

THE IMPORTANCE OF LOW-MASS CLUSTERS FOR SATELLITE QUENCHING IN C-EAGLE SIMS

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QUENCHING OF GALAXIES

Quenching may start shortly after the first appearance (Oesch+16).

Environment start to play an important role at $z \sim 1.6$ (Nantais+ 2016,2017).

Mixed components in different regions of the clusters (Moran+ 2007)

Even more complicated for dwarf galaxies!! (Benitez-Llambay+ 2014).

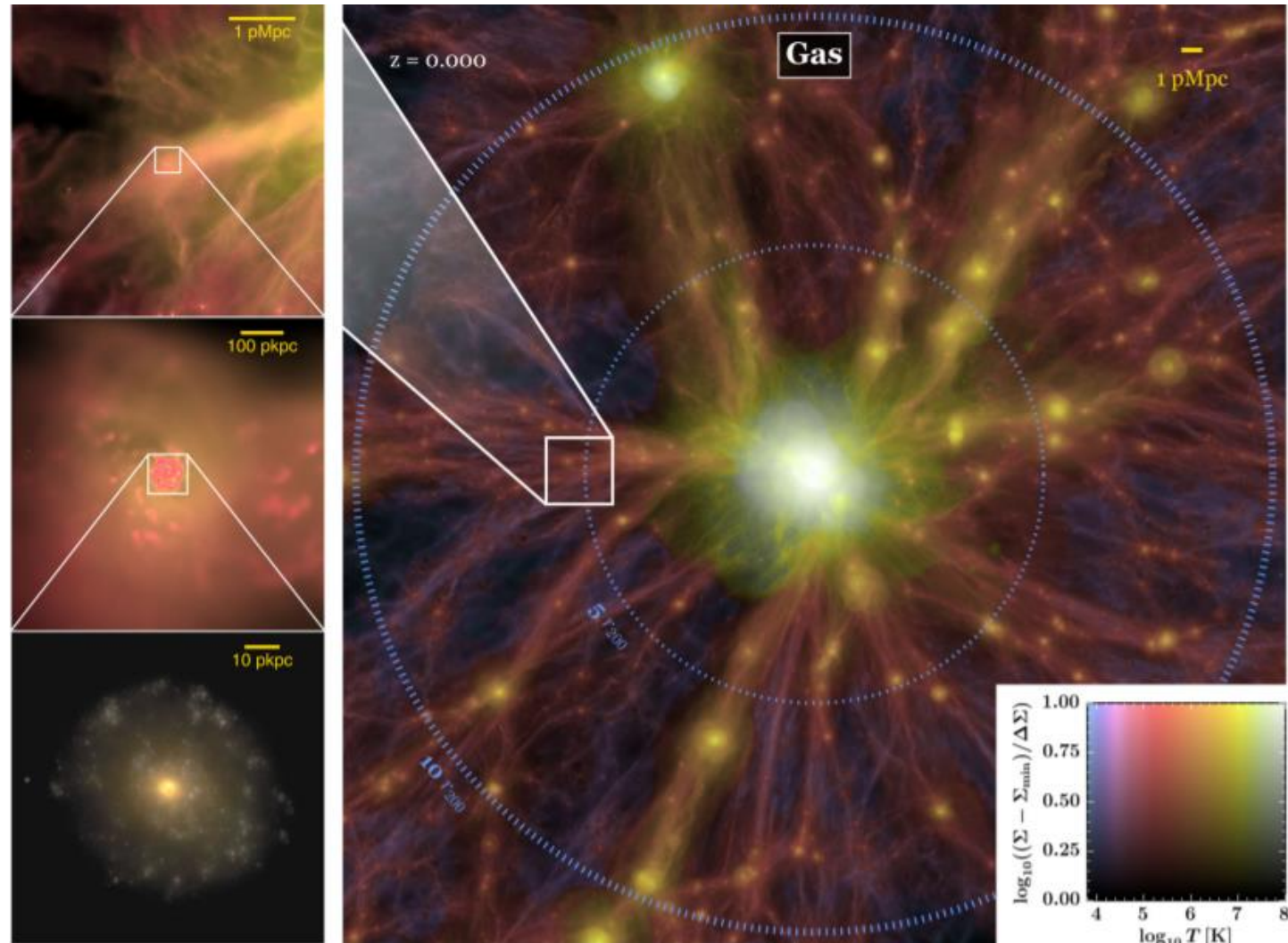
Recent studies suggest a needed threshold for quenching to happen (Roberts+ 2019)



DATA

C-EAGLE PROJECT

- ✓ 30 Clusters with masses between $10^{14} < M_{200}/M_{\text{sun}} < 10^{15.4}$.
- ✓ Time resolution for particles of ~ 125 My, and for 3 Interval redshifts (0-1, 4-5, 7-8) resolution ~ 25 My. For Group Catalogues time resolution of 500 My.
- ✓ X-Ray and S-Z properties calculated.
- ✓ Gas particle resolution $\sim 10^6 M_{\text{sun}}$



