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Evolution of Compressible Decaying Isotropic Turbulence with Multi-temperature Non-equilibrium WEI LIAO, YAN PENG, LI-SHI LUO, Old Dominion University — Understanding and predicting of transition and turbulence under non-thermodynamical-equilibrium (NTE) conditions are important for hypersonic flight and other industrial applications. In NTE turbulence, the Kolmogorov paradigm, which forms the basis of most equilibrium turbulence models, may be invalid. Furthermore, under the NTE conditions, multiple temperatures often take place in diatomic gases even at room temperature due to the insufficient particle collisions. Therefore, the effect due to the internal degrees of freedom interactions on turbulence physics is essential in non-equilibrium flows. Here, we apply gas kinetic scheme for DNS of compressible decaying isotropic turbulence with multi-temperature non-equilibrium. Our results show that the rotational collision number in the rotational energy relaxation model and the initial energy ratio of rotational and translational modes can significantly affect the evolution of the decaying turbulence.

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