Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

WITHDRAWN–On the dynamics of transition to incompressibility from compressible MHD turbulence DASTGEER SHAIKH, GARY P. ZANK, Institute of Geophysics and Planetary Physics — Compressibility is regarded as an essential characteristic of interplanetary, interstellar, and laboratory magnetohydrodynamic (MHD) plasmas, yet small scale low-frequency phenomena, and interplanetary or laboratory turbulence are frequently described on the basis of incompressible MHD. Understanding why magnetofluids observed in the solar wind or interstellar medium frequently behave as though they are incompressible has proved a major challenge to our understanding of small-scale dynamical processes in a plasma. The past 15 years have witnessed an effort to understand this apparent paradox of compressible MHD behaving as though it were incompressible in a variety of environments ranging from the solar wind to the interstellar medium. On the basis of 3D time dependent numerical simulations, we find that compressible magneto hydrodynamic fluids describing super-Alfvenic supersonic and strongly magnetized space and laboratory plasmas decay progressively to a state of near incompressibility. This transition is mediated dynamically by disparate spectral energy dissipation rates in compressible magnetosonic and shear Alfvenic modes. Dissipation leads to super-Alfvenic turbulent motions decaying to a sub-Alfvenic regime that couples weakly with (magneto) acoustic cascades. Consequently, the supersonic plasma motion dissipates into highly subsonic motion and density fluctuations experience a passive convection.

Dastgeer Shaikh
Institute of Geophysics and Planetary Physics

Date submitted: 20 Oct 2005 Electronic form version 1.4