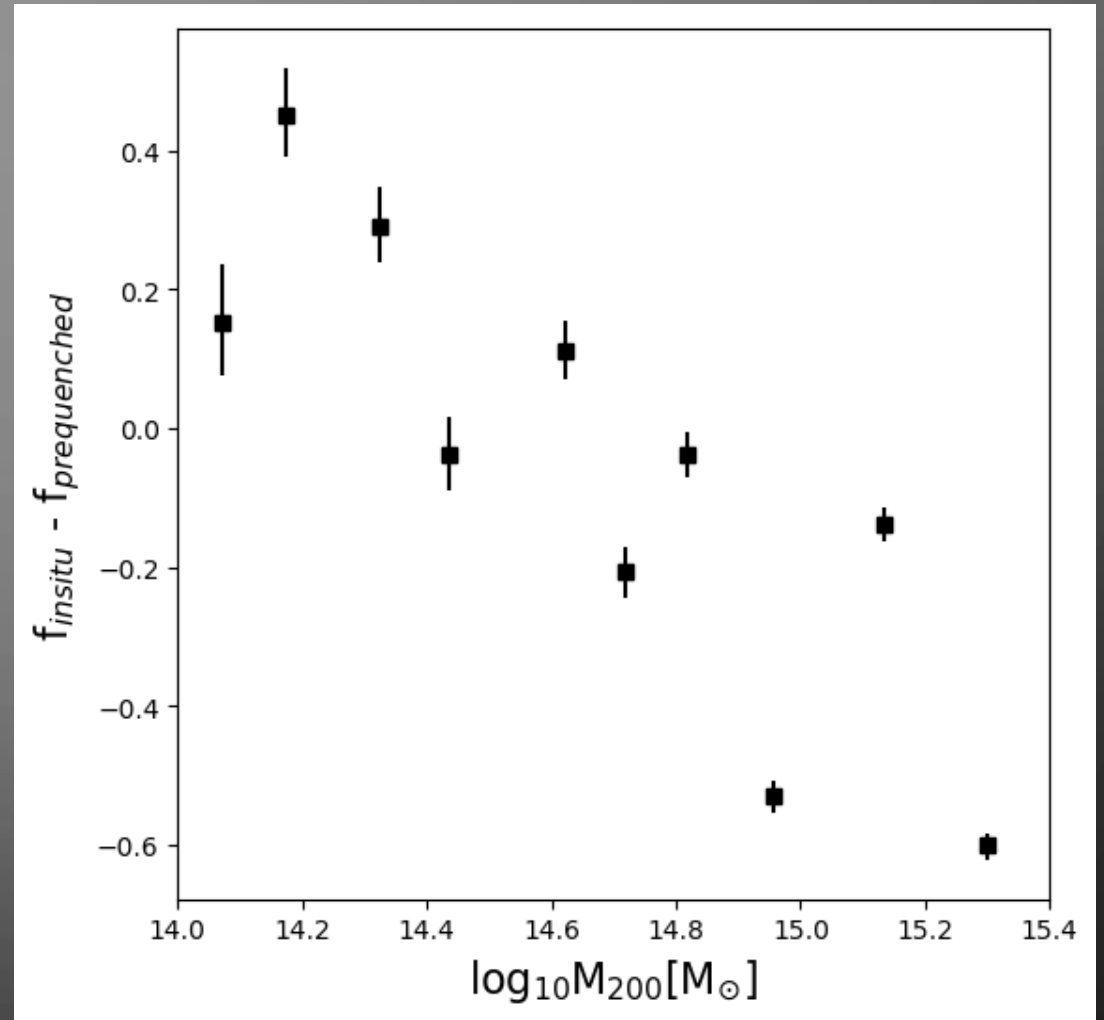
Barnes+2017; Bahé+2017

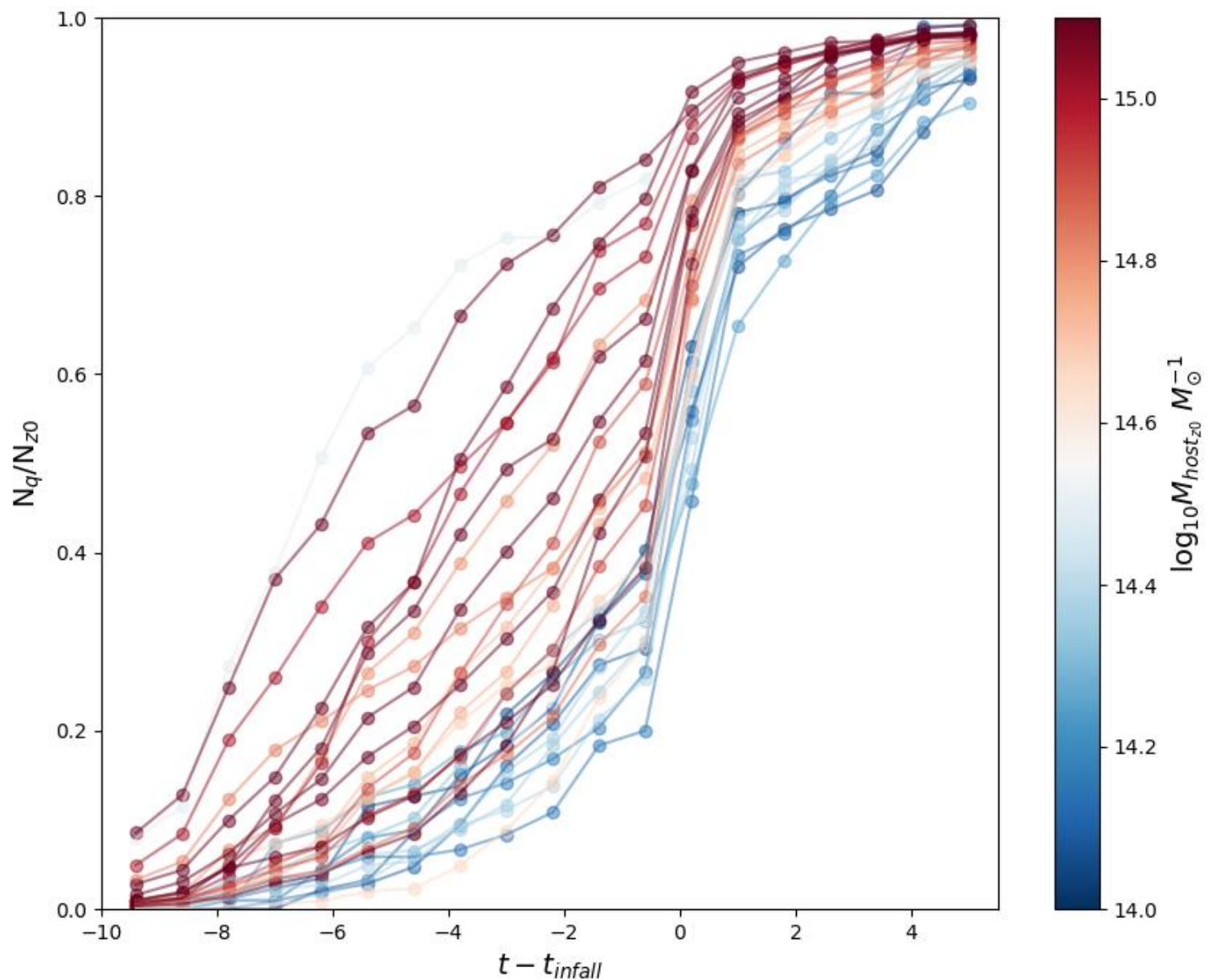


RESULTS

DOMINANT POPULATION

- High mass clusters quench less galaxies than low mass clusters.
- When $M_{200} \sim 10^{14.6} M_{\text{sun}}$ the predominant population change.
- Low mass clusters are the structures responsible for satellite quenching.

