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Lattice Boltzmann Methods for thermal flows: applications to compressible Rayleigh-Taylor systems LUCA BIFERALE, MAURO SBRAGAGLIA, ANDREA SCAGLIARINI, University of Rome, Tor Vergata, KAZUYASU SUGIYAMA, University of Tokyo, FEDERICO TOSCHI, Technische Universiteit Eindhoven — We compute the continuum thermo-hydrodynamical limit of a new formulation of Lattice Kinetic equations for thermal compressible flows, recently proposed in [*Sbragaglia et al. "Lattice Boltzmann method with self-consistent thermo-hydrodynamic equilibria", J. Fluid Mech.* **628** *299 (2009)*]. We show that the hydrodynamical manifold is given by the correct compressible Fourier-Navier-Stokes equations for a perfect fluid.We also apply the method to study Rayleigh-Taylor instability for compressible stratified flows and we determine the growth of the mixing layer at changing Atwood numbers up to $At \sim 0.4$. Both results show that this new Lattice Boltzmann Methods can be used to study highly stratified/compressible systems with strong temperature gradients, opening the way to applications to Non-Oberbeck-Boussinesq Convection and compressible Rayleigh-Taylor turbulence.

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