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Numerical simulations of flagellated micro-swimmers and ciliated surfaces HENRY SHUM, ANURAG TRIPATHI, Department of Chemical & Petroleum Engineering, University of Pittsburgh, JULIA YEOMANS, Rudolf Peierls Centre for Theoretical Physics, University of Oxford, ANNA BALAZS, Department of Chemical & Petroleum Engineering, University of Pittsburgh — Cilia are filamentous organelles found in many organisms for achieving locomotion or for driving fluid flows within the body. Cilia-like structures can be constructed and have potential for application in microfluidics, where they may be used to locally control flow and the motion of particles in the fluid. We implement a lattice Boltzmann method to simulate fluid flows produced by externally actuated artificial cilia and explore the influence of such cilia on objects in the surrounding fluid. In particular, we show examples of interactive effects between cilia arrays and self-motile swimmers propelled by a rotating helical flagellum. Artificial swimmers mimicking the motion of flagellated bacteria in this way have been experimentally realized in recent years and our simulations produce testable predictions for the behavior of such swimmers in the presence of cilia.

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