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Pairing and Collective Dynamics of Particles and Deformable Drops in Parallel-Wall Channels PATRICK ANDERSON, PIETER JANSSEN, Eindhoven University of Technology, MATTHEW BARON, JERZY BLAWZDZIEWICZ, MICHAEL LOEWENBERG, Yale University — Fluids used in microfluidic applications often consist of multiple phases, i.e. polymer blends, blood and biological mixtures. One application is the generation of a regular array by the use of T-junctions and flow-focusing devices. In this work, we focus on the pairing and collective dynamics of these trains, and in particular on the influence of the deformability of the dispersed phase, by comparing trains of solid particles and trains of drops. Numerical methods employed are boundary integrals for drops and Stokesian-dynamics techniques for solid particles. We show that isolated pairs of drops undergo pairing, while isolated pairs of rigid spheres do not cluster. By contrast, confined linear arrays of particles and drops always undergo pairing regardless of deformability. Depending on the deformability and the initial separation between the drops, the initial dynamics of the pairing behavior can be quite complex. At prolonged time scales, all drop pairs reach the same velocity, while particle pairs migrate at a different velocity due to different intra-particle distances. In addition, the response of linear arrays to particle displacements shows a qualitative dependence on deformability. For example, drops are self-centering between the bounding walls and therefore linear arrays of drops are more stable to displacements normal to the walls. Complex collective behavior is also observed for linear arrays with particle and drop displacements parallel to the walls.

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