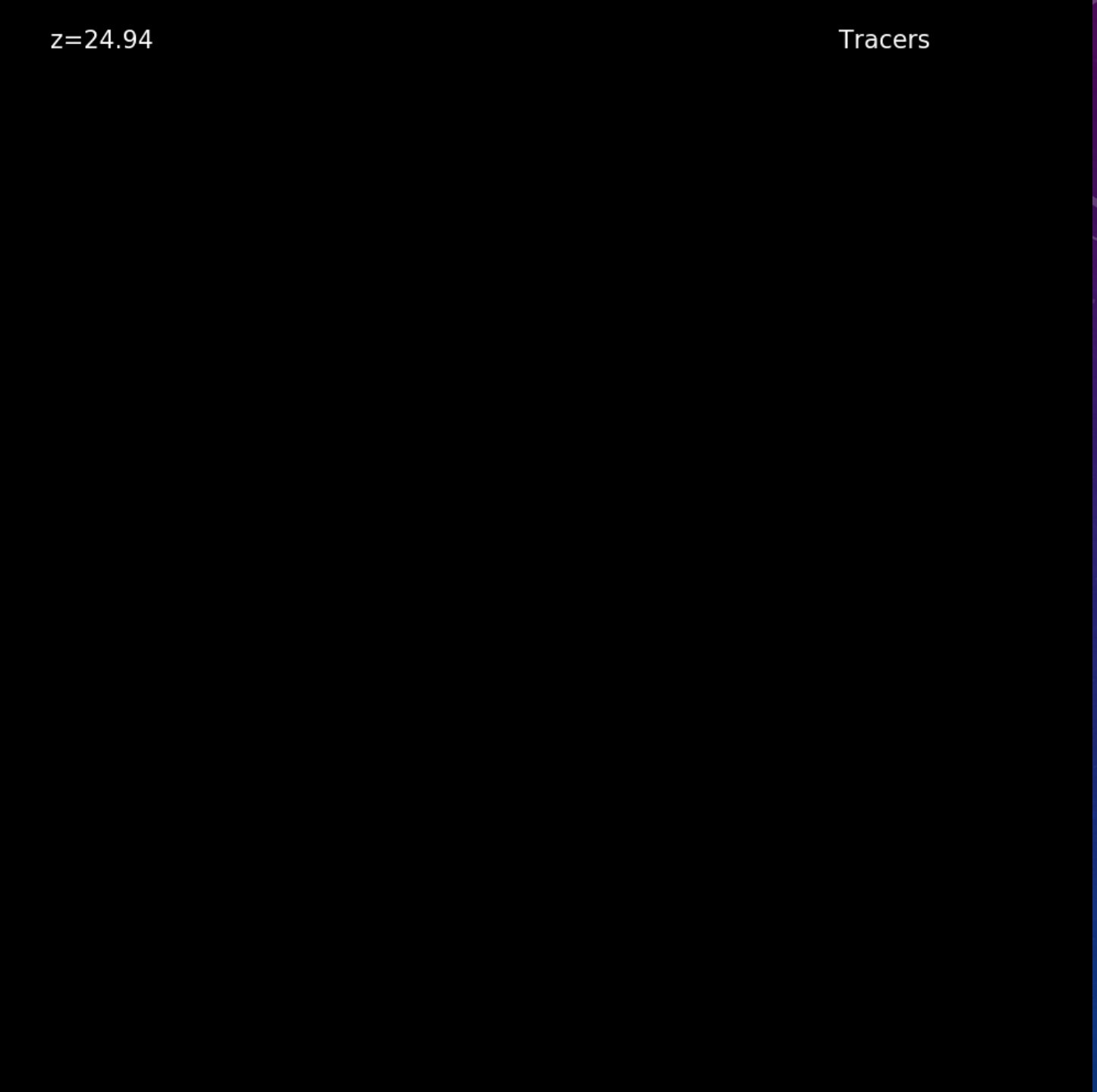


probably genetic

HOW REIONIZATION QUENCHES DWARF GALAXIES

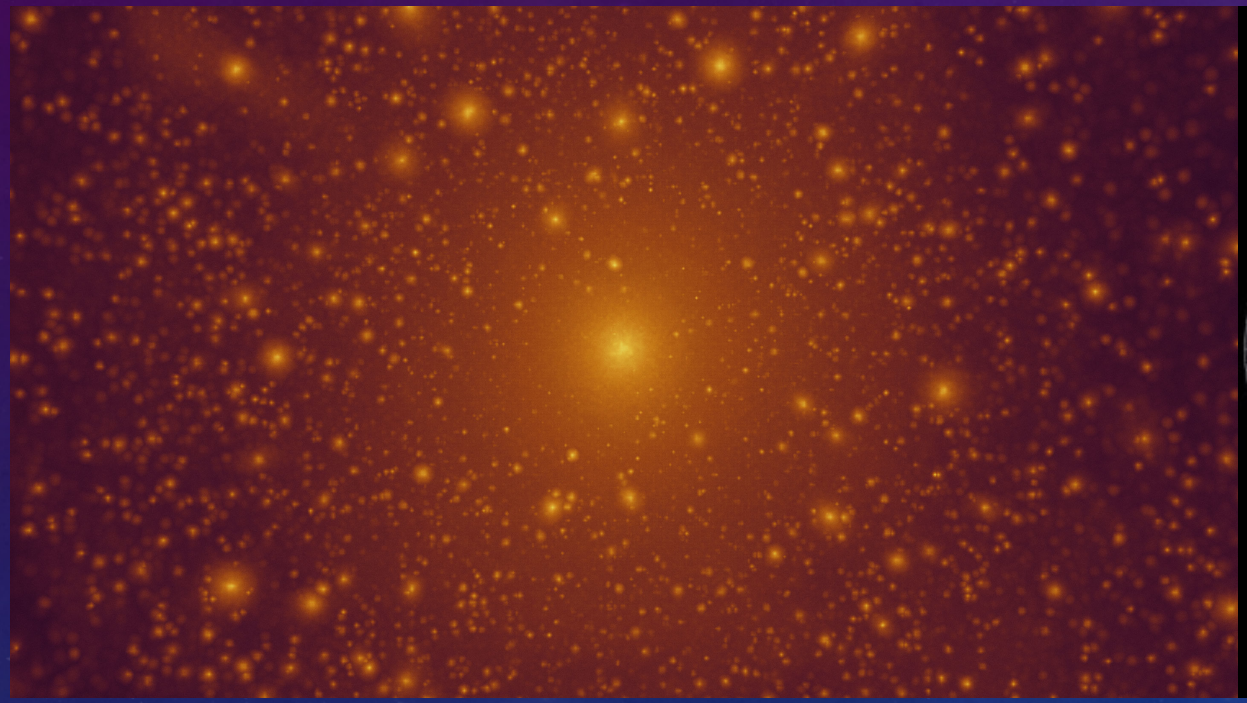
HARLEY KATZ | PROBABLY GENETIC | 19/09/2019

JOKI ROSDAHL, TAYSUN KIMM, MARTIN HAEHNELT, JEREMY BLAIZOT, JULIEN DEVRIENDT, ADRIANNE SLYZ, MARIUS RAMSOY, CLOTILDE LAIGLE

