Zooming in on accretion

the structure of halo gas & its interaction with inflow

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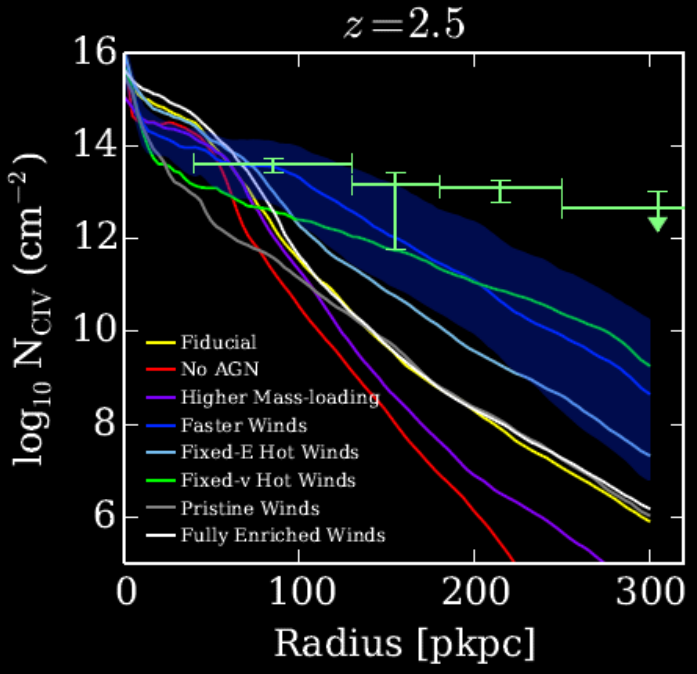
(are hydro simulations sufficiently resolving the circumgalactic regime?)

- What does the hot halo look like at significantly higher resolution?
- Does the interaction between streams and the hot halo change?
- Can we identify and quantify the virial shock?
- Accretion rates from full cosmological boxes robust?

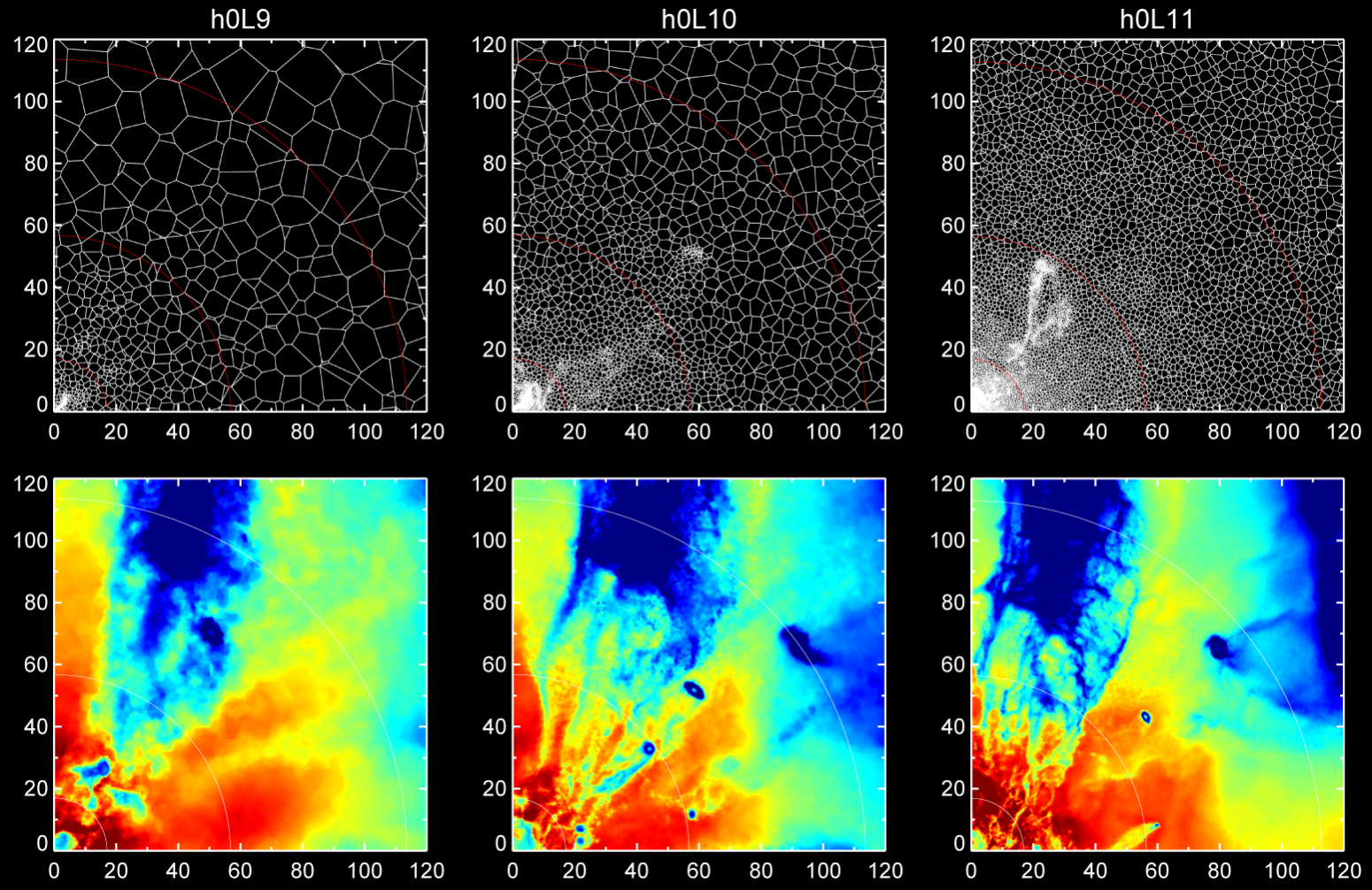
Suresh+ (2015)



