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Density Effects on the Shock-Turbulence Interaction YIFENG TIAN, FARHAD JABERI, Michigan State University, DANIEL LIVESCU, ZHAORUI LI, Los Alamos National Laboratory — High-order numerical simulations of isotropic multi-fluid turbulence interacting with a planar shock wave are performed using a hybrid numerical method, which combines a monotonicity-preserving scheme with a compact scheme. The main objective of this study is to investigate the effects of density variations due to compositional changes on the shock-turbulence interaction and mixing. Convergence tests are conducted to establish the accuracy of results using different meshes with a wide range of grid sizes inside and outside the shock zone. The computed statistics are found to be independent of the grid when the turbulence after the shock is well resolved and the scale separation between numerical shock thickness and turbulent scales is adequate. A reference simulation of single-fluid turbulence is also conducted with similar conditions. Compared to the single-fluid reference case, turbulence amplification by the normal shock wave is much higher and the reduction in turbulent length scales is much more significant in the presence of density variations due to compositional changes. Turbulent mixing enhancement by the shock wave is also more important in the multi-fluid case. The mechanisms behind multi-fluid shock-turbulence interaction and scalar mixing are identified by analyzing the transport equations for the Reynolds stress, vorticity and scalar variance.

Yifeng Tian
Michigan State Univ

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