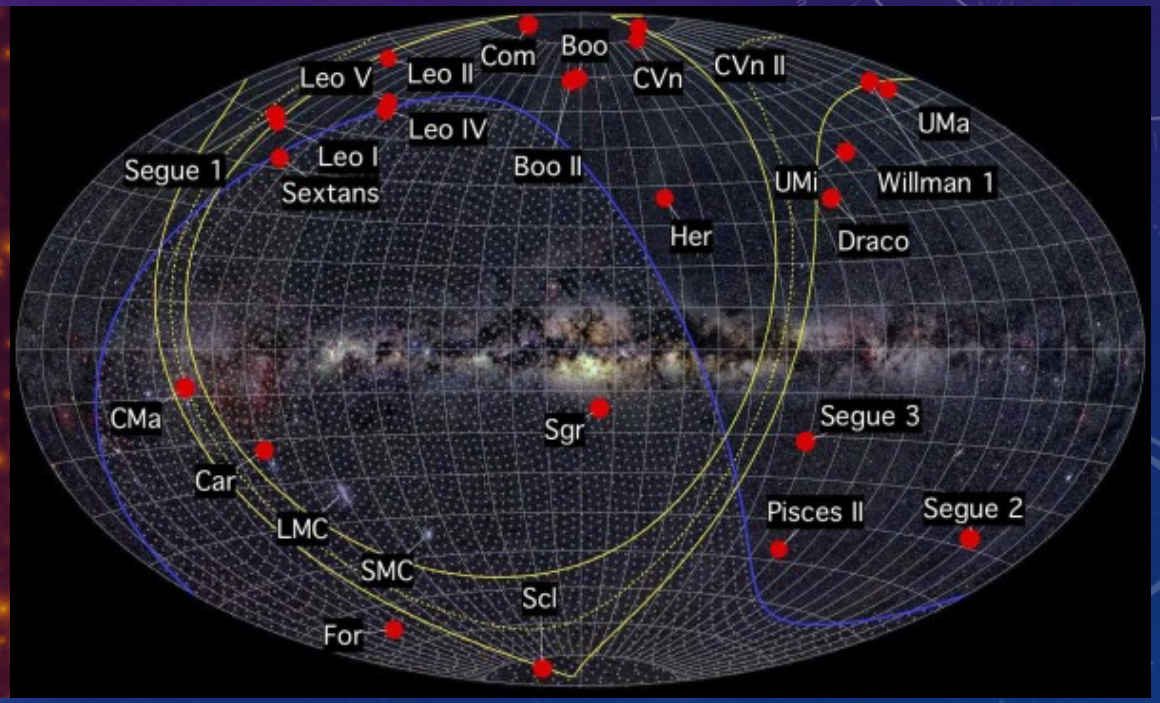
Katz et al. 2019 - arXiv 1905.11414

MISSING SATELLITES PROBLEM

Dark Matter Only Simulation

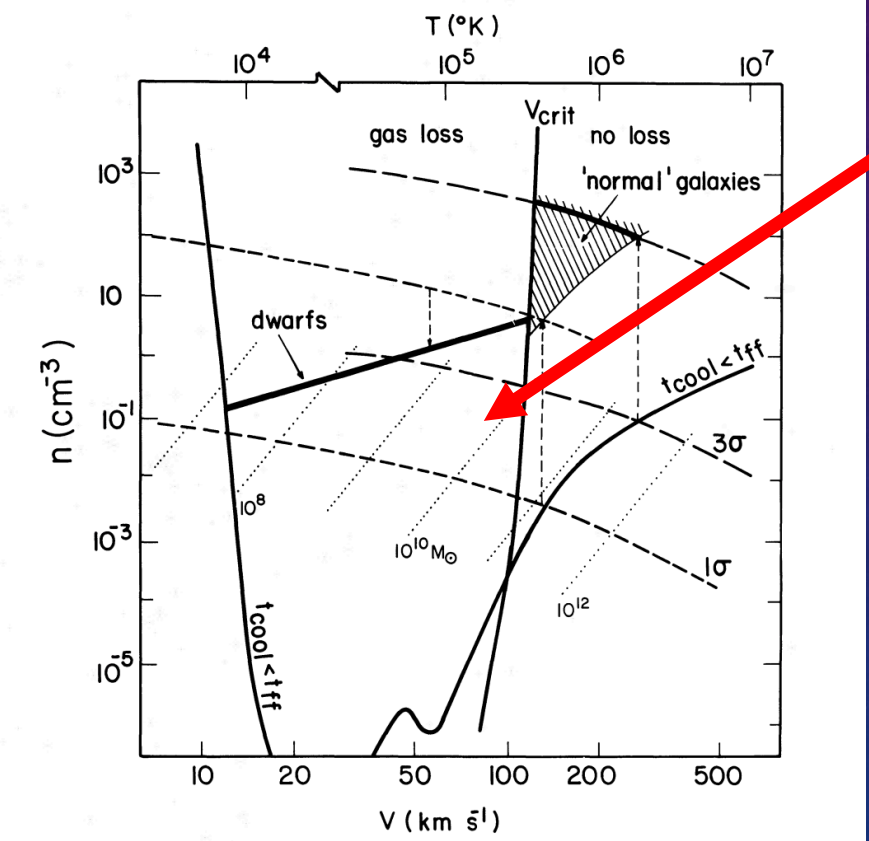


Observations



THE ROLE OF FEEDBACK FOR MISSING SATELLITES

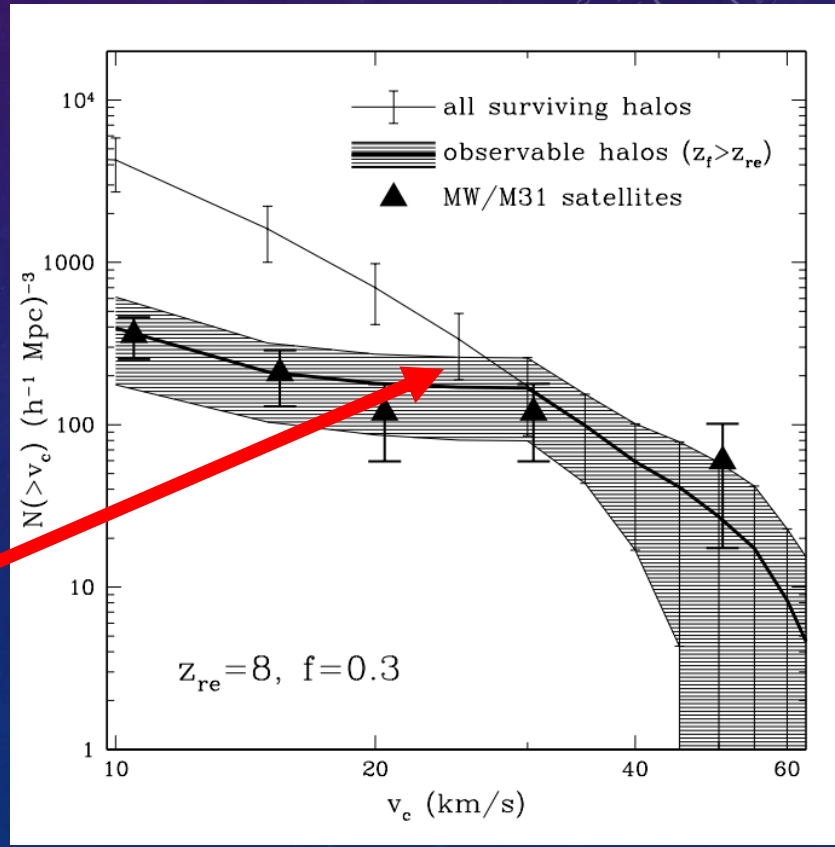
Supernova Feedback: Dekel & Silk 1986



SN Feedback effective at $v < v_{crit}$

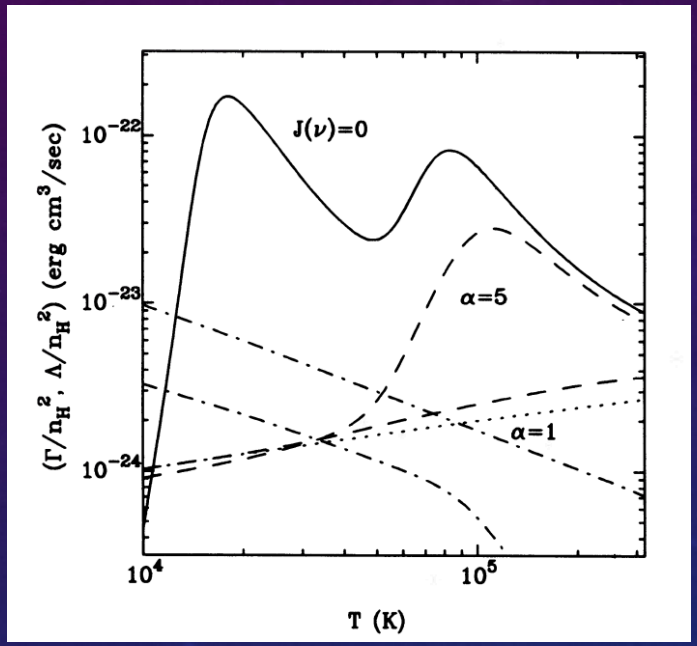
Reionization Feedback effective at v < 30 km/s

