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Subgrid-scale backscatter after the shock-turbulence interaction DANIEL LIVESCU, ZHAORUI LI, Los Alamos National Laboratory — The interaction of a shock wave with isotropic turbulence (IT) represents a unit problem for studying some of the phenomena associated with high speed flows, such as hypersonic flight, supersonic combustion and Inertial Confinement Fusion (ICF). In general, in practical applications, the shock width is much smaller than the turbulence scales and the upstream turbulent Mach number is modest. In this case, recent high resolution shock-resolved Direct Numerical Simulations (DNS) (Ryu and Livescu, J. Fluid Mech., 756, R1, 2014) show that the interaction can be described by the Linear Interaction Approximation (LIA). By using LIA to alleviate the need to solve the shock, DNS post-shock data can be generated at much higher Reynolds numbers than previously possible. Here, such results are used to investigate the properties of the subgrid scales (SGS). In particular, it is shown that the shock interaction decreases the asymmetry of the SGS dissipation PDF as the shock Mach number increases, with a significant enhancement in size of the regions and magnitude of backscatter. The LIA results are compared to the DNS database of Ryu and Livescu and then used to examine the backscatter properties at shock Mach numbers much larger than those feasible in DNS.

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