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Stirring and Mixing in Microstreaming Transport Flows SASCHA HILGENFELDT, BHARGAV RALLABANDI, LIN GUO, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, CHENG WANG, Mechanical and Aerospace Engineering, Missouri University of Science and Technology — Microfluidic mixing in closed geometries has inspired a wealth of theoretical models focusing on the simplest flow ingredients necessary for efficient micromixing. For transport devices with given throughput, often required in applications, such fundamental descriptions have largely been absent. We suggest microbubble streaming flows, for which we have developed an analytical flow field description, as a model system for these transport flows. Conducting experiments with nanoparticle tracers, we focus on the advection field (the stirring dynamics) in flows driven by modulated ultrasound. A simplified theory of stirring yields predictions of rapid decay of mixing variance measures for a limited time, indicating optimum time scales for modulation of the driving. Experiments confirm that the model captures the physical features of the stirring (and thus mixing) mechanism. Set-ups with multiple bubbles can be used to further optimize the outcome.

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