Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Hydrodynamic trapping of microrollers by cylindrical obstacles[1]

ERNEST VAN DER WEE, Northwestern University, FLOREN BALBAO USABIAGA, Basque Center for Applied Mathematics, MICHELLE DRISCOLL, Northwestern University — Suspensions of microrollers show unique collective effects and emergent structure formation, such as clusters stabilized by hydrodynamics alone. Microrollers are rotating colloidal particles that become active close to a wall due to an asymmetric flow of the fluid around the particles. The flow field of the fluid around the microroller is distinctively different to the flow field of other commonly used swimmers such as pullers and pushers. Here, we study the interaction of microrollers with obstacles in their path. In contrast to many other active matter systems, the propagation direction in this system is prescribed, resulting in unique particle-obstacle interactions. Inspired by experiments, we study the interaction of the microrollers with cylindrical obstacles using high-resolution Brownian dynamics simulations, including long range hydrodynamics. Even in this basic model system for a complex environment, we find hydrodynamic trapping of the microroller in the wake of the obstacles for parameters readily accessible in the lab. We measure the trapping strength as a function of the size ratio of the microroller and obstacle, and the frequency of rotation of the microroller. Moreover, we find that Brownian motion is required for the microroller to both enter and leave the trap.

[1]This work was supported by the National Science 315 Foundation under award number CBET-1706562.

Ernest van der Wee
Northwestern University

Date submitted: 31 Jul 2020 Electronic form version 1.4