Reionization Feedback: Bullock+ 2000



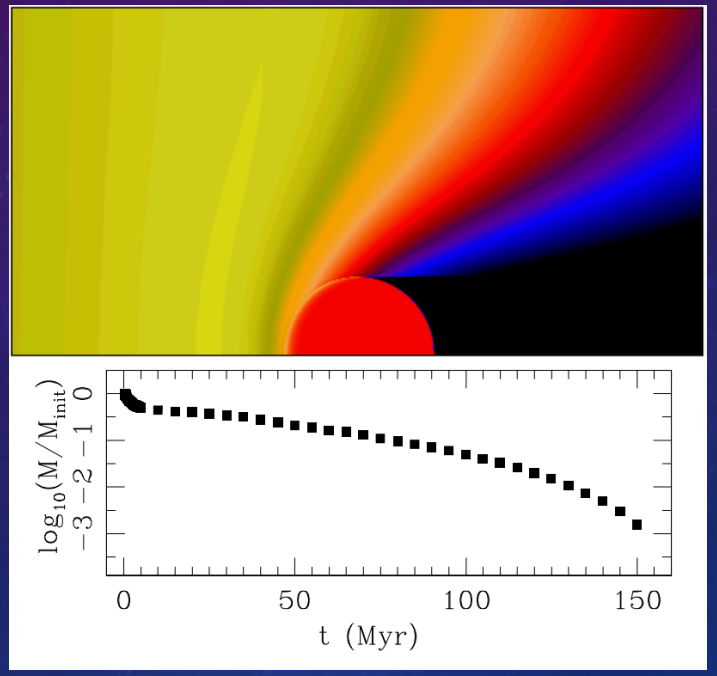
THE PHYSICS OF RADIATION FEEDBACK

Prolonged cooling times



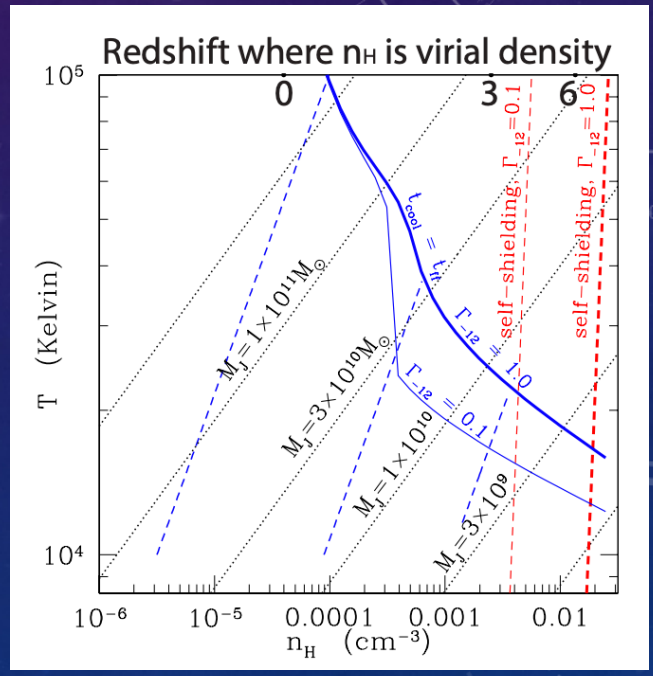
Efstathiou 1992

Photoevaporation



Shapiro+ 2004

Reduced Accretion

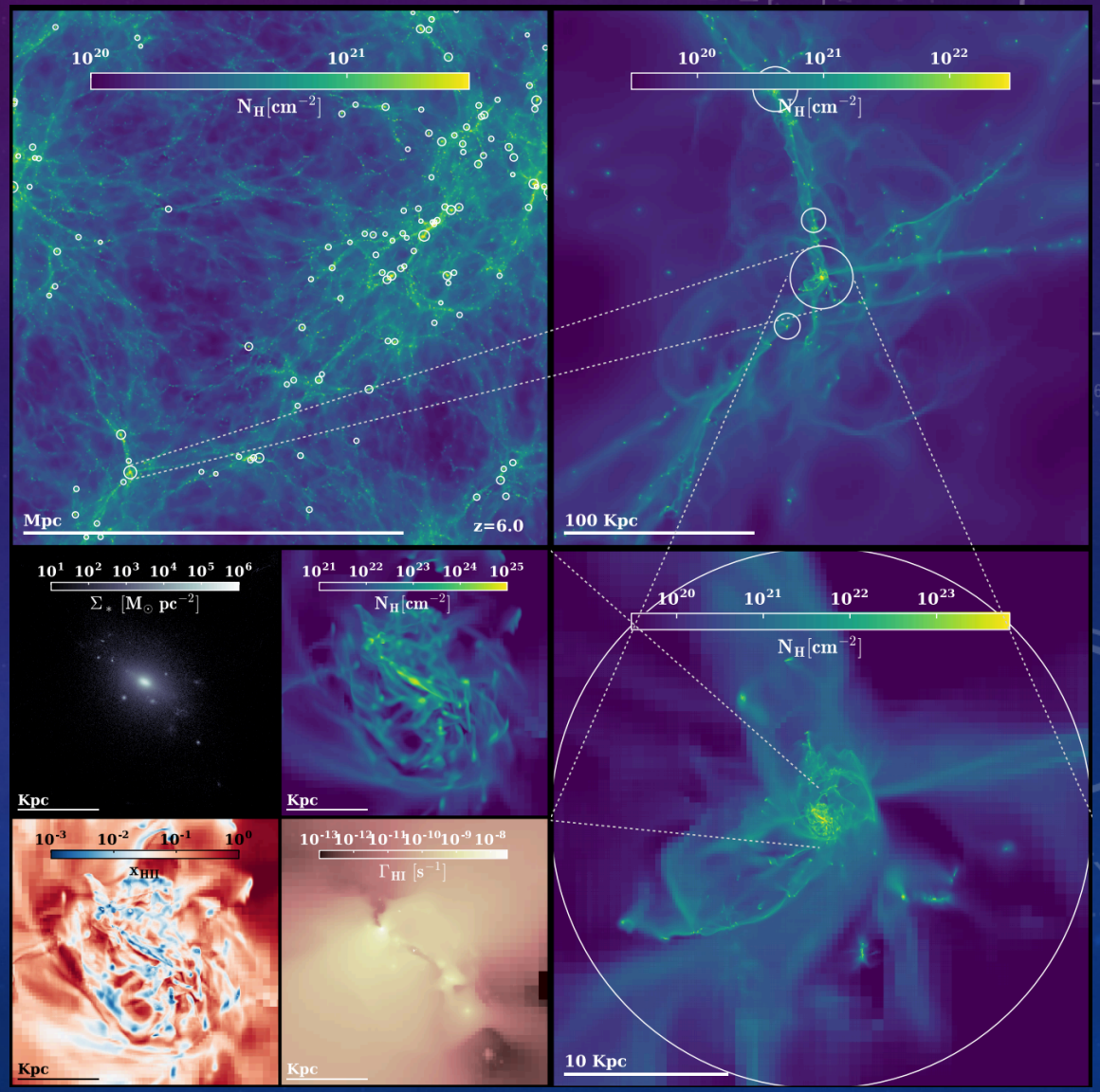


Noh+ 2014

INTRODUCING THE SPHINX SIMULATIONS

Suite of cosmological radiation hydrodynamics simulations run on PRACE

- Includes 5, 10, and 20 Mpc boxes
- Resolution 10.9 pc
- Stellar Mass: $10^3 M_{sun}$
- DM Mass: 2.5e5 M_{sun} (3.1e4 M_{sun} – hi-res)
- Variable speed of light approximation (up to 0.2c)
- Mechanical SN feedback
- 3 radiation bins (HI, HeI, and HeII ionizing)
- Single + Binary Star SEDs
- Post-Processed with RASCAS for Lya and Escape Fraction