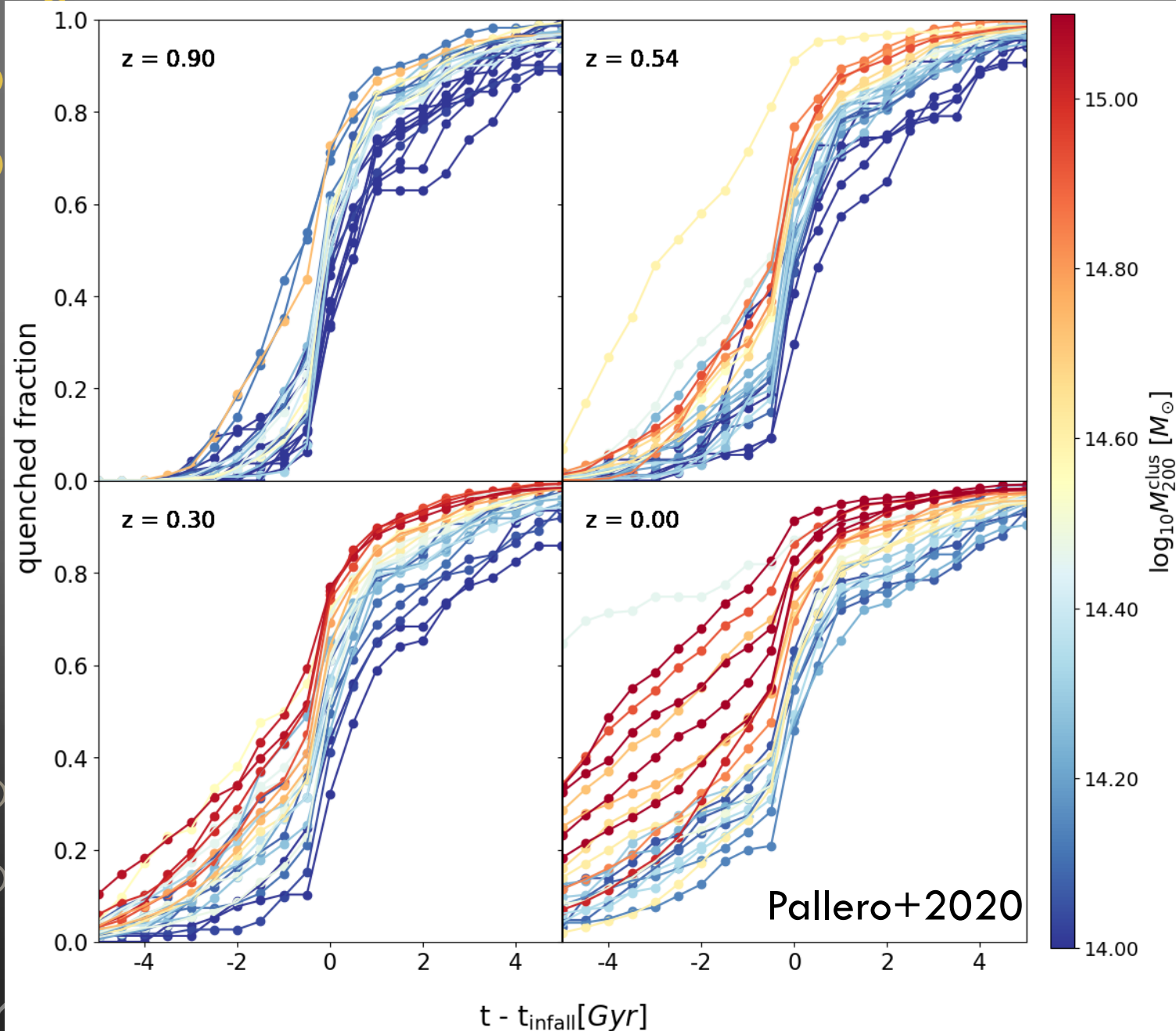




TIME EVOLUTION OF THE QUENCHED FRACTION

- Strong change in the slope at R200.
- LMC are the most efficient structures to quench the star formation.
- Between 20% and 80% of galaxies arrives to clusters quenched.
- After 4Gy all galaxies reach their quenching state, regardless the halo mass.

