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Density Effects on Post-shock Turbulence Structure YIFENG TIAN, FARHAD JABERI, Michigan State University, DANIEL LIVESCU, Los Alamos National Laboratory, ZHAORUI LI, Texas AM University-Corpus Christi, MICHIGAN STATE UNIVERSITY COLLABORATION, LOS ALAMOS NATIONAL LABORATORY COLLABORATION, TEXAS AM UNIVERSITY-CORPUS CHRISTI COLLABORATION — The effects of density variations due to mixture composition on post-shock turbulence structure are studied using turbulence-resolving shock-capturing simulations. This work extends the canonical Shock-Turbulence Interaction (STI) problem to involve significant variable density effects. The numerical method has been verified using a series of grid and LIA convergence tests, and is used to generate accurate post-shock turbulence data for a detailed flow study. Density effects on post-shock turbulent statistics are shown to be significant, leading to an increased amplification of turbulent kinetic energy (TKE). Eulerian and Lagrangian analyses show that the increase in the post-shock correlation between rotation and strain is weakened in the case with significant density variations (referred to as the "multi-fluid" case). Similar to previous single-fluid results and LIA predictions, the shock wave significantly changes the topology of the turbulent structures, exhibiting a symmetrization of the joint PDF of second and third invariant of the deviatoric part of velocity gradient tensor. In the multi-fluid case, this trend is more significant and mainly manifested in the heavy fluid regions. Lagrangian data are also used to study the evolution of turbulence structure away from the shock wave and assess the accuracy of Lagrangian dynamical models.

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