Observationally:

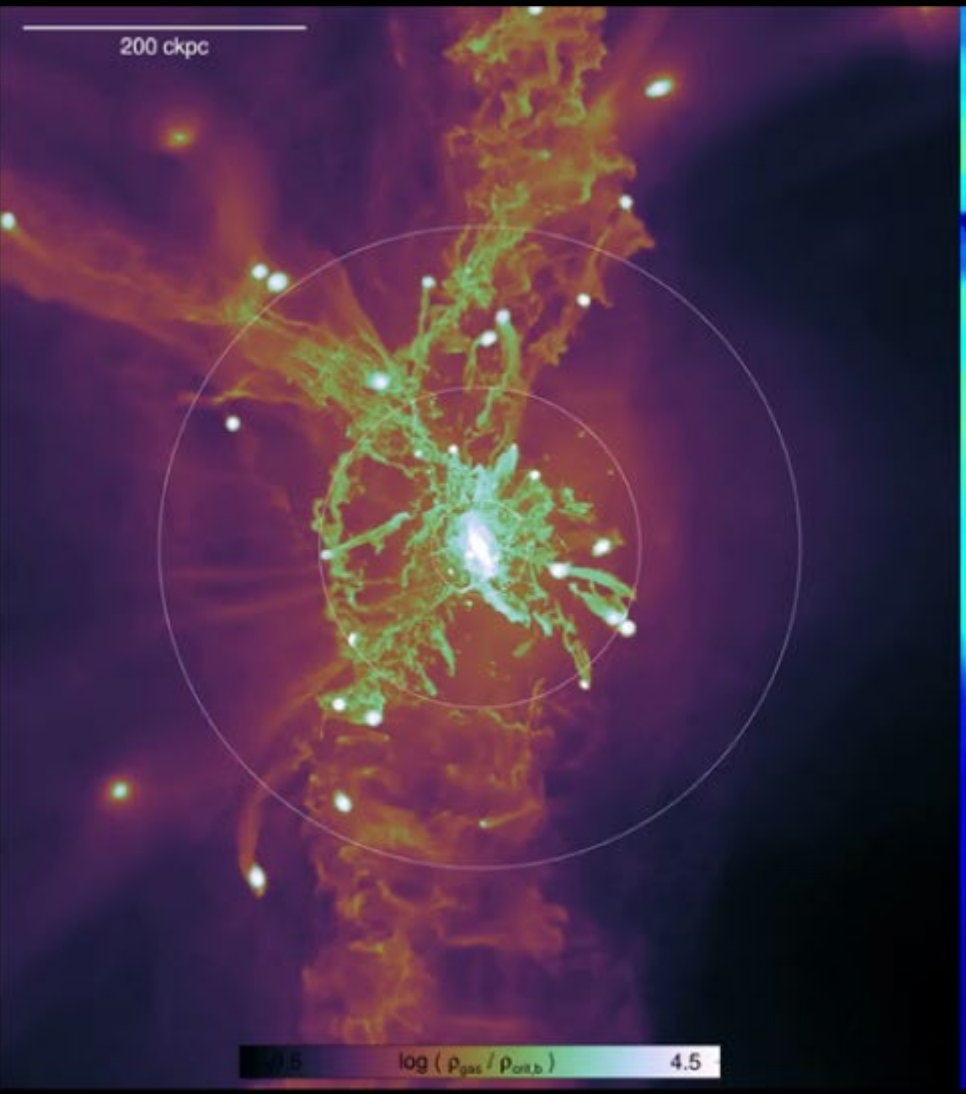
- High covering fractions of cold metal ions (M~12.5 at z~2)
  - Rather unclear: high velocity outflows vs. cosmological inflows vs. ...?
- Small size scale of absorbers
  - Estimates: sub-pc to 100s of parsecs

