Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The influence of compressibility on nonlinear spectral energy transfer Part 1: Fundamental mechanisms DIVYA SRI PRATURI, SHARATH GIRIMAJI, Texas AM Univ — Nonlinear spectral energy transfer by triadic interactions is one of the foundational processes in fluid turbulence. Much of our current knowledge of this process is contingent upon pressure being a Lagrange multiplier with the only function of re-orienting the velocity wave vector. In this study, we examine how the nonlinear spectral transfer is affected in compressible turbulence when pressure is a true thermodynamic variable with a wave character. We perform direct numerical simulations of multi-mode evolution at different turbulent Mach numbers of $M_t = 0.03, 0.6$. Simulations are performed with initial modes that are fully solenoidal, fully dilatational and mixed solenoidal-dilatational. It is shown that solenoidal-solenoidal interactions behave in canonical manner at all Mach numbers. However, dilatational and mixed mode interactions are profoundly different. This is due to the fact that wave-pressure leads to kinetic-internal energy exchange via the pressure-dilatation mechanism. An important consequence of this exchange is that the triple correlation term, responsible for spectral transfer, experiences non-monotonic behavior resulting in inefficient energy transfer to other modes.

Divya Sri Praturi
Texas A
M Univ

Date submitted: 30 Jul 2017 Electronic form version 1.4