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Axial and lateral particle ordering in finite Reynolds number channel flows PANDURANG KULKARNI, Levich Institute and Department of Chemical Engineering, The City College of New York, KATHERINE HUMPHRY, Department of Physics, Harvard University, HOWARD STONE, Department of Mechanical and Aerospace Engineering, Princeton University, JEFFREY MORRIS, Levich Institute and Department of Chemical Engineering, The City College of New York — In pressure-driven channel flows at finite Reynolds number, suspended particles are known to undergo cross-streamline migration to a specific position off the centerline. We investigate the combined effects of channel geometry and particle concentration on the migration and ordering of particles in the channels with rectangular cross-sections using both experiments and numerical simulations. First we show that under confinement a single particle always migrates to the center of the longer dimension of the cross section for a range of cross-sectional aspect ratios. In case of a dilute suspension, the particles exhibit lateral and axial ordering owing to the hydrodynamic interactions of neighboring particles. Upon increasing the particle loading, a stepwise transition from one to two to many trains of particles in the lateral direction is observed. For a given channel cross-section, we present a criterion for this transition based on the number of particles per unit length.

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