

Introduction

- CGM: Reservoir of gas and connects galaxies to their surroundings
- Merger: Affect galaxy properties (SF, AGN, ISM, Quenching)
- Interplay between CGM and merger
 - Gas inflows from CGM are enhanced → SB, AGN
 - Outflow from merged galaxies to CGM
- Detailed physical mechanisms remain incompletely understood
 - Too simplified cosmic environment in merger simulations
- Systematic study of CGM during galaxy mergers within a fully cosmological framework
 - FIREbox : hydrodynamic cosmological simulation (Feldmann+2023)

Simulation

- FIREbox = Cosmological hydrodynamical simulation with FIRE-2 physics
 - Radiative cooling
 - Heating mechanisms
 - Star formation
 - Stellar feedback
- Selection
 - Merging
 - on-going, in past 1 Gyr
 - Mass ratio > 1:10
 - Control
 - Gas and stellar mass
- 18 mergers (11 major 1:3, 7 minor)

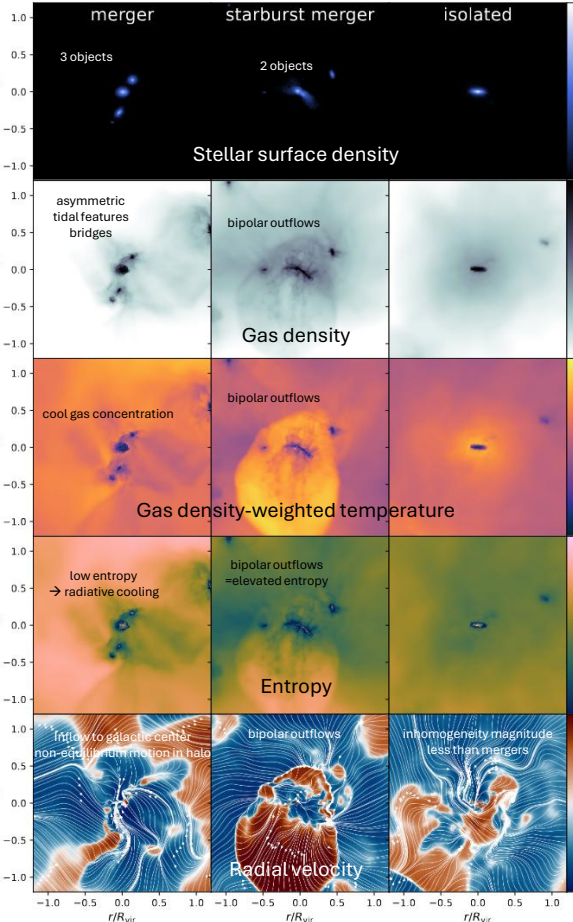
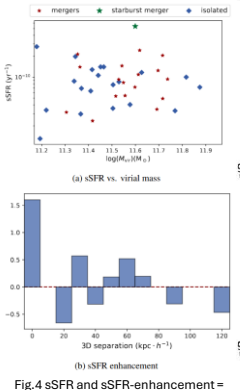
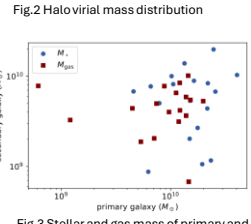
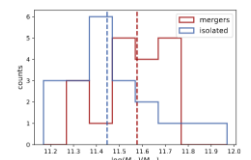


Fig.1 Projected distributions of key physical properties

Results

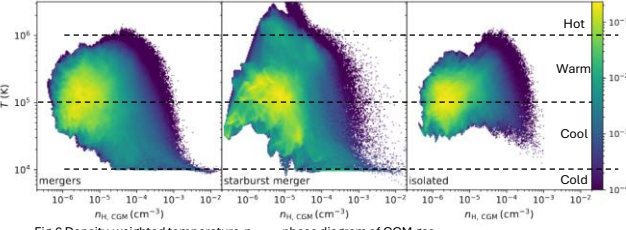


Fig.6 Density-weighted temperature- $n_{H,CGM}$ phase diagram of CGM gas

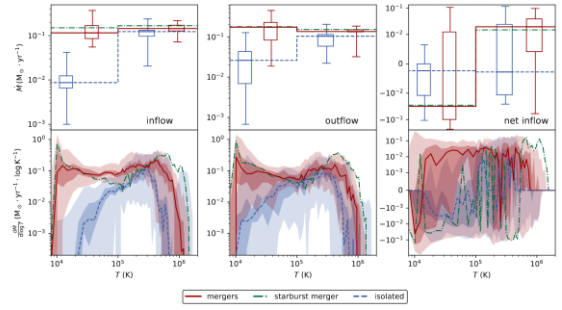


Fig.7 Mass flux of inflows (left), outflows (middle), and net inflows (right; positive values denote inflow)

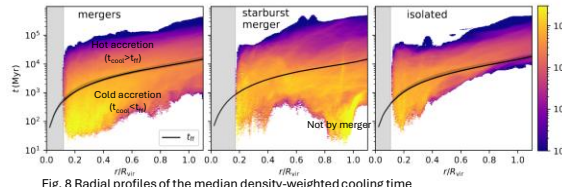


Fig.8 Radial profiles of the median density-weighted cooling time

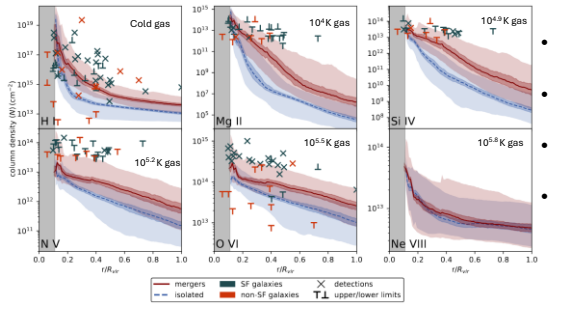


Fig.10 Radial profiles of ion column density

- Broader range in phase space in mergers
 - comparable baryon content
 - low-temperature, high-density gas formed in merger
- High-temperature, low-density in starburst → Stellar feedback
- Multiphase nature of gas flows is amplified in mergers
- Gas exchange in high temperature range for isolated galaxies
- Broad temperature range from cool to hot for mergers
 - complex & dynamic multiphase CGM structure

- Cold accretion mode in mergers
 - Tidal compression and shocks heat and compress infall gas
 - Post-shock cooling make gas thermally unstable ($\tau_{cool} \sim \tau_{ff}$)
 - Subsequent fragmentation and condensation creates multiphase medium

- Enhancement in low temperature ions (HI, MgII, SiIV) for mergers
- For intermediate temperature ions (NV, OVI), a modest difference
- For hot ion NeVIII, negligible difference
- Simulated values are lower than observation
 - Limited resolution of sub-kpc mixing layer
 - AGN physics
 - Exclusion of satellite galaxies

Galaxy merger alter the thermal structure of CGM by efficient radiative cooling

- Also related to merger-triggered starburst
 - Enhanced radiative cooling and amplified inflows → Starburst
 - Powerful feedback or gas exhaustion → Quench

Merger object and multiphase CGM gas IFU observation with SWIMS-IFU?

Merger also accelerates gas cycles (Section 3.5 and Fig.9)