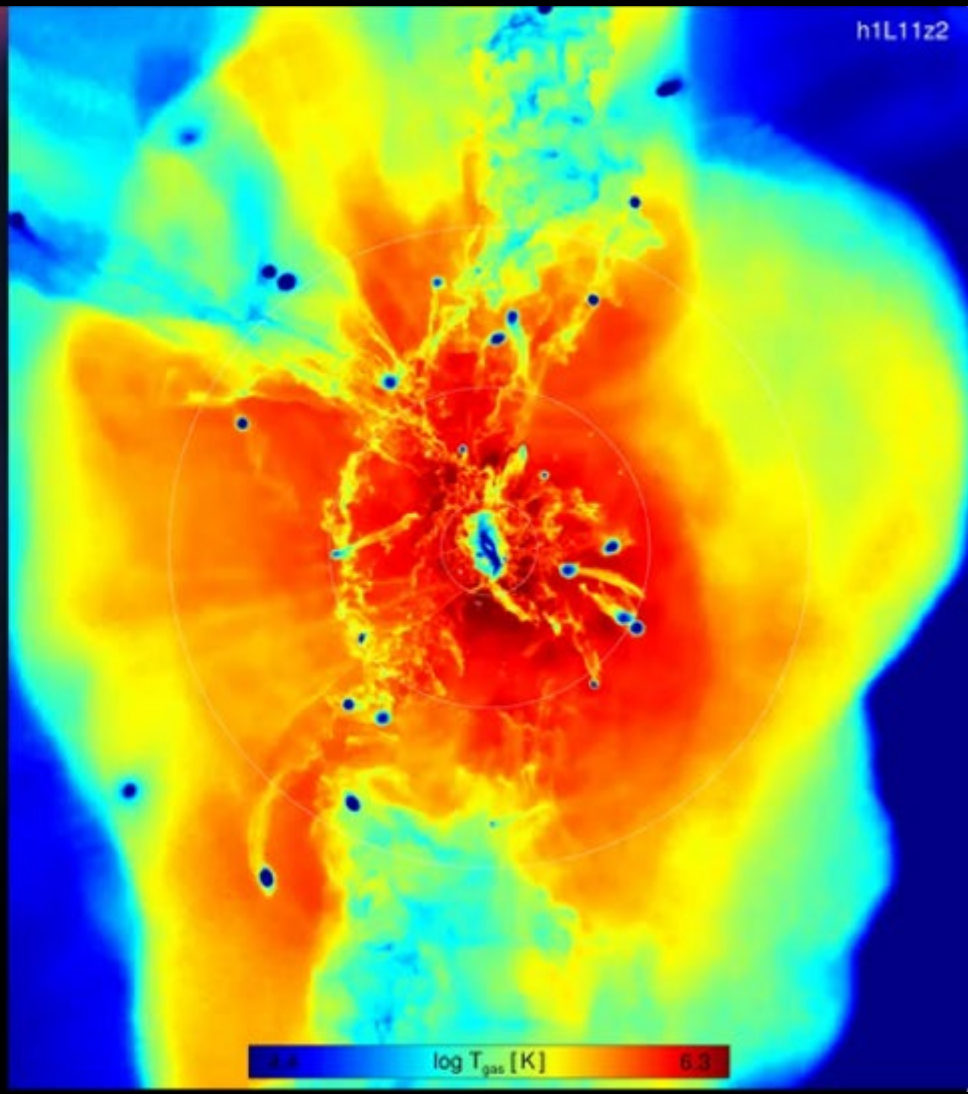
Res	N_{part}^{eff}	N_{part}^{HR}	Δt [#]	m_{baryon} [$M_\odot$]	m_{DM} [$M_\odot$]	$\epsilon_{grav}^{comoving}$ [pc]	$\epsilon_{grav}^{z=2}$ [pc]	r_{cell}^{min} [pc]	r_{cell}^{halo} [kpc]
L9	512^3	800,000	80,000	1.0×10^6	5.1×10^6	1430	480	31	2.7
L10	1024^3	7,000,000	260,000	1.3×10^5	6.4×10^5	715	240	11	1.6
L11	2048^3	64,000,000	870,000	1.6×10^4	8.0×10^4	357	120	3.3	0.8



Eight simulated 10^{12} M_{sun} halos at z=2.

