Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

A bacterial swimming strategy with two alternating speeds of propagation MATTHIAS THEVES, University of Potsdam, JOHANNES TAKTIKOS, Technical University Berlin, VASILY ZABURDAEV, Max-Planck-Institute for the Physics of Complex Systems, HOLGER STARK, Technical University Berlin, CARSTEN BETA, University of Potsdam — We used microfluidics together with high-speed video microscopy to acquire large data sets of swimming trajectories of *Pseudomonas putida*, a bacterium with multiple polar flagella known for its ability to degrade aromatic hydrocarbons. The motion of cells in the bulk fluid is dominated by periods of persistent displacement along a straight line (runs) and sharp reorientation events (turns). The distribution of turning angles is bimodal with a dominating peak around 180 degrees and a minor peak around zero degrees. During the majority of turns, the cell reverses its swimming direction and the corresponding trajectories resemble a zig-zag pattern. Our analysis revealed that upon a reversal, the cell systematically changes its swimming speed by a factor of two on average. Based on the experimentally observed values for rotational diffusion and average runtime we developed a run-reverse random walk model with two distinct swimming speeds, which successfully recovers the mean square displacement and in an extended version also the observed negative dip in the directional autocorrelation. Our model demonstrates that by alternating between two swimming speeds, the cell explores its environment more efficiently than a cell swimming at a constant intermediate speed.

Matthias Theves
University of Potsdam

Date submitted: 10 Nov 2013

Electronic form version 1.4