Turbulent Mixing at the High Re Limit: VV/UQ

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Abstract

Validated numerical simulations of turbulent mixing will be presented, based on the Front Tracking/LES/Dynamic Subgrid Scale method. Both macroscopic and molecular level mixing variables will be studied, including joint probability distribution functions of fluctuating fluid variables. Theoretical arguments and numerical exidence are presented for the existence of a two parameter family of mixing solutions in the high Reynolds number limit. These solutions are universal relative to modification of physical diffusive transport processes; the convergence is slow for thermal effects in the case of a plasma like fluid. The two parameter family is labeled by turbulent Schmidt and Prandtl numbers (selected in a theoretically determined manner by the dynamic SGS model). It is sensitive to choice of the turbulent subgrid stress models or to numerical methods which mimic these effects through algorithmic choices. A series expansion for the Reynolds stress and related SGS terms will be given based on Renormalization Group ideas.