Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Mobility of a Semiflexible Chain in a Nanochannel DOUGLAS TREE, University of Minnesota, YANWEI WANG, Soochow University, KEVIN DORFMAN, University of Minnesota — The fundamental understanding of the dynamics of biopolymers in nanoscale devices is an important problem with real-world applicability in high-tech genomic mapping devices. Accordingly, we have developed a comprehensive picture of tube-confined polymers that goes beyond the limiting cases given by the decades-old scaling laws of de Gennes and Odijk for polymer mobility in weak and strong confinement. By using a numerical solution of the confined Green's function and by sampling polymer configurations using a Metropolis Monte Carlo algorithm, we are able to estimate the Kirkwood mobility of long, semiflexible polymers (e.g. DNA) in a square nanochannel with full hydrodynamic interactions. We will present results using this approach that show a broad plateau exists in the mobility as a function of the chain extension for moderate confinement, and that the width of the plateau depends on the anisotropy of the monomers (and hence the ionic strength of the buffer). For dilute, high-ionic strength solutions of DNA, our analysis indicates that the classic results of Odijk and de Gennes apply over a distinctly narrow range of extensions, and we predict that the Rouse-like behavior of moderate confinement will be observed for most of the measurable chain extensions seen in experiments.

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Date submitted: 19 Jul 2012 Electronic form version 1.4