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Dynamics of chains of deformable particles in strongly confined Poiseuille and Couette flows[1] SAGNIK SINGHA, Texas Tech University, ABHILASH REDDY MALIPEDDI, George Washington University, MAURICIO ZURITA-GOTOR, Universidad Loyola Andalucia, KAUSIK SARKAR, George Washington University, JERZY BLAWZDZIEWICZ, Texas Tech University — In a strongly confined system of deformable drops shear flow triggers their rearrangement into highly ordered linear arrays oriented in the flow direction. In our recent investigation [Soft Matter, 2019,15, 4873-4889] we have found that the drop arrays behave like strongly overdamped bead-spring chains, with springs representing effective inter-drop hydrodynamic interactions. As a result, the relaxation of perturbed chains is diffusive. This behavior is in contrast to the drop-chain dynamics in a confined Poiseuille flow, which is described by the first-order wave equation. To elucidate this difference, we analyze how elementary contributions of inter-particle interactions, i.e., (i) dipolar, (ii) quadrupolar, and (iii) swapping-trajectory effects influence the collective drop dynamics. Due to antisymmetry with respect to the flow reflection, the Hele–Shaw dipoles contribute to wave propagation in a particle array. The symmetric Hele–Shaw quadrupoles together with the swapping trajectory effect produce diffusive relaxation in Couette flow and either wave decay or growth in Poiseuille flow.

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