Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Helical and rod-shaped bacteria swim in helical trajectories with little additional propulsion from helical shape HENRY FU, University of Utah, MAIRA CONSTANTINO, Boston University, MEHDI JABBARZADEH, University of Utah, RAMA BANSIL, Boston University — It has frequently been hypothesized that the helical body shapes of flagellated bacteria may yield some advantage in swimming ability. The helical-shaped pathogen Helicobacter pylori allows us to test these claims. Using fast time-resolution and high-magnification phase-contrast microscopy to simultaneously image and track individual bacteria we determine cell body shape as well as rotational and translational speeds. Using the method of regularized Stokeslets, we directly compare observed speeds and trajectories to numerical calculations to validate the numerical model. Although experimental observations are limited to select cases, the model allows quantification of the effects of body helicity, length, and diameter. We find that due to relatively slow body rotation rates, the helical shape makes at most a 15% contribution to propulsive thrust. The effect of body shape on swimming speeds is instead dominated by variations in translational drag required to move the cell body. Because helical cells are one of the strongest candidates for propulsion arising from the cell body, our results imply that quite generally, swimming speeds of flagellated bacteria can only be increased a little by by body propulsion.

Henry Fu
University of Utah

Date submitted: 01 Aug 2017 Electronic form version 1.4