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Scattering analysis of streaming flow in a microfluidic channel J.-C. TSAI, Inst. of Physics, Academia Sinica, DAVID HANSEN, ESAM, Northwestern Univ., SASCHA HILGENFELDT, Dept. of Mech. Sci. and Engg., Univ. of Illinois, Urbana-Champaign — We study the effect of a localized streaming source on the viscous flow in a thin microfluidic channel. A mean flow is established through a global applied pressure gradient, while the local streaming is superimposed by means of a microbubble oscillating at small amplitude. The character of the resulting flow changes qualitatively with the relative strengths of these flow components. Our experiments and simulations show a well- defined lateral range of influence of the bubble streaming. Using a narrow beam of tracer particles passing by the oscillating bubble, analogous to conventional fixed-target scattering experiments, we investigate microscopic details of the flow, such as the sensitive dependence of the final transverse distance and time of flight on a slight variation of initial position, useful for describing micromixing. Further investigations show that active variation of the bubble oscillation amplitude significantly enhances mixing compared to the passive superposition of the two steady viscous flows, but only when the modulation frequency is comparable to the inverse mean flow passage time.

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