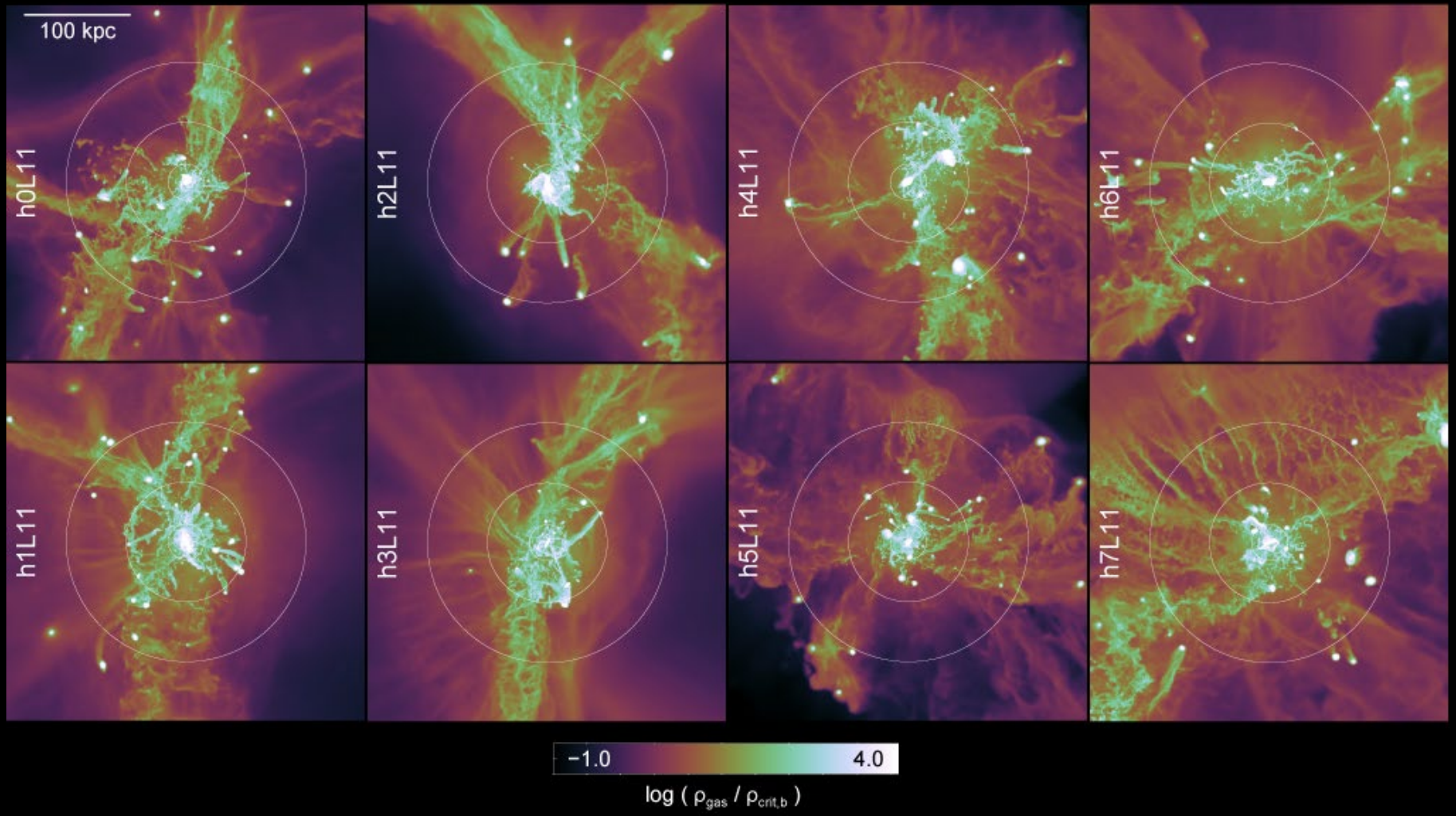
"simple physics": primordial radiative cooling, SF, no resolved feedback (arepo)

