Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Entropic transport - a step beyond Fick-Jacobs STEFFEN MARTENS, Humboldt-University Berlin, Department of Physics, Newtonstr. 15, 12489 Berlin, Germany, GERHARD SCHMID, University Augsburg, Department of Physics, Universitaetsstr. 1, 86135 Augsburg, Germany, LUTZ SCHIMANKY-GEIER, Humboldt-University Berlin, Department of Physics, Newtonstr. 15, 12489 Berlin, Germany, PETER HÄNGGI, University Augsburg, Department of Physics, Universitaetsstr. 1, 86135 Augsburg, Germany — We investigate the transport of point-size Brownian particles under the influence of a constant and uniform force field through a three-dimensional channel with smoothly varying periodic cross-section. We apply the standard long-wave asymptotic analysis and show that the leading order term is equivalent to the Fick-Jacobs approximation. Using the higher order corrections of the probability density we derive an expression for the spatially dependent diffusion coefficient. In addition, we demonstrate that in the diffusion dominated regime the averaged velocity and the effective diffusion coefficient are determined by the product of the Fick-Jacob result and the expectation value of the spatially dependent diffusion coefficient. Analytic findings are confirmed by numerical simulations of the particle dynamics in a reflection symmetric sinusoidal channel.

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Date submitted: 22 Dec 2010 Electronic form version 1.4