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Magnetohydrodynamic Turbulence and the Geodynamo

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Abstract: Recent research results concerning forced, dissipative, rotating magnetohydrodynamic (MHD) turbulence will be discussed. In particular, we present new results from long-time Fourier method (periodic box) simulations in which forcing contains varying amounts of magnetic and kinetic helicity. Numerical results indicate that if MHD turbulence is forced so as to produce a state of relatively constant energy, then the largest-scale components are dominant and quasi-stationary, and in fact, have an effective dipole moment vector that aligns closely with the rotation axis. The relationship of this work to established results in ideal MHD turbulence, as well as to models of MHD turbulence in a spherical shell will also be presented. These results appear to be very pertinent to understanding the Geodynamo and the origin of its dominant dipole component. Our conclusion is that MHD turbulence, per se, may well contain the origin of the Earth's dipole magnetic field.