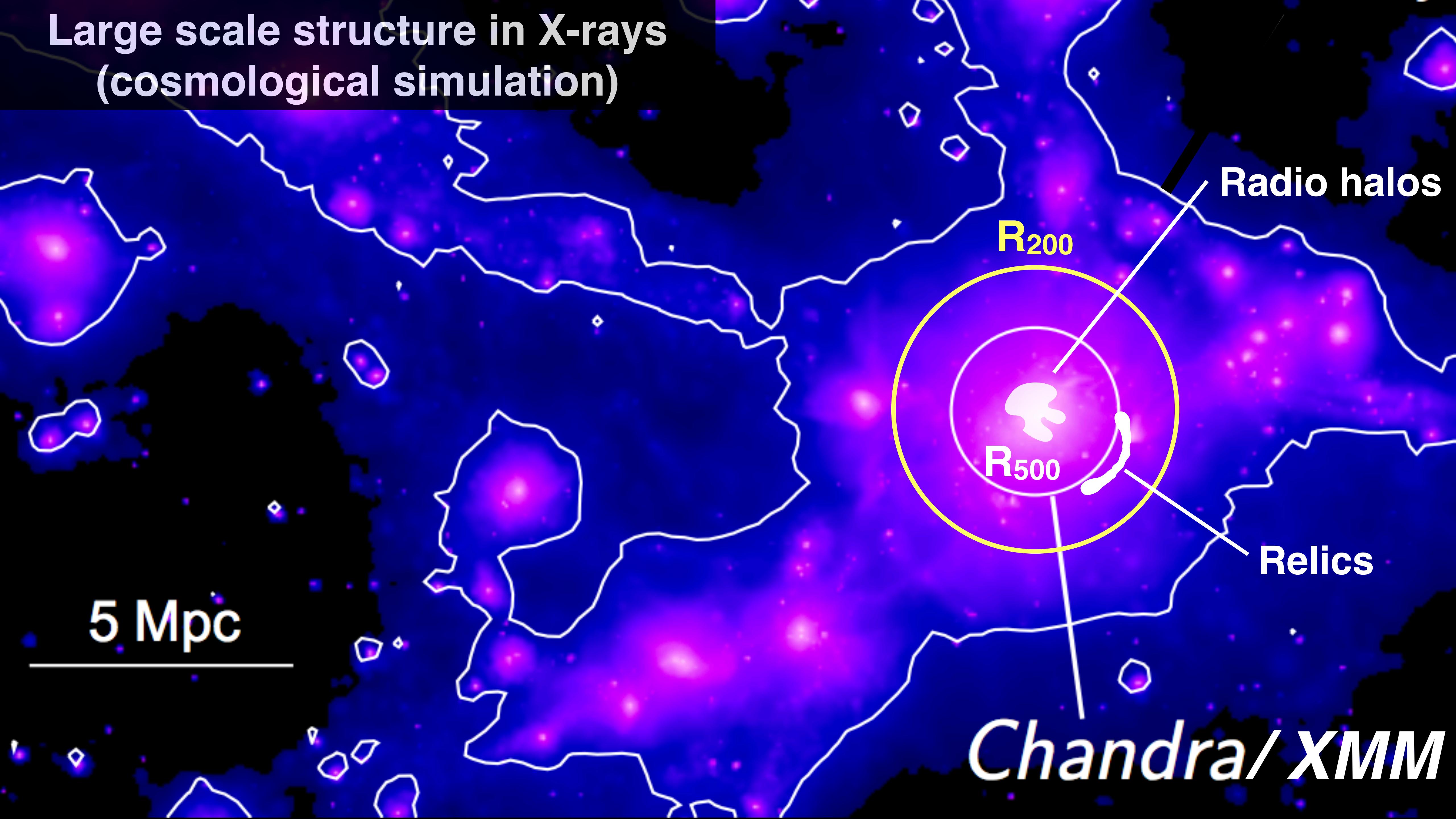
Large scale structure in X-rays (cosmological simulation)



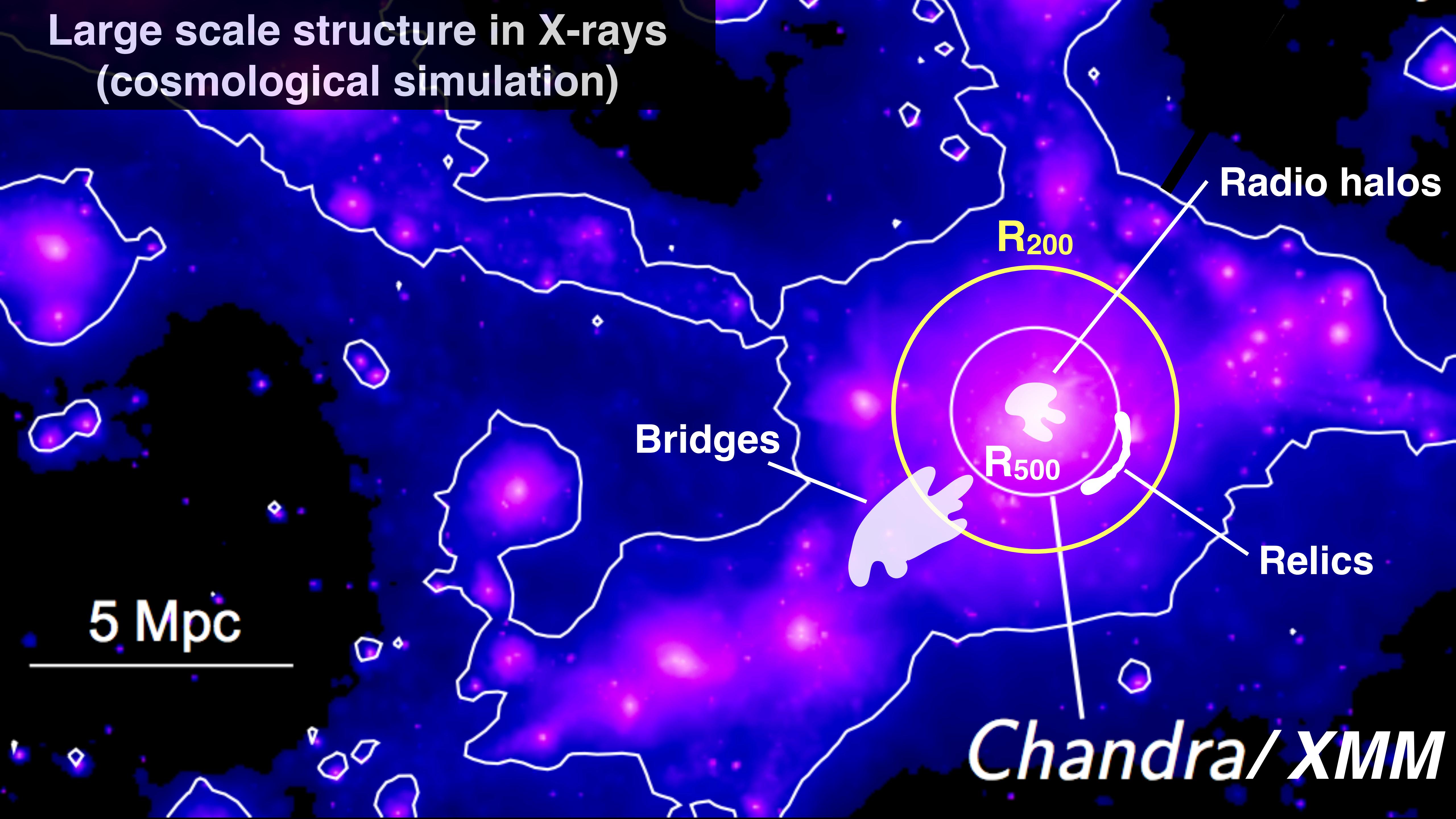
Large scale structure in X-rays (cosmological simulation)



Large scale structure in X-rays (cosmological simulation)

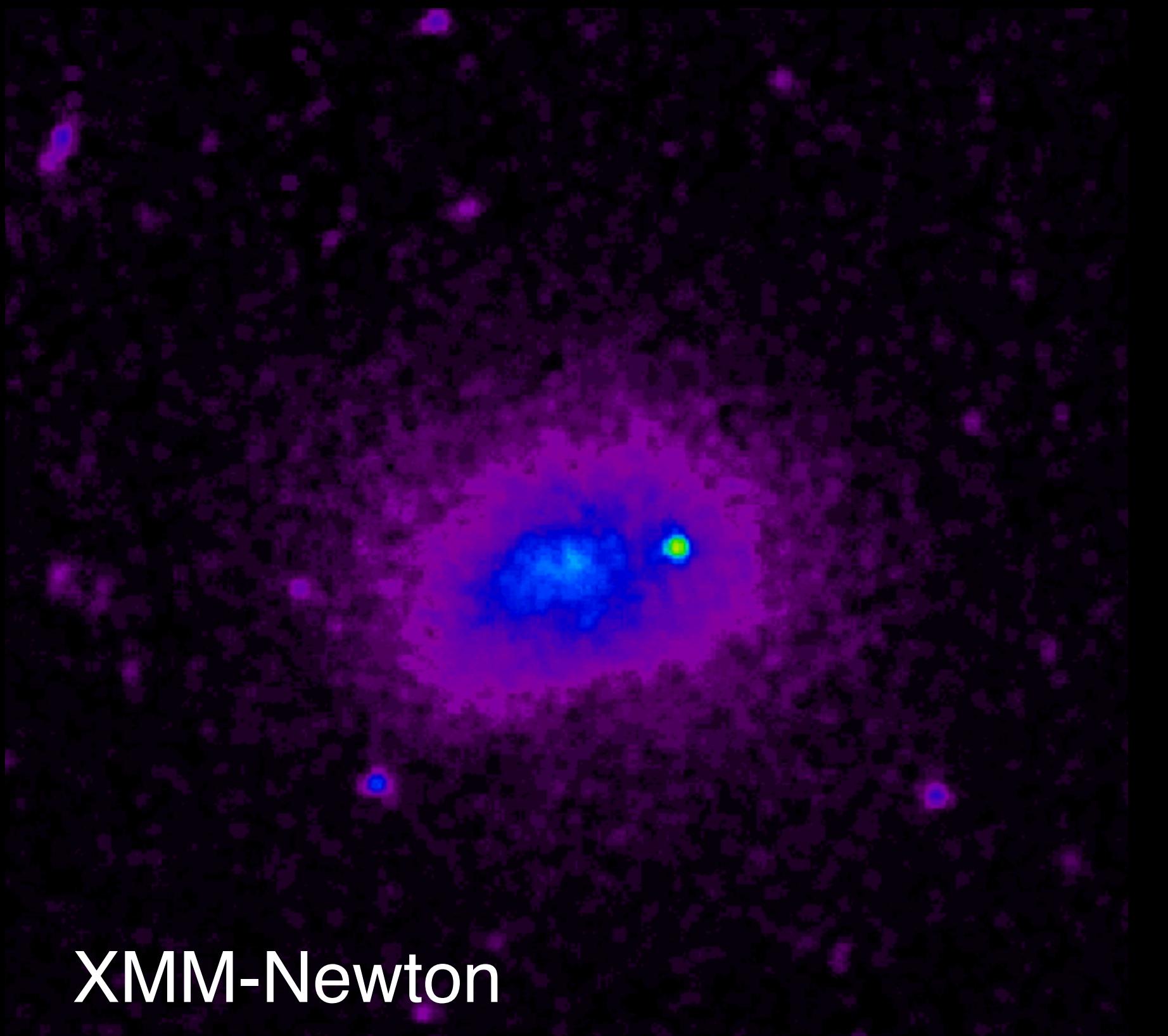


Large scale structure in X-rays (cosmological simulation)



Zwcl 0634.1+4750

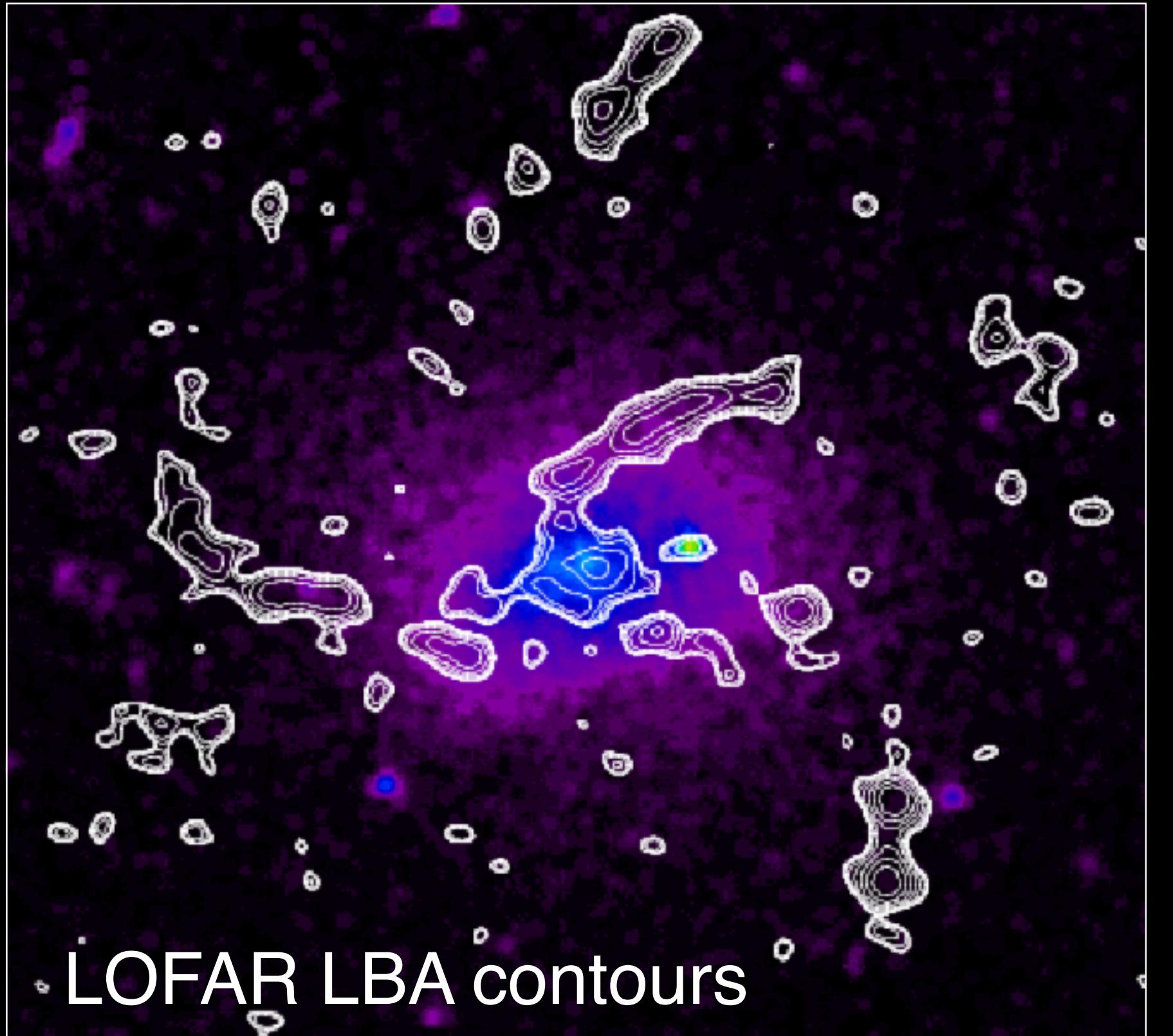
$M_{500} \approx 6.5 \times 10^{14} M_\odot$, $z=0.17$



