Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Efficient Modeling of Multicomponent Diffusive Mixing ANDY NONAKA, Lawrence Berkeley National Laboratory, AMIT BHATTACHARJEE, Courant Institute of Mathematical Sciences, ALEJANDRO GARCIA, San Jose State University, JOHN BELL, Lawrence Berkeley National Laboratory, ALEKSANDAR DONEV, Courant Institute of Mathematical Sciences — We have developed a low Mach number hydrodynamics code appropriate for modeling diffusive mixing of an arbitrary number of fluids with different densities and transport properties. Our low Mach number formulation eliminates acoustic waves and allows for an advective CFL time step constraint. Unlike models for incompressible flow which eliminate acoustic waves by imposing that the divergence of the velocity be zero, in this formulation the divergence is determined by the mixing of the fluids. We couple the divergence constraint to an implicit viscosity treatment using a newly-developed staggered-grid, finite-volume Stokes solver with a projection-method based preconditioner. Our code supports multiple time-stepping schemes suitable for both inertial and large Schmidt number regimes. The code has been implemented in the highly-scalable BoxLib software framework publicly available at Lawrence Berkeley Laboratory. The code also contains modules for thermal fluctuations using stochastic forcing terms as proposed by Landau and Lifshitz. We have successfully used the code to replicate multi-mode instabilities observed in experiments.

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Date submitted: 11 Jul 2014 Electronic form version 1.4