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Hydrodynamic Coupling of Small Clusters of Particles in a Narrow Channel WILLIAM USPAL, MATTHEW HELGESON, PATRICK DOYLE, Massachusetts Institute of Technology — Control of flowing suspensions is central to many emerging microfluidic applications. For instance, manipulation of small clusters is important in the synthesis of functional particles. Via theory, simulations, and experiment, we study small clusters confined in a microchannel with thin cross section and subject to an external flow. Our stop flow lithography (SFL) technique uniquely allows for precise control over particle shape, rigidity, and initial placement. We show that many-body hydrodynamic interactions sustain long-lived bound states with complex dynamics. As these interactions are sensitive to confinement, we investigate modulation of channel geometry as a means to perform sequential operations in a continuous process. We also probe the effects of shape and rigidity via SFL and a Lattice Boltzmann/Lattice Spring code, finding that near-field and orientational effects of shape enrich behavior. For soft, extended particles, we probe hydrodynamic self-deformation and self-excitation of elastic modes. Our results demonstrate phenomena that could be exploited for assembly of soft colloids in microchannels.

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