XMM-Newton

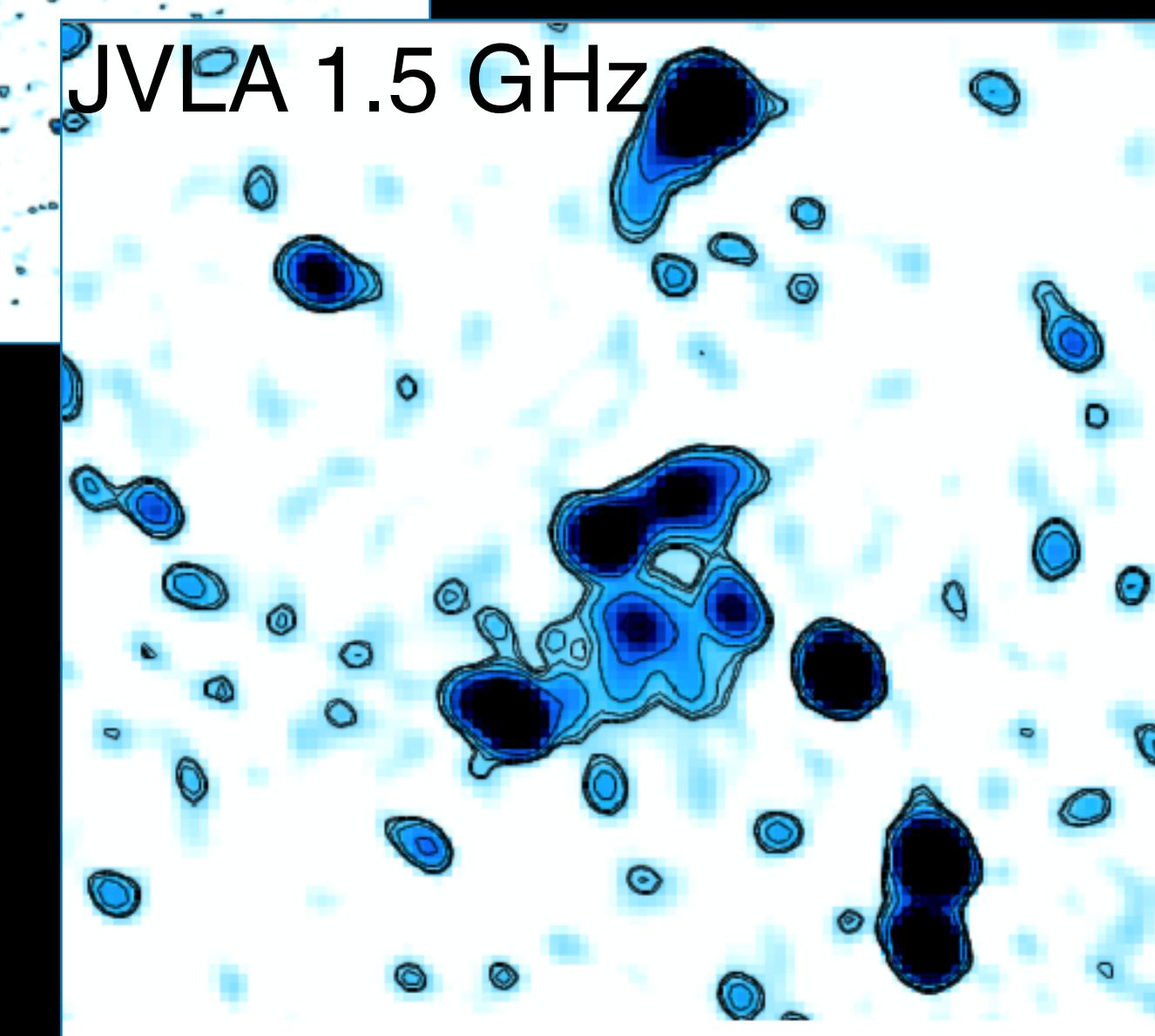
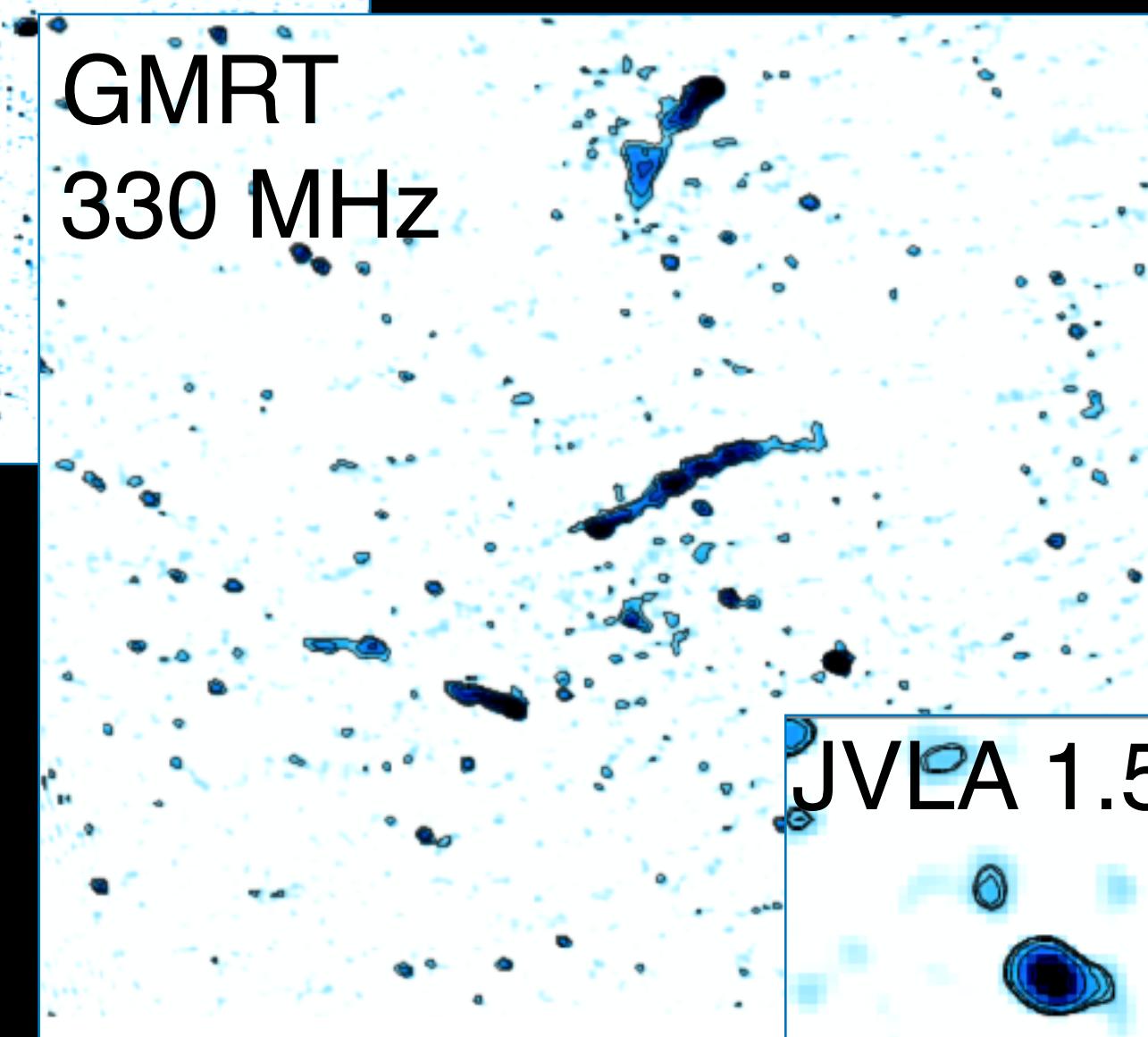
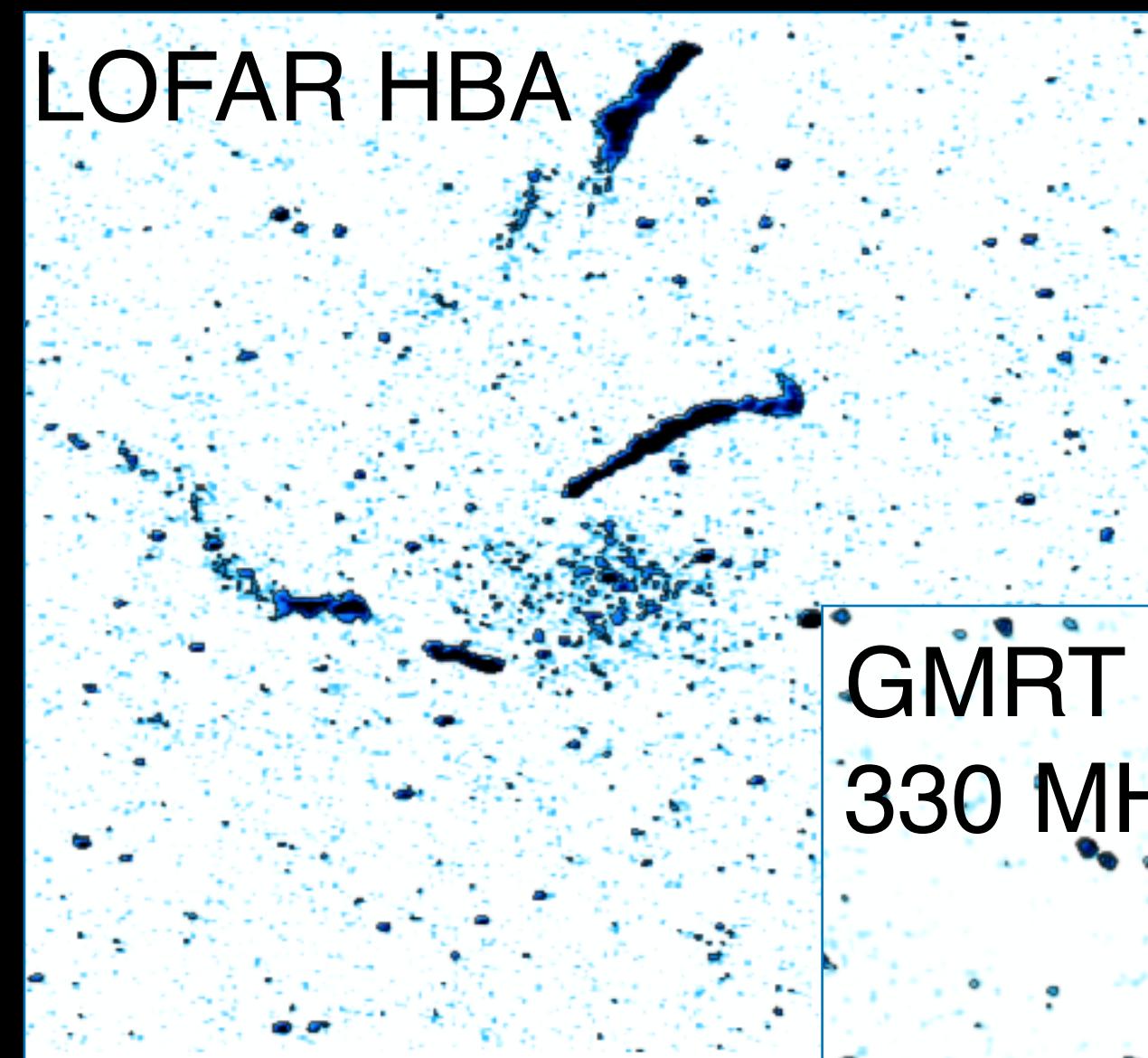
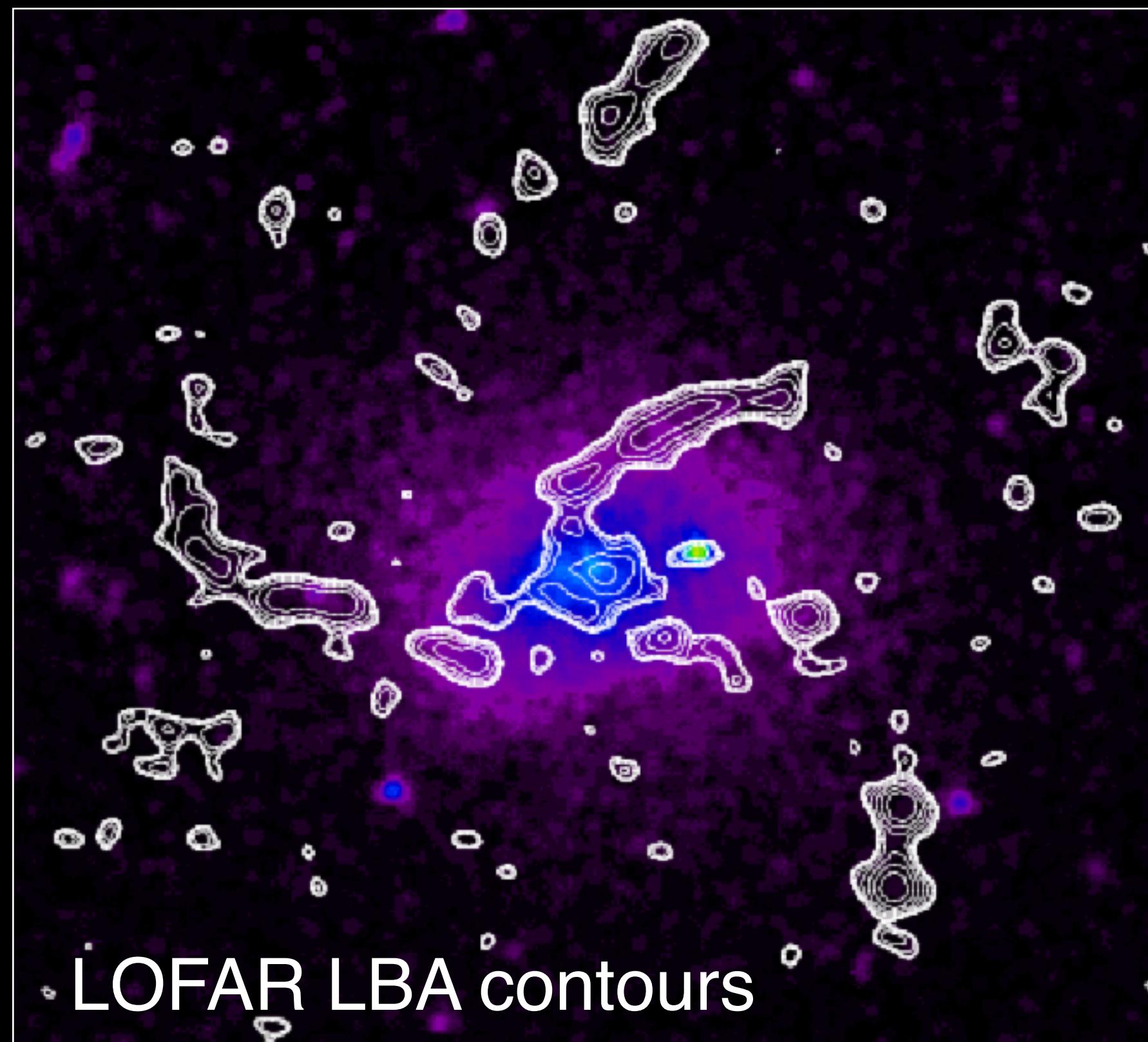
Zwcl 0634.1+4750

