Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Fundamental Differences between Large-Eddy Simulation of Incompressible Turbulence vs Premixed Turbulent Combustion JAMES BRASSEUR, Univ of Colorado, YASH SHAW, Penn State University, PAULO PAES, Gamma Technologies, YUAN XUAN, Penn State University — In contrast with RANS where the modeled terms are of leading order, the LES framework requires that the modeled subfilter-scale (SFS) contributions be of lower order than the leading-order terms. This will be the case if the resolved-scale (RS) contributions to the triadic sum of advective nonlinearities in spectral space dominate the SFS triads, requiring an effective grid that resolves well Reynolds stress motions. Turbulent combustion deviates from the LES framework is several key ways, primarily in the existence of the chemical source terms that lead to the release of thermal energy at scales generally unresolved. In this study we quantify the dominant SFS contributions to the key nonlinearities that underlie RS evolution in LES of premixed turbulent combustion to isolate fundamental deviations from the LES framework. With a new method to remove spurious spectral content in inhomogeneous directions, we apply a concurrent physical-Fourier space methodology to compressible DNS of flame-turbulence interactions to isolate the triadic structure of advective nonlinearities and the quadratic structure of chemical nonlinearities in the Fourier representation from which the dynamically dominant contributions are determined. We find that when the RS fluctuations in momentum and energy are well resolved, the relative SFS contributions are very different depending on the class of nonlinearity and the relative RS vs. SFS contributions to the evolution of the individual species. *Supported by AFOSR.*

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Date submitted: 29 Jul 2019 Electronic form version 1.4