Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Spectral Kinetic Energy Transfer Through a Premixed Flame Brush COLIN A.Z. TOWERY, Univ of Colorado - Boulder, ALEXEI Y. POLUDNENKO, Naval Research Laboratory, PETER E. HAMLINGTON, Univ of Colorado - Boulder — Turbulence-flame interactions are of fundamental importance for understanding and modeling premixed turbulent reacting flows. These interactions can result in nonlinear feedback leading to large changes in both the turbulence and flame. Recent computational studies have indicated, however, that not all scales of turbulent motion are affected equally. Small-scale motions appear to be suppressed while larger-scale motions are unaffected or even enhanced. In order to determine the scale-dependence of turbulence-flame interactions, direct numerical simulations of statistically planar, premixed flames have been performed and analyzed. Two-dimensional kinetic energy spectra, conditioned on the planar-averaged fuel mass-fraction, are measured through the flame brush and compared to both compressible and incompressible non-reacting flow spectra. Changes in the spectra with respect to fuel mass-fraction are then connected to the dynamics of the kinetic energy spectrum transport equation. Particular focus is placed on understanding triadic velocity, pressure, and dilatation interactions, including the characterization of backscatter due to heat release and compressibility. Finally, the implications of these results for modeling practical premixed combustion problems are outlined.

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Date submitted: 01 Aug 2014 Electronic form version 1.4