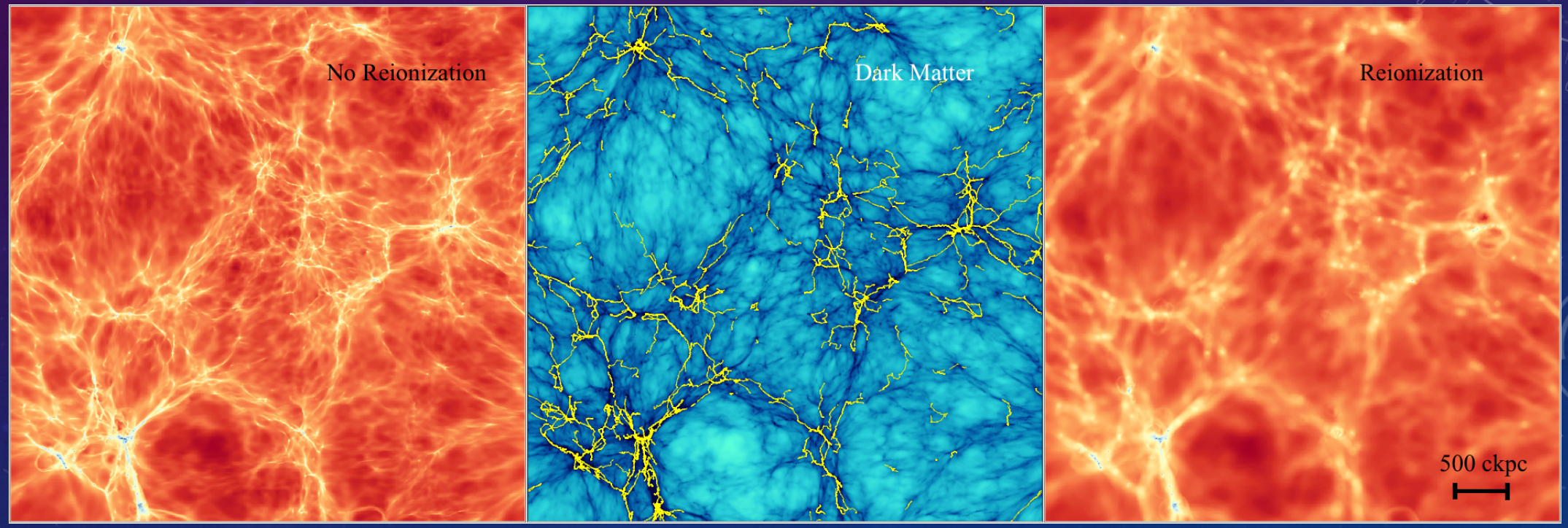


REIONIZATION SMOOTHS THE IGM

Without Reionization

Dark Matter

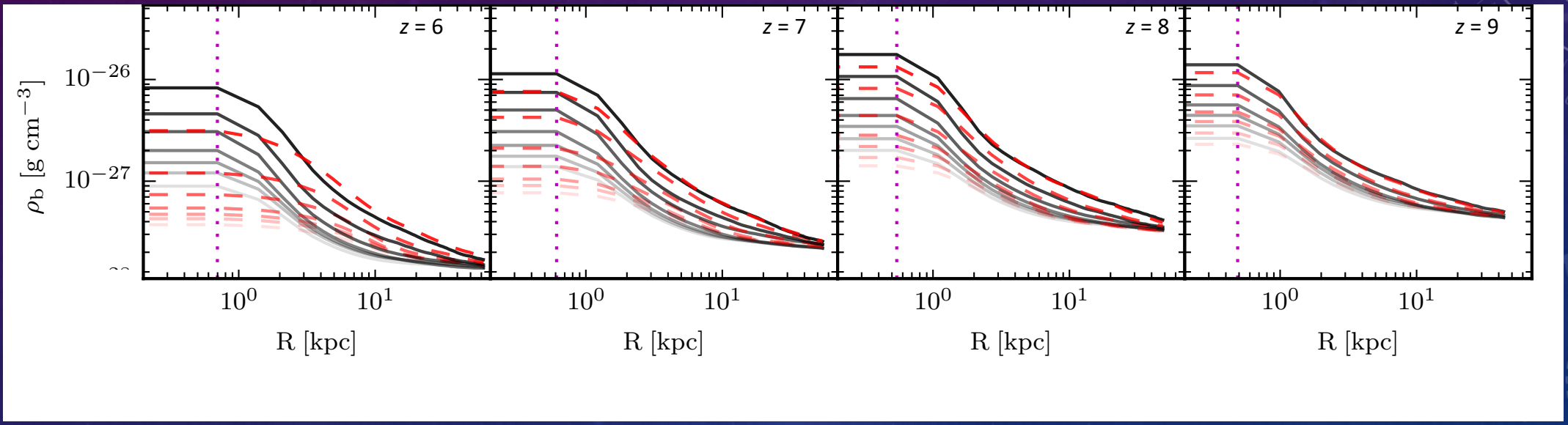
With Reionization



THE GAS CONTENT OF FILAMENTS IS STRONGLY IMPACTED BY REIONIZATION

After reionization

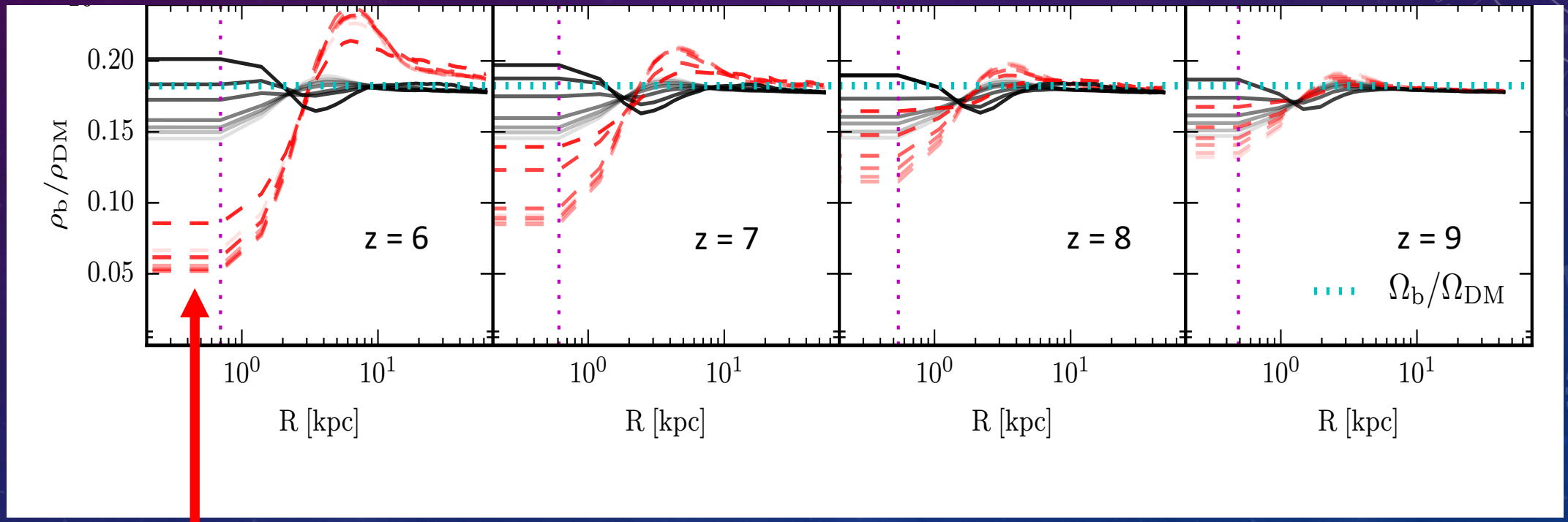
Before reionization



EXTRA PRESSURE SUPPORT REMOVES GAS AND PREVENTS ACCRETION ONTO FILAMENTS

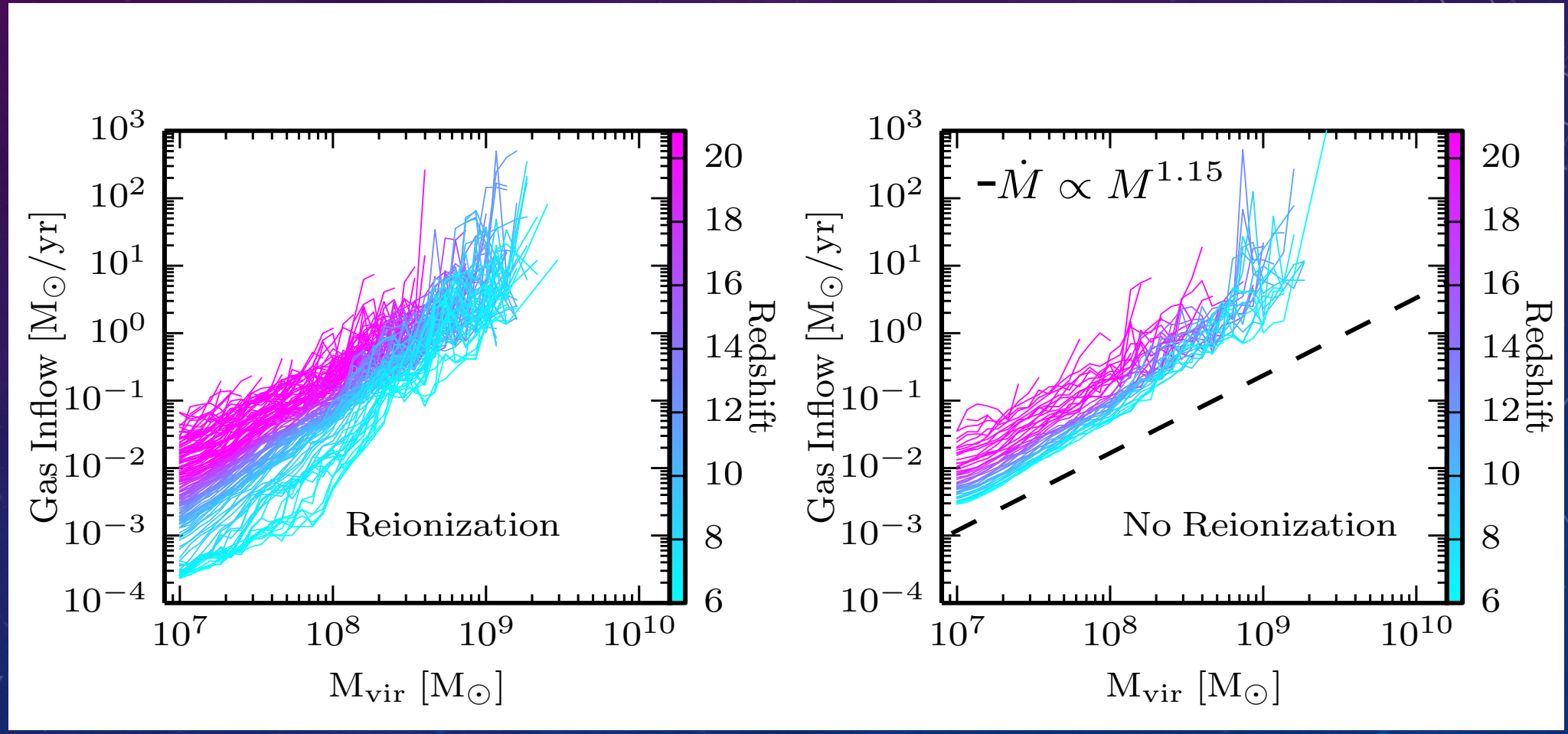
After reionization

Before reionization



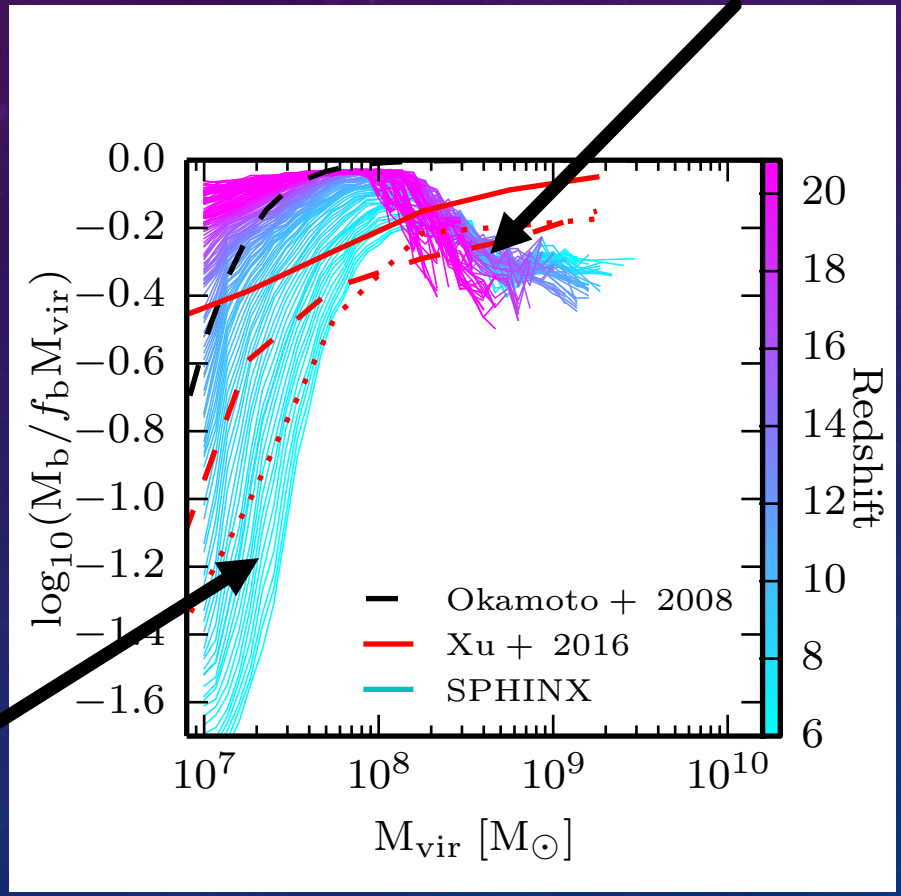
