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Can we predict differential diffusion effects on the turbulent flame structure in non-premixed flames? NICHOLAS BURALI, GUILLAUME BLANQUART, Caltech — Differential diffusion effects in turbulent non-premixed flames have been the subject of a vast body of work spanning over four decades. These effects have been shown to have a strong impact on the flame structure close to the burner exit plane, even at high turbulence intensities, and are observed to diminish with increasing downstream distance and increasing Reynolds numbers. Yet, the transition from molecular diffusion controlled mixing, to turbulence dominated transport in non-premixed flames remains poorly understood. The correct representation of these effects is important for phenomena which are sensitive to accurate scalar transport, such as soot formation. In recent work, we proposed a quantitative approach to extract "effective" Lewis numbers from conditional mean species profiles. This methodology is based on the popular flamelet assumption, and was applied to the "Sandia flames" experimental data set. In this work, the analysis is extended to Direct Numerical Simulation data. Statistics of the mixture fraction and its scalar dissipation are shown, differential diffusion effects are presented, and a budget analysis of the flamelet equations is discussed.

Nicholas Burali
Caltech

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