Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Effects of elasticity and geometry on the locomotion of a model bacterium[1] FRANK NGUYEN, MICHAEL GRAHAM, University of Wisconsin, Madison — The locomotion of flagellated bacteria in viscous fluid provides the blueprint for a number of micro-scale engineering applications. The elasticities of both the hook protein (connecting cell body and flagellum) and the flagella themselves play a key role in determining the stability of locomotion. We use a coarse-grained discretization of elastic flagella connected to a rigid cell body to examine trajectories and flow fields for free swimmers. We indeed find that hook and/or flagellar buckling occurs above a critical flexibility relative to the swimmers torque input. This renders straight swimming ineffective, though not necessarily undesirable in practice. Simulations with multiple flagella show bundling may partially stabilize the buckling effect. For a single flagellum or single bundle, we define a parameter space of characteristic angles tracking the overall time-averaged shape of the swimmer while also delineating stability boundaries between different modes of buckling. Ultimately our results may provide insight on how swimmers move through complex environments and how to design microrobotic swimmers for specific applications.

[1]NHS, GERS

Frank Nguyen
University of Wisconsin, Madison

Date submitted: 31 Jul 2017 Electronic form version 1.4