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Attractive and Repulsive Forces on Particles in Oscillatory Flow SIDDHANSH AGARWAL, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, BHARGAV RALLABANDI, Mechanical and Aerospace Engineering, Princeton University, DAVID RAJU, RAQEEB THAMEEM, SASCHA HILGENFELDT, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — A large class of oscillating flows gives rise to rectified streaming motion of the fluid. It has recently been shown that particle transport in such flows, excited by bubbles oscillating at ultrasound frequencies, leads to differential displacement and efficient sorting of microparticles by size. We derive a general expression for the instantaneous radial force experienced by a small spherical particle in the vicinity of an oscillating interface, and generalize the radial projection of the Maxey-Riley equation to include this effect. Varying relevant system parameters, we show that the net effect on the particle can be either an attraction to or a repulsion from the bubble surface, depending in particular on the particle size and the particle/fluid density contrast. We demonstrate that these predictions are in agreement with a variety of experiments.

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