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Rayleigh-Taylor turbulent mixing of immiscible, miscible and stratified fluids ANDREI E. GOROBETS, International Center for Theoretical Physics, Italy, SNEZHANA I. ABARZHI, Center for Turbulence Research, Stanford, KATEPALLI R. SREENIVASAN, International Center for Theoretical Physics, Italy — We propose a simple phenomenological model to describe the Rayleigh-Taylor turbulent mixing of immiscible, miscible, and stratified fluids. The model accounts for the multi-scale character of the interface dynamics and distinguishes between the evolution of horizontal and vertical scales. The results obtained indicate two distinct mechanisms for the mixing development. The first is the traditional merge associated with the growth of horizontal scales. The second is associated with the production of small-scale structures and with the growth of the vertical scale, which plays the role of the integral scale for energy dissipation. For immiscible fluids, the rate of momentum loss is the flow invariant, whereas the energy dissipation rate is not, and the fundamental scaling properties of the accelerated flow differ from those of the classical Kolmogorov turbulence. The turbulent diffusion calculated through the temperature fluctuations does not stop mixing, but decreases its growth-rate significantly, makes it time-dependent and sensitive to the initial conditions. A stratified density distribution can terminate the mixing process.

Snezhana I. Abarzhi
Center for Turbulence Research, Stanford

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