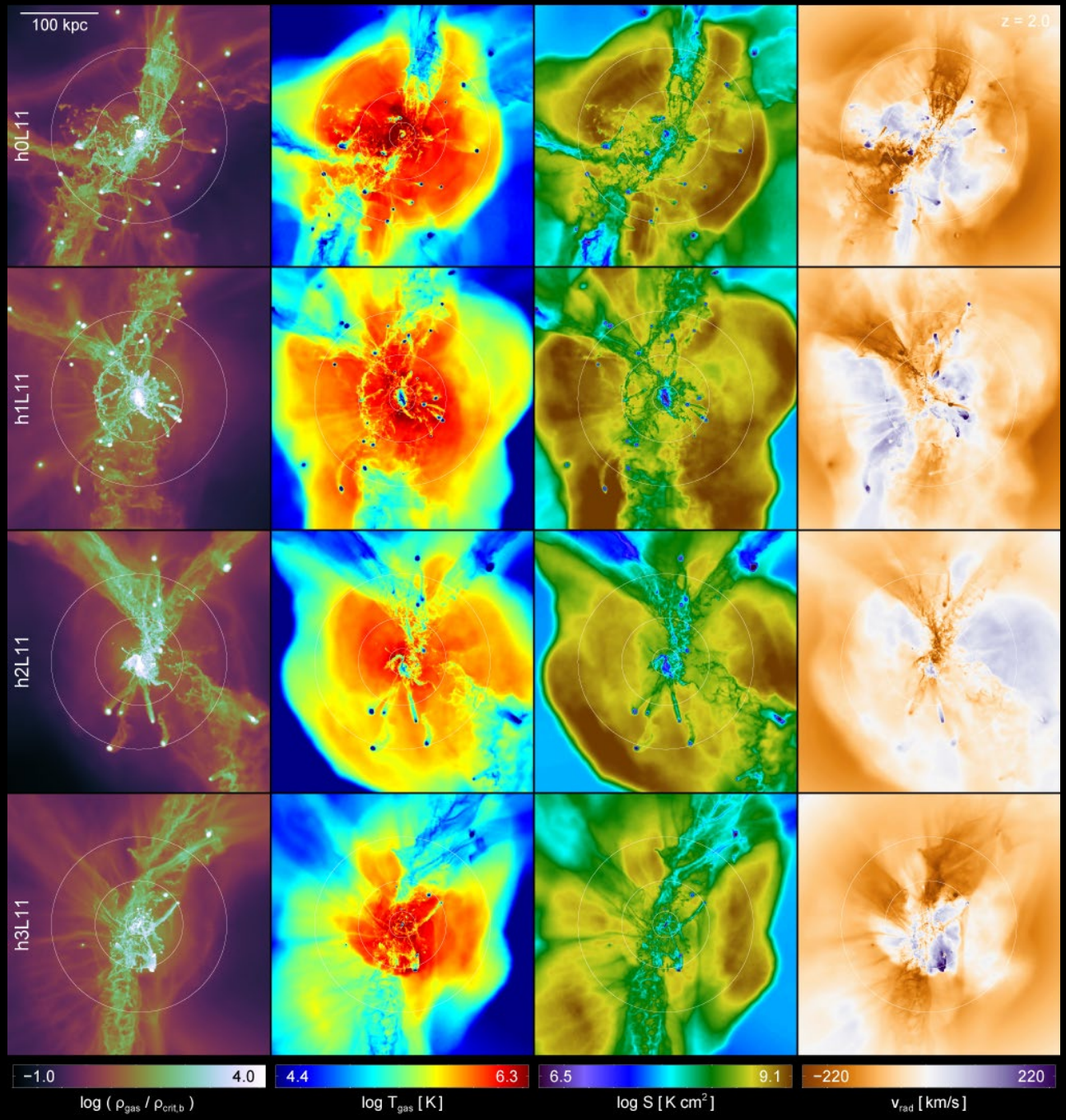




significant variation in the halo gas density structure.

non-spherical inflow + virialization boundary + orbiting substructures



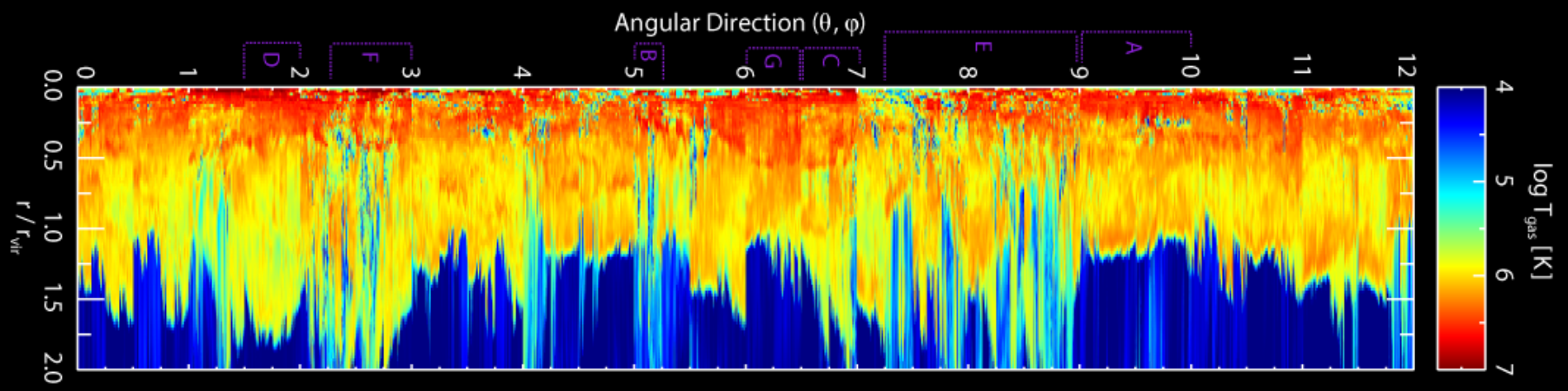


Coherent flows can penetrate 0.5 r_{vir}, maintain over-density (and relatively low entropy) while heating.