Central gas mass reduced by 80%-90%

GAS INFLOW RATES AT THE VIRIAL RADIUS ARE SIGNIFICANTLY REDUCED



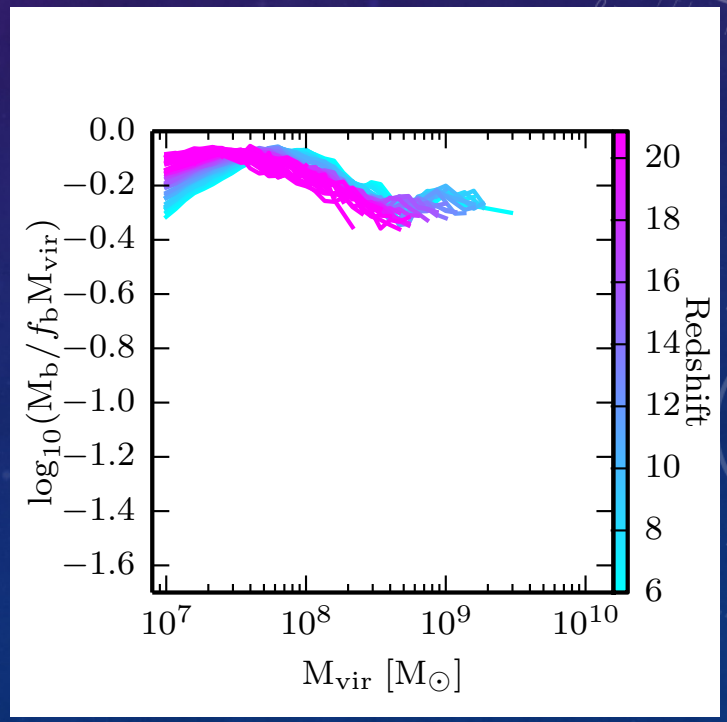
BARYON FRACTIONS ARE REDUCED AS REIONIZATION PROGRESSES

Supernova feedback dominates

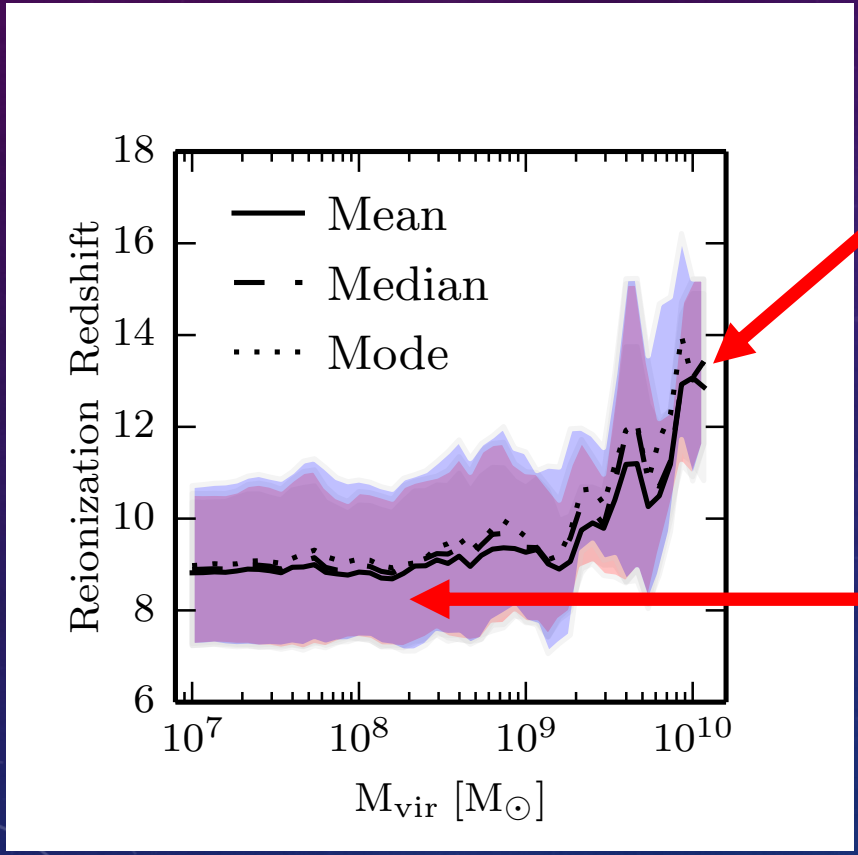


Radiation feedback dominates

Without Reionization

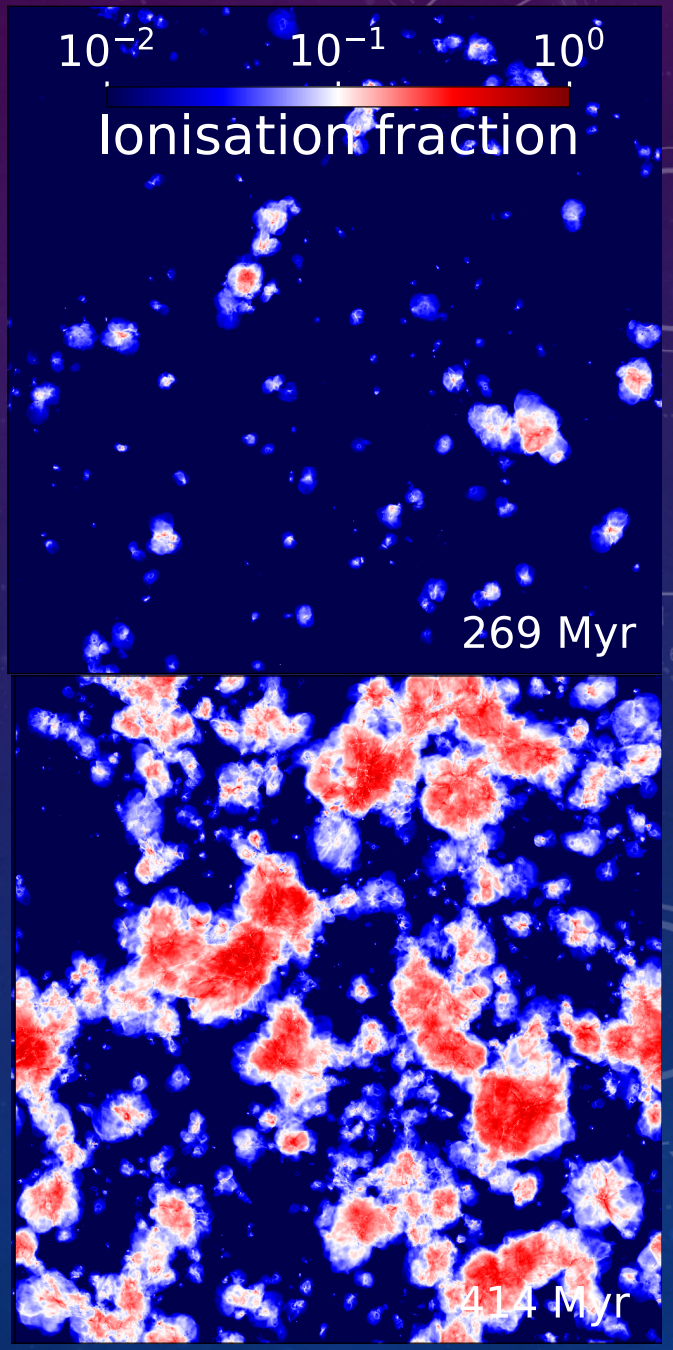


REIONIZATION IS INHOMOGENEOUS

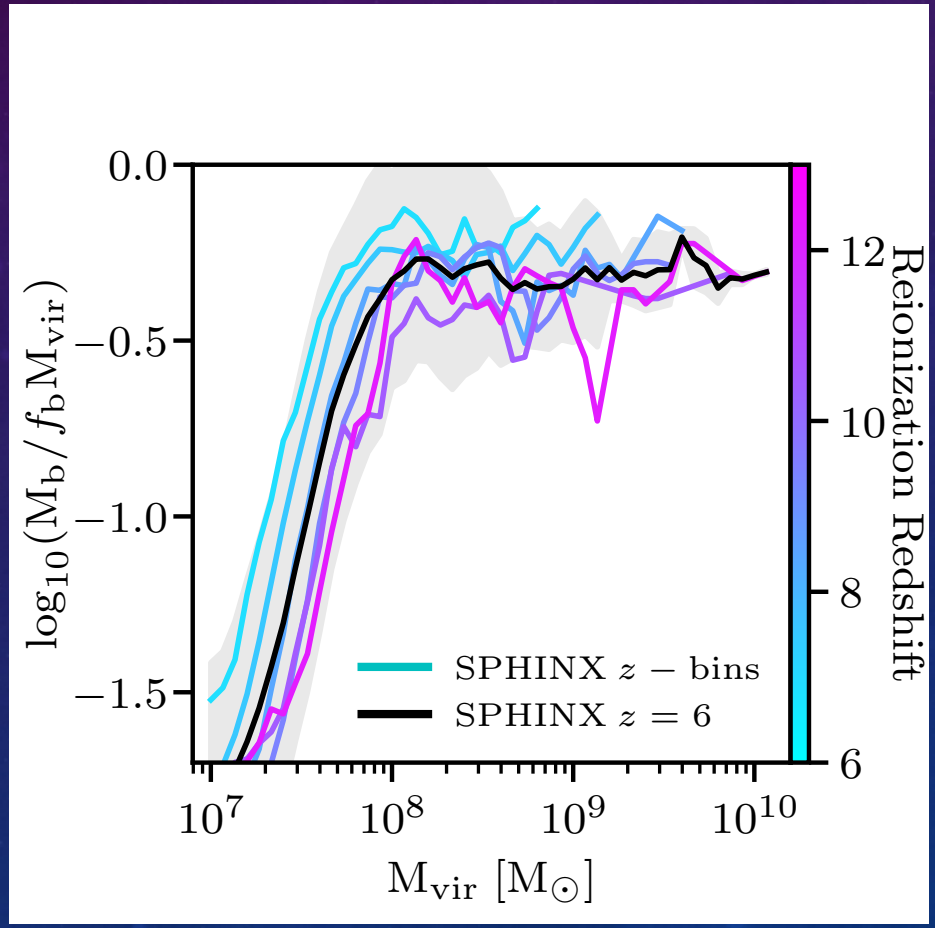


Regions around high mass galaxies reionize first

Regions around low mass galaxies reionize late

