McCormick

Northwestern Engineering

Engineering Sciences and Applied Mathematics

ESAM Seminar Series Presents:

Fluid Flows Created by Swimming Bacteria Drive Self-Organization

Presented by:

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Brown University and Courant Institute

Concentrated suspensions of swimming microbes and other forms of active matter are known to display intricate, self-organized spatiotemporal patterns on scales larger than those of the individual motile units. The collective dynamics of swimming microorganisms exhibits a complex interplay with the surrounding fluid: the motile cells stir the fluid, which in turn can reorient and advect them. This feedback loop can result in long-range interactions between the cells. We present a computational model that takes into account these cell-fluid interactions and cell-cell forces and that predicts counterintuitive cellular order driven by long-range flows. The predictions are confirmed by new experiments with Bacillus Subtilis bacteria. Simulations and experiments show that if the micro-swimmers are confined inside thin cylindrical chambers the suspension self-organizes into a stable swirling vortex. If the micro-swimmers are confined in thin racetracks, a persistent unidirectional stream can be observed. Both these phenomena emerge as a result of the complex interplay between the swimmers, the confining boundaries and the fluid flow. Last, I will discuss the dynamics in another type active system where the units are micro-rotors, and the role of hydrodynamics in the emerging collective behavior.

Monday, December 1st, 4:00 PM
Technological Institute M416

For further information see http://www.esam.northwestern.edu

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