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Self-similar magnetic, turbulent and thermal energy evolution in massive galaxy clusters

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Massive galaxy clusters (GC) are filled with a hot, turbulent and magnetised intra-cluster medium (ICM). They are still forming under the action of gravitational instability driving supersonic accretion flows, which partially dissipate into heat through a complex network of large scale shocks, while partly excite giant turbulent eddies and cascade. Amongst others turbulence amplifies magnetic energy by way of dynamo action. This pattern of gravitational energy turning kinetic, thermal, turbulent and magnetic is a basic feature of GC hydrodynamics but quantitative modelling remains a challenge.
In this contribution we present results from recent high resolution numerical simulations of structure formation in which the time dependent turbulent motions of the intracluster medium of a massive galaxy cluster are resolved and their statistical properties quantified for the first time.
Combined with independent state-of-theart results on turbulent dynamo we determine without adjustable parameters the thermal, turbulent and magnetic history of giant GC.
I will discuss the scale free character of energy structure in the intracluster medium and how it encodes information about the efficiency of turbulent heating and dynamo action directly accessible through astronomical observations.

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