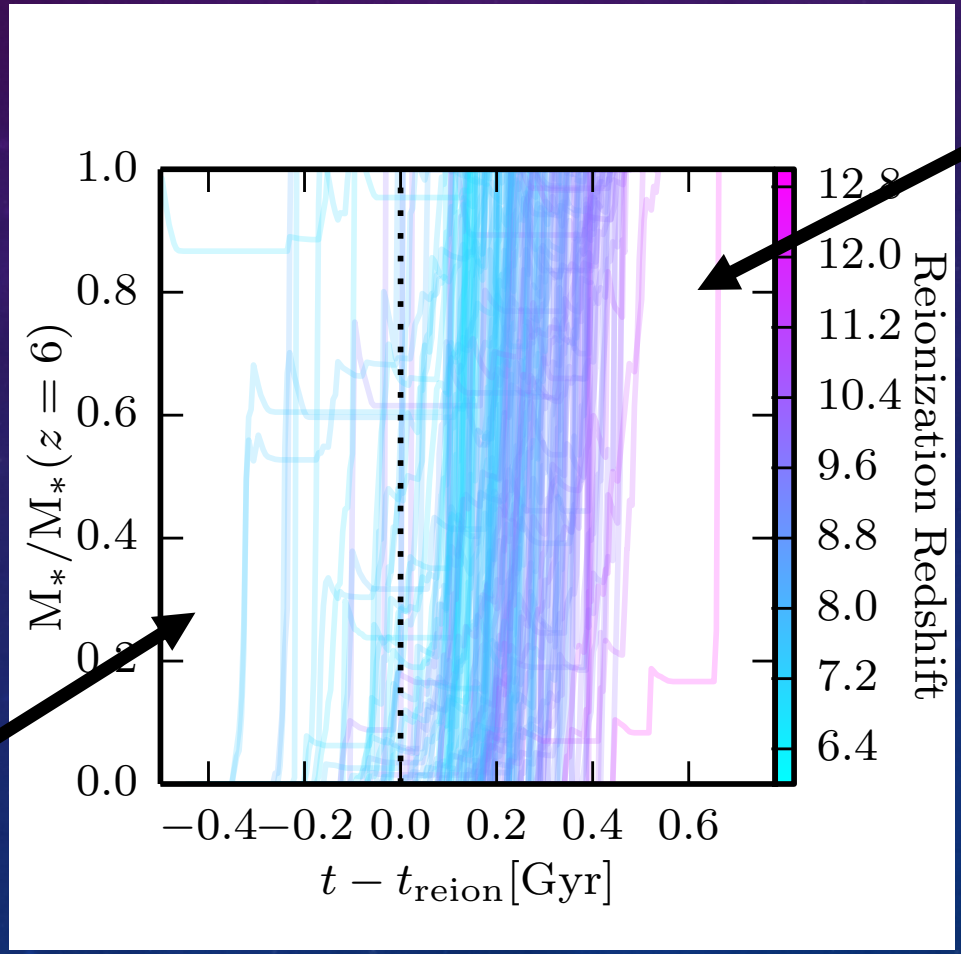


THE REDSHIFT BARYON FRACTION IS A DIRECT PROBE OF REIONIZATION



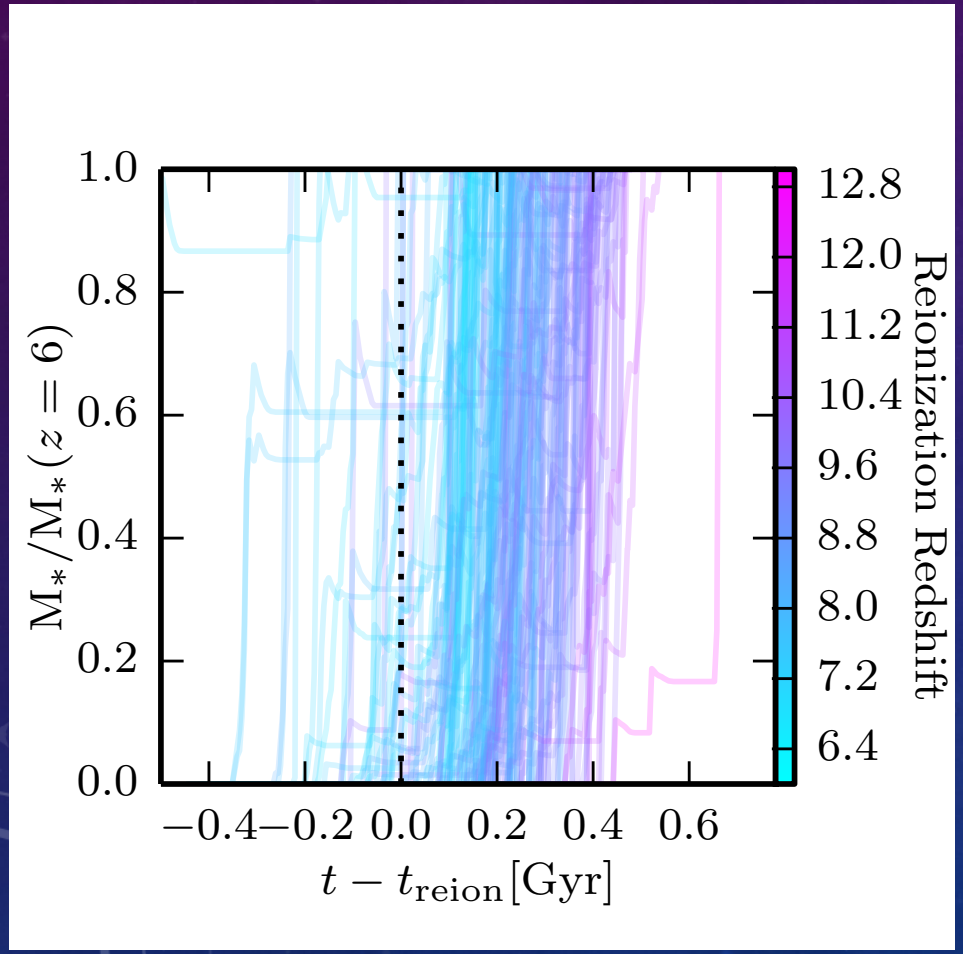
MOST STARS FORM AFTER REIONIZATION: DWARF GALAXIES ARE QUENCHED BY STARVATION

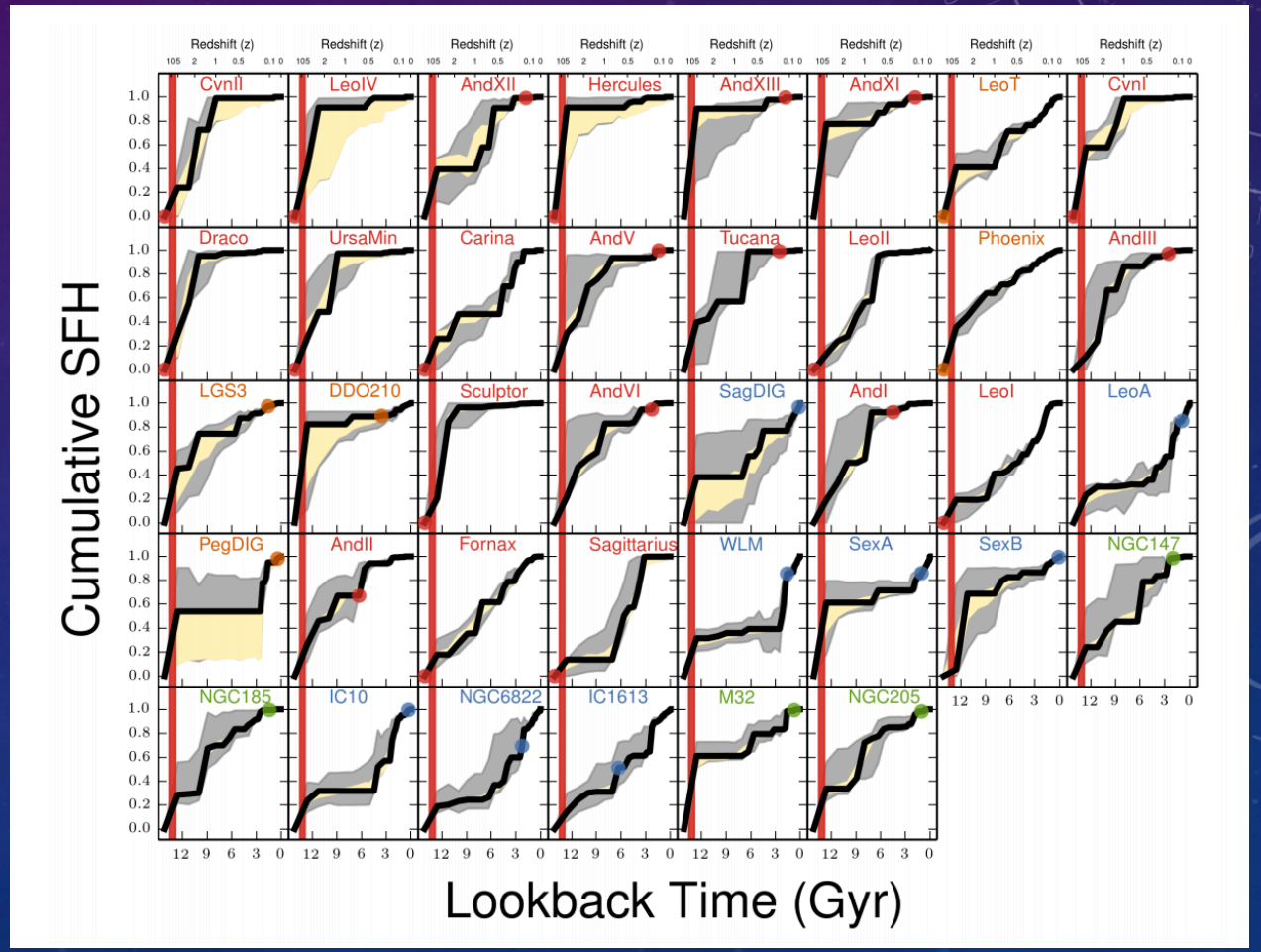
Stars formed after reionization



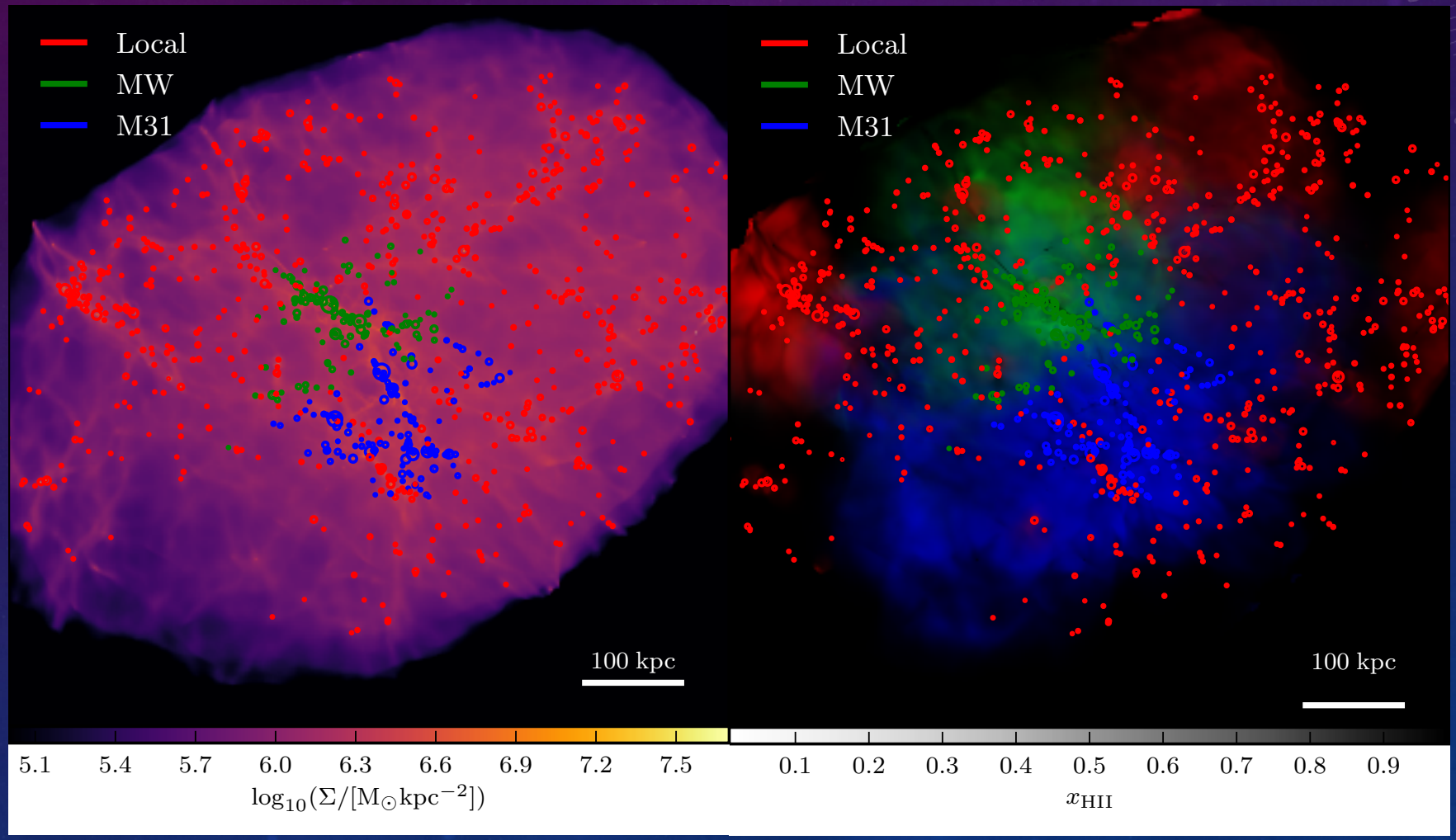
Stars formed before reionization

MOST STARS FORM AFTER REIONIZATION: DWARF GALAXIES ARE QUENCHED BY STARVATION

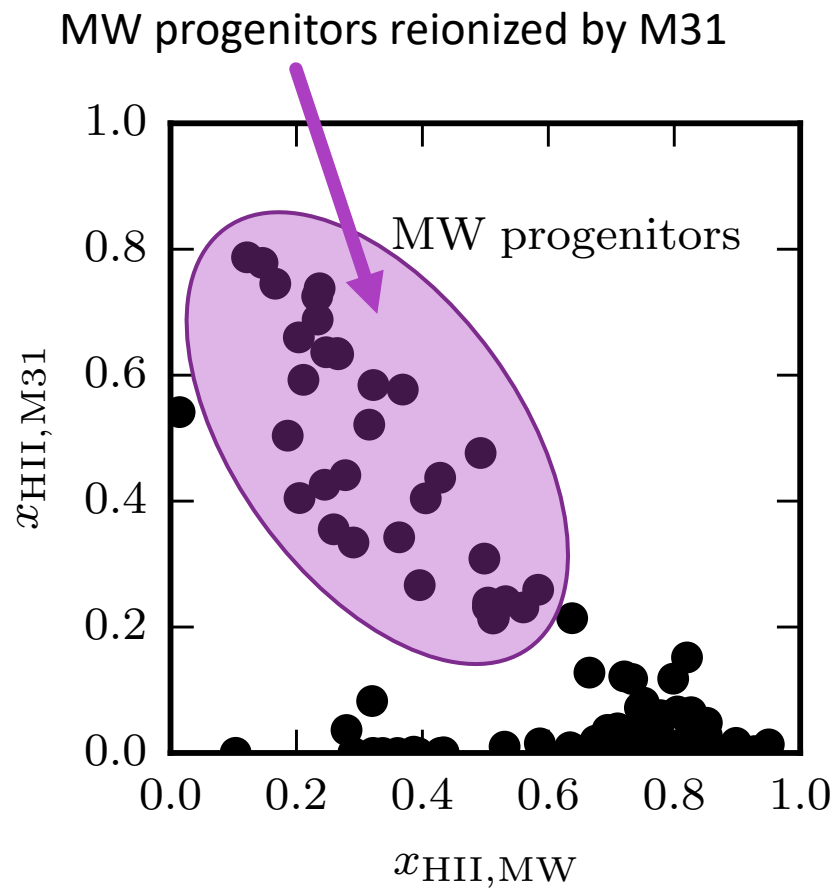


