Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

**Instabilities and dynamics in suspensions of self-locomoting rods**
MICHAEL SHELLEY, DAVID SAINTILLAN, Courant Institute, New York University — Suspensions of swimming microorganisms are characterized by complex dynamics involving strong fluctuations and large-scale correlated motions. These motions, which result from the many-body interactions between the particles, are biologically relevant as they impact mean particle transport, mixing and diffusion, with possible consequences for nutrient uptake. In this work, we use numerical simulations to investigate aspects of the dynamics and microstructure in suspensions of interacting self-locomoting rods at low Reynolds number. We propose a detailed model that accounts for hydrodynamic interactions based on slender-body theory and encompasses both biological and non-biological locomotion mechanisms. In agreement with previous predictions, we demonstrate that aligned suspensions of swimming particles are unstable as a result of hydrodynamic fluctuations. In spite of this instability, we demonstrate that a local orientational ordering persists over short length scales and has a significant impact on the mean swimming speed. Consequences of large-scale orientational disorder for particle dispersion are discussed and explained in the context of generalized Taylor dispersion theory. Dynamics in thin liquid films are also presented, and are characterized by a strong particle migration towards the interfaces.

David Saintillan
Courant Institute, New York University

Date submitted: 08 Aug 2007 Electronic form version 1.4