Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Large Bubbles in Vibrated Liquid Are Levitated by Wall Motions

J.R. TORCZYNSKI, T.P. KOEHLER, Sandia National Laboratories — Experiments have shown that, if a thin slab of liquid confined between vertical transparent walls is vibrated vertically, a large bubble can be stably levitated between the free surface and the bottom [O'Hern et al., "Bubble Oscillations and Motion Under Vibration," Physics of Fluids 24, 091108 (2012)]. At that time, bubble levitation and stability could not be explained because the downward Bjerknes force is too weak to overcome the upward buoyancy force. However, if wall flexibility is taken into account, the pressure-induced lateral oscillations of the walls lead to a resonance that increases the Bjerknes force. Below resonance, bubbles are driven to the bottom. Above resonance, bubbles are driven to the region of the levitated bubble. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. This paper describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the paper do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

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Date submitted: 23 Jul 2020 Electronic form version 1.4