Colloquium

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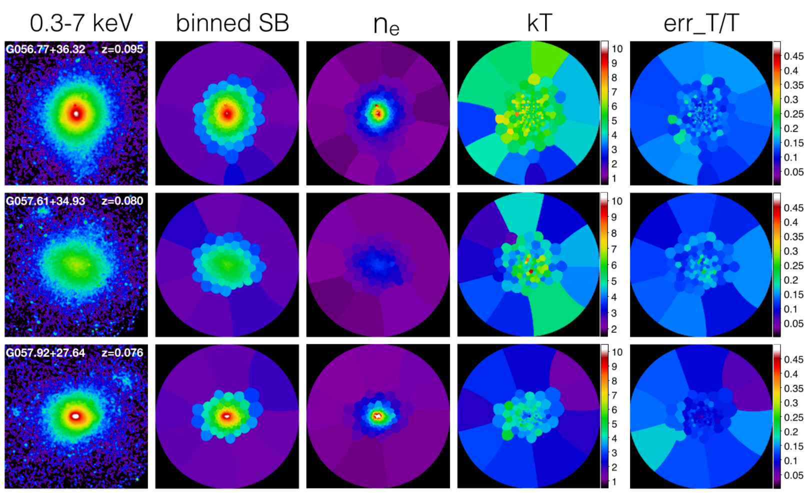
CHARACTERIZATION OF THE INTRA-CLUSTER MEDIUM TEMPERATURE DISTRIBUTION



Abstract

It is often assumed that, after the collapse of the main halo progenitor, the galaxy cluster gas settles in hydrostatic equilibrium into a spherically symmetric potential well. Under this assumption, all thermodynamic properties (e.g., temperature, density, and pressure) depend only on the distance from the center and are therefore homogeneous within a narrow radial shell. However, turbulent motions due to a large variety of other astrophysical ICM processes (e.g., sloshing, AGN feedback, thermal instabilities) can significantly alter the hydrostatic equilibrium at different scales. Thus, the complex physics of galaxy clusters may result in a high level of temperature and density substructures (i.e., fluctuations) which are tied to the dynamical history of the clusters. The presence of substructures may induce biases in the determination of cluster properties, such as global gas temperature or total mass (and therefore impact the scaling relations of galaxy clusters). We used the spatially resolved 2D temperature and density distributions of 28 clusters to evaluate and characterize the level of gas inhomogeneities and the related dynamical state of the ICM. I will show how, by comparing the scatter of temperature and density profiles to hydrodynamic simulations, we constrained the average Mach number regime of the sample. Moreover, I will show how these results can provide an estimate of the ratio between turbulent and thermal energy, and therefore provide an independent estimate of the hydrostatic mass bias.

Giovedì 21 Dicembre 2023 alle ore 11,30

presso l'Auditorium dell'Osservatorio Astronomico di Cagliari