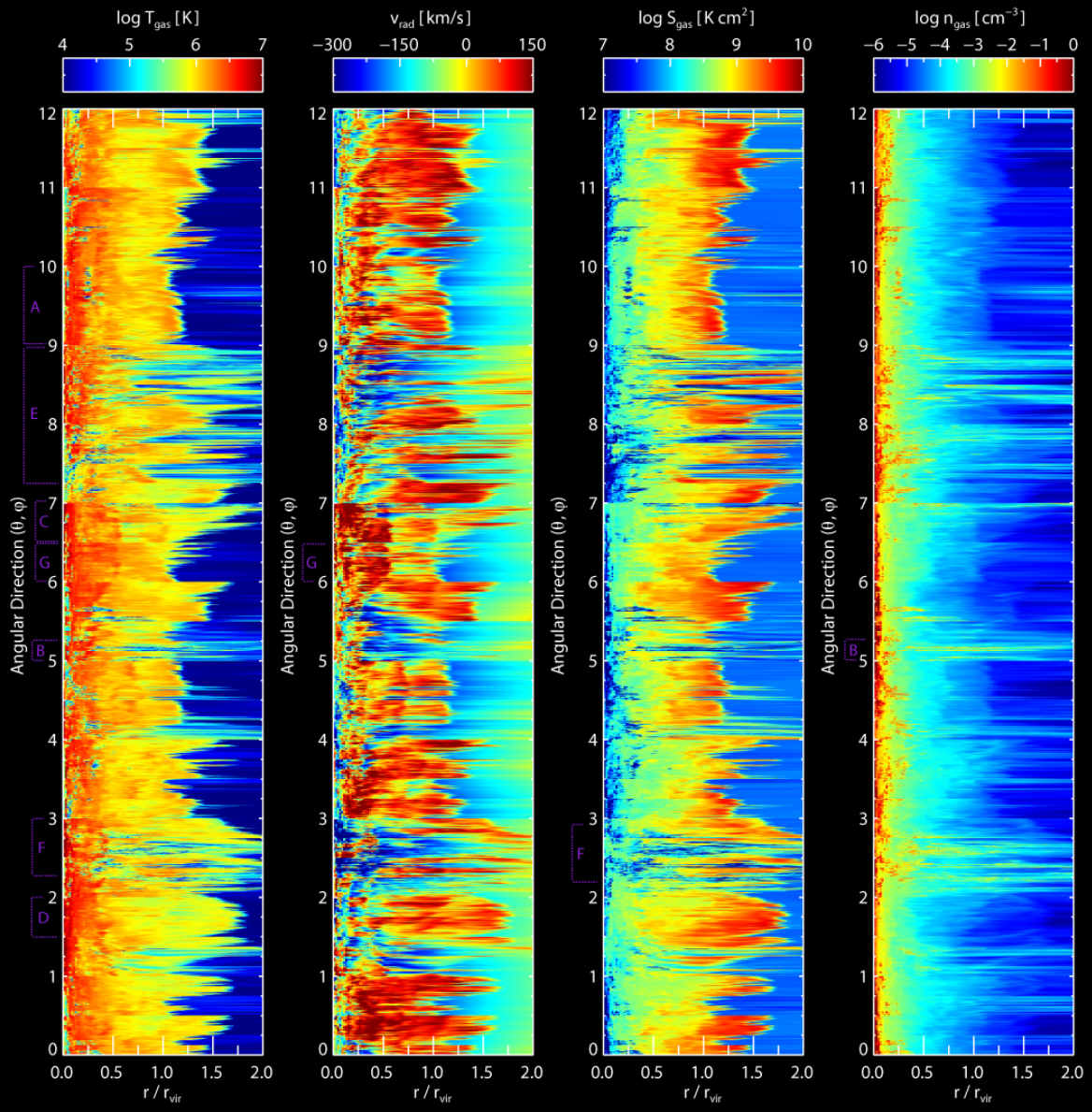
Orbiting substructures experience strong stripping. Mixing with CGM enhances cooling and fallback onto central.

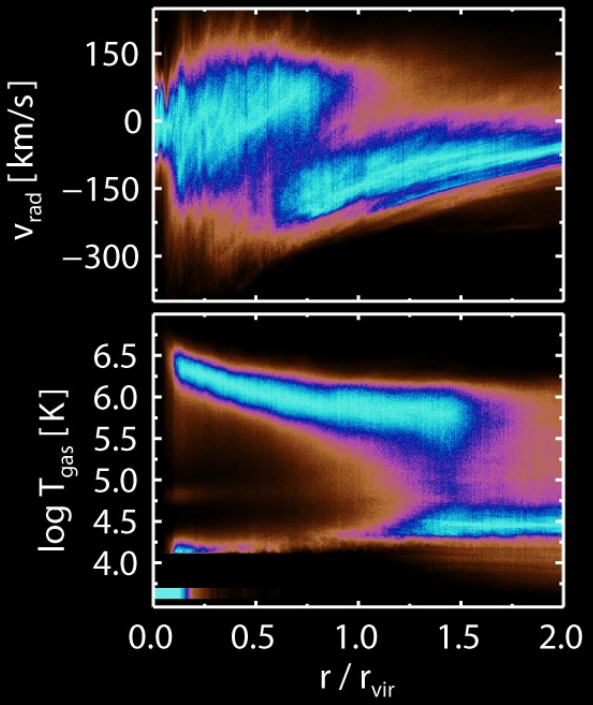
Virial shock clear in T,S jumps, radial stalling.

Radial sightline analysis to quantify the angular structure of halo gas.



Cool gas in the halo associated with rapid inflow, and overdensities at large radius.

