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Multiscale Interactions and Backscatter in Premixed Combustion PETER HAMLINGTON, COLIN TOWERY, University of Colorado, Boulder, JEF-FREY O'BRIEN, Stanford University, ALEXEI POLUDNENKO, Naval Research Laboratory, JAVIER URZAY, Center for Turbulence Research, Stanford University, MATTHIAS IHME, Stanford University — Multiscale interactions and energy transfer between turbulence and flames are fundamental to understanding and modeling premixed turbulent reacting flows. To investigate such flows, direct numerical simulations of statistically planar turbulent premixed flames have been performed, and the dynamics of kinetic energy transfer are examined in both spectral and physical spaces. In the spectral analysis, two-dimensional kinetic energy spectra and triadic interactions are computed through the flame brush. It is found that there is suppression of turbulent small-scale motions in the combustion products, along with backscatter of energy for a range of scales near the thermal laminar flame width. In the physical-space analysis, a differential filter is applied to examine the transfer of kinetic energy between subgrid and resolved scales in the context of large eddy simulations. Subgrid-scale backscatter of kinetic energy driven by combustion is found to prevail over forward scatter throughout the flame brush. The spectral- and physicalspace analyses thus both suggest an enhancement of reverse-cascade phenomena in the flame brush, which is possibly driven by accumulation of kinetic energy in the scales where combustion-induced heat release is preferentially deployed.

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