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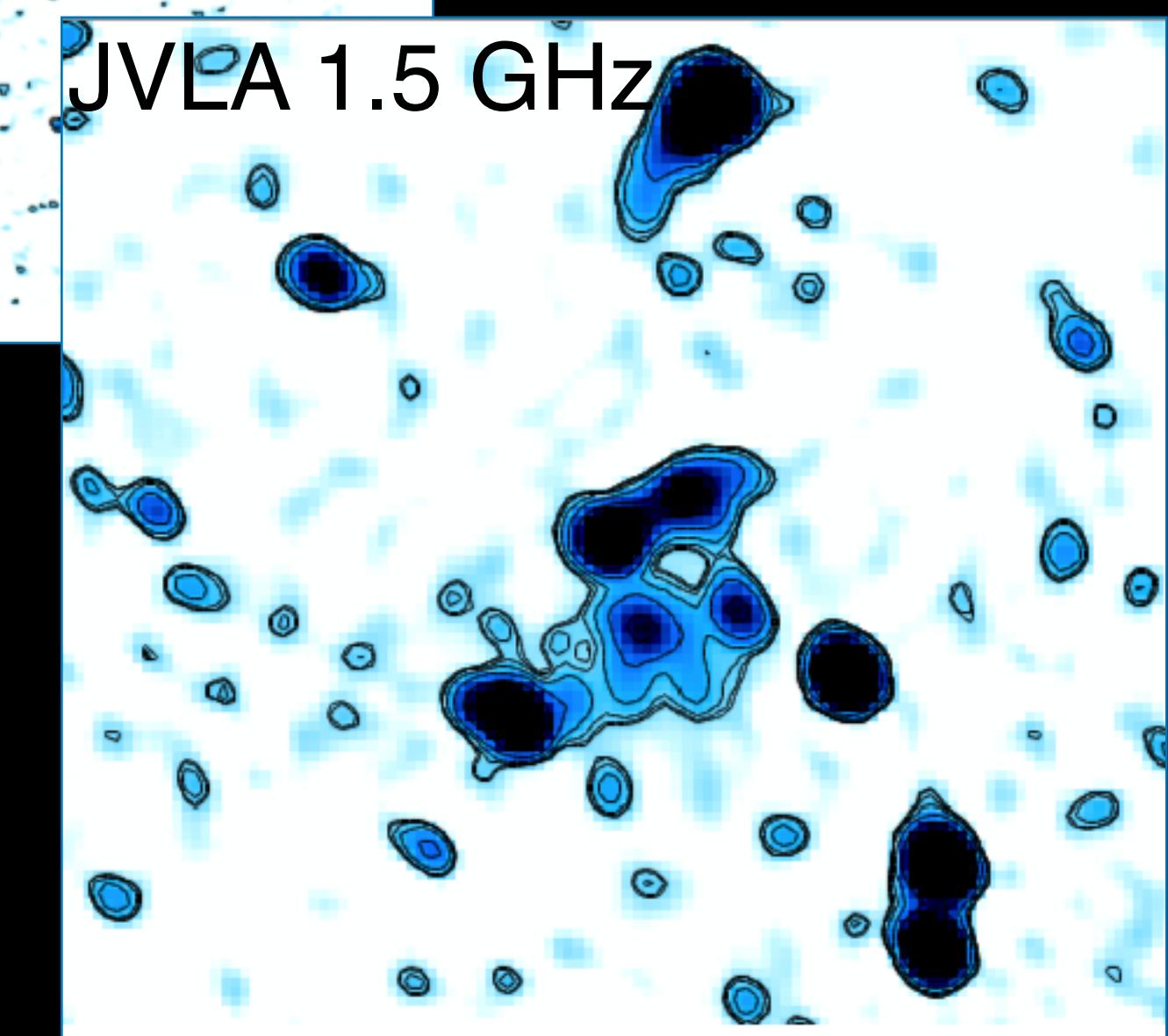
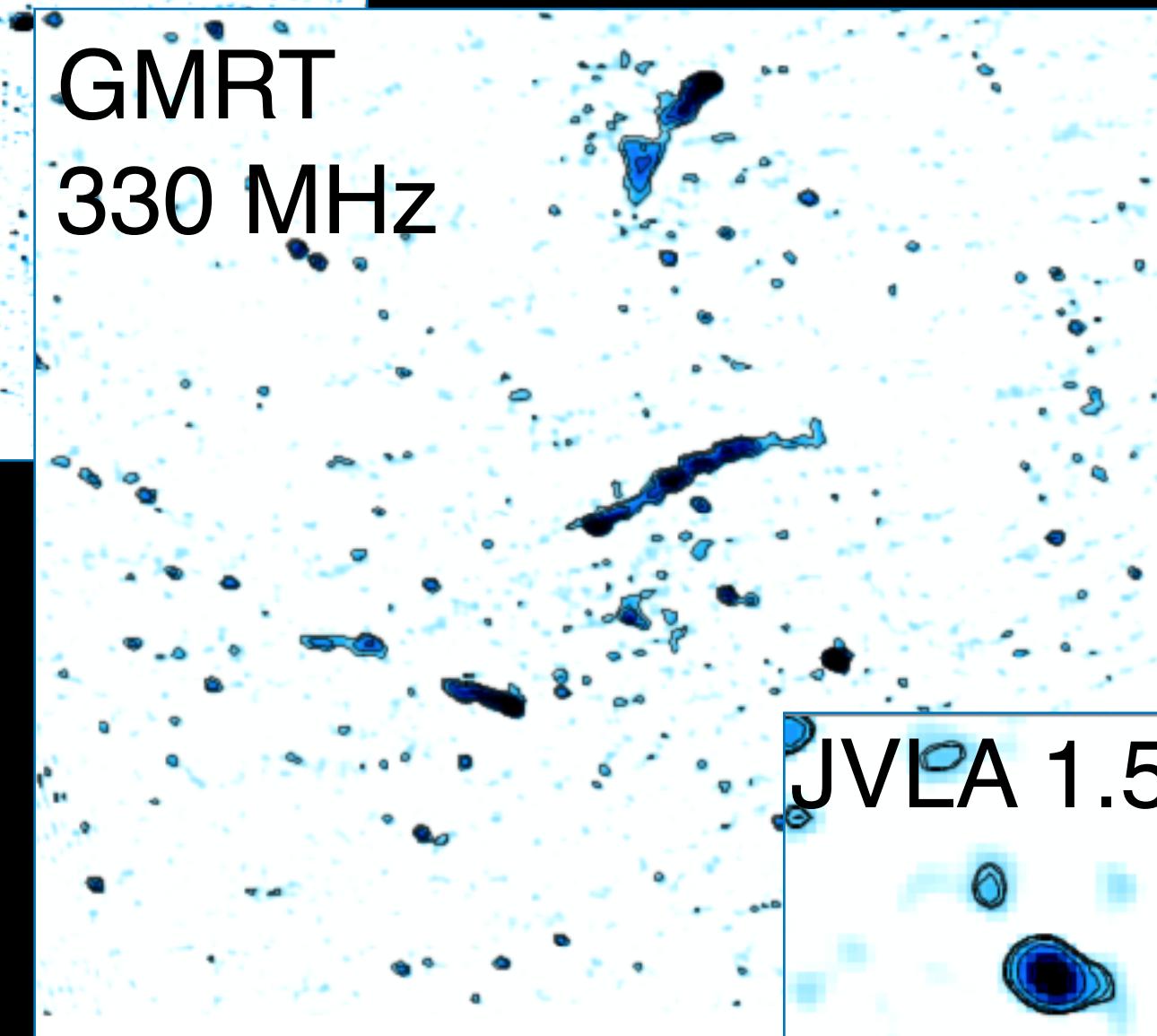
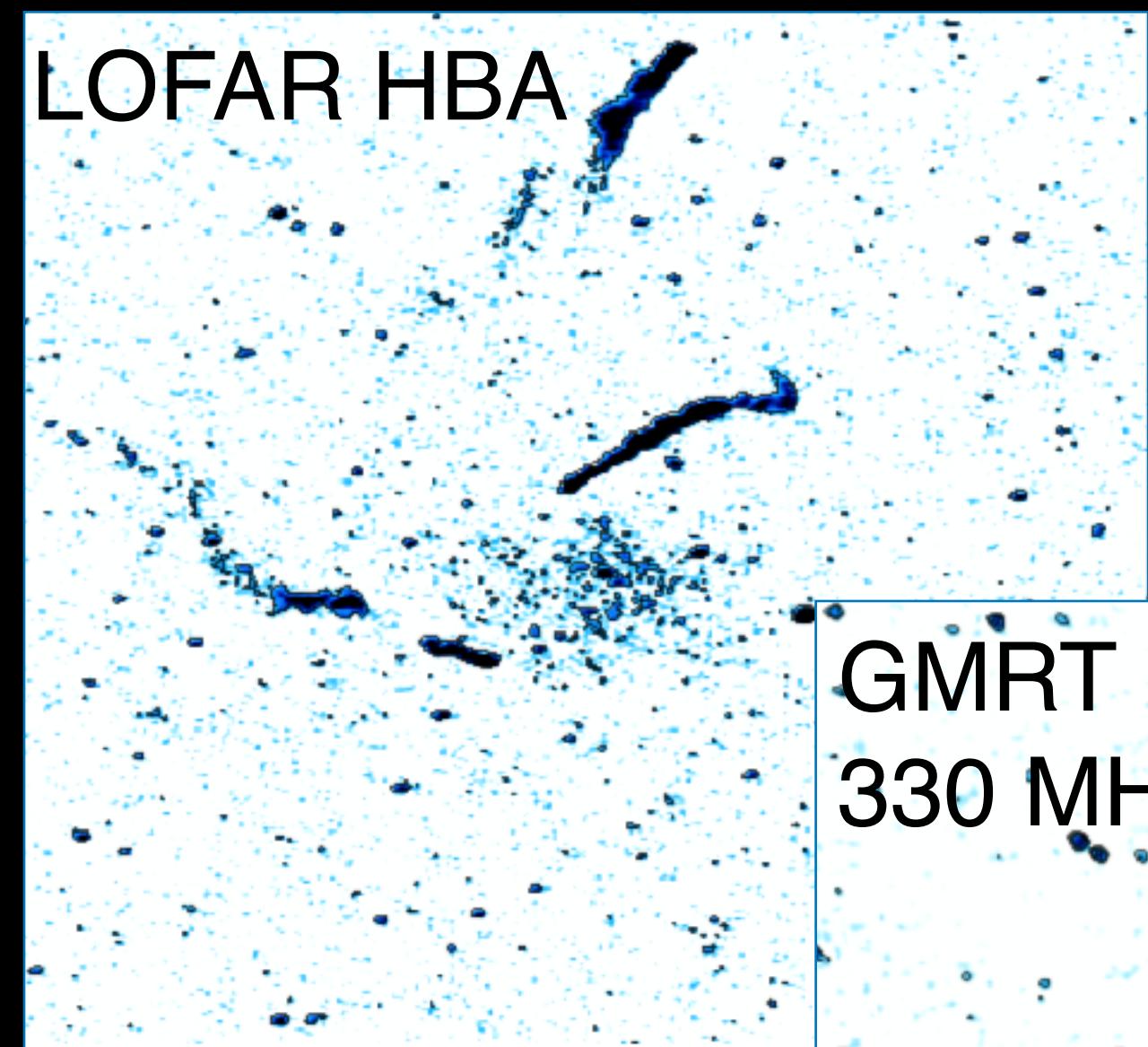
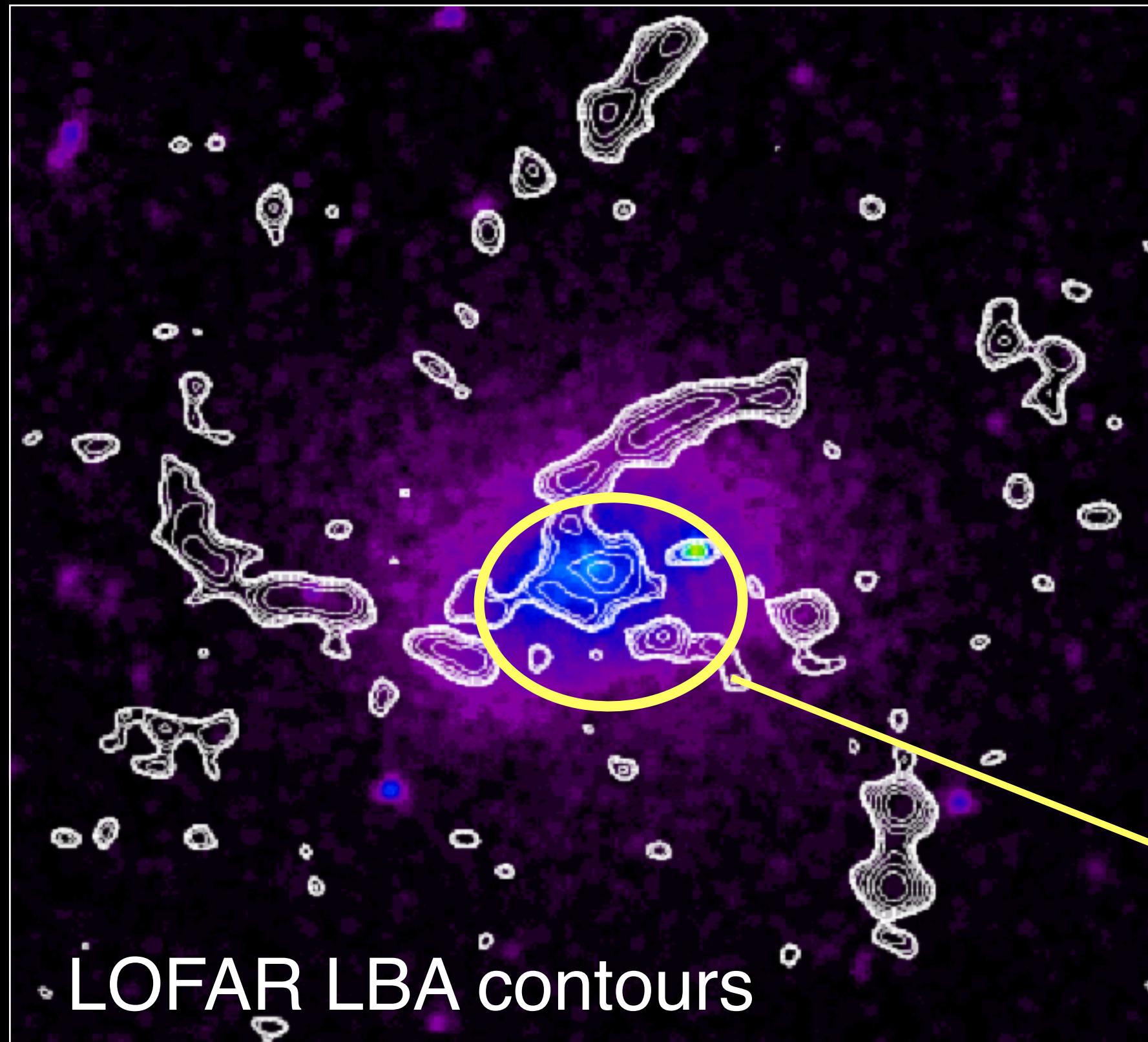
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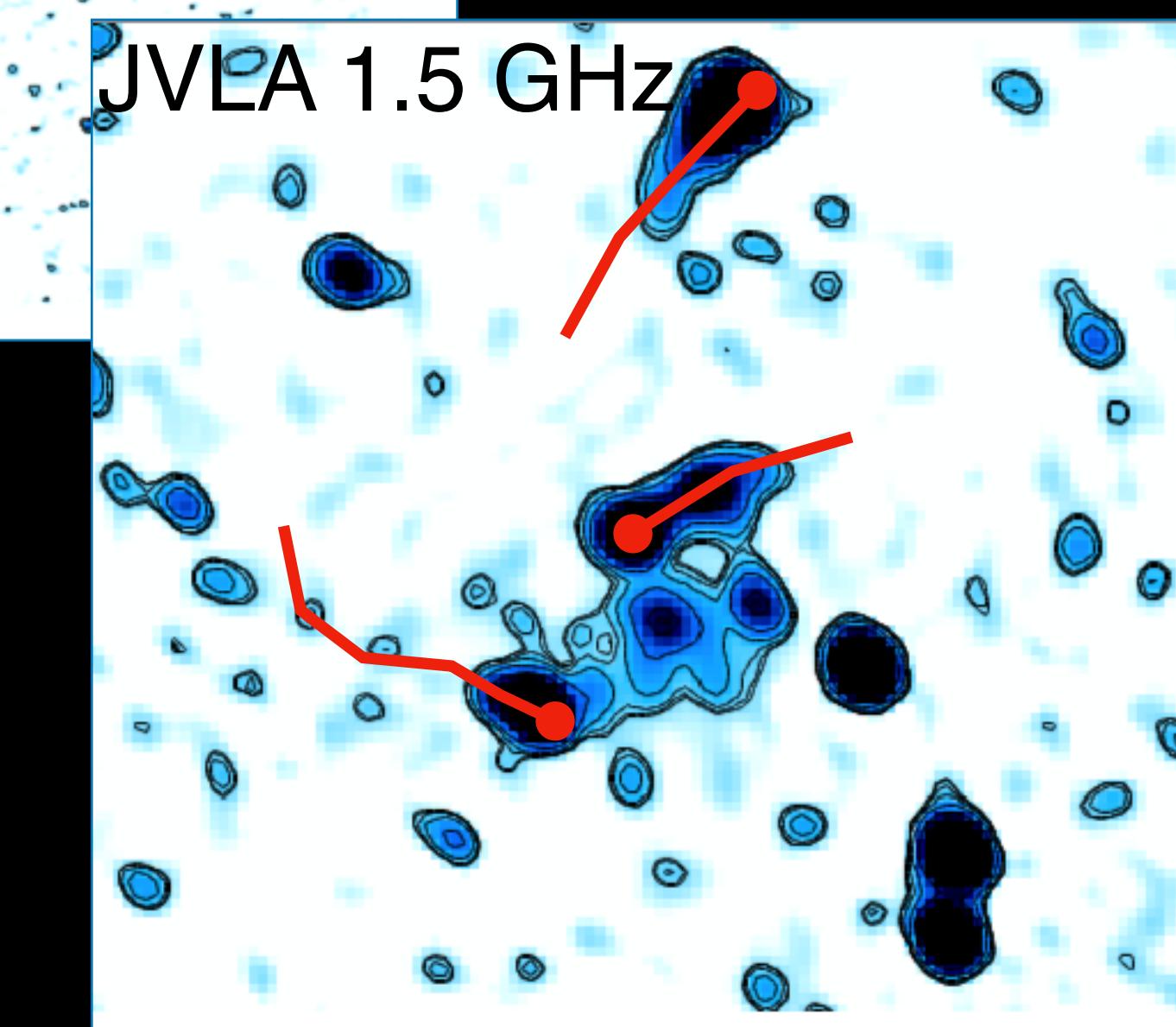
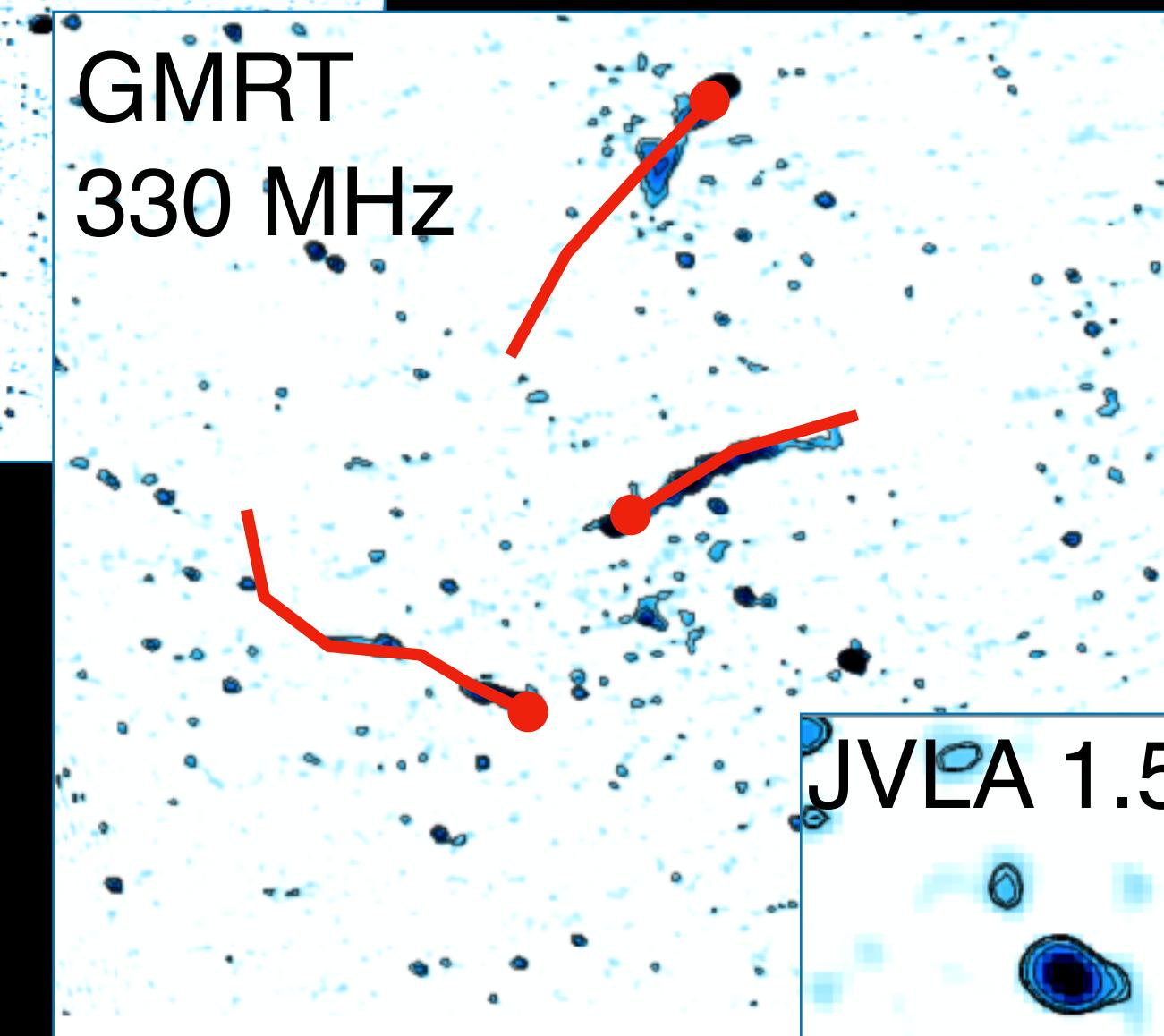
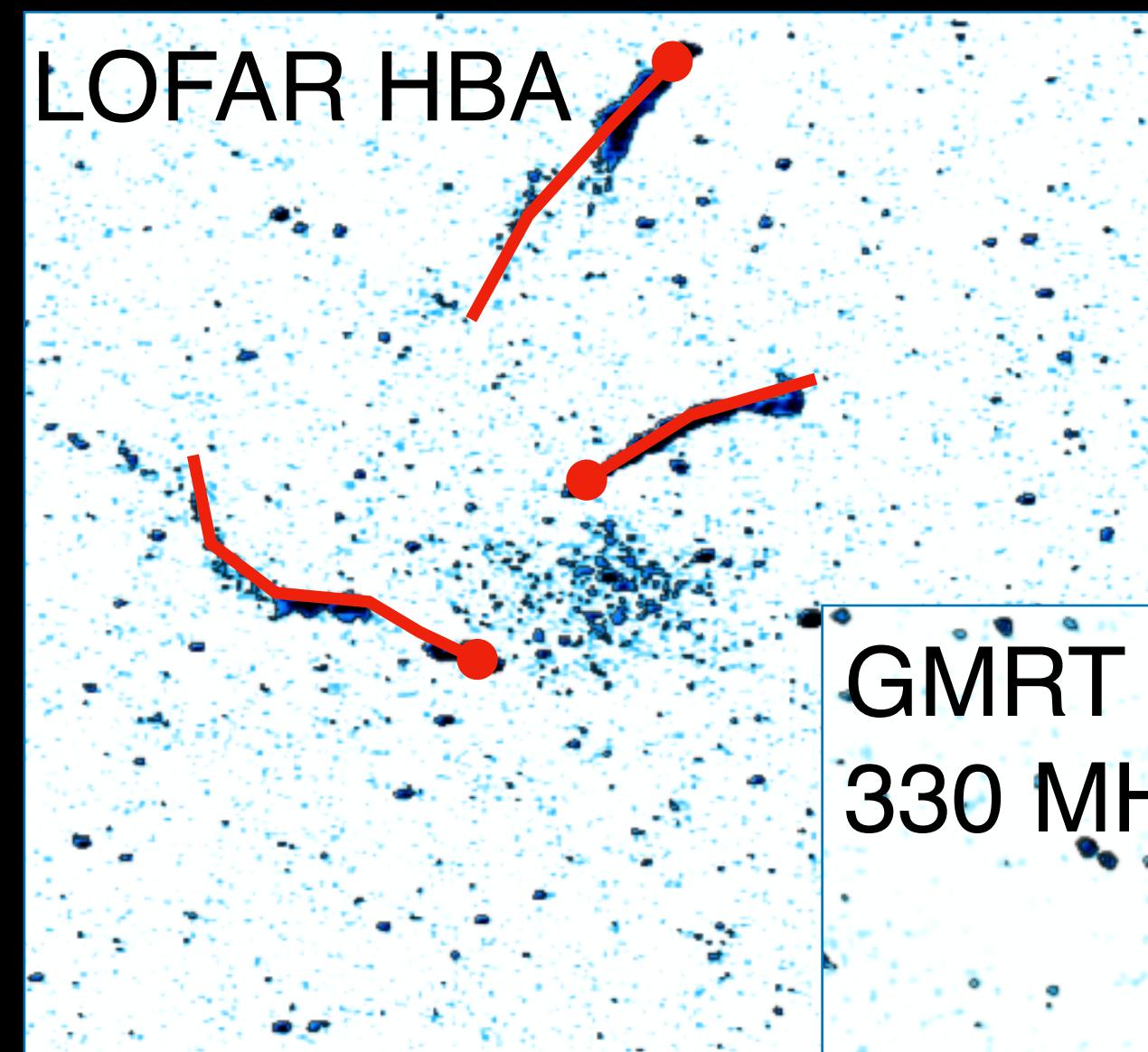
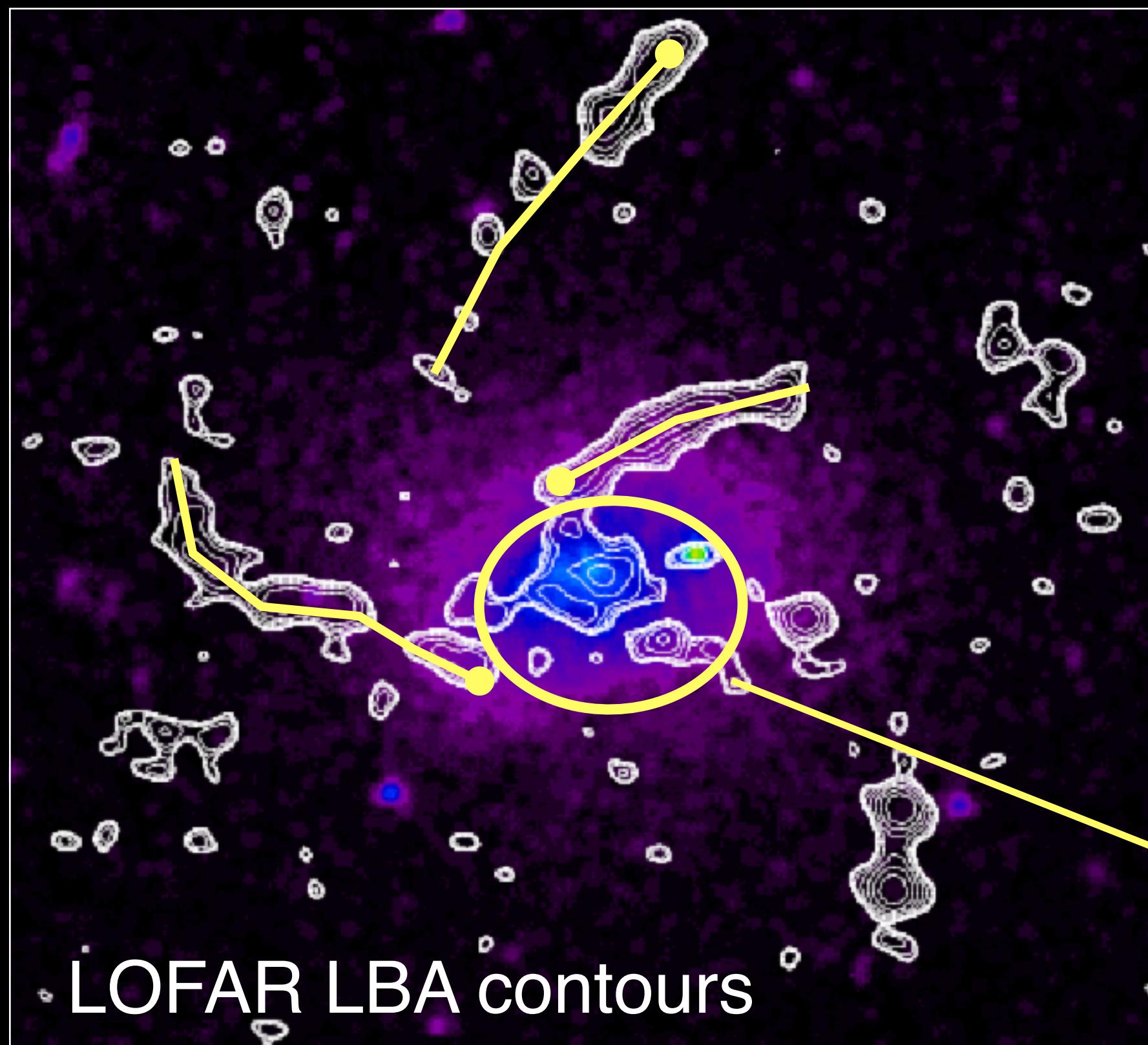
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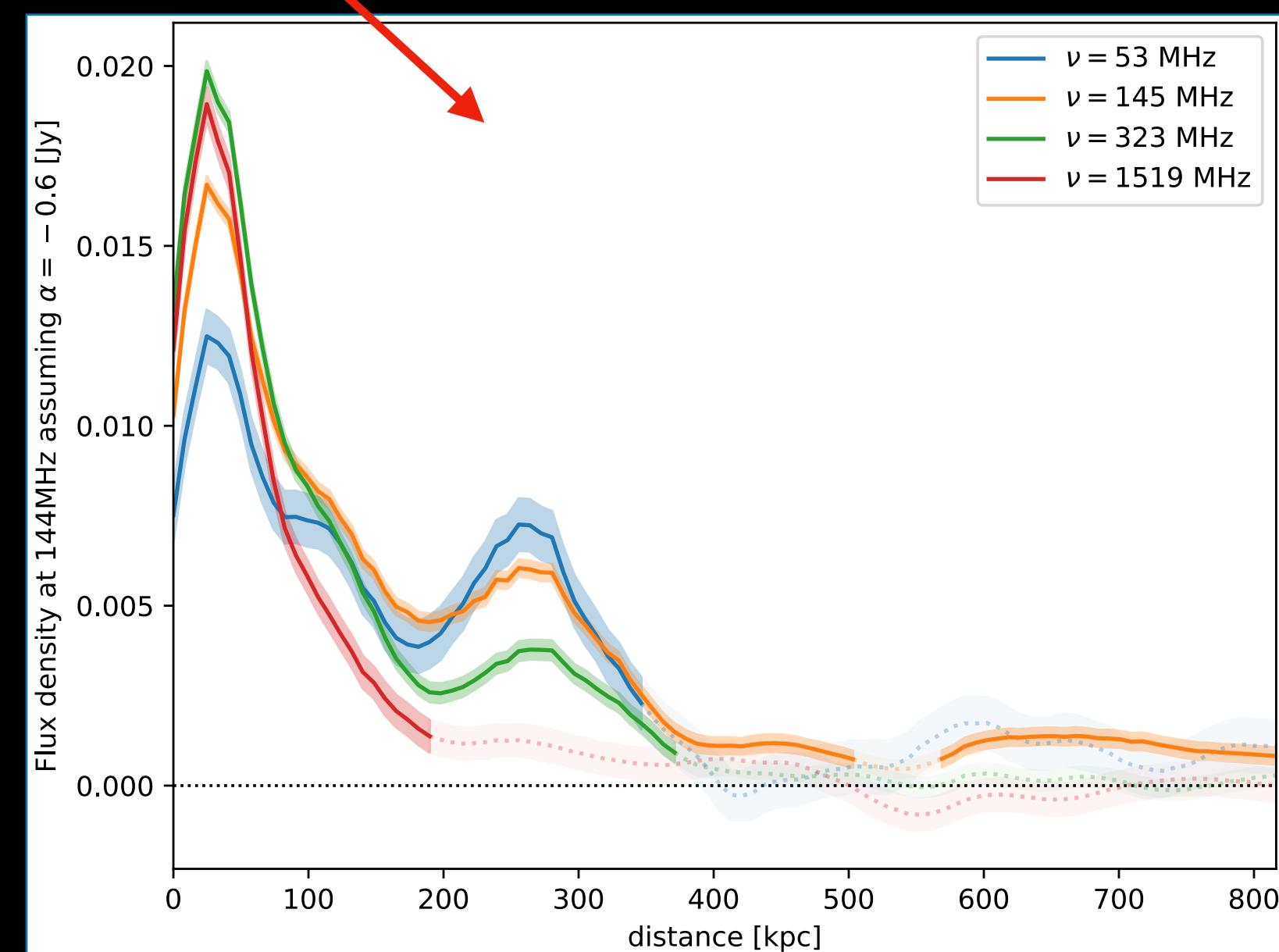
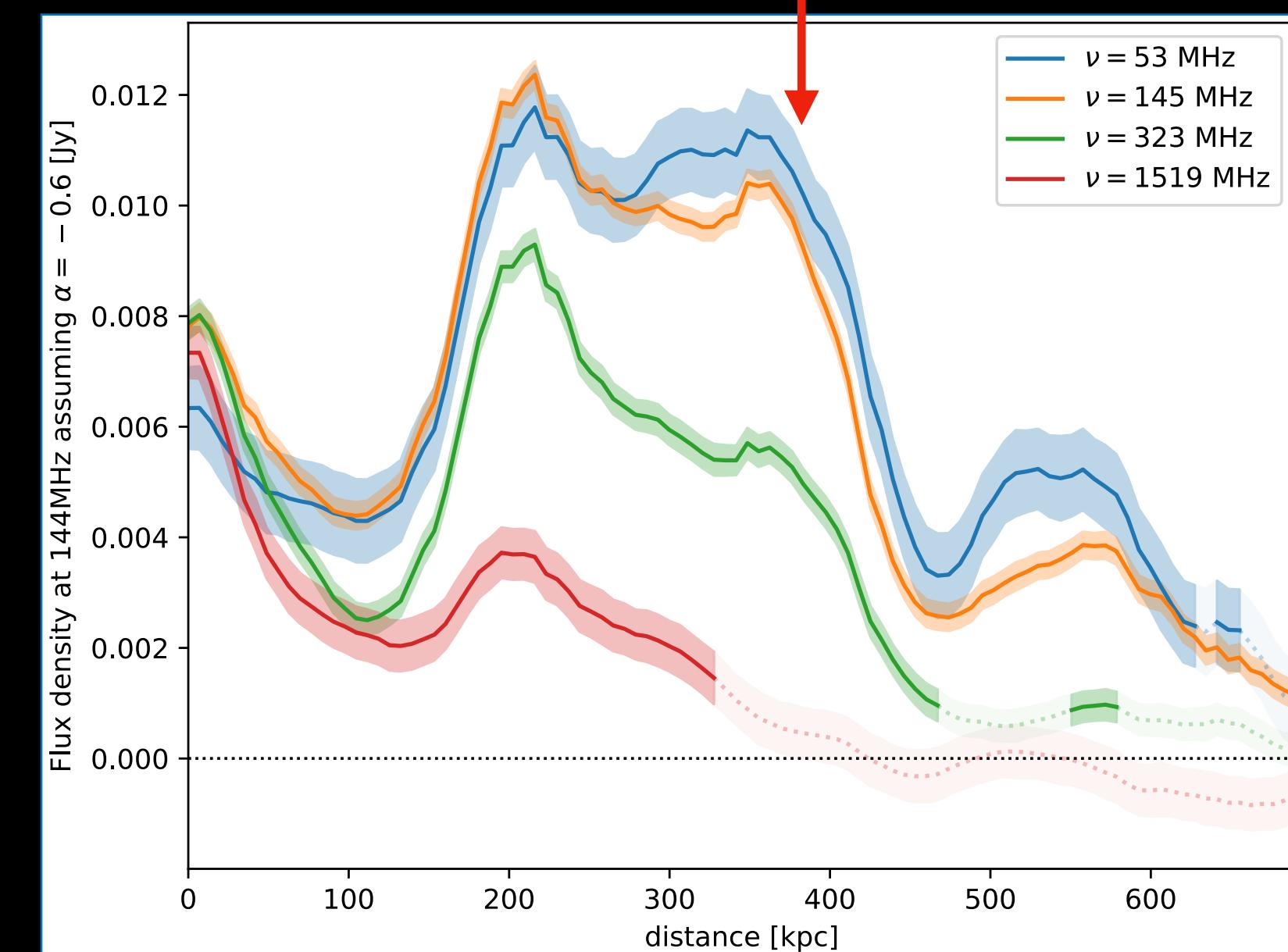
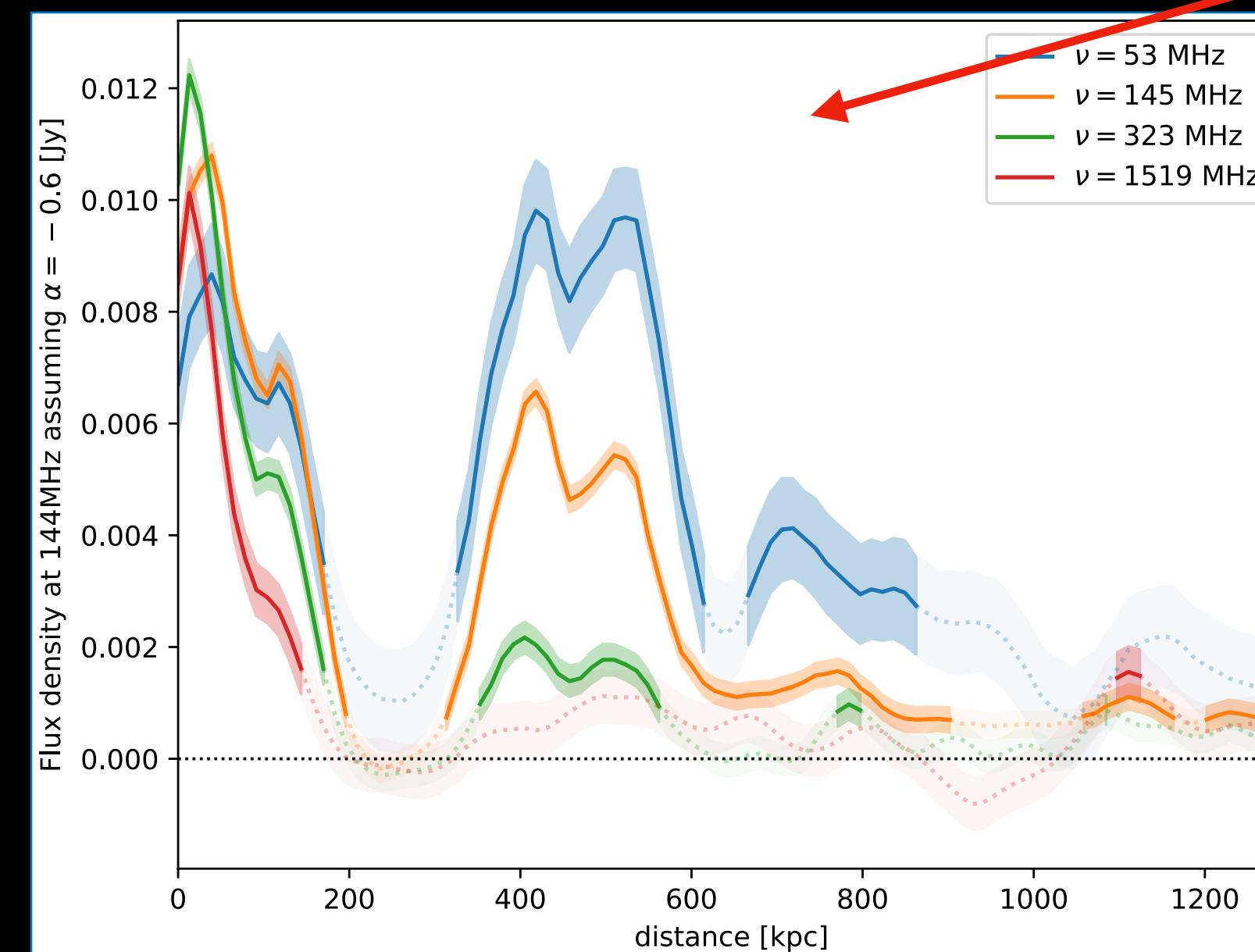
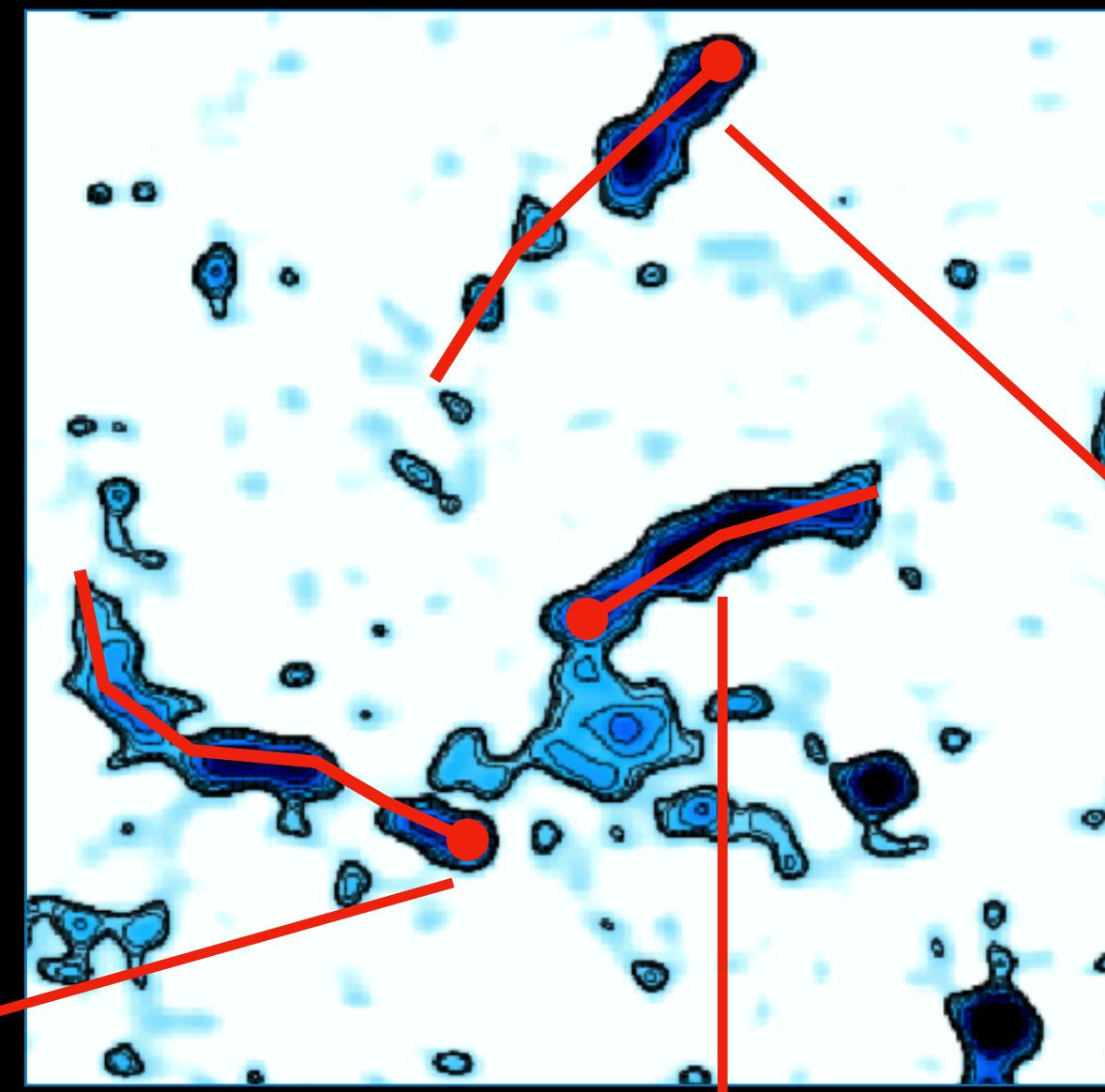
Zwcl 0634.1+4750

