Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Heavy tailed bacterial motor switching statistics define macroscopic transport properties during upstream contamination by E. coli N. FIGUEROA-MORALES, PMMH-ESPCI, CNRS, A. RIVERA, IMRE, UH, E. ALTSHULER, FF, U. of Havana, T. DARNIGE, PMMH, U. Paris , C. DOUARCHE, LPS, CNRS, U. Paris-Sud, R. SOTO, DF, U. de Chile, A. LINDNER, E. CLÉMENT, PMMH, U. Paris — The motility of E. Coli bacteria is described as a run and tumble process. Changes of direction correspond to a switch in the flagellar motor rotation. The run time distribution is described as an exponential decay of characteristic time close to 1s. Remarkably, it has been demonstrated that the generic response for the distribution of run times is not exponential, but a heavy tailed power law decay, which is at odds with the motility findings. We investigate the consequences of the motor statistics in the macroscopic bacterial transport. During upstream contamination processes in very confined channels, we have identified very long contamination tongues. Using a stochastic model considering bacterial dwelling times on the surfaces related to the run times, we are able to reproduce qualitatively and quantitatively the evolution of the contamination profiles when considering the power law run time distribution. However, the model fails to reproduce the qualitative dynamics when the classical exponential run and tumble distribution is considered. Moreover, we have corroborated the existence of a power law run time distribution by means of 3D Lagrangian tracking. We then argue that the macroscopic transport of bacteria is essentially determined by the motor rotation statistics.

Nuris Figueroa Morales
PMMH-ESPCI, CNRS

Date submitted: 14 Nov 2016 Electronic form version 1.4