Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Quantifying the locality/nonlocality of nonlinear interactions in MHD turbulence J.A. DOMARADZKI, USC, B. TEACA, EPF Lausanne, D. CARATI, ULB Bruxelles — The locality functions introduced by Kraichnan give the fraction of the energy flux across a given cutoff wavenumber k_c that is due to nonlinear interactions with wavenumbers k smaller than the cutoff (the infrared locality function) or greater than the cutoff (the ultraviolet locality function). Previous analysis of DNS data for hydrodynamic turbulence (HD) confirmed the theoretical scaling exponent of n=4/3 in the wavenumber ratio k/k_c. We have extended the analysis of DNS data to MHD turbulence. The analysis is performed in spectral space, which is decomposed into a series of shells following a power law for the boundaries. The triadic transfers occurring among these shells are computed and the fluxes and locality functions are recovered by partial summations over the relevant shells. Values of 1/3 and 2/3 are found for the scaling exponents of the four individual MHD energy fluxes corresponding to the four nonlinear terms in MHD equations. However, when a sum of two energy conversion terms, among the kinetic and the magnetic energy, is considered instead of its two individual components, its scaling exponent is 2/3, the same as for the remaining two redistribution terms for the kinetic and the magnetic energy. All scaling exponents are smaller than the value of 4/3 found for HD turbulence, indicating significantly more nonlocal character of nonlinear interactions in MHD turbulence.

Julian Domaradzki
University of Southern California

Date submitted: 02 Aug 2011 Electronic form version 1.4