$M_{500} \approx 6.5 \times 10^{14} M_\odot$, $z=0.17$



Tails: evidence of re-energization

De Gasperin et al. 2017
Cuciti et al. 2018
Hedler et al. in prep. (see next talk)



Zwcl 0634.1+4750: radio halo

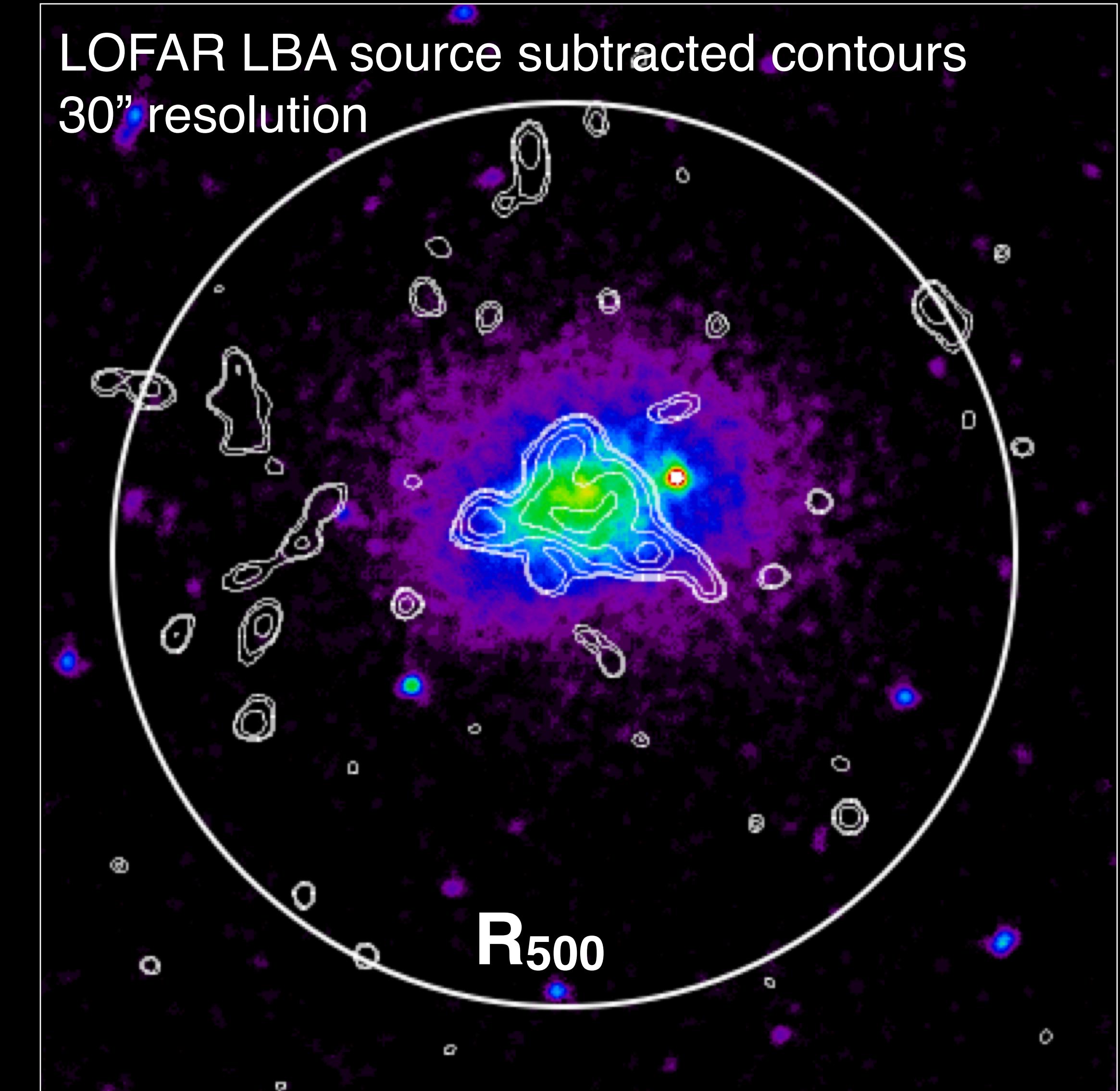
$M_{500} \approx 6.5 \times 10^{14} M_\odot$, $z=0.17$

