Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

DNA translocation through a nanopore in a single layered doped semiconductor membrane[1] INING A. JOU, DMITRIY V. MELNIKOV, CHRISTOPHER R. MCKINNEY, MARIA E. GRACHEVA, Clarkson University — We have recently developed a computational model that allows us to study the influence a semiconductor membrane has on a DNA molecule translocating through a nanopore in this membrane. Our model incorporates both the self-consistent Poisson-Nernst-Planck simulations for the electric potential of a solid state membrane immersed in an electrolyte solution together with the Brownian Dynamics of the biomolecule. We study how the applied electrolyte bias, the semiconductor membrane bias and the semiconductor material type (n-Si or p-Si) affect the translocation dynamics of a single-stranded DNA moving through a nanopore in a single layered semiconductor membrane. Our results show that the type of semiconductor material has a prominent effect on the biomolecule's translocation time, with DNA exhibiting much longer translocation times through the p-type membrane than through the n-type at the same electrolyte and membrane potentials. In addition, we find the optimal combination for membrane/electrolyte system's parameters to achieve longest translocation time and largest DNA extension. With our single layered electrically tunable membranes, the DNA translocation time can be manipulated to have an order of magnitude increase.

[1]This work was supported by the NSF grant CBET-1119446 and by the XSEDE awards for computational resources TG-PHY110023 and TG-TRA120010.

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Date submitted: 05 Nov 2012 Electronic form version 1.4