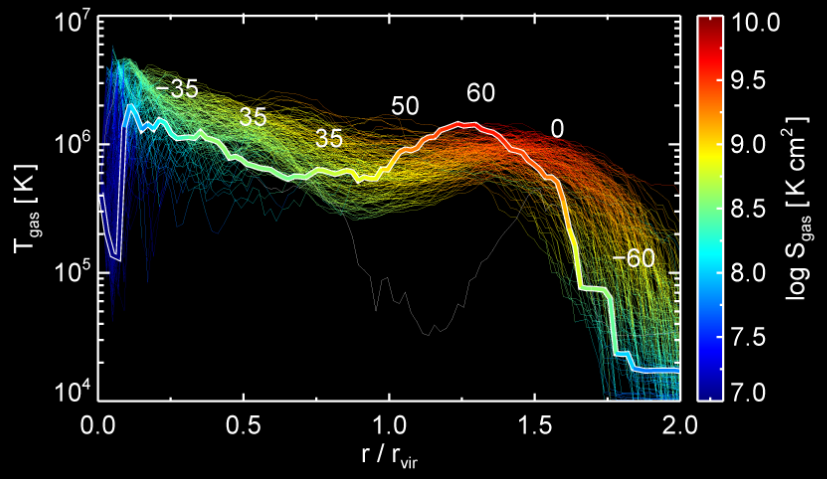


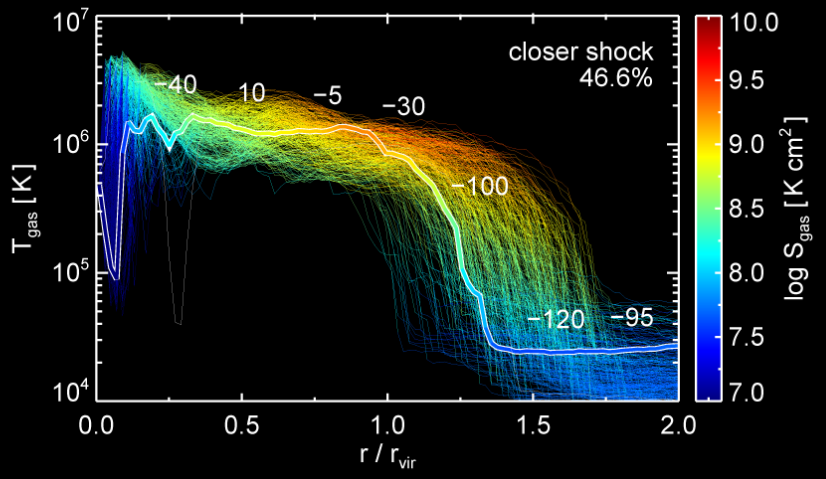


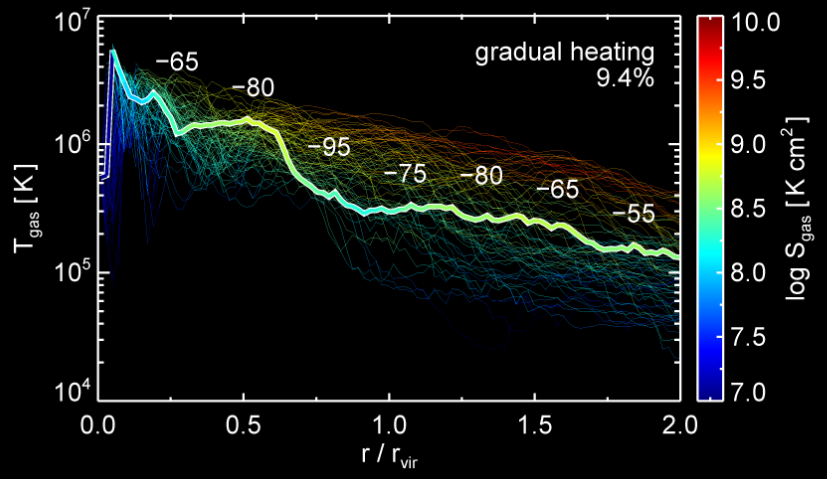
Two overlapping velocity components.

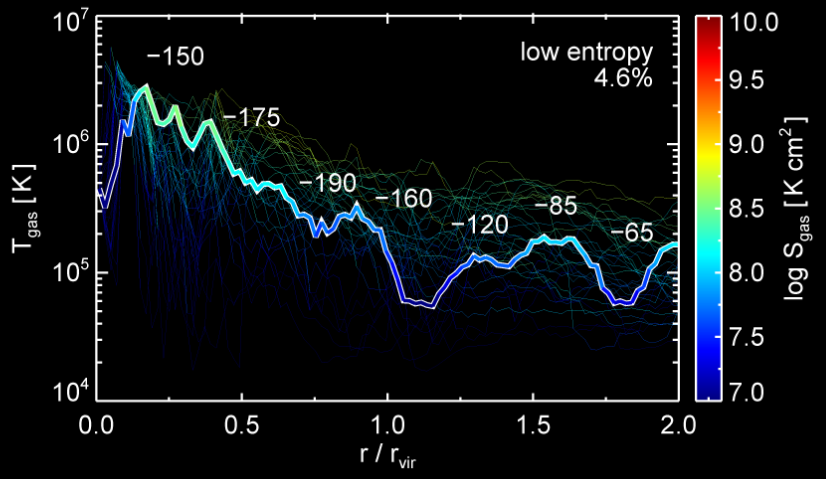
Broad temperature jump an artifact of angular smoothing.

