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Numerical simulations of inertial migration in a square duct: An investigation of multiple equilibrium positions[1] BYOUNGJIN CHUN, University of Florida, TONY LADD — In Poiseuille flow, a neutrally-buoyant particle migrates to a position that is determined by the balance of forces generated by the gradient of the shear rate and interactions of the flow field with the container walls. In a cylindrical flow, uniformly distributed particles migrate to form a stable ring located at approximately 0.6 times the cylinder radius. However, recent experiments show two interesting new observations. First the suspended particles tend to align near the walls to make linear chains of more or less equally-spaced particles, and second, at high Reynolds numbers (Re 1000), an additional inner ring of particles is formed. The inner ring is only formed when the particle are large, of the order of 1:10 the cylinder diameter. We have used numerical simulations based on the lattice-Boltzmann method to investigate inertial migration of neutrally buoyant particles in a square duct over a range of Reynolds numbers from 100 to 1000. Our results show trains of particles being formed along the axis of the flow, near the planar equilibrium positions of single particles. At Reynolds number greater than 750, particles appear near the center of the duct as well. We will present a new mechanism to interpret and understand these results, which was discovered by examining the migration of single particles and rigid dumbbells.

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