Contributed Talk

Splinter Computation

Simulations of merging cool-core clusters

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Major mergers are considered to be a significant source of turbulence in clusters. We present simulations of a major merger event with the Nyx code developed in collaboration with the Computational Cosmology Center at Lawrence Berkeley National Laboratory. To follow the evolution of the merger, we applied nested-grid initial conditions, adaptive mesh refinement, radiative cooling of primordial gas, and a homogeneous ultraviolet background. The turbulent velocity dispersion in the intracluster medium (ICM) and warm-hot intergalactic medium (WHIM) is computed with a new in-situ method based on adaptive temporal filtering. An important open question concerns the impact of magnetic fields on fluid properties of the ICM and WHIM. By calculating the microscopic viscosity on the basis of various theoretical assumptions and estimating the Kolmogorov length from the turbulent dissipation rate computed with a subgrid-scale model, we are able to demonstrate that most of the WHIM can sustain a fully turbulent state only if the magnetic suppression of viscosity is considerable. Accepting this as premise, it turns out that ratios of turbulent and thermal quantities change only little in the course of the merger. This confirms the tight correlations between the mean thermal and non-thermal energy content for large samples of clusters in earlier studies, which can be interpreted as second self-similarity on top of the self-similarity for different halo masses.