Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

High-order accurate interface-capturing schemes for gas-liquid flows: pressure and temperature considerations[1] ERIC JOHNSEN, Mechanical Engineering Department, University of Michigan — Direct simulations of the inertial collapse and rebound of a cavitation bubble are challenging due to the necessity to accurately represent discontinuities (e.g., interfaces and shock waves) and transport processes. A direct application of shock-capturing schemes is known to lead to spurious pressure oscillations and may further generate temperature and conservation errors. The present focus is on high-order accurate schemes (e.g., Weighted Essentially Non-Oscillatory or Discontinuous Galerkin) for interface capturing, which, in analogy to shock capturing, regularize material discontinuities over a few grid points while preserving interfacial conditions. Although approaches have been developed to prevent spurious pressure oscillations in the Euler equations by appropriately coupling a transport equation, temperature spikes may be generated, which in turn lead to transient pressure errors in Navier-Stokes simulations or erroneous mass transfer rates during phase change. These errors are analyzed in the context of gas/liquid and vapor/liquid flows. By appropriately transporting the relevant parameters of a stiffened equation of state, pressure, temperature and conservation errors can be prevented. Results pertaining to cavitation-bubble collapse will be presented.

[1]This work was supported by ONR grant N00014-12-1-0751.

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Date submitted: 03 Aug 2012 Electronic form version 1.4