Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Single-Electron Capacitance Spectroscopy of Individual Dopants in Silicon MATTHEW DENINNO, MOREWELL GASSELLER, JAMES HARRISON, STUART TESSMER, Michigan State University, SVEN ROGGE, Centre for Quantum Computation and Communication Technology, School of Physics, The University of New South Wales, ROGER LOO, MATTY CAYMAX, IMEC, Belgium —
Motivated by recent transport experiments and proposed atomic-scale semiconductor devices, we present measurements that extend the reach of scanned-probe methods to discern the properties of individual dopants tens of nanometers below the surface of a silicon sample. Using a capacitance-based approach, we have both spatially resolved individual subsurface boron acceptors and spectroscopically detected single holes entering and leaving these minute systems of atoms. A resonance identified as the B^+ state is shown to shift in energy from acceptor to acceptor. The resonance is absent in a control sample that does not contain the boron acceptors. By directly measuring the quantum levels and testing the effect of dopant-dopant interactions, this method represents a valuable tool for the development of future atomic-scale semiconductor devices.

Matthew DeNinno
Michigan State University

Date submitted: 11 Nov 2011 Electronic form version 1.4