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Stably Levitated Large Bubbles in Vertically Vibrating Liquids

TIMOTHY O'HERN, BION SHELDEN, LOUIS ROMERO, JOHN TORCZYNSKI,
Sandia National Laboratories — Vertical vibration of a liquid can cause small gas bubbles to move downward against the buoyancy force. Downward bubble motion is caused by the oscillating bubble volume (induced by the oscillating pressure field) interacting with the bubble drag force. The volume-drag asymmetry and the oscillating pressure gradient produce net downward bubble motion analogous to that caused by the Bjerknes force in high-frequency vibrations. Low-frequency (below 300 Hz) experiments demonstrate downward bubble motion over a range of vibration conditions, liquid properties, and pressure in the air above the free surface. Small bubbles deep in a quasi-two-dimensional test cell usually coalesce to form a much larger bubble that is stably levitated well below the free surface. The size and position of this levitated bubble can be controlled by varying the vibration conditions. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Timothy O'Hern
Sandia National Laboratories

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