Abstract Submitted
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Single electron transistor (SET) devices for probing single donors in Si and for microscopic CV characterization L. SUN, K. R. BROWN, B. E. KANE, University of Maryland — We will describe SET devices fabricated in our group for measurement of single donors. The $Al/Al_2O_3/Al$ SET is fabricated with standard electron-beam lithography and double-angle thermal evaporation. A SiO_2 barrier layer about 20 nm thick isolates the SET from the lightly n-doped silicon, and the substrate is heavily boron doped using high energy ion implantation, and hence conducting at low temperature, beginning a few hundred nm below the SiO_2/Si interface. We will describe our fabrication process and characterization of our devices made with capacitance voltage (CV) measurement. CV measurement is a traditional tool for probing doping, carrier densities and interface trap densities. It can be extended to microscopic regime using SET electrometers. In the SET measurements, after the voltage on the substrate was swept, the recorded coulomb blockade peaks were counted and the capacitance could be extracted. We will compare the macroscopic and microscopic CV measurements in our devices. Finally, we will present the results of electrostatic modeling of our device design and discuss improvements to the design that will enhance the sensitivity to motion of single electrons at donors..

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