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Three-dimensional particle migration in a bubble-driven acoustic streaming flow ANDREAS VOLK, MASSIMILIANO ROSSI, Bundeswehr University Munich, BHARGAV RALLABANDI, Princeton University, SASCHA HILGENFELDT, University of Illinois at Urbana-Champaign, CHRISTIAN J. KAEHLER, ALVARO MARIN, Bundeswehr University Munich — Oscillations of hemicylindrical bubbles in microchannels generate streaming flows with characteristic toroidal structures. Over long times, a passive tracer in such a flow typically explores a large fluid volume extending several bubble radii away from the bubble center and covering the whole height of the microchannel parallel to the bubble axis. In contrast, finite-sized particles are observed to migrate to specific confined locations along the axial direction while being confined to orbits of much smaller radial extent. The size of the orbits and the axial location not only depend on the particle size, but also on the relative particle density with the surrounding fluid. In this work we will show three-dimensional measurements that reveal the size- and density-sensitive migration of the particles. A simple way to emulate the migration is to solve numerically the trajectory of a particle including only steric interactions with the bubble and the walls due to its finite size (no penetration). By comparing the experimental results with this simplistic numerical model, we will show that additional forces are necessary to explain the particle dynamics. Finally, we will discuss the effect of hydrodynamic and acoustic forces experienced by the particle in the vicinity of the bubble.

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