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Simulation of suspensions of hydrodynamically interacting self-propelled particles JUAN HERNANDEZ-ORTIZ, MICHAEL GRAHAM, Department of Chemical and Biological Engineering, University of Wisconsin-Madison — Simulations of large populations of confined hydrodynamically interacting swimming particles are performed at low Reynolds number. Each swimmer is modeled as a bead-rod dumbbell with a propulsion force exerted on one bead (with an equal and opposite force exerted on the fluid) and excluded volume potentials at the beads and center of mass. Hydrodynamic coupling between the swimmers leads to large-scale vortex motions and regimes of anomalous diffusion that are qualitatively consistent with experimental observations. At low concentrations, hydrodynamic interactions cause the swimmers to form pairs while the swimming speed remains unchanged or is slightly reduced from the value for isolated swimmers. In confined geometries, the swimmers migrate towards solid surfaces organizing in layers where the swimmers form larger groups, especially in highly confined (monolayer) geometries. As the concentration is increased, the swimming speed also increases due to large-scale collective motion; in confined geometries the layers at the walls and the larger groups are disrupted.

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