Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Scale-locality of energy transfer in magnetohydrodynamic turbulence.[1] HUSSEIN ALUIE, GREGORY L. EYINK, Johns Hopkins University — We investigate scale-locality of energy cascade in magnetohydrodynamic (MHD) turbulence at high kinetic and magnetic Reynolds numbers. There is a growing consensus that large-scale flow can transfer energy to the magnetic field at arbitrarily small scales in the inertial range (Alexakis et al. (2005,2007), Carati et al. (2006), Yousef et al. (2007), Schekochihin et al. (2008), etc.) However, we rigorously prove that such non-local transfer cannot occur, under very weak scaling conditions for velocity and magnetic-field increments accepted to hold in the inertial-inductive range of turbulent MHD flows. Our analysis shows that inter-scale fluxes of two conserved quantities, total energy and cross helicity, are dominated by local triadic interactions. Nonlocal triads make an asymptotically negligible contribution, decaying as a power of the scale-disparity. Furthermore, nonlocal-in-scale triads may dominate in field-line stretching, but energy conversion by stretching is primarily between velocity and magnetic-field modes at comparable scales. To verify our analytical results, we present data of forced MHD turbulence from a pseudospectral simulation on a grid of 1024^3 points with phase-shift dealiasing.

[1]Computer time provided by DLMS at the Johns Hopkins University and support from NSF grant # ASE-0428325 are gratefully acknowledged.

Hussein Aluie
Johns Hopkins University

Date submitted: 16 Jul 2009 Electronic form version 1.4