Cluster's $R_{500} \sim 1250$ kpc

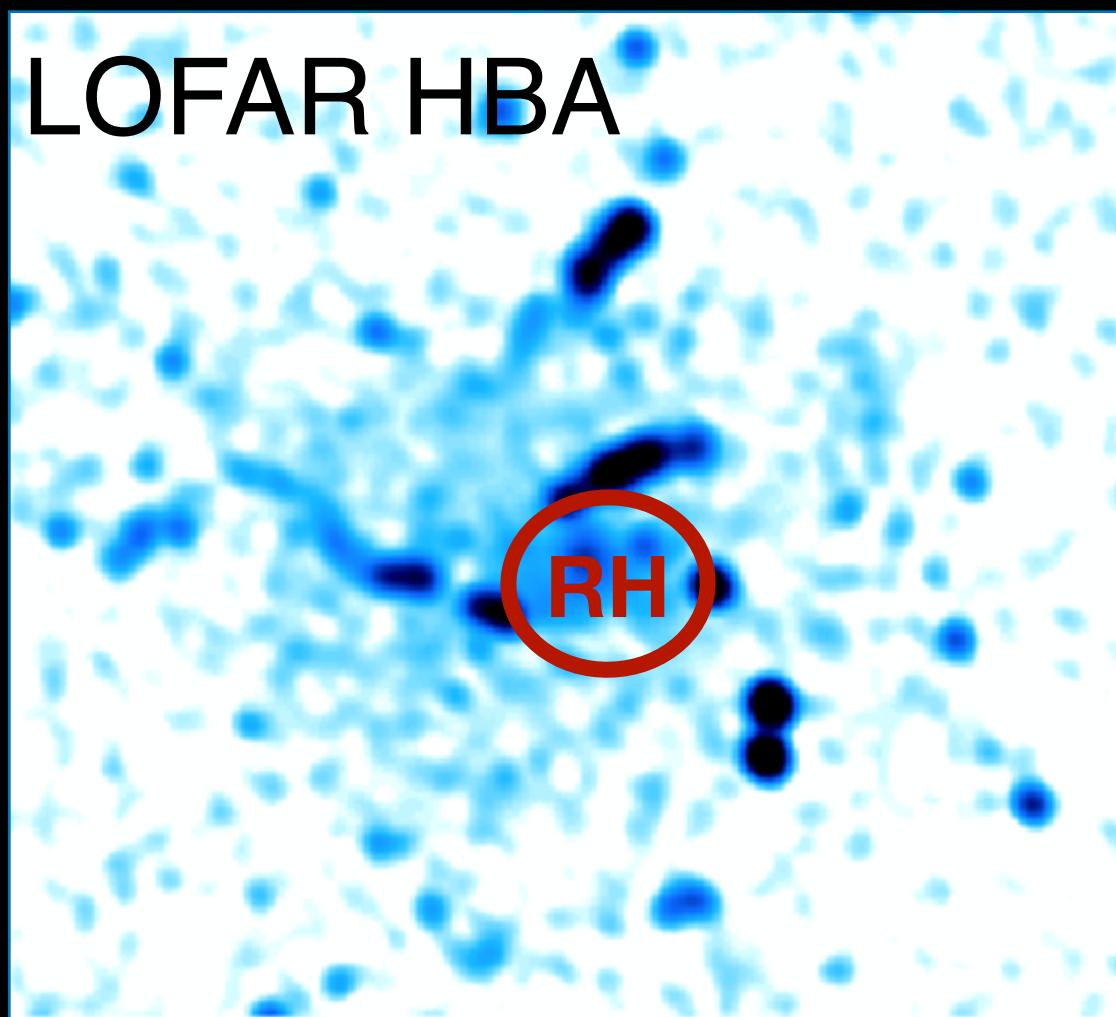
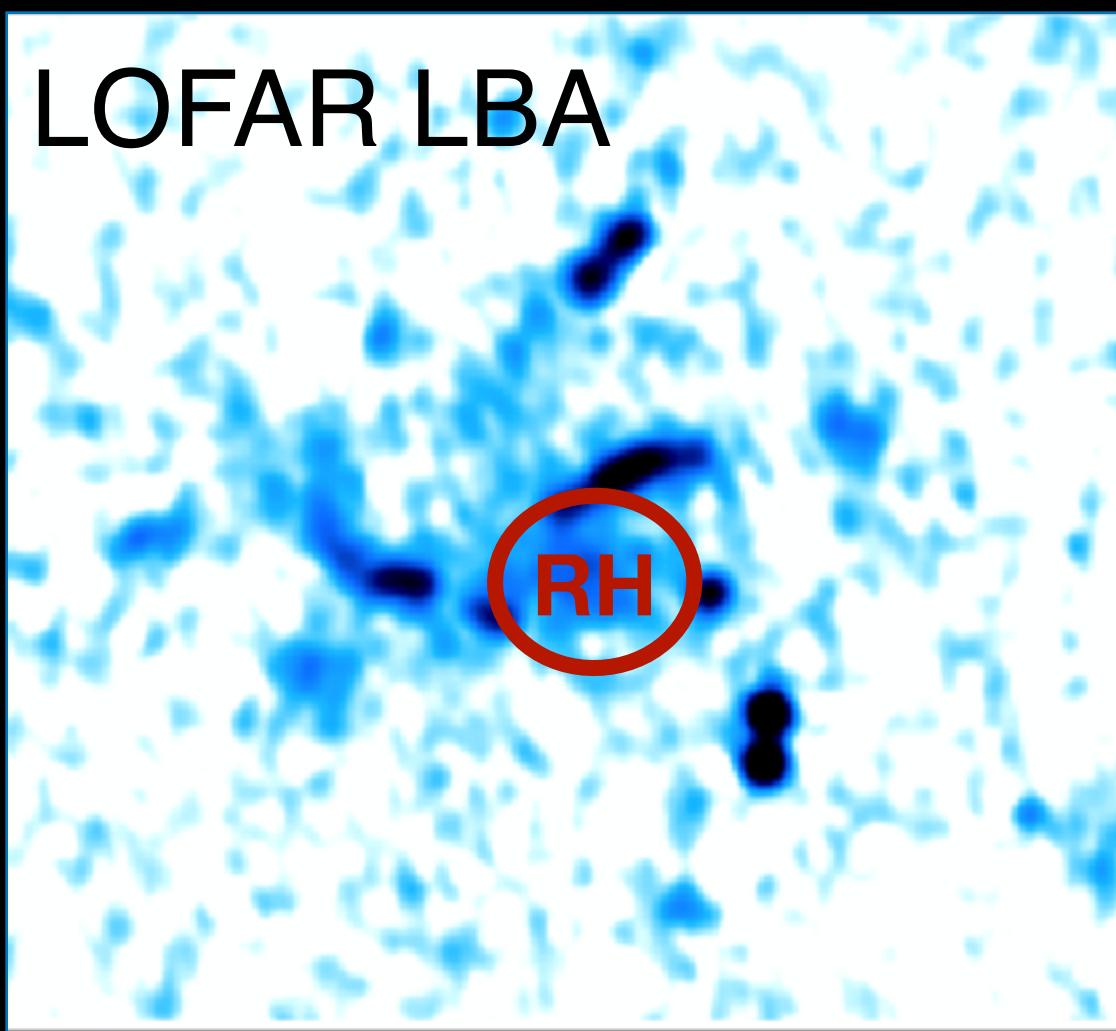
Radio halo LLS ~ 700 kpc

spectral index 50 - 1500 MHz

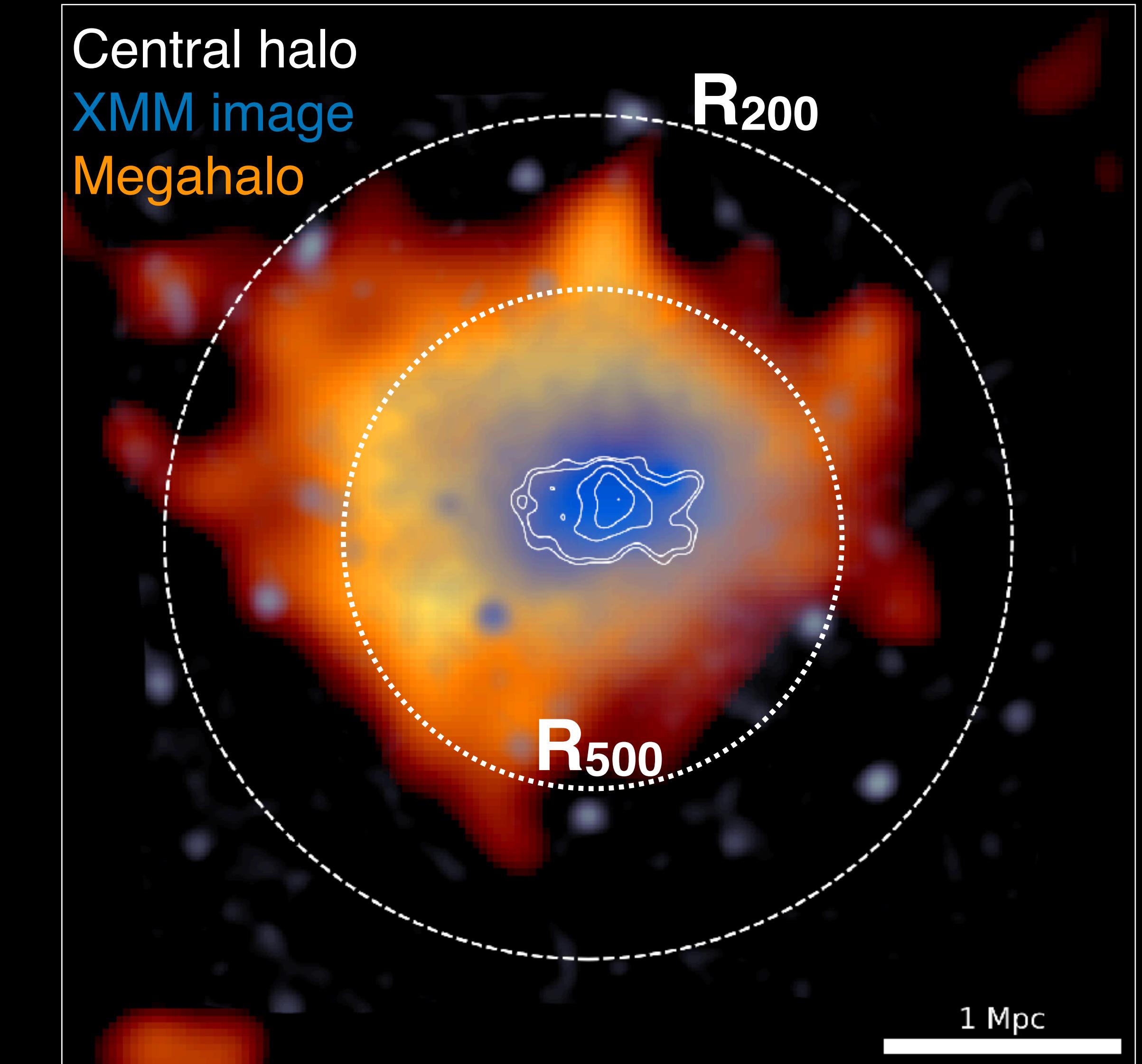
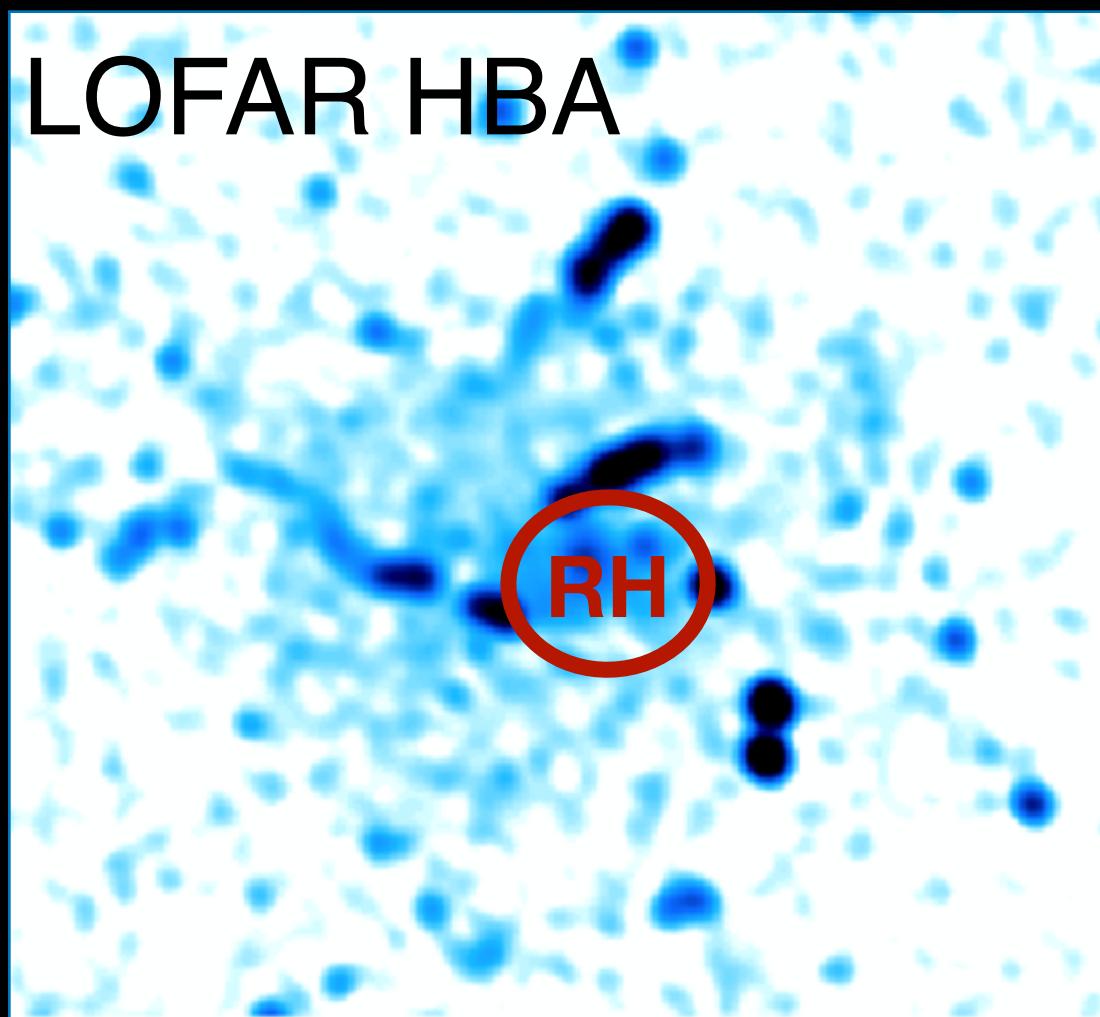
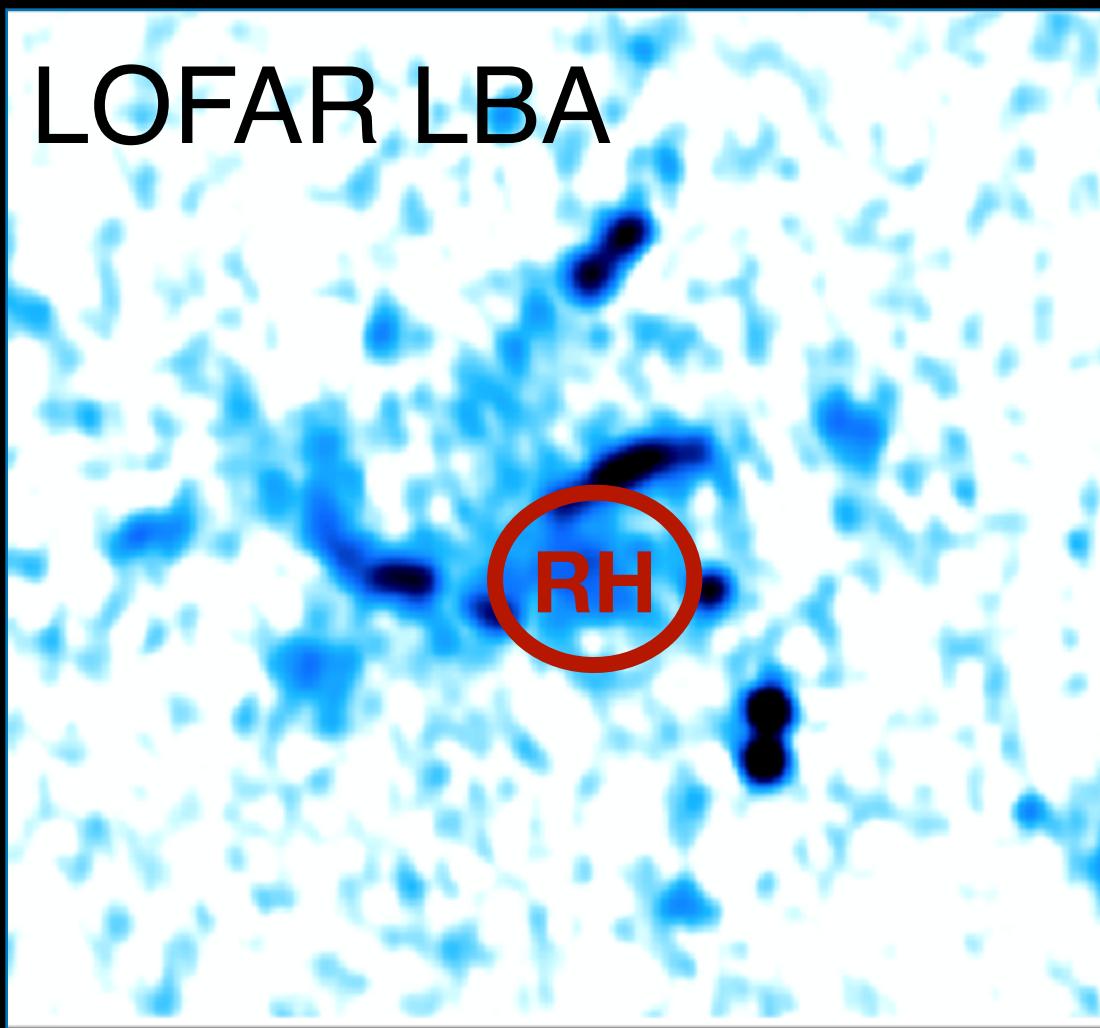
$\alpha \sim 1.1-1.3$



