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Kinematics of bubble-driven gas uplift and gas perturbations as tracers of velocities in unrelaxed clusters

Understanding the properties of gas motions in the intracluster medium (ICM), processes that drive them, and observational methods of probing them is important for a broad range of problems, from plasma physics to cluster cosmology. In my talk, I will focus on two problems: (1) kinematics of bubble-driven gas uplift in the central regions of galaxy clusters and (2) prospects of probing gas dynamics driven by mergers in outer cluster regions through density or pressure fluctuations, and their connection to mass bias. The former is based on numerical modeling of gas uplift by a rigid-body bubble that allows us to trace long-term interactions of the uplifted gas with the ambient ICM. I will show that our model reproduces the observed H-alpha velocity structure function of filaments and provides a simple interpretation for its steepening and normalization. The second project utilizes a large sample of clusters from cosmological simulations and expands the previous ideas of measuring velocity power spectra through gas fluctuations on unrelaxed regions within the ICM and larger radii. If time permits, corresponding observational results will be briefly summarized.

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