Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Scanning capacitance microscopy of atomically-precise donor devices in Si EZRA BUSSMANN, M. RUDOLPH, S.M. CARR, G. SUBRAMANIA, G. TEN EYCK, J. DOMINGUEZ, M.P. LILLY, M.S. CARROLL, Sandia National Labs, QIST TEAM — Recently, a scanning tunneling microscopy (STM) technique to fabricate atomically-precise dopant-based nanoelectronics in Si has been developed. Phosphorus donors are placed via an atomic-precision template formed by STM H-depassivation lithography, then capped with epi-Si and lastly metal contacts are made to the buried donor layer using conventional microfabrication. New challenges are introduced with this approach that center around difficulties to locate and characterize the pattern of buried donors. In this talk, we show that scanning capacitance microscopy (SCM) can image these buried donor nanostructures with sub-100-nm tip-limited resolution. The technique is used to successfully locate and characterize buried donor nanostructures relative to surface alignment marks. This approach relaxes alignment requirements for the STM lithography step and can offer improved alignment of subsequent metallization steps. The SCM technique is also used to nondestructively image the shape of the electronic carrier distribution and characterize the relative doping levels. This work, performed in part at the Center for Integrated Nanotechnologies, a U.S. DOE Office of Basic Energy Sciences user facility, was supported by Sandia's Lab Directed Research and Development Program. Sandia is a multi-program lab operated by Sandia Corp, a Lockheed-Martin Company, for U. S. DOE under Contract DE-AC04-94AL85000.

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Date submitted: 15 Nov 2013 Electronic form version 1.4