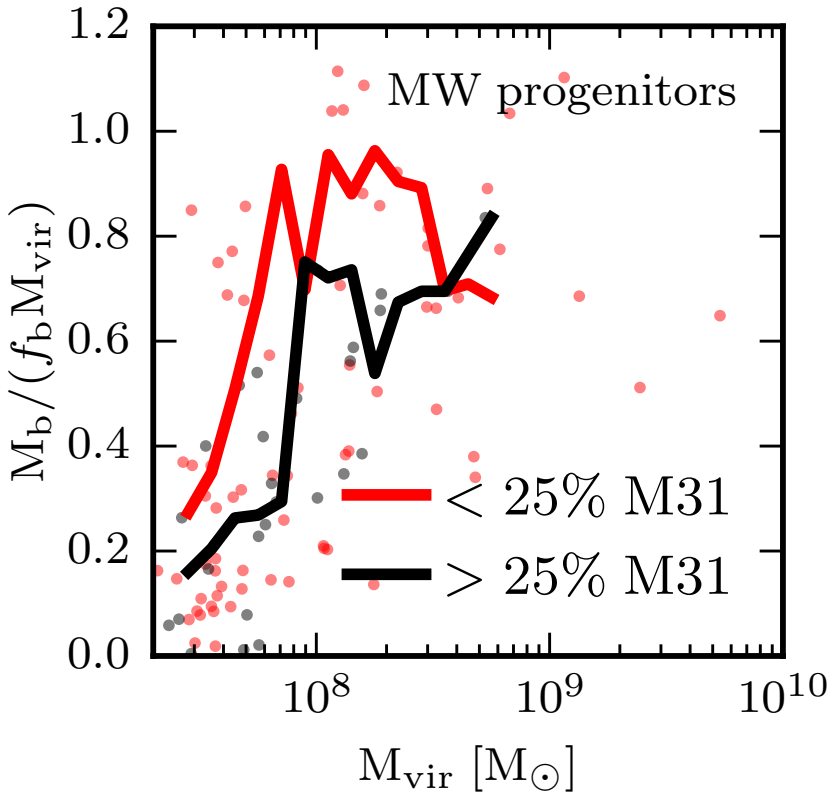


REIONIZATION SIMULATIONS OF OUR LOCAL GROUP



M31 MIGHT SUPPRESS DWARF GALAXY FORMATION IN THE MILKY WAY

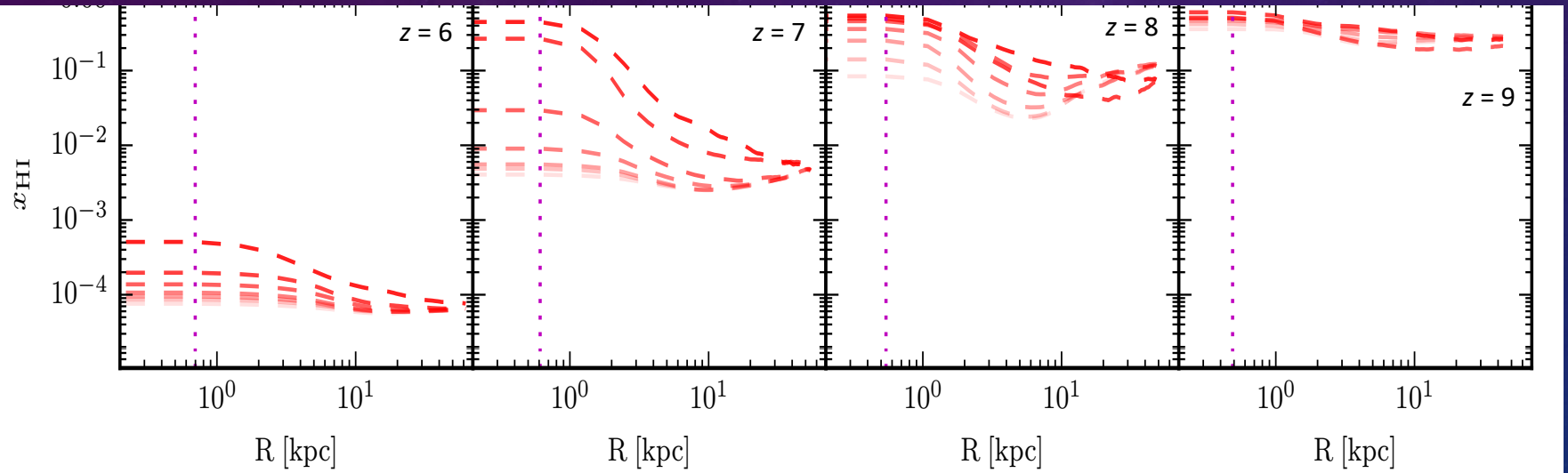


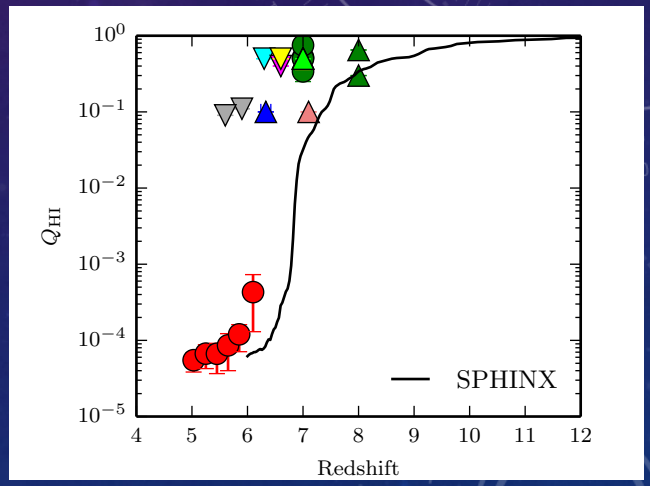


CONCLUSIONS

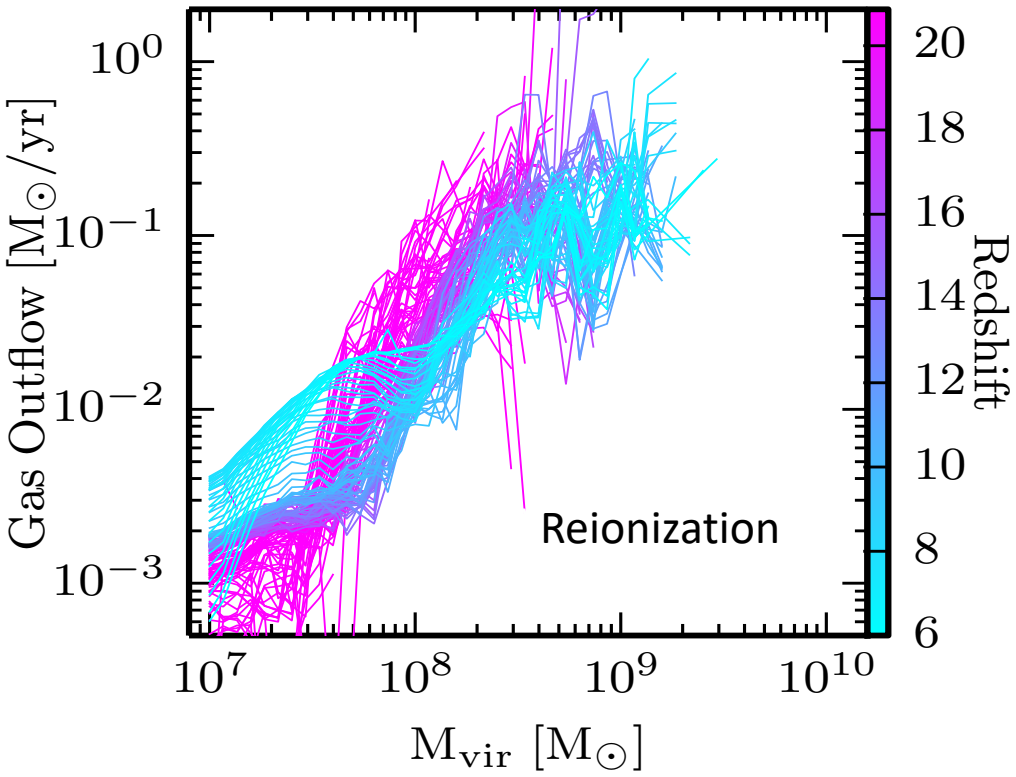
- Reionization predominantly quenches dwarf galaxies by suppressing inflows
- Much of this is regulated by the amount of matter that can be accreted onto filaments
- Star formation can continue long after reionization
- The MW may have been reionized by M31