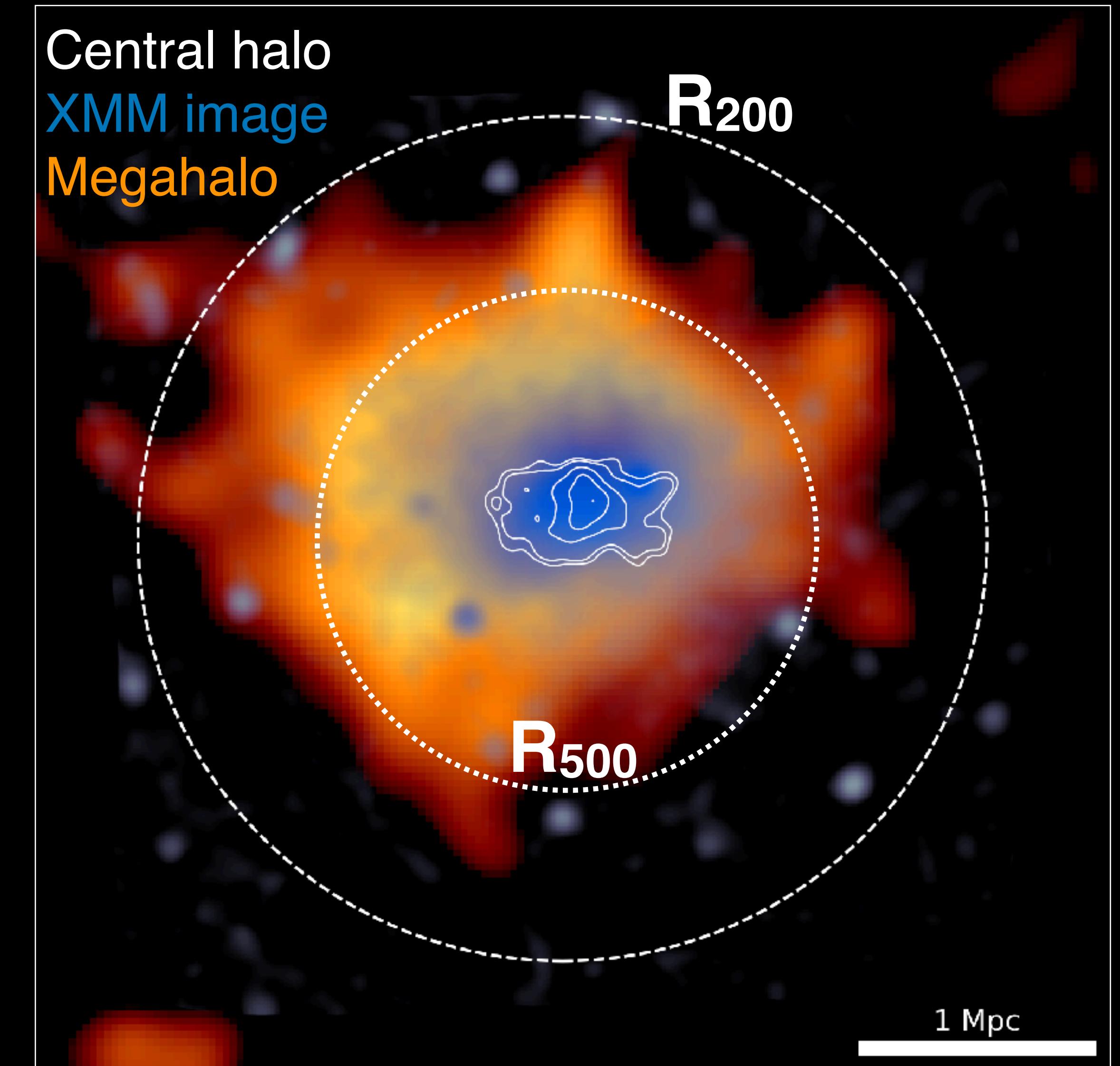
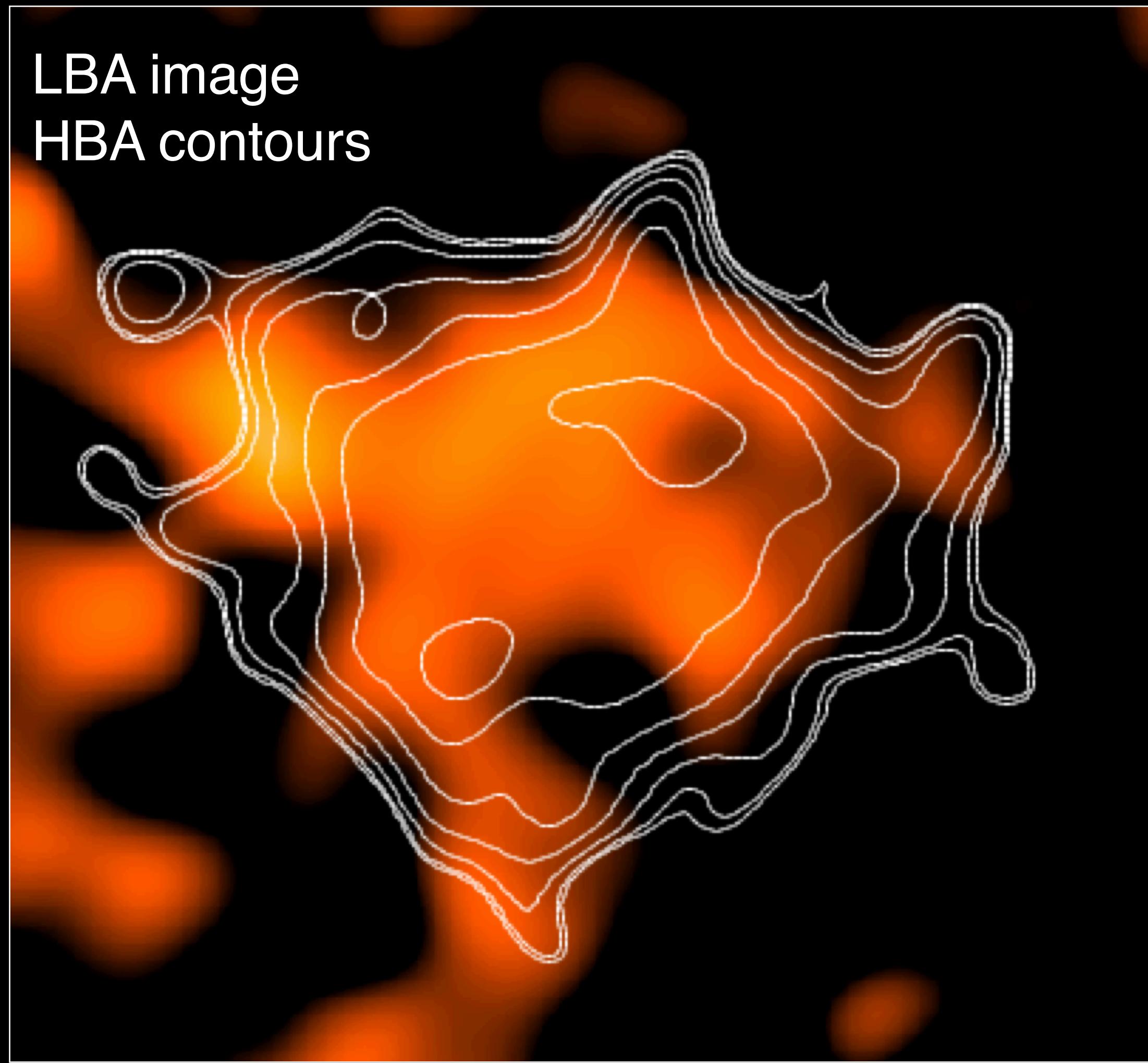
Zwcl 0634.1+4750: radio emission filling the cluster's volume



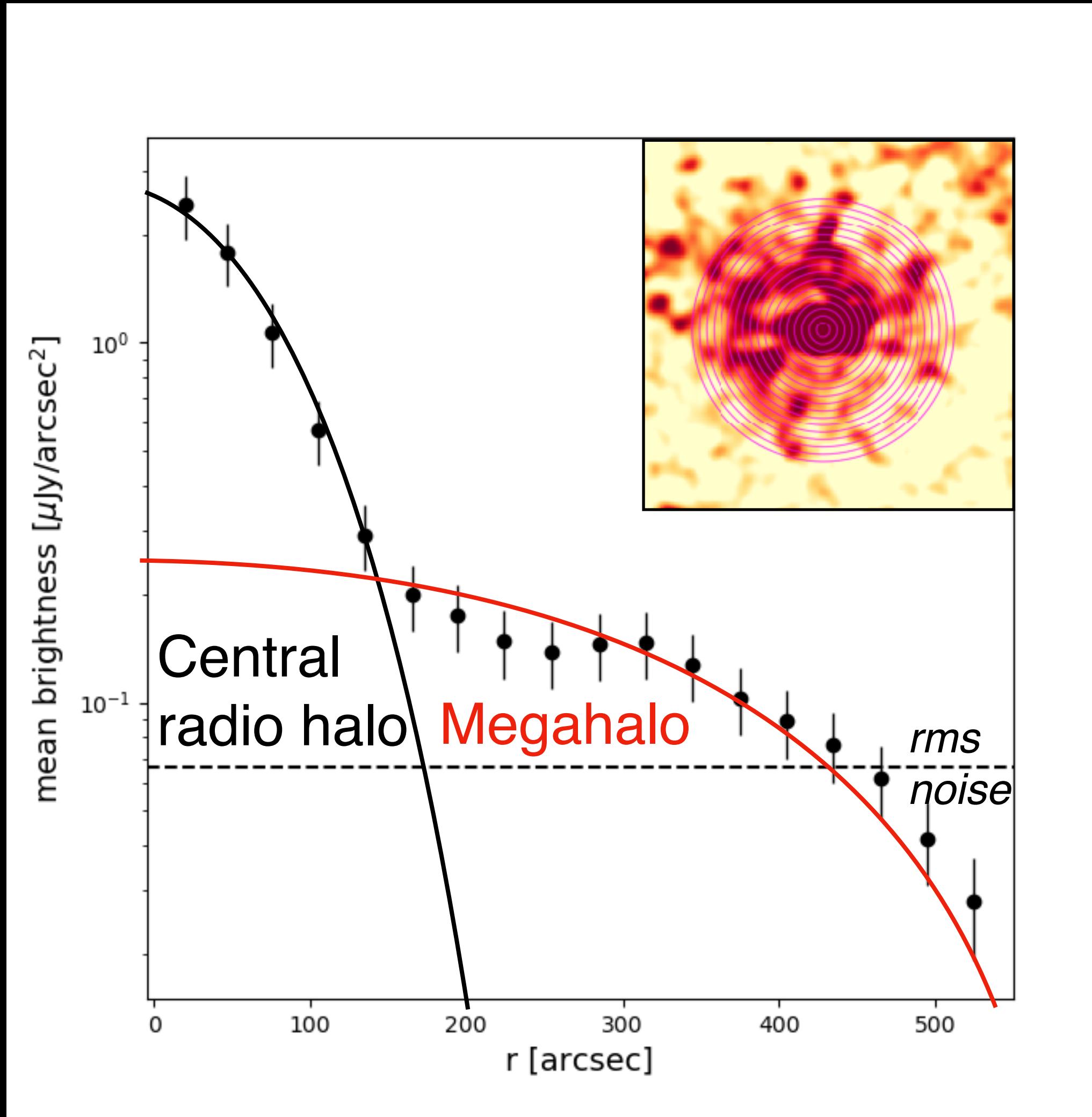
Zwcl 0634.1+4750: radio emission filling the cluster's volume



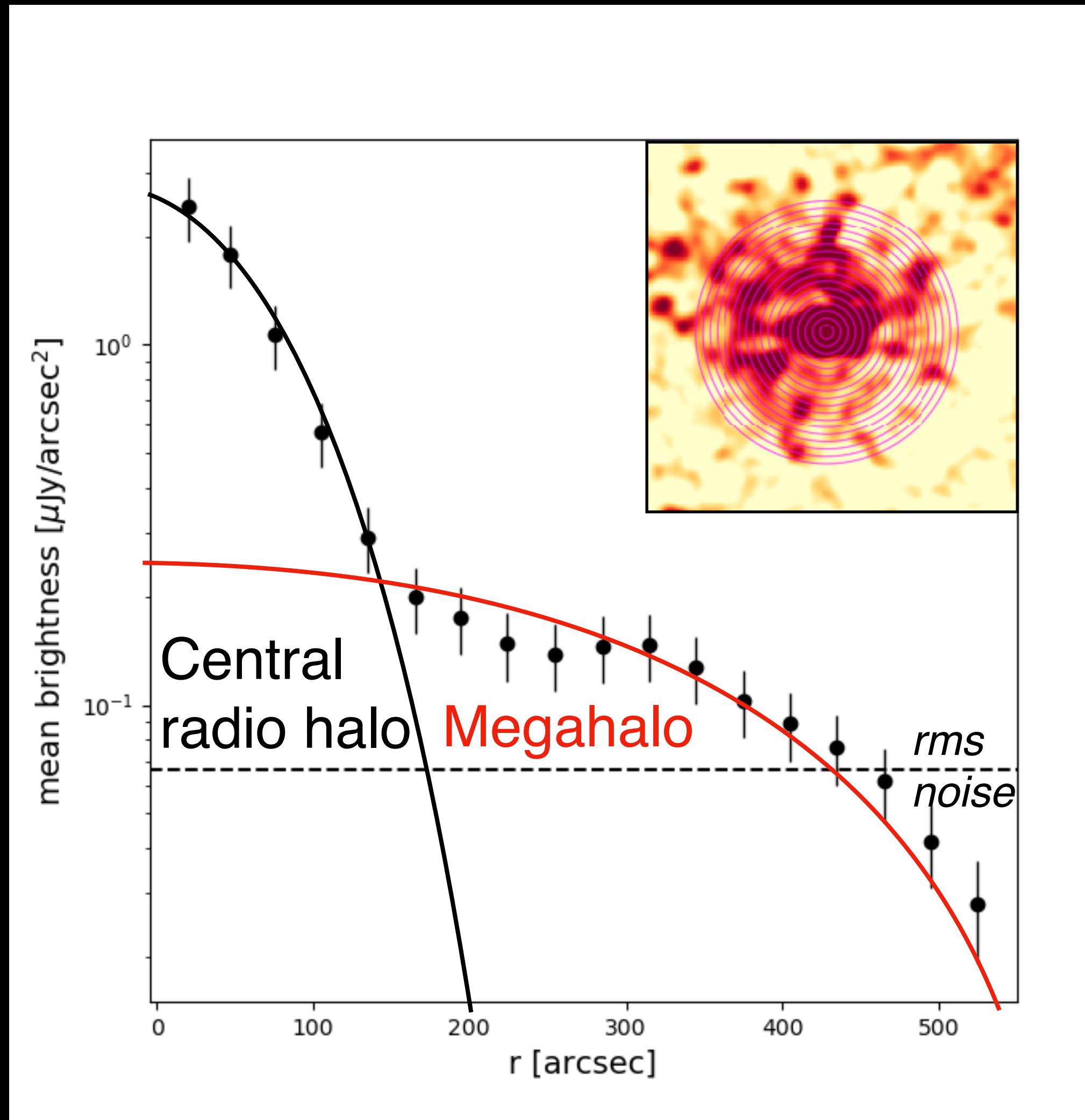
Zwcl 0634.1+4750: radio emission filling the cluster's volume



Zwcl 0634.1+4750: radio emission filling the cluster's volume



Zwcl 0634.1+4750: radio emission filling the cluster's volume



Megahalo

Not a simple extension of the central halo

Different surface brightness profile:

- Different magnetic field?
- Different acceleration efficiency?
- Different population of seed particles?



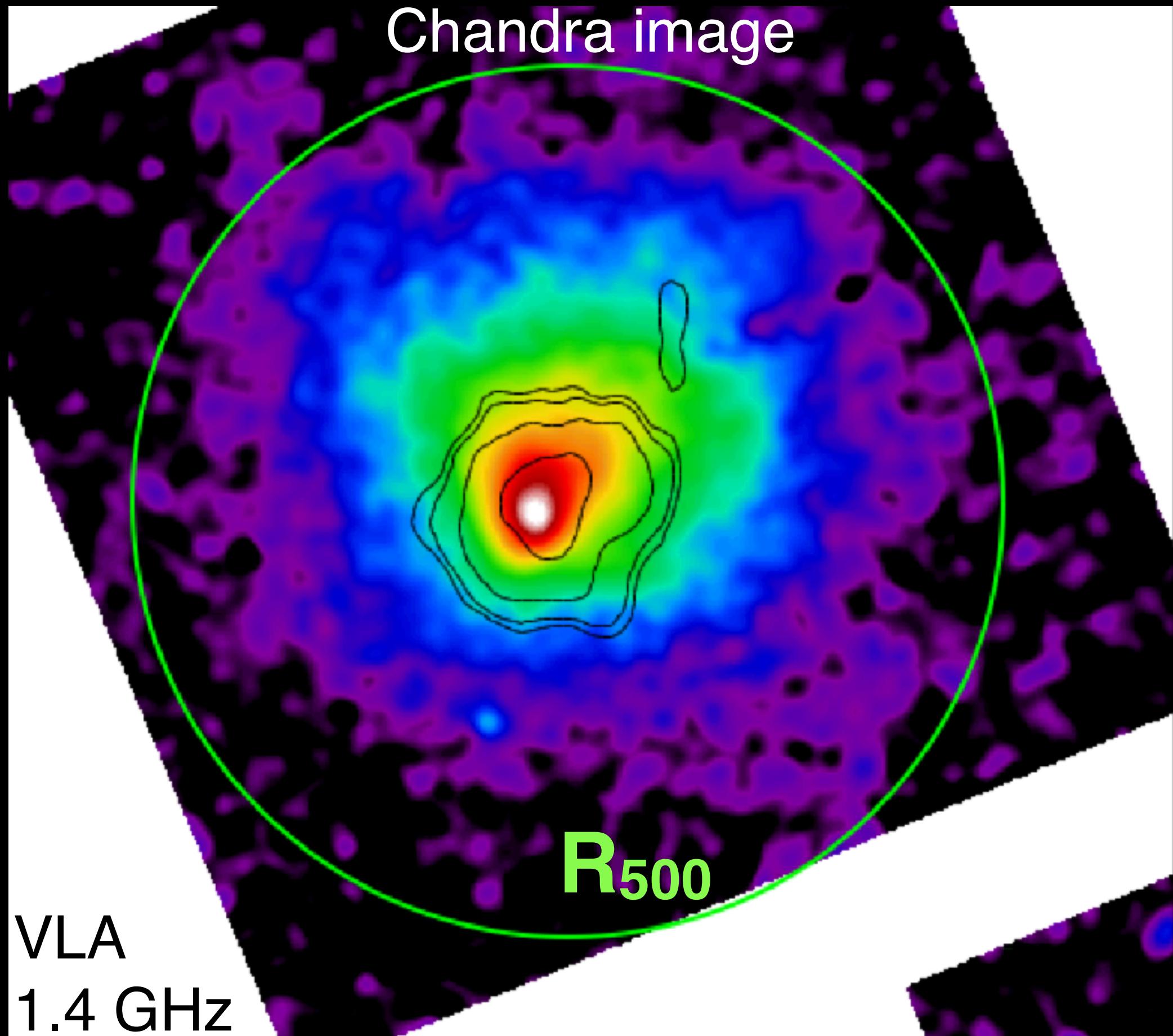
Is the Megahalo in ZwCl 0634.1+4750 unique?

