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Analysis of Turbulent Scales of Motion in Premixed Flames Using Structure Functions PETER HAMLINGTON, SAMUEL WHITMAN, COLIN TOWERY, University of Colorado, Boulder, ALEXEI POLUDNENKO, Texas A&M University — Recently, multiscale turbulence-flame interactions in premixed reacting flows have been examined using both physical space and spectral approaches. However, there remains relatively little understanding of how turbulent scales of motion vary through the internal structure of the flame itself (i.e., through premixed flamelets). Such an analysis is made difficult by the inhomogeneity, small scale, and spatial locality of many premixed flames, particularly at high Damköhler and low Karlovitz numbers. Conditional structure functions provide a possible solution to this analysis challenge, and in this talk we present results from the calculation of structure functions using data from highly-resolved direct numerical simulations (DNS) of turbulent premixed flames. The high resolution of the DNS allows structure functions to be calculated normally and tangentially to the local flame surface, revealing the specific effects of the flame on turbulent scales of motion near the scale of the local flame width. Moreover, the conditional nature of the analysis allows the effects of different flame regions (e.g., the preheat and reaction zones) on turbulence to be isolated. The implications of these results for the theory and modeling of turbulent flame physics are outlined.

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