Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Force-driven transport in entropy barriers KEVIN DORFMAN, NABIL LAACHI, MARTIN KENWARD, University of Minnesota, EHUD YARIV, Technion — We consider theoretically the transport of a point-sized Brownian particle in a two-dimensional channel with a slowly varying, periodic cross-section. Such channels are associated with the concept of an "entropy barrier," where the change in the number of available "states" for the Brownian particle governs the transport process. Using generalized Taylor-Aris dispersion theory and long-wavelength asymptotics, we exactly compute the mean particle velocity and effective diffusivity (dispersivity) for two cases: electrophoretic transport in an insulating channel and motion under the influence of a constant force. At the same time, we arrive at rational definitions for the concept of an entropy barrier as a function of the driving force. The agreement between simulations and the exact calculation for a constant force is excellent and represents a significant advance over existing models of the transport process.

Kevin Dorfman
University of Minnesota

Date submitted: 21 Nov 2007 Electronic form version 1.4