Is the Megahalo in Zwcl 0634.1+4750 unique?

Among the 309 Planck clusters in DR2 we found two other good candidates

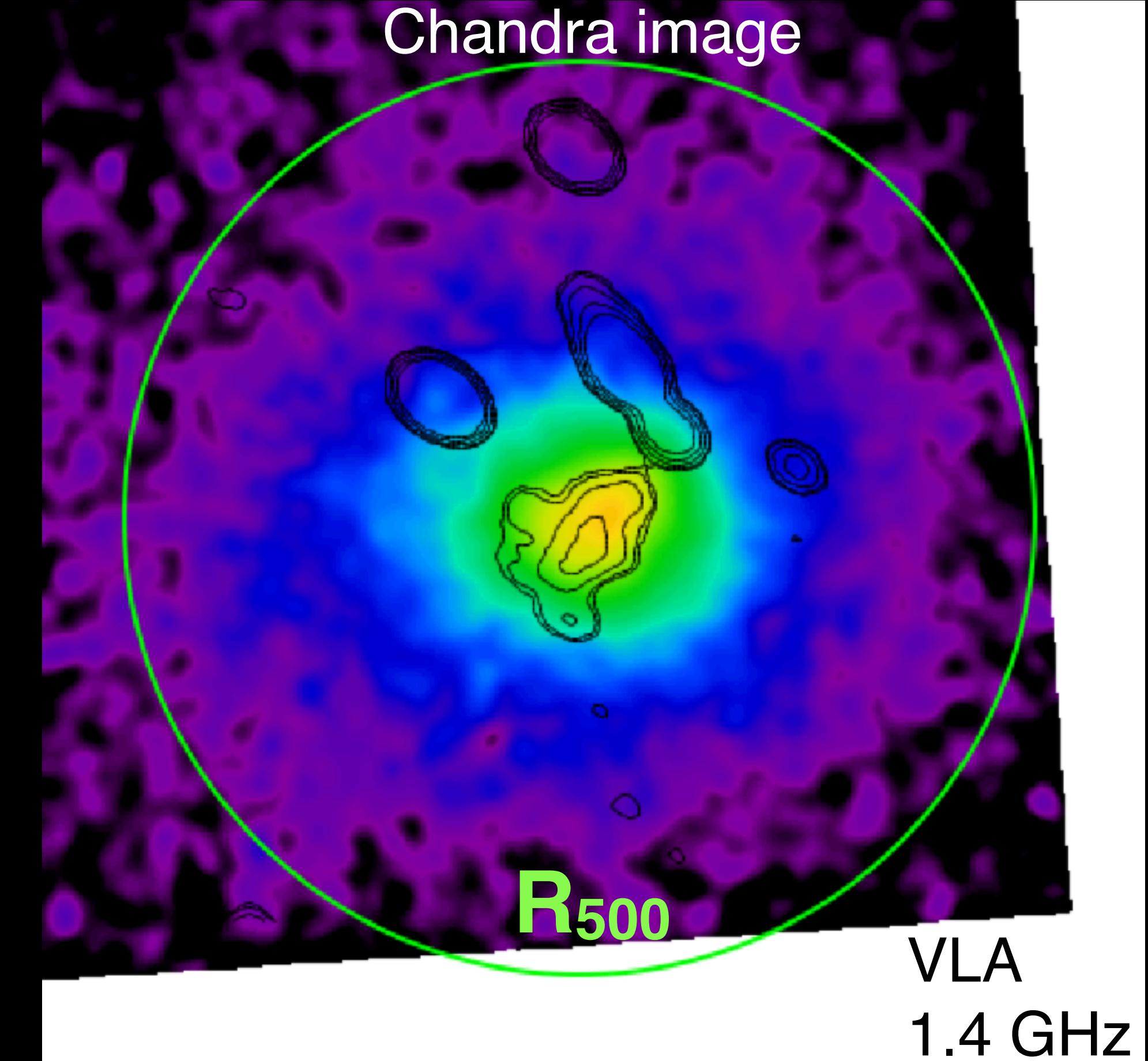
A665

$M_{500} \approx 8.8 \times 10^{14} M_\odot$, $z=0.18$



A2218

$M_{500} \approx 6.6 \times 10^{14} M_\odot$, $z=0.17$

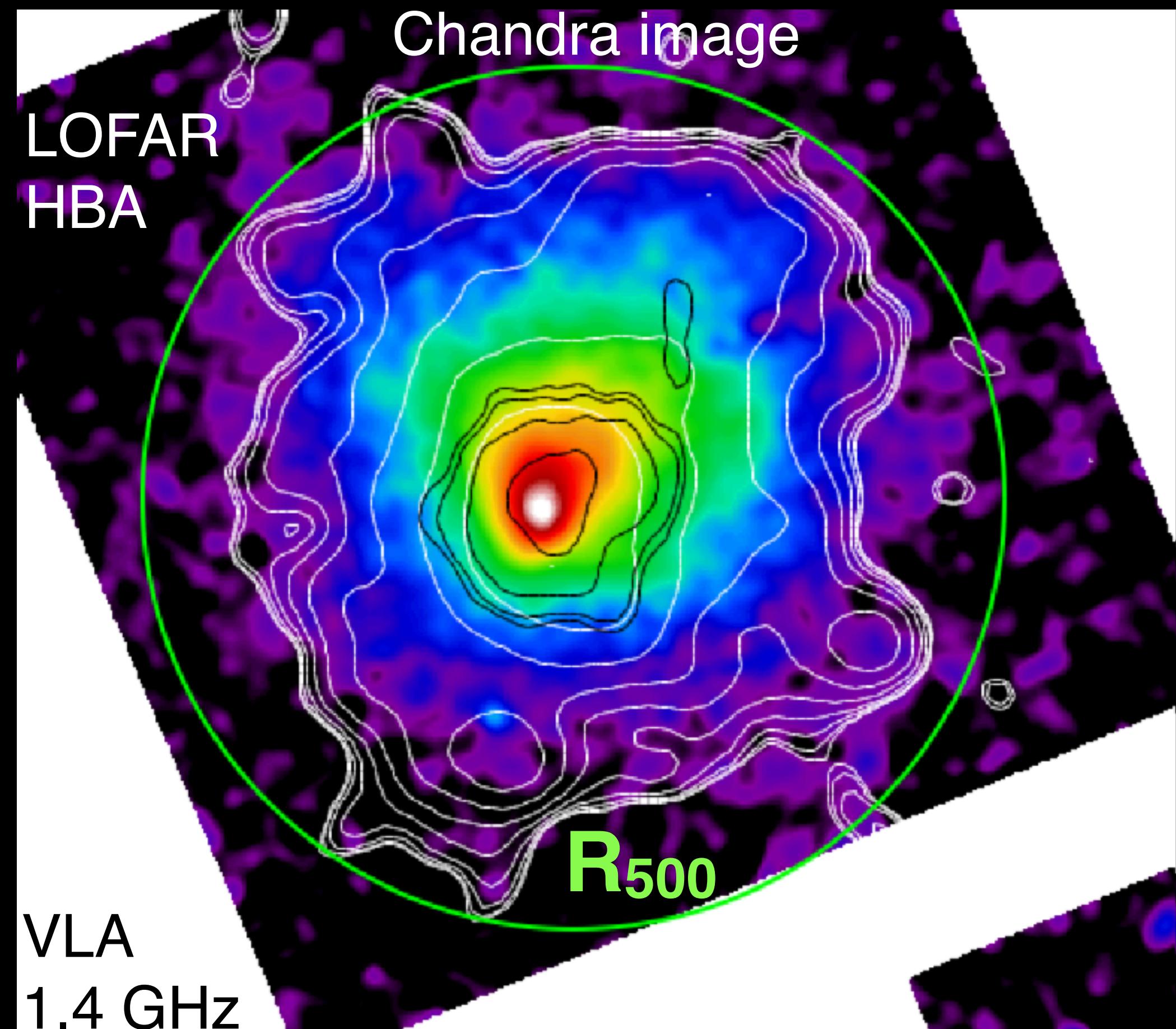


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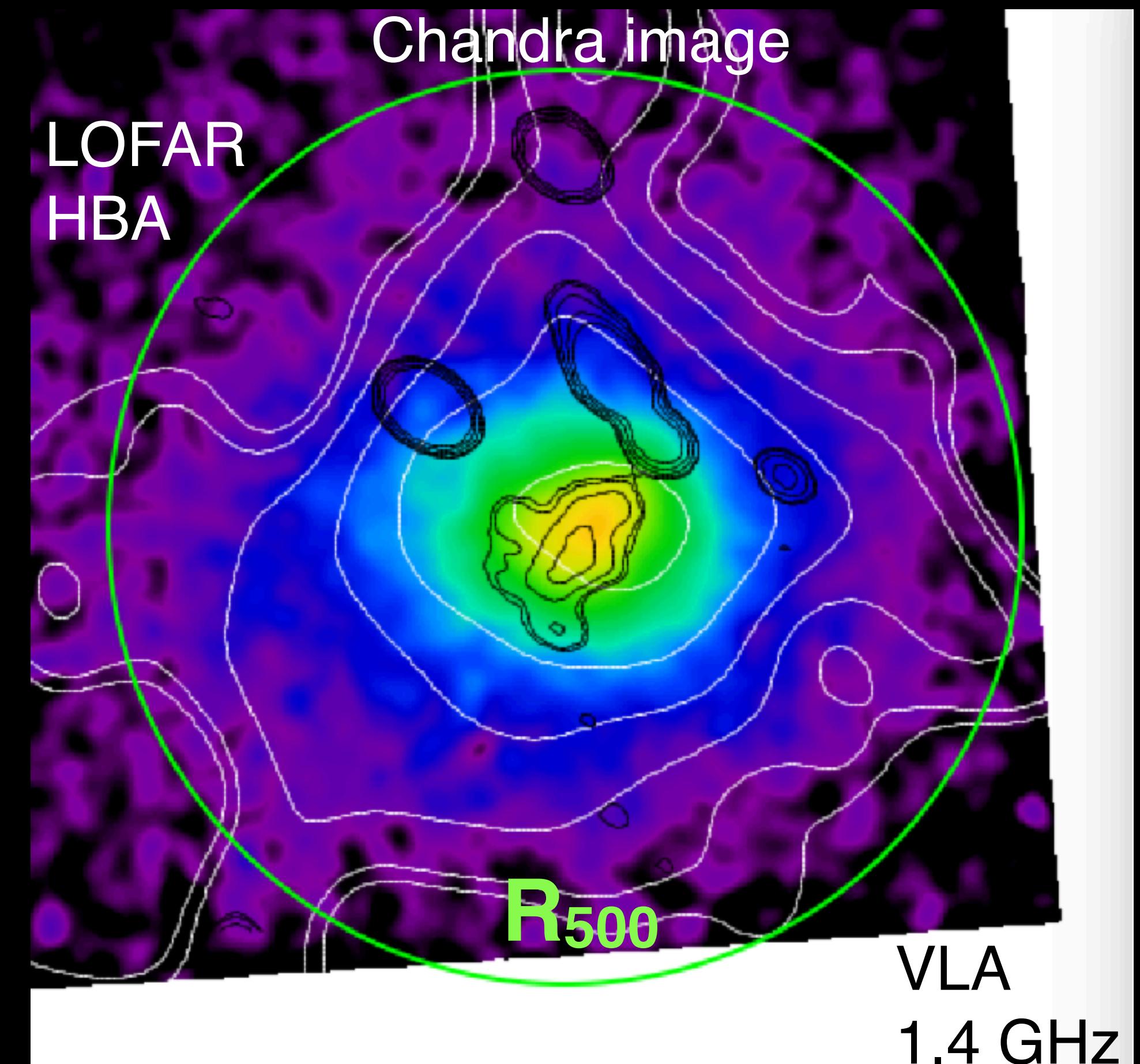
A665

$M_{500} \approx 8.8 \times 10^{14} M_\odot$, $z=0.18$



A2218

$M_{500} \approx 6.6 \times 10^{14} M_\odot$, $z=0.17$

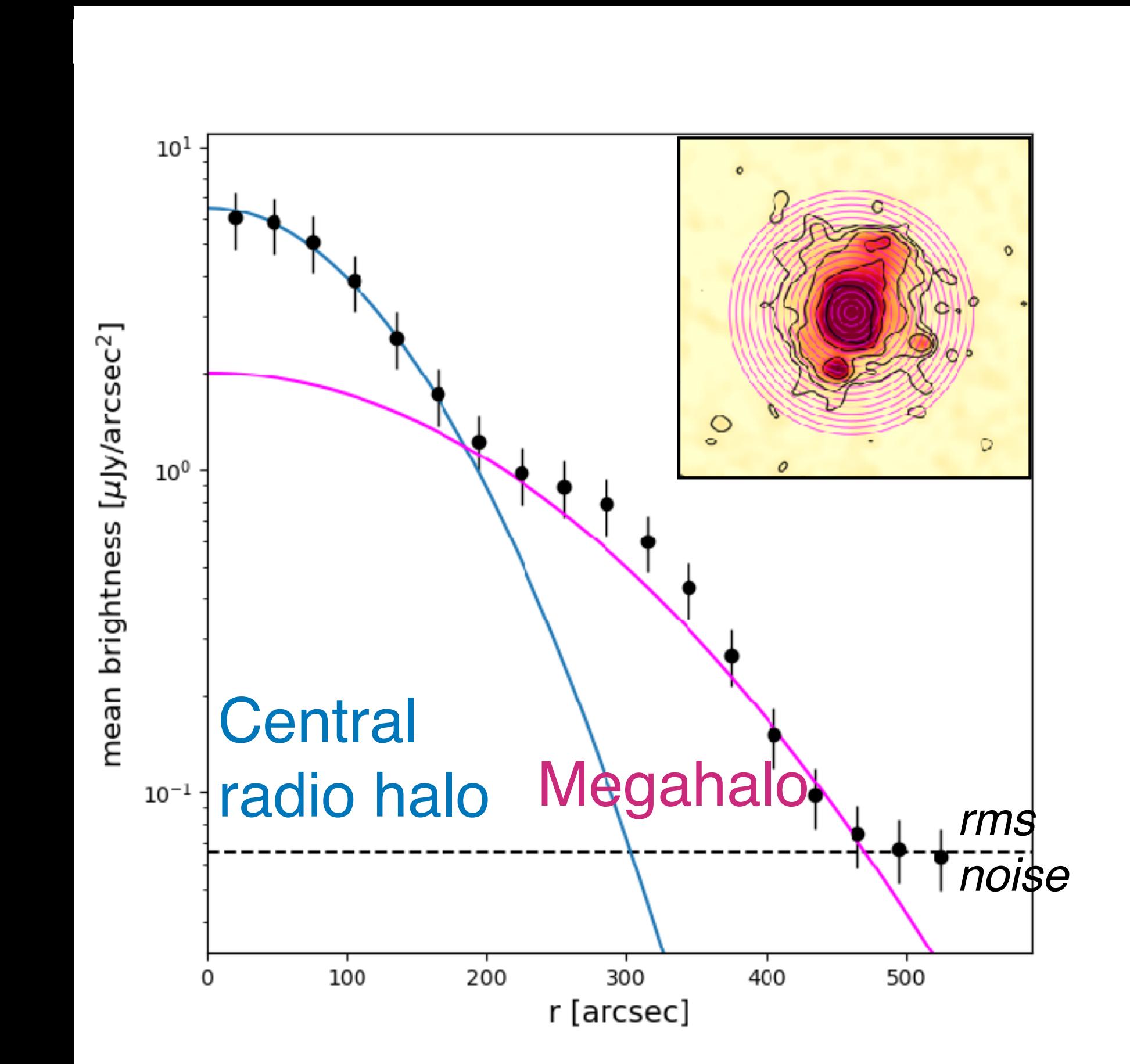
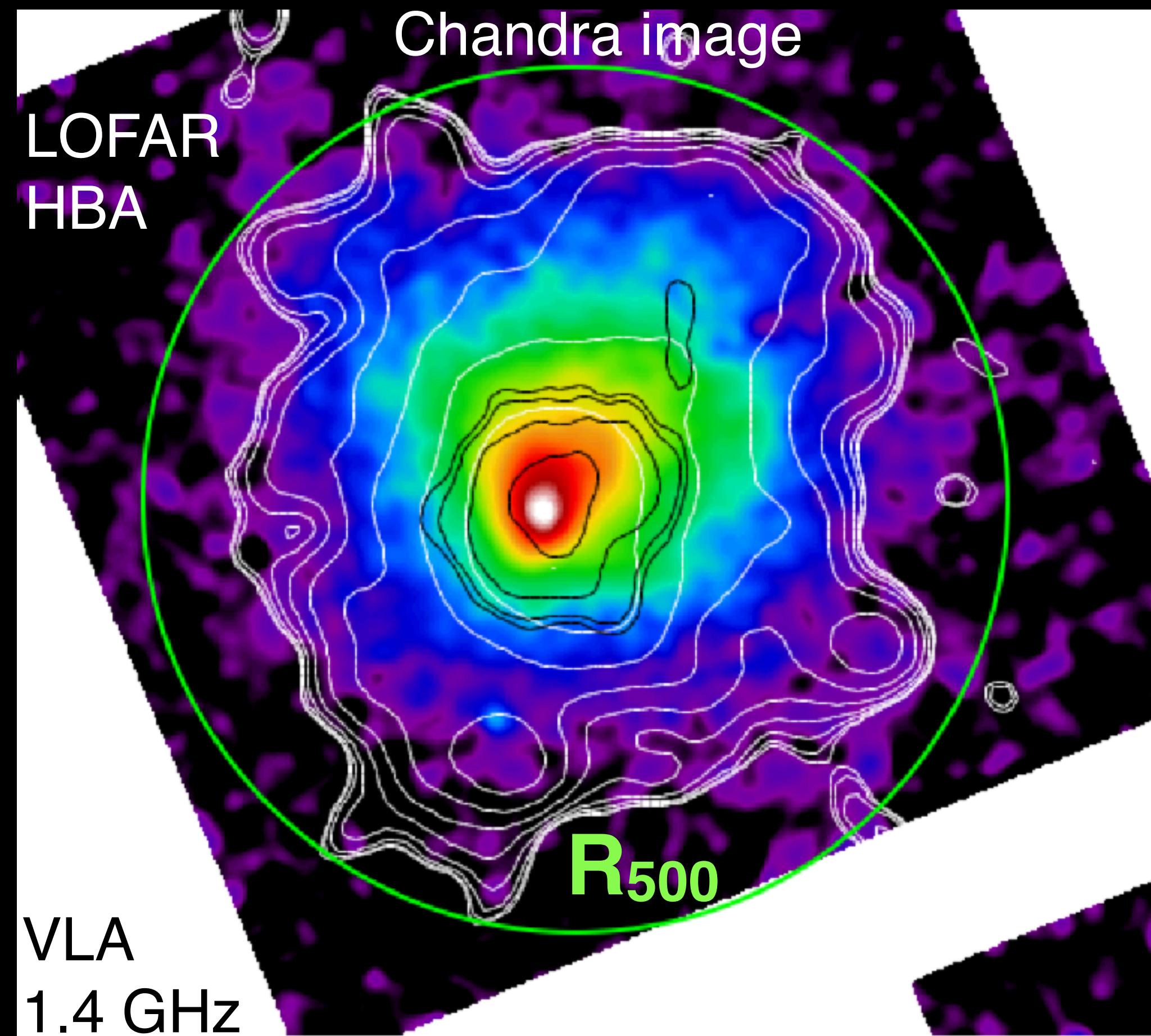


