Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Probing surface electronic structure with conductance measurements on Si nanomembranes WEINA PENG, JAMES ENDRES, SHELLEY SCOTT, DONALD SAVAGE, IRENA KNEZEVIC, MARK ERIKSSON, MAX LAGALLY, University of Wisconsin Madison, MRSEC OF UNIVERSITY OF WISCONSIN MADISON TEAM — The surface electronic structure of nanostructures has a strong, sometimes dominant, influence on their transport properties, because of their large surface to volume ratios. Different surface terminations result in different transport behavior, and therefore conductance measurements on nanostructures can be used to study surface and interface electronic spectra. In our experiments, the conductance of the thin (200nm or less in thickness) top Si layer in silicon-on-insulator is measured as the back gate voltage is varied, for both hydrogen terminations and clean reconstructed surfaces in UHV. Experimental results on samples of different thicknesses are compared systematically with simulations to understand the role of the Si/SiO_2 interface and the electronic structure of the front surface. We explain why the transport behavior of NMs with a clean Si(001) surface is distinct from that with hydrogen termination. Donor type surface states are present in the majority on the hydrogenated surface, and their concentration is on the order of 10^{12} cm^{-2}. On the reconstructed Si surface, instead, pseudo-pinning of the Fermi level occurs because of the high density of states of the clean-surface band (2x1 reconstruction) and the presence of surface defect states.

Weina Peng
University of Wisconsin Madison

Date submitted: 09 Dec 2010 Electronic form version 1.4