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DNS and Rapid Distortion Theory investigations of Mach number effects on velocity- pressure field interactions in strongly sheared flows GAURAV KUMAR, SHARATH GIRIMAJI, REBECCA BERTSCH, Texas A&M University — Computations based on the Rapid Distortion Theory of homogeneously sheared compressible flow show three distinct types of velocity and thermodynamic field interactions depending upon the gradient Mach number. The difference arises due to the changing role of pressure at sub-sonic, sonic and hypersonic gradient Mach numbers. To understand and further examine the varying role of pressure, we perform direct numerical simulations (DNS) of compressible homogeneous shear flow using Gas Kinetic Method (GKM). We investigate linear and non-linear effects of (a) gradient Mach number (b) perturbation Mach number and (c) initial thermodynamic fluctuations on velocity-thermodynamics interactions. This study is expected to contribute toward the development of improved transition and turbulence closure models in highly compressible shear flows.

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