Abstract Submitted
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Detailed thermodynamic analyses of high-speed compressible turbulence[1] COLIN TOWERY, RYAN DARRAGH, University of Colorado - Boulder, ALEXEI POLUDNENKO, Texas A&M University, PETER HAMLINGTON, University of Colorado - Boulder — Interactions between high-speed turbulence and flames (or chemical reactions) are important in the dynamics and description of many different combustion phenomena, including autoignition and deflagration-to-detonation transition. The probability of these phenomena to occur depends on the magnitude and spectral content of turbulence fluctuations, which can impact a wide range of science and engineering problems, from the hypersonic scramjet engine to the onset of Type Ia supernovae. In this talk, we present results from new direct numerical simulations (DNS) of homogeneous isotropic turbulence with turbulence Mach numbers ranging from 0.05 to 1.0 and Taylor-scale Reynolds numbers as high as 700. A set of detailed analyses are described in both Eulerian and Lagrangian reference frames in order to assess coherent (structural) and incoherent (stochastic) thermodynamic flow features. These analyses provide direct insights into the thermodynamics of strongly compressible turbulence. Furthermore, presented results provide a non-reacting baseline for future studies of turbulence-chemistry interactions in DNS with complex chemistry mechanisms.

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