LOOKING CLUSTERS AT DIFFERENT REDSHIFTS



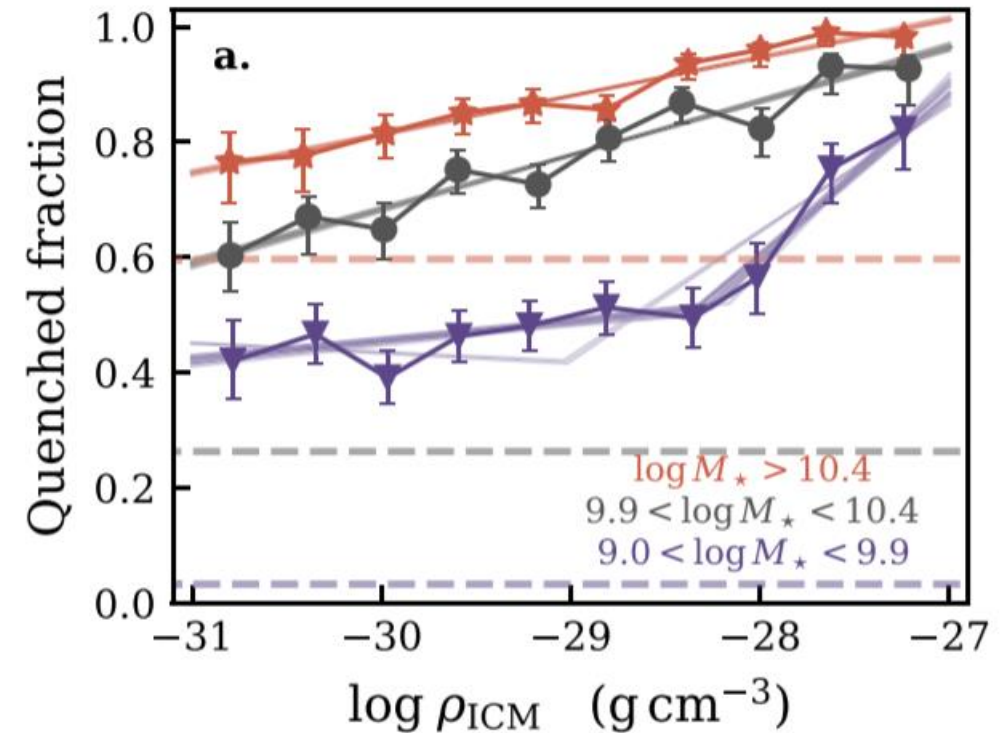
- Fraction of pre-quenching decreases as we look at higher redshifts.
- Clusters with same mass present different quenched fractions at different redshifts.
- Consequence of the different assembly history suffered by clusters at different redshifts.

An abstract graphic on the left side of the slide, consisting of thin, light-colored lines that branch out and connect to small circles, resembling a circuit board or a neural network diagram.

A CHARACTERISTIC THRESHOLD IN DENSITY?

