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Steady streaming created by a bunch of acoustically excited bubbles in microfluidics[1] THOMAS COMBRIAT, PIERRE THIBAULT, PHILIPPE MARMOTTANT, Univ de Grenoble — Thanks to the non-linearity of Navier-Stokes equation, objects vibrating with high-amplitude in a fluid can produce a steady flow called streaming. For sufficiently high amplitudes and/or frequencies of vibration, this phenomenon holds in microfluidic systems despite usually low Reynolds number flows. We present here the steady streaming produced by acoustically excited bubbles in such conditions: thanks to a coupling mechanism, a cluster of bubbles can produce long-range and fast steady flows. This is due to the apparition of a translational mode in addition to a pulsating mode. The present experimental study evidence of a rich variety of flows produced by this system in agreement with the theory developed by F. Mekki-Berrada et al published in the Journal of Fluid Mechanics in 2016. In particular, we observed interesting patterns, with closed recirculations around bubbles in which a portion of the fluid remains trapped. Since this exclusion zones may persist even under incoming flow and as long as the acoustical excitation is present, they may prove useful for the contactless trapping of chemical compounds, allowing to switch solvent or bring new reactants. More generally, this study shows the ability of acoustically driven bubbles to create high velocity flows at microscale.

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