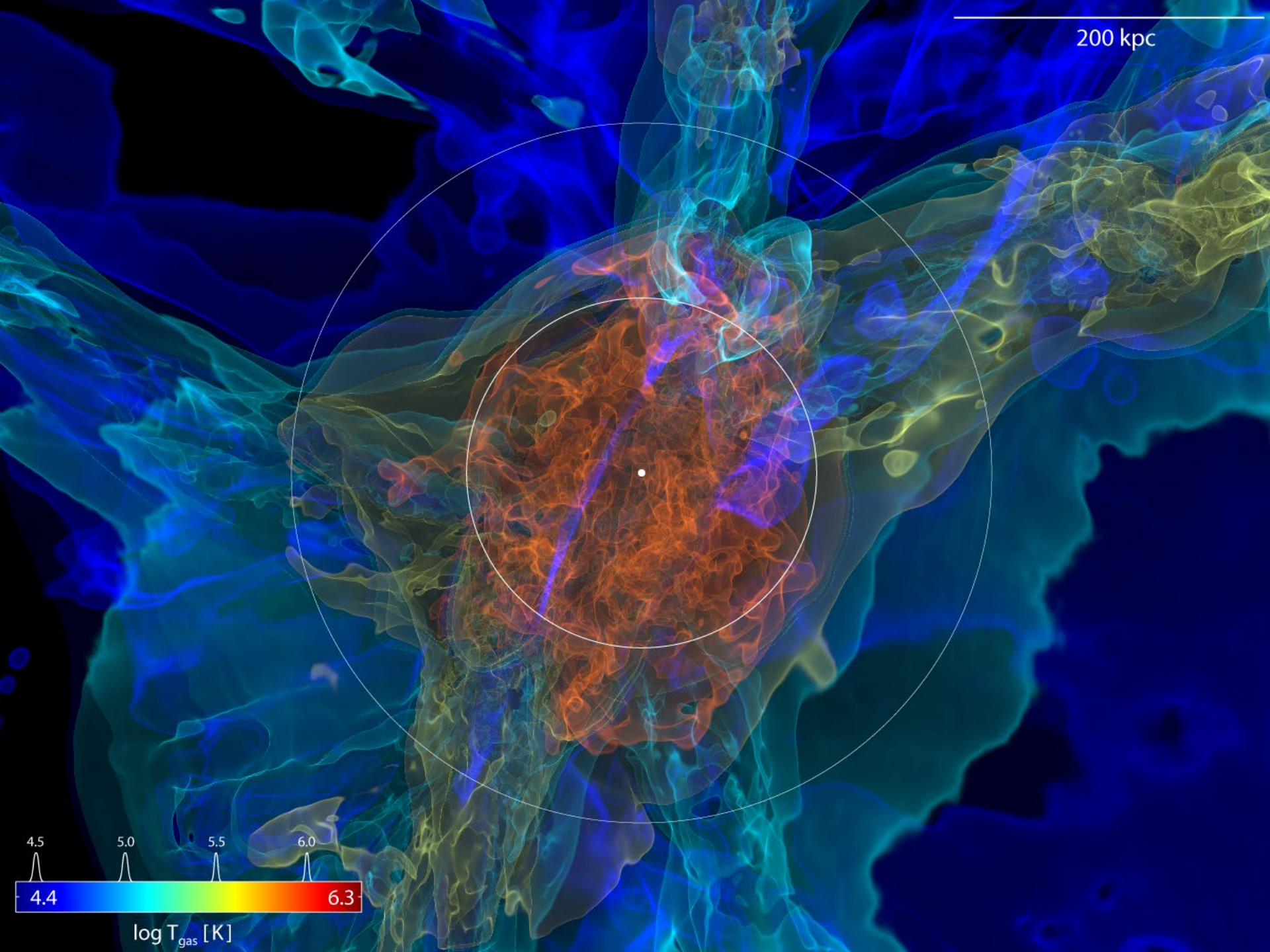
Identifying distinct types of radial structure:










200 kpc
4.5
5.0
5.5
6.0
4.4
6.3
log T gas [K]

conclusions and future directions

1. Resolution discrepancy in the halo vs. the galaxy presents a challenge.
2. Different gas components co-exist at the same radii.
3. Inflow along different directions undergoes different heating processes.

- Look at evolution of tracer entropy, what heating is due to small shocks vs. the virial shock vs. adiabatic compression?
- Are the accretion rates of gas robust @ typical cosmological simulation resolutions (and balance of ‘hot’/’cold’)
- Ultimately: inform the observational puzzles & simultaneously constrain the feedback models.