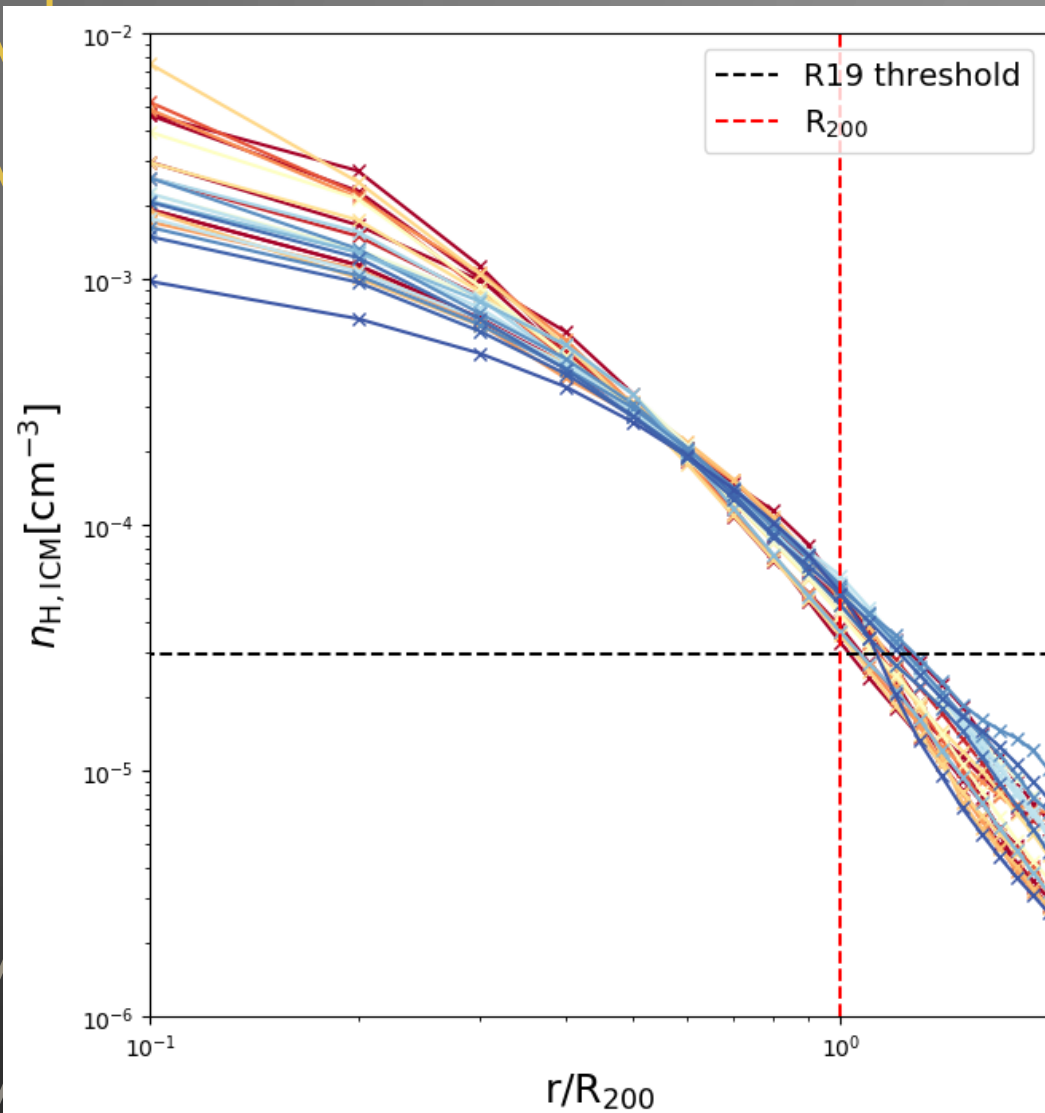
ROBERTS + 2019

- They found that the quenched fraction of satellite galaxies grows with ρ_{ICM} .
- Also found a change in the slope for low mass galaxies when $\rho_{\text{ICM}} > 10^{-28.3} \text{ gr cm}^{-3}$
- What do we found...

