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The Bumper Boats Effect: Effect of Inertia on Self Propelled Active Particles Systems[1] CHENGYU DAI, Department of Physics, University of Michigan, Ann Arbor, ISAAC BRUSS, Department of Chemical Engineering, University of Michigan, Ann Arbor, SHARON GLOTZER, Department of Chemical Engineering, Department of Physics, Department of Material Science and Engineering, University of Michigan, Ann Arbor — Active matter has been well studied using the standard Brownian dynamics model, which assumes that the self-propelled particles have no inertia. However, many examples of active systems, such as sub-millimeter bacteria and colloids, have non-negligible inertia. Using particle-based Langevin Dynamics simulation with HOOMD-blue, we study the role of particle inertia on the collective emergent behavior of self-propelled particles. We find that inertia hinders motility-induced phase separation. This is because the effective speed of particles is reduced due to particle-particle collisionsmuch like bumper boats, which take time to reach terminal velocity after a crash. We are able to fully account for this effect by tracking a particle's average rather than terminal velocity, allowing us to extend the standard Brownian dynamics model to account for the effects of momentum. This study aims to inform experimental systems where the inertia of the active particles is non-negligible.

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