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Mixing asymmetry in variable density turbulence DANIEL LIVESCU, RAY RISTORCELLI, ROBERT GORE, Los Alamos National Laboratory — The homogenization of a heterogeneous mixture of two pure fluids with different densities by molecular diffusion and stirring induced by buoyancy generated motions is studied using Direct Numerical Simulations in two configurations: a) classical Rayleigh-Taylor instability using a 3072^3 data set (Cabot and Cook, Nature Phys. 2006, Livescu et al, J. Turb. 2009) and b) an idealized triply periodic Rayleigh-Taylor flow named hereafter homogeneous Rayleigh-Taylor (HRT), using up to 1024^3 meshes (Livescu and Ristorcelli, J. Fluid Mech. 2007, 2008). As a consequence of the differential accelerations experienced by the fluids, important differences between the mixing in a variable density flow, as compared to the Boussinesq approximation, are observed. In short, the pure heavy fluid mixes more slowly than the pure light fluid: in HRT, an initially symmetric double delta density PDF is rapidly skewed, as the light pure fluid vanishes, and only at long times and small density differences it relaxes to a symmetric, Gaussian-like PDF. The effect is shown to be related to the local structure of the flow and consequences for the high Atwood number Rayleigh-Taylor mixing are discussed.

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