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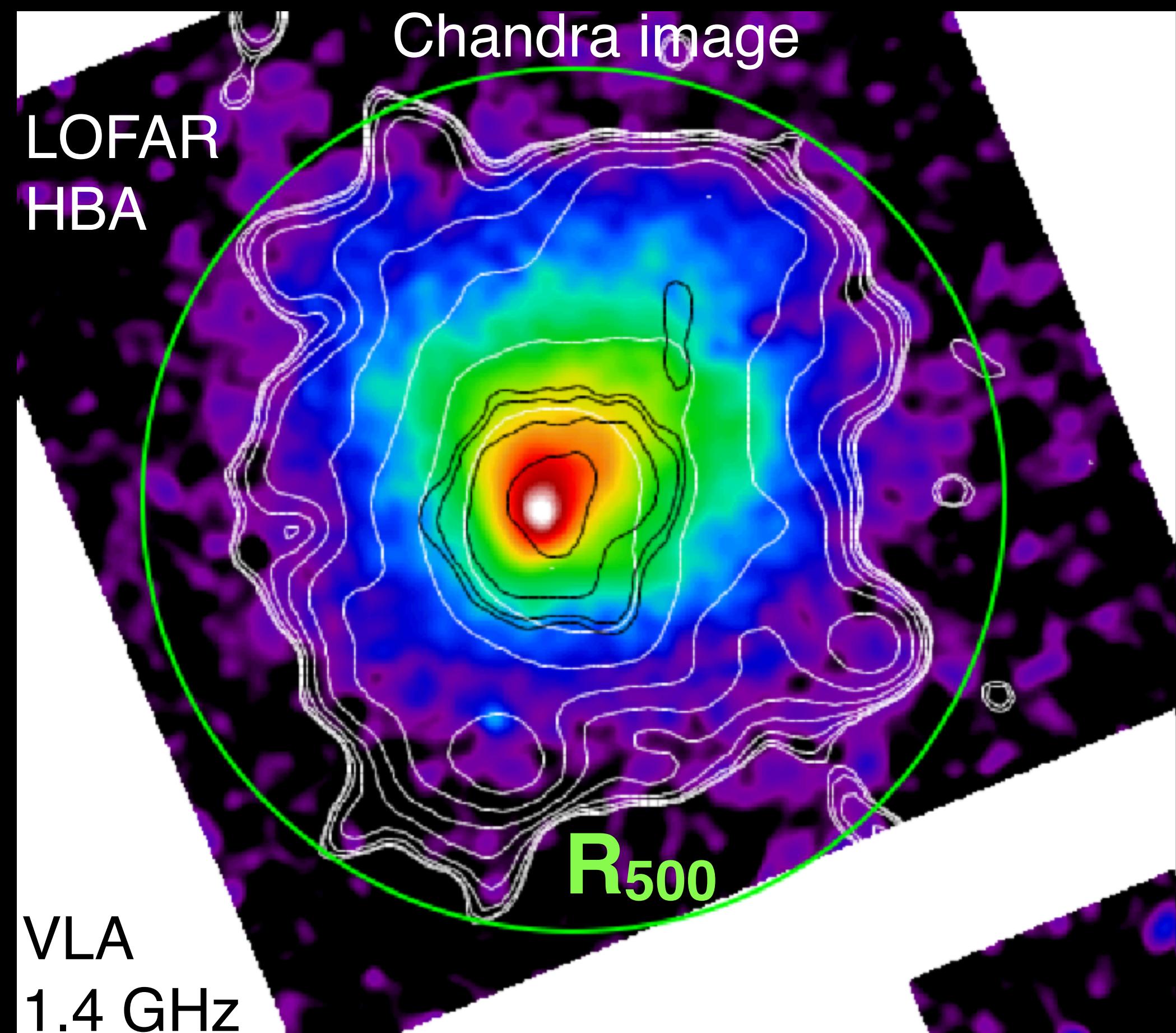


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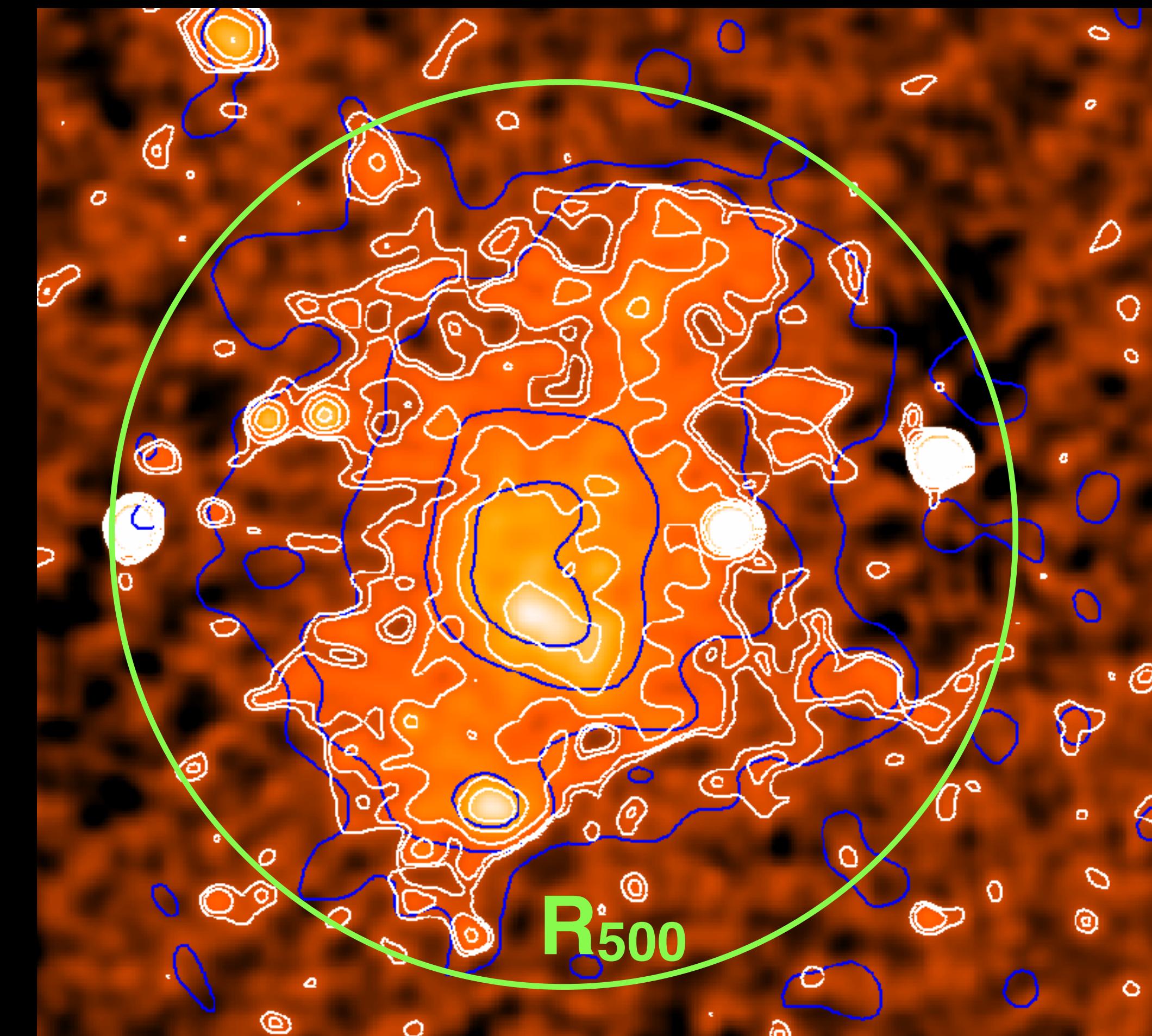
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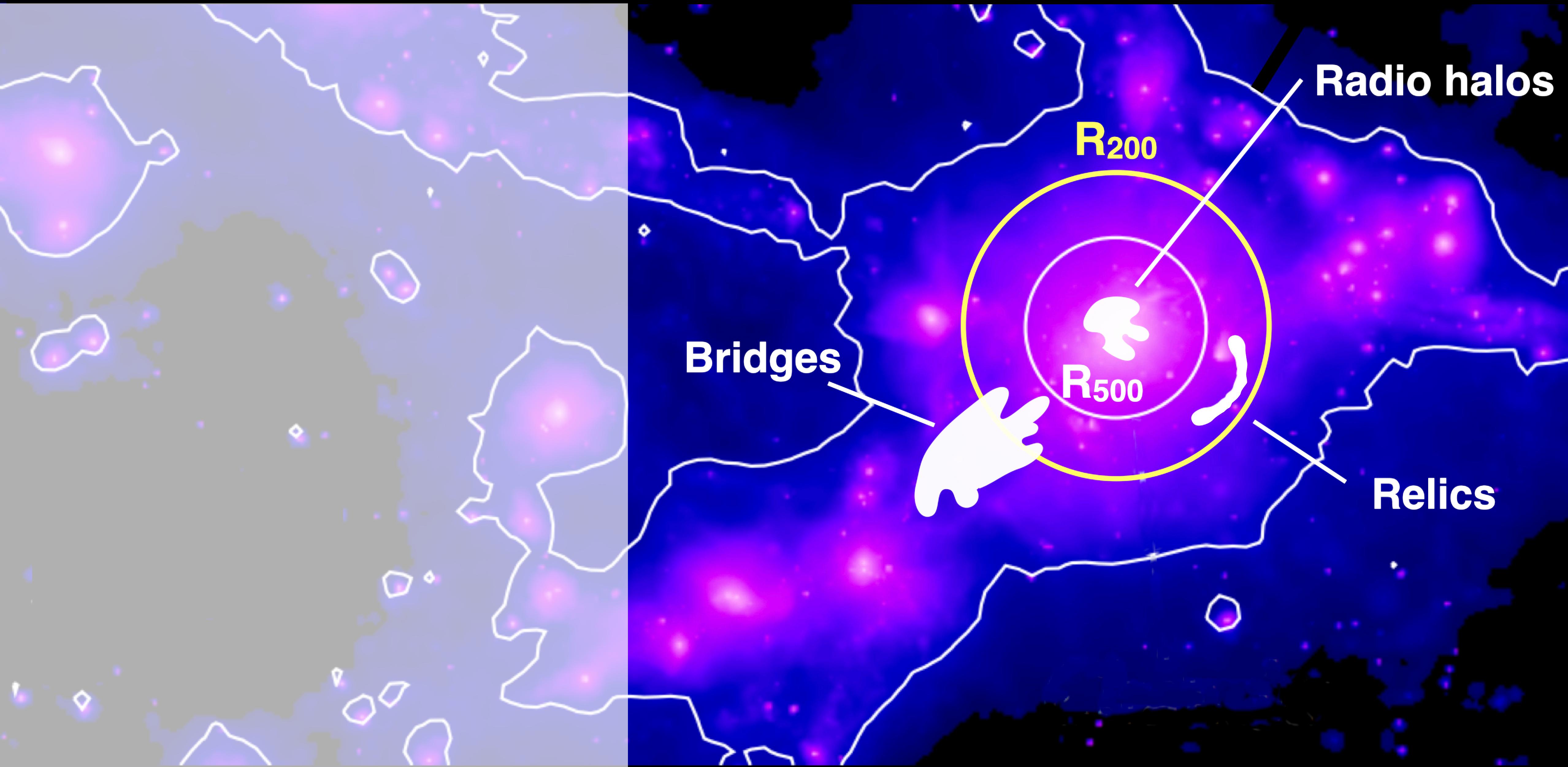
$M_{500} \approx 8.8 \times 10^{14} M_\odot$, $z=0.18$



Preliminary LOFAR LBA image and contours
LOFAR HBA contours

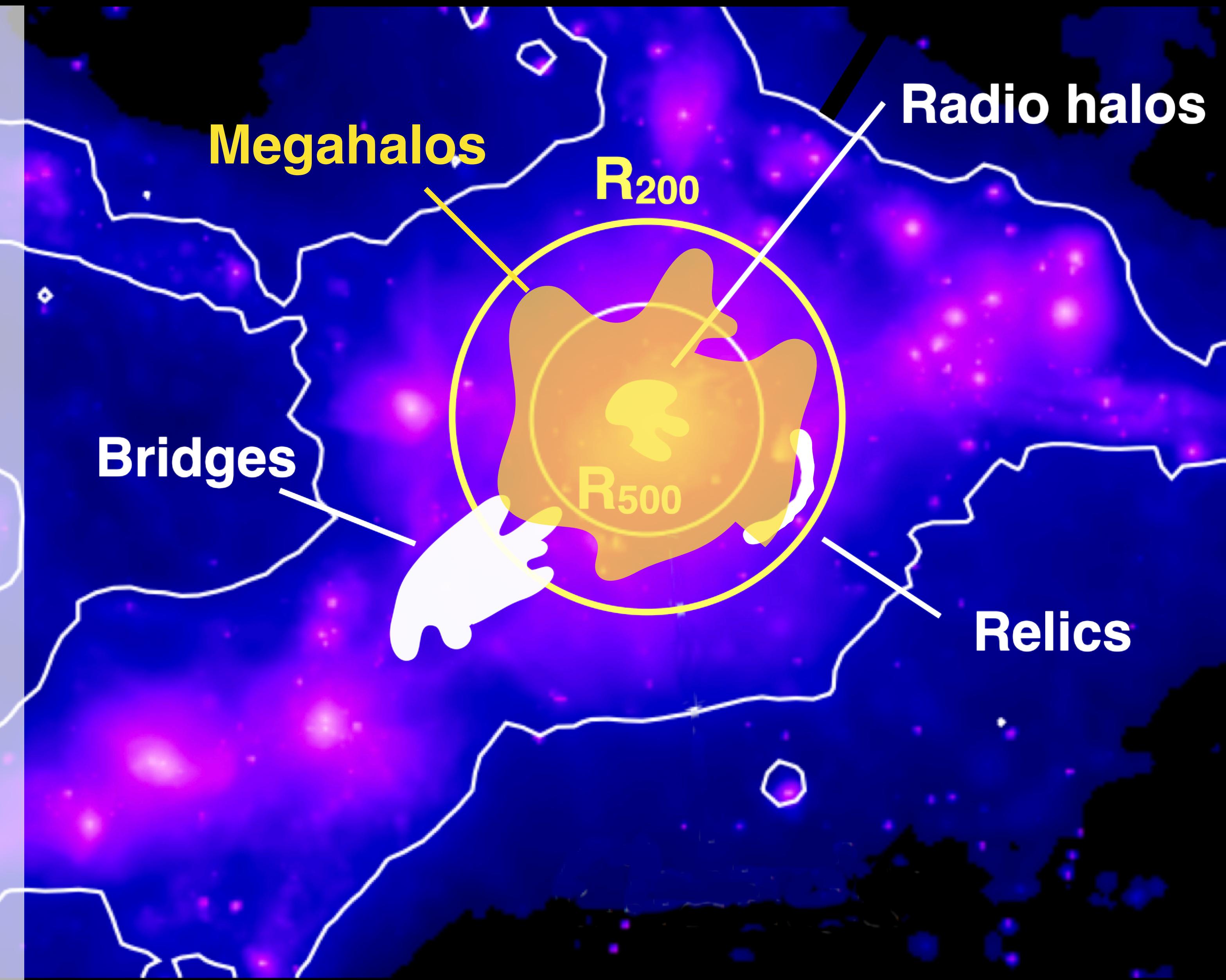


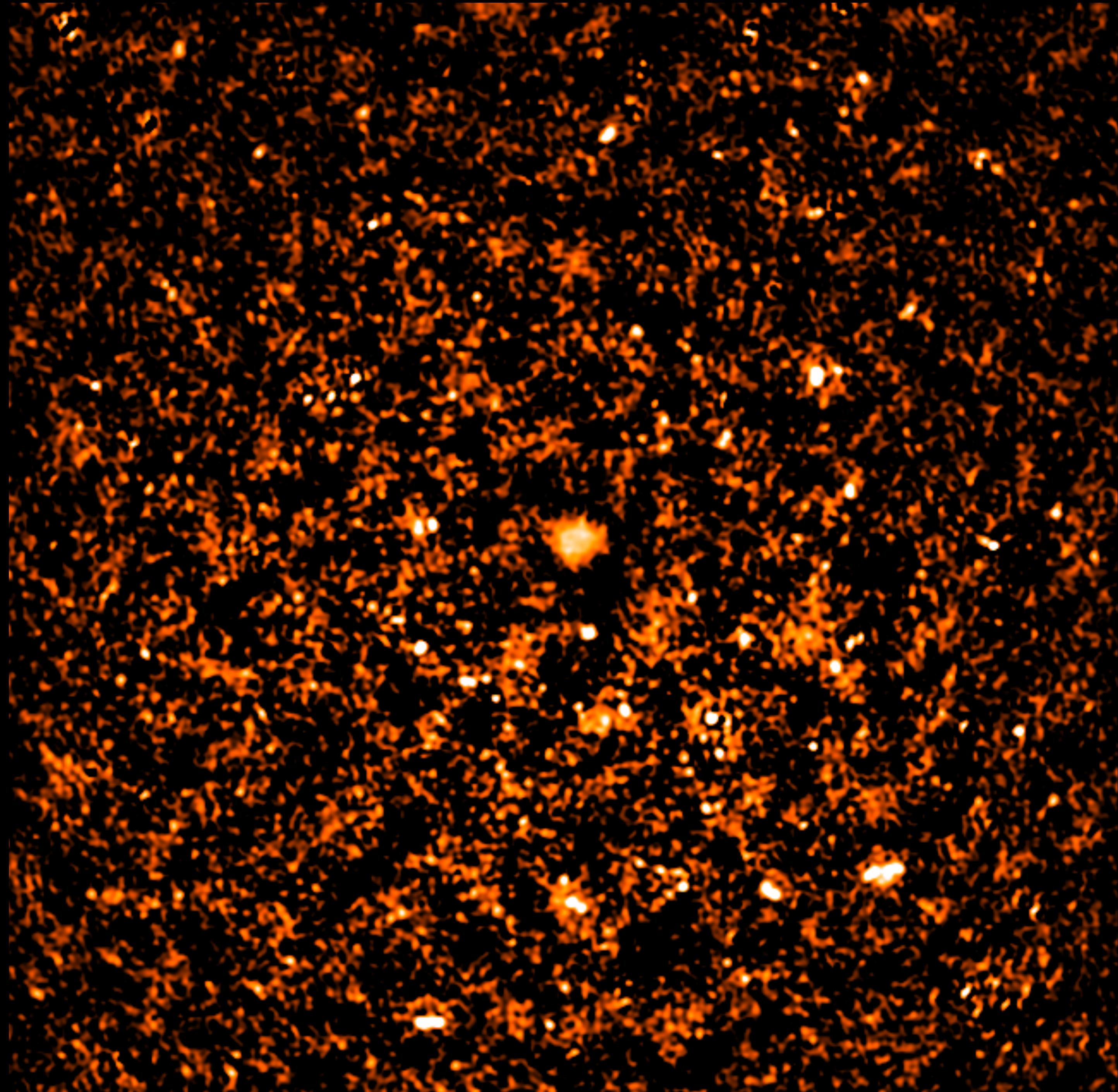
Conclusions



Conclusions

- The radio halo in Zwcl 0634.1+4750 is surrounded by a Megahalo: a larger diffuse source with shallower profile filling up the entire cluster volume
- Among the Planck clusters in LoTSS DR2 we found two other candidates of Megahalos: A665 and A2218
- One possibility is that Megahalos probe a different population of seed particles that are re-accelerated by turbulence





Zwcl 0634.1+4750 morphological parameters

