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MHD Turbulence, Dynamo, and the Origin of Magnetic Fields in Galaxy Clusters HUI LI, LANL, HAO XU, LANL/UCSD — We present self-consistent cosmological magnetohydrodynamic (MHD) simulations that simultaneously follow the formation of a galaxy cluster and the magnetic field ejection by an active galactic nuclei (AGN). We find that the magnetic fields ejected by the AGN, though initially distributed in relatively small volumes, can be transported throughout the cluster and be further amplified by the intra-cluster medium (ICM) turbulence during the cluster formation process. The ICM turbulence is generated and sustained by the frequent mergers of smaller halos. A cluster-wide dynamo process is shown to exist in the ICM and amplify the magnetic field energy and flux. The total magnetic energy in the cluster can reach $\sim 10^{61}$ ergs while micro Gauss (μG) fields can distribute over $\sim$ Mpc scales throughout the whole cluster. This finding shows that magnetic fields from AGNs, being further amplified by the ICM turbulence through small-scale dynamo processes, can be the origin of cluster-wide magnetic fields.

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