Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Studies of DNA Translocation Dynamics Using Asymmetrical Nanopores[1] XU LIU, KARRI DIPETRILLO, JASON CHAN, DEREK STEIN, Brown University — Despite extensive studies of DNA translocations through voltage-biased solid-state nanopores, the influence of the DNA coil on the translocation dynamics remains poorly understood. We investigated this issue experimentally by controlling the separation between the DNA coil and the nanopore. We studied lambda DNA translocations through devices comprising a 400 nm-high, 2500 nm-wide, disc-shaped cavity bounded from above by a 20 nm-thin silicon nitride membrane with a 10 nm wide nanopore in the center, and from below by at 400 nm-thick silicon nitride membrane with a 300 nm-wide opening in the center. The asymmetric nanopore-cavity structure introduced an 800 nm gap between the initial DNA coil and the nanopore when a molecule translocated from below, but no gap when it translocated from above. Translocation times were longer and the integrated charge deficit was larger for molecules translocating from below. These results are explained by the viscous drag on the DNA outside the pore, whose importance relative to the drag inside the pore we quantify. We outline a consistent model of DNA translocation speeds that depends on the initial configuration of the DNA coil, similar to the velocity fluctuation model of Lu et al.

[1]This material is based upon work supported by the National Science Foundation under Grant No. CBET0846505.

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Date submitted: 10 Nov 2011

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