Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Collapse of individual bubbles near rigid boundaries SHAHABODDIN ALAHYARI BEIG, ERIC JOHNSEN, Mechanical Engineering Department, University of Michigan — Cavitation happens in a variety of applications ranging from naval hydrodynamics to biomedical ultrasound. The inertial collapse of cavitation bubbles concentrates energy into a small volume, and is capable of producing high pressures and temperatures and emitting radially propagating shock waves. One important consequence of such phenomenon is structural damage to neighboring objects following repeated collapse of cavitation bubbles. In order to provide a better understanding of this problem, we perform high-resolution numerical simulations of the inertial collapse of individual bubbles near rigid surfaces by solving the three-dimensional compressible Navier-Stokes equations for gas/liquid systems. By considering the collapse of a single bubble as well as a bubble pair near a rigid surface, we explain that the bubble-boundary and/or bubble-bubble interactions can affect the energy concentration, give rise to the kinetic energy of non-converging motions, and break the symmetry of the collapse that modify the pressures and temperatures thereby produced. The results are used to investigate the non-spherical bubble dynamics and characterize the pressure and temperature fields based on the relevant parameters entering the problem: initial stand-off distance, distance and angle between the two bubbles, and driving pressure This work was supported by ONR grant N00014-12-1-0751 under Dr. Ki-Han Kim.

Shahaboddin Alahyari Beig
Mechanical Engineering Department, University of Michigan

Date submitted: 31 Jul 2019 Electronic form version 1.4