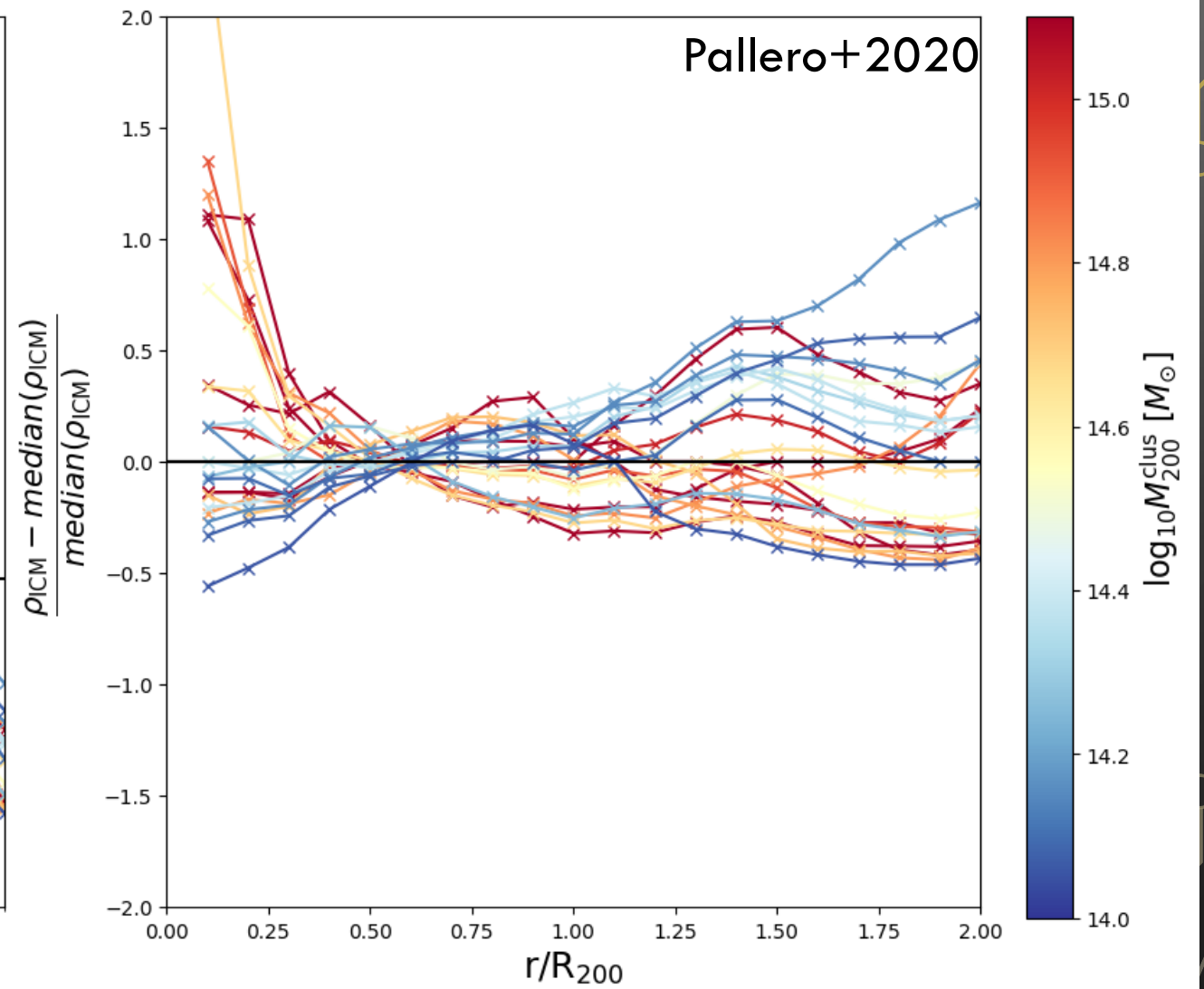


ROBERTS + 2019

GAS DENSITY PROFILES

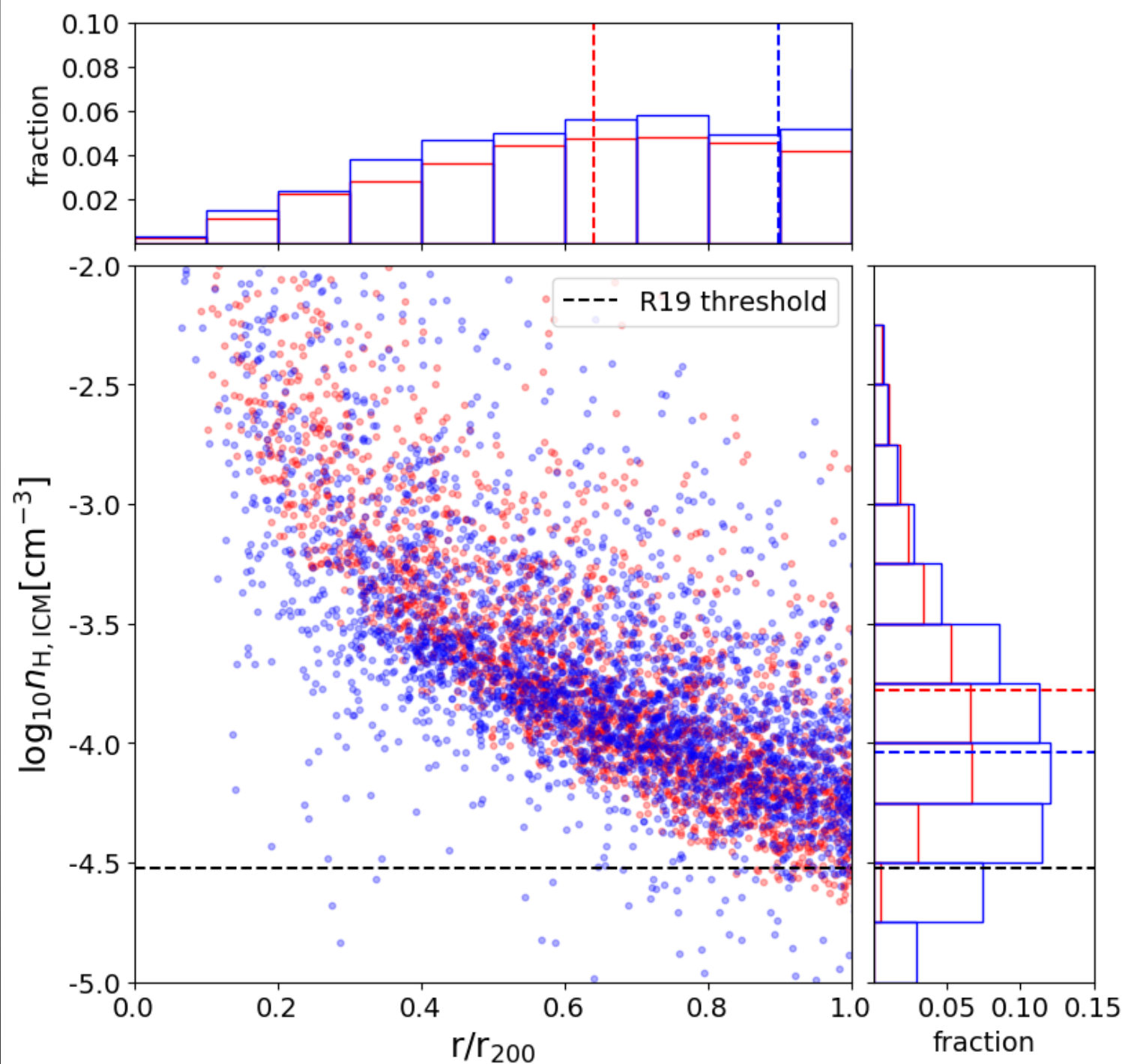


- Threshold proposed in R19 reached at $r \geq r_{200}$.

