Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Run and tumble, run and reverse, or run reverse and flick - who wins the chemotaxis race? VASILY ZABURDAEV[1], School of Engineering and Applied Sciences, Harvard University, SERGEY DENISOV[2], Insitute of Physics, Augsburg University, DAVID WEITZ[3], School of Engineering and Applied Sciences, Harvard University — Run and tumble of *E.coli* bacteria is a well understood example of the stochastic cell motion that is alternated in the presence of signaling chemicals. By regulating the tumbling frequency bacteria are able to navigate toward the food sources. Another bacteria that use twitching to move on a surface, *M. xanthus*, utilize a different strategy - at the end of the run they completely reverse the direction of motion and continue moving in the opposite direction. The frequency of reversals was shown to be connected to the chemotactic response of the cell. Recently yet another pattern was discovered in marine bacteria *V. alginolyticus* which alternate sharp reversals with flicks – making a turn to an angle with a broad distribution and centered around 90 degrees. In this work we are presenting a theoretical framework that describes all above motion patterns. As a highlight of the developed approach we find the exact analytical expressions for the mean squared displacement of moving cells for arbitrary distribution of run times. That allows us to quantitatively compare the performance of bacteria exploring the environment with and without signaling chemicals and, therefore, to find the winner of the chemotactic race.

[1]29 Oxford Street, Cambridge, MA 02138, USA
[2]Universitätstr. 1, Augsburg, D-86159, Germany
[3]29 Oxford Street, Cambridge, MA 02138, USA

Vasily Zaburdaev
Harvard University

Date submitted: 10 Nov 2011 Electronic form version 1.4