Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Reaching the Ionic Current Detection Limit in Silicon-Based Nanopores MATTHEW PUSTER, University of Pennsylvania, Department of Physics and Astronomy, Department of Materials Science and Engineering, JULIO ALEJANDRO RODRIGUEZ-MANZO, University of Pennsylvania, Department of Physics and Astronomy, ADRIEN NICOLAI, VINCENT MEUNIER, Rensselaer Polytechnic Institute, Department of Physics, Applied Physics, and Astronomy, MARIJA DRNDIC, University of Pennsylvania, Department of Physics and Astronomy — Solid-state nanopores act as single-molecule sensors whereby passage of an individual molecule in aqueous electrolyte through a nanopore is registered as a change in ionic conductance (ΔG). Future nanopore applications such as DNA sequencing at high bandwidth require high ΔG for optimal signal-to-noise ratio. Reducing the nanopore diameter and thickness increase ΔG. Molecule size limits the diameter, thus efforts concentrate on minimizing the thickness by thinning oxide/nitride films or using 2D materials. Weighted by electrolyte conductivity the highest ΔG reported to date for DNA translocations were obtained with nanopores made in oxide/nitride films. We present a controlled electron irradiation technique to thin such films to the limit of their stability, producing nanopores tailored to molecule size in amorphous Si with thicknesses less than 2 nm. We compare ΔG values with results found in the literature for DNA translocation through these nanopores, where access resistance becomes comparable to the resistance through the nanopore itself.

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Date submitted: 14 Nov 2014 Electronic form version 1.4