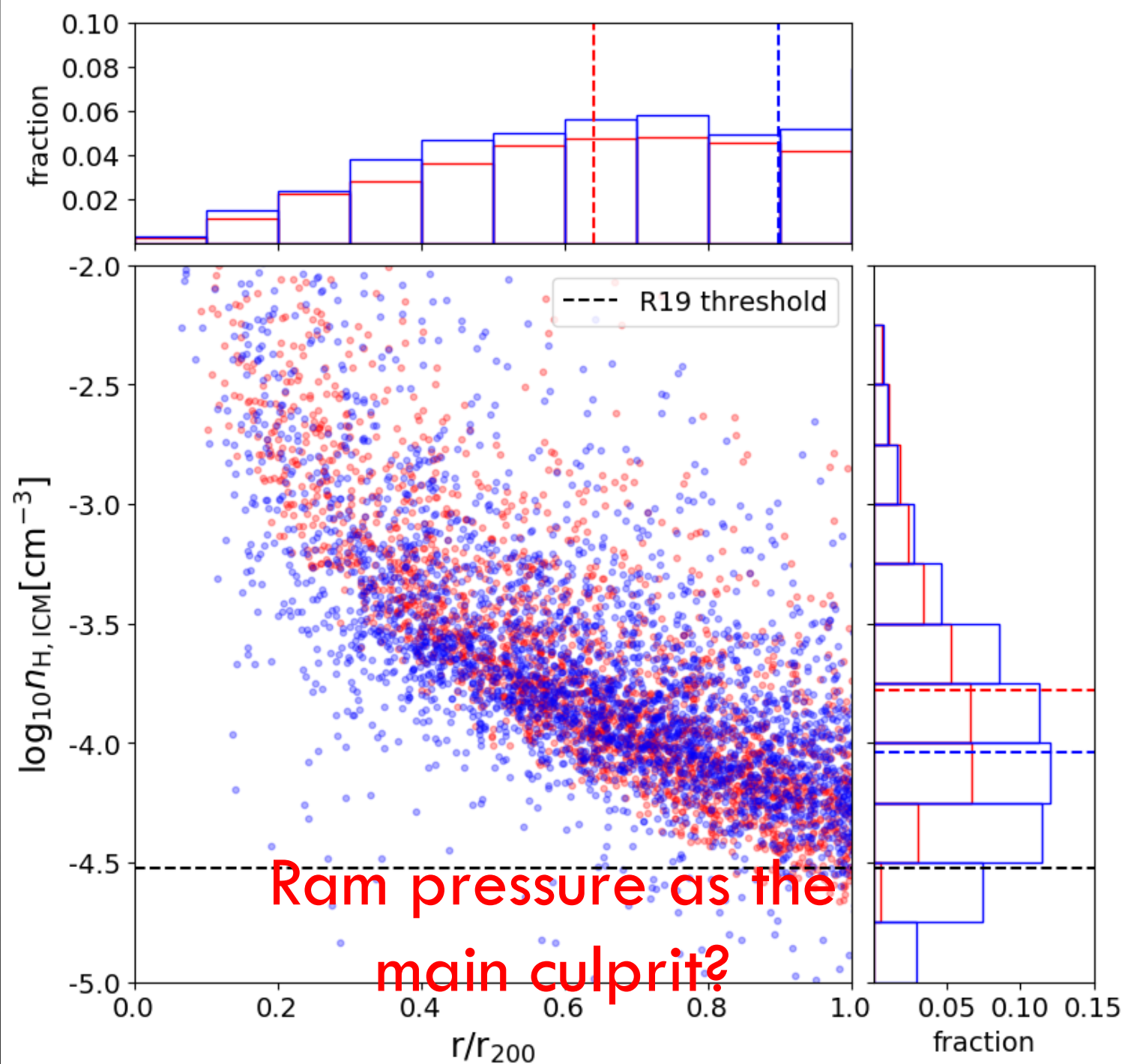


- Low mass clusters shows an extended envelope.

