PLANCK CONSTRAINTS ON TURBULENCE IN THE COMA CLUSTER

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Abstract. Turbulence within the intracluster medium (ICM) fundamentally influences galaxy cluster thermodynamics and virialisation, contributing to the non-thermal pressure support, that need accounting for in hydrostatic mass estimates. Characterising this turbulence through thermodynamic fluctuations remains observationally challenging due to notably the non-linear relationships between observables, e.g., density and pressure, and the underlying velocity field.

This study aims to constrain the properties of ICM turbulence through a comprehensive reanalysis of Sunyaev-Zel'dovich (SZ) surface brightness fluctuations in the Coma cluster. We analyse the 2D power spectrum of SZ fluctuations derived from *Planck* observations of the Coma cluster. The underlying 3D pressure fluctuation power spectrum is modelled assuming Kolmogorov-type turbulence as its origin. We infer the key parameters: the injection scale (l_{inj}), the inertial-range slope (α), and the amplitude, which is directly related to the 3D Mach number ($\mathcal{M}_{3D}$). Our parameter estimation relies on a simulation based inference (SBI) framework based on normalising flows to accurately recover posterior distributions.

Keywords: Galaxy Clusters, Intracluster Medium, Coma, Turbulence

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