Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Kinetic Energy Backscatter in High-Speed, Compressible Reacting Turbulence ARNAB MOITRO, ASHWATH SETHU VENKATARAMAN, ALEXEI POLUDNENKO , Texas A&M University — Previous studies have shown that in certain reacting flow regimes, near the flame region, the direction of kinetic energy cascade reverses compared to the non-reacting turbulence, and is primarily directed from small scales to large scales on average. Studying this phenomenon (often termed backscatter) is important for developing large-eddy simulation (LES) models for turbulent combustion. Previous studies, however, were limited to relatively low-Mach number flows in idealized geometries. In the present work, we study the backscatter in highly-compressible regimes characterized by large Reynolds numbers. In particular, we present direct numerical simulations (DNS) of the flow in a Turbulent Shock Tube facility designed at the University of Central Florida with the goal of probing the dynamics of turbulent flames in such fast regimes. We quantify the backscatter by low-pass filtering the primitive variables in the DNS at various scales, and evaluating the the sub-filter scale terms in the equation for the transport of kinetic energy. Finally, we discuss the implications of these results for the development of the new generation of LES models for high-speed, compressible reacting flows.

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Date submitted: 01 Aug 2019 Electronic form version 1.4