Active motion: Tracing the path of microswimmers

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Abstract

Active motion of artificial and biological microswimmers is relevant in microfluidics and biological applications but also poses fundamental questions in nonequilibrium statistical physics. Mechanisms of single microswimmers either designed by nature or in the lab need to be understood and a detailed modeling of microorganisms helps to explore their complex cell design and their behavior. The emergent collective motion of microswimmers generates appealing dynamic patterns as a consequence of the non-equilibrium.

In this talk I review some of our work modeling biological microswimmers such as *E. coli* and the *African trypanosome*, the causative agent of the sleeping sickness, in order to contribute to their better understanding. Using simpler model microswimmers, I will demonstrate the richness of their emerging collective behavior. Hydrodynamic interactions lead to a clustering transition dependent on swimmer type or to the formation of fluid pumps in 3D harmonic traps. Self-phoretic active colloids are able to sense their environment and perform chemotactic motion mimicking bacterial systems. Finally, in thin liquid films microswimmers generate regular and chaotic dynamic patterns.