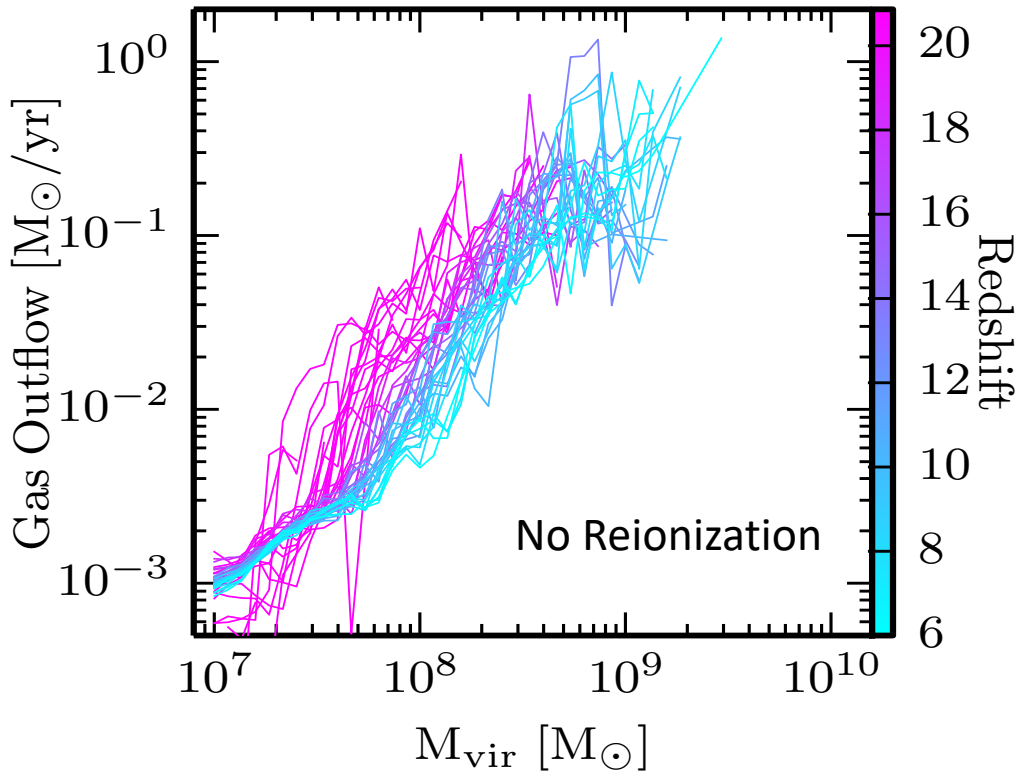
FILAMENTS ARE THE LAST REGIONS OF THE UNIVERSE TO REIONIZE



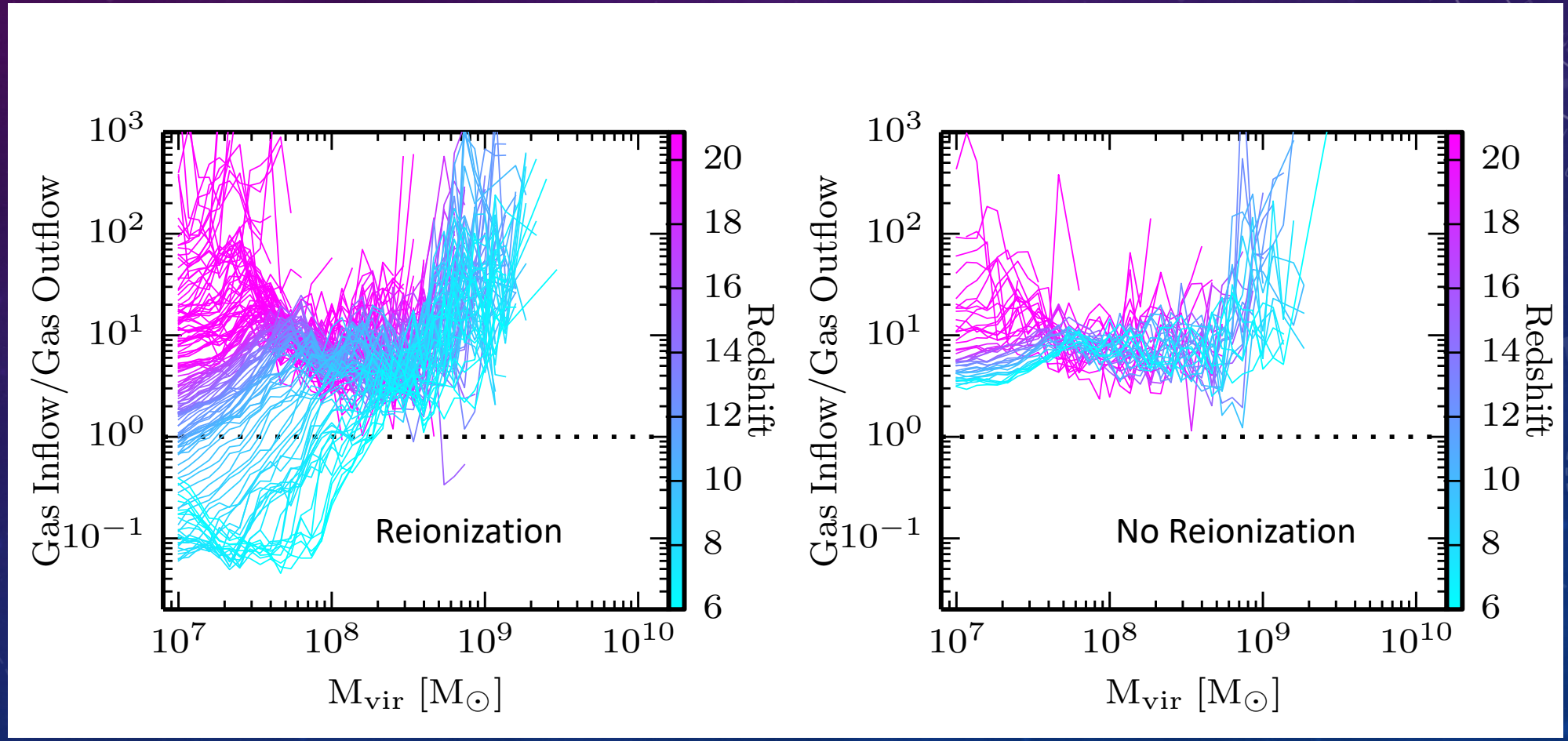


GAS OUTFLOWS ARE STRONGLY ENHANCED: PHOTOEVAPORATION

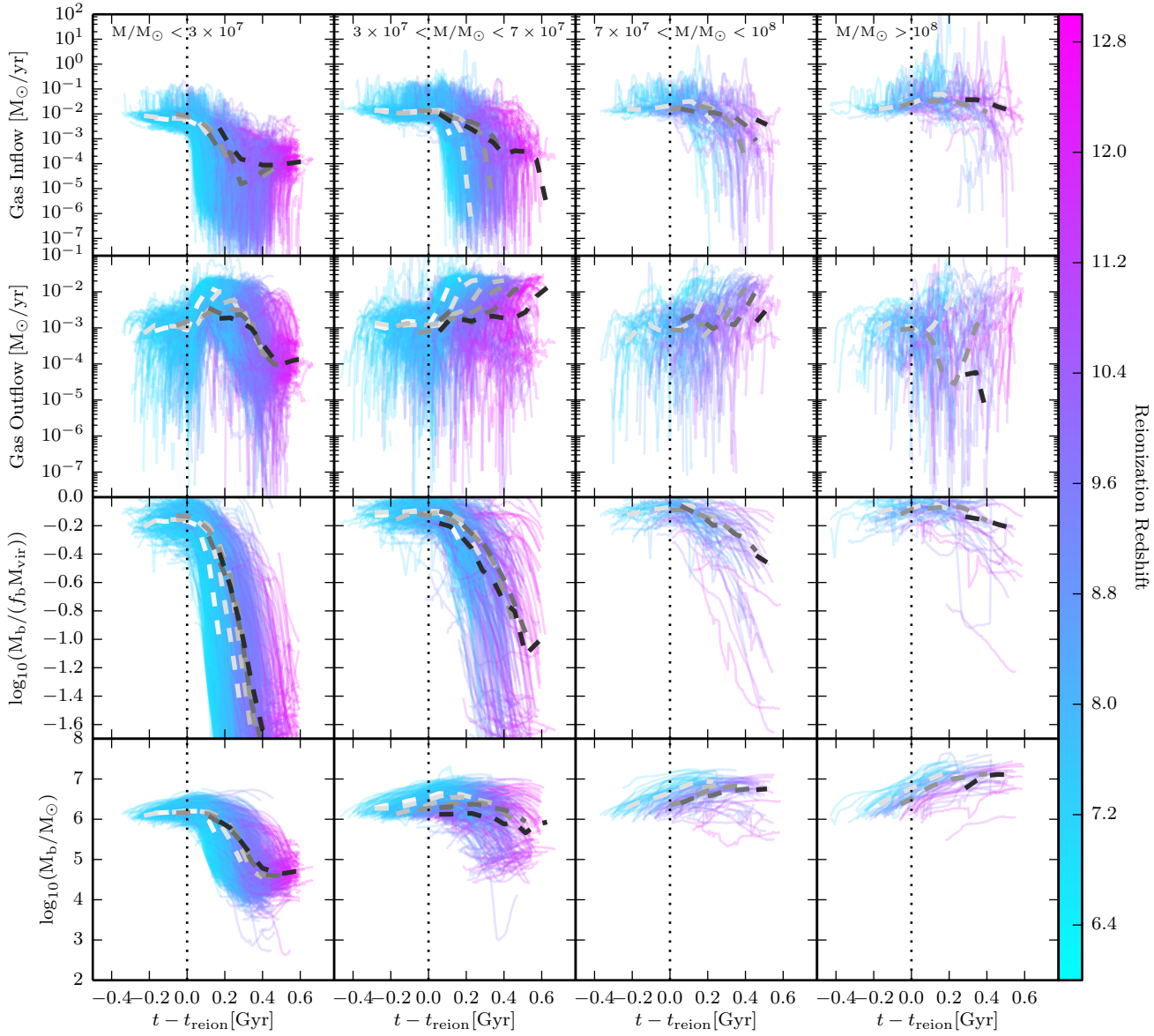




LOW MASS GALAXIES ARE ACTIVELY LOSING GAS



← Photoevaporation | Inflow Suppression →



M31 COULD HAVE REIONIZED THE MILKY WAY