Abstract Submitted
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Inverse cascades and the evolution of decaying magnetohydrodynamic turbulence[1] MORITZ LINKMANN, ARJUN BERERA, University of Edinburgh — Ensemble averaged high resolution direct numerical simulations of inverse cascade are presented, extending on the many single realization numerical studies done up to now. This identifies inverse cascade as a statistical property of magnetohydrodynamic turbulence and thus permits reliable numerical exploration of its dynamics. Our results show that at early times during the decay the properties of the ensemble average are represented by one realization, as the deviations between realizations are small. In contrast, at late times we measure significant deviations between realizations, thus the ensemble average cannot be avoided in this time frame. This is important for measurements of the magnetic energy decay exponent, which has been determined from these ensemble runs to be $n_E = (0.47 \pm 0.03) + (13.9 \pm 0.8)/R_\lambda$ for initially helical magnetic fields. We show for the first time that even after removing the Lorentz force term in the momentum equation, thus decoupling it from the induction equation, inverse cascade persists. The induction equation is now a linear partial differential equation with an externally imposed velocity field, thus amenable to numerous analysis techniques. A new door has opened for analyzing inverse cascade, with various ideas discussed.

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