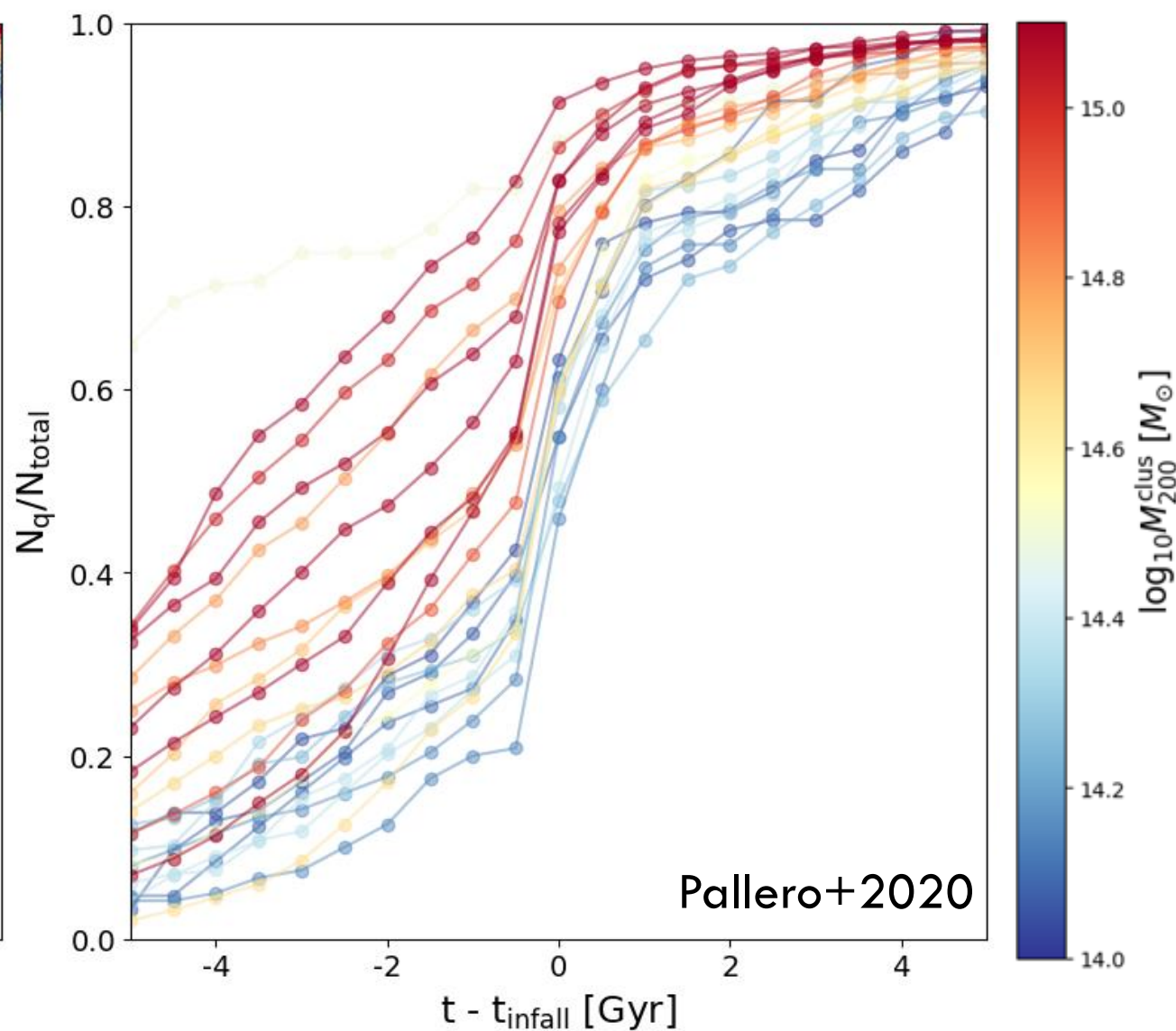
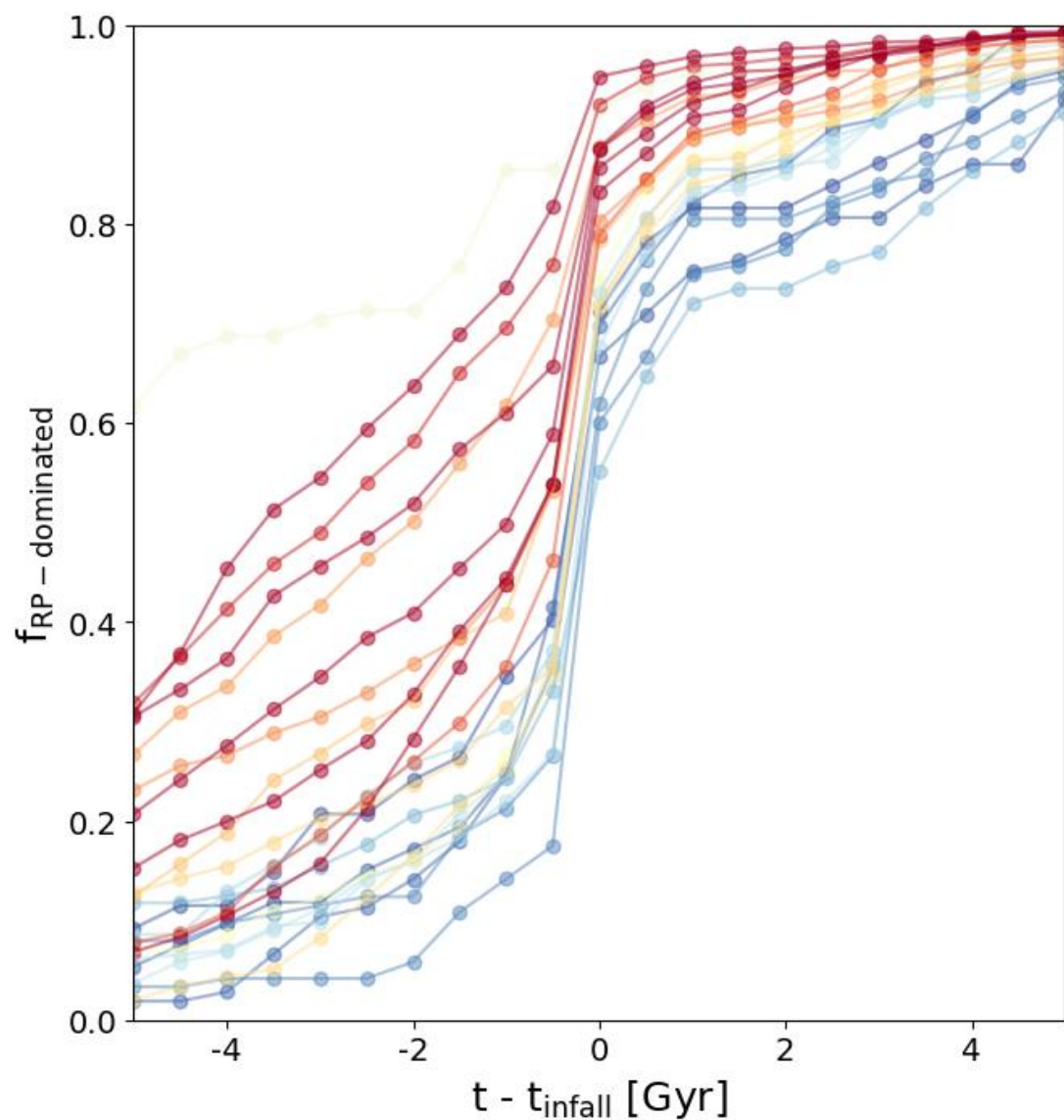
- Density experienced by galaxies at their quenching time as a function of the cluster-centric distance.
- Galaxies get quenched when ρ_{ICM} denser than the proposed threshold
- Density measured following Vega-Martinez+2021.



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- Density measured following Vega-Martinez+2020 (in prep).



RAM PRESSURE, MAIN CULPRIT OF SATELLITE QUENCHING !



SUMMARY AND CONCLUSIONS

- Low mass clusters are the precursors of quenching ($13.8 < \log_{10} M_{200}/M_{\text{sun}} < 14.2$).
- Quenching in-situ dominates the LMC regime, while pre-quenching dominates the HMC regime at $z = 0$.
- When looking at higher redshift, in-situ quenching become dominant regardless the halo mass.
- A lower threshold of $\rho_{\text{ICM}} > 10^{-28.3} \text{ gr cm}^{-3}$ ($3 \times 10^{-5} n_{\text{H}} [\text{cm}^{-3}]$) is needed for quenching to happen.
- Ram Pressure as the main culprit for satellite quenching in galaxy clusters!

The image features a central black rectangle with rounded corners, containing the word "THANKS!" in white, bold, sans-serif capital letters. This rectangle is set against a light gray background with a subtle, large-scale circular gradient. On either side of the black rectangle, there are stylized circuit board traces in a dark gray color. These traces consist of straight lines and right-angle turns, ending in small circles that represent solder pads or vias. The circuitry is symmetrical, extending from the left and right edges of the black rectangle towards the sides of the frame.

THANKS!