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Size-selective sorting in bubble streaming flows: Particle migration on fast time scales[1] RAQEEB THAMEEM, BHARGAV RALLABANDI, SASCHA HILGENFELDT, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Steady streaming from ultrasonically driven microbubbles is an increasingly popular technique in microfluidics because such devices are easily manufactured and generate powerful and highly controllable flows. Combining streaming and Poiseuille transport flows allows for passive size-sensitive sorting at particle sizes and selectivities much smaller than the bubble radius. The crucial particle deflection and separation takes place over very small times (milliseconds) and length scales (20-30 microns) and can be rationalized using a simplified geometric mechanism. A quantitative theoretical description is achieved through the application of recent results on three-dimensional streaming flow field contributions. To develop a more fundamental understanding of the particle dynamics, we use high-speed photography of trajectories in polydisperse particle suspensions, recording the particle motion on the time scale of the bubble oscillation. Our data reveal the dependence of particle displacement on driving phase, particle size, oscillatory flow speed, and streaming speed. With this information, the effective repulsive force exerted by the bubble on the particle can be quantified, showing for the first time how fast, selective particle migration is effected in a streaming flow.

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