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**Three-dimensional microstreaming flows**[1] BHARGAV RALLABANDI, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, ALVARO GOMEZ-MARIN, MASSIMILIANO ROSSI, Institute of Fluid Mechanics und Aerodynamics, Bundeswehr University Munich, CHENG WANG, Mechanical and Aerospace Engineering, Missouri University of Science and Technology, CHRISTIAN KAEHLER, Institute of Fluid Mechanics und Aerodynamics, Bundeswehr University Munich, SASCHA HILGENFELDT, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Streaming due to acoustically excited bubbles has been used successfully for applications such as size-sorting, trapping and focusing of particles, as well as fluid mixing. Many of these applications involve the precise control of particle trajectories, typically achieved using cylindrical bubbles, which establish planar flows. Using astigmatic particle tracking velocimetry (APTV), we show that, while this two-dimensional picture is a useful description of the flow over short times, a systematic three-dimensional flow structure is evident over long time scales. We demonstrate that this long-time three-dimensional fluid motion can be understood through asymptotic theory, superimposing secondary axial flows (induced by boundary conditions at the device walls) onto the two-dimensional description. Beyond microbubble streaming, this leads to a general framework that describes three-dimensional flows in confined microstreaming systems, guiding the design of applications that profit from minimizing or maximizing these effects.

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