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New experimental results on microbubble streaming J.-C. TSAI, Dept. of Mech-E & Dept. of Engr. Sci. and Applied Math, Northwestern Univ., DAVID HANSEN, Dept of Engr. Sci. and Applied Math, Northwestern Univ., SASCHA HILGENFELDT, Dept. of Engr. Sci. and Applied Math & Dept. of Mech-E, Norhtwestern.edu — Fast, ultrasound-driven oscillation of air bubbles situated at or close to a stationary wall induces a steady Stokes flow (microstreaming) of the surrounding fluid. The flow achieves high speeds and can exert strong hydrodynamic forces capable of rupturing cells [1]. In the semi-infinite space bounded by a wall it can be successfully described by analytical means [2]. Here, we report new results including the possibility of flow reversal by amplitude regulation, the excitation of rotating flows, and the effects of an additional confining wall on the microstreaming. Time-resolved imaging of passive tracers from different view angles reveals the 3D structure of the flow field. The results show that ultrasound-driven streaming is effective and versatile in a number of practically relevant geometries and suggests a unique combination of effective transport and effective mixing capabilities in microfluic applications.

[1] P. Marmottant and S. Hilgenfeldt, Nature 423, p153 (2003);
[2] D. Hansen, P. Marmottant, J.-C. Tsai, and S. Hilgenfeldt (submitted to Journal of Fluid Mechanics, 2006)

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