Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Development of Atomically Precise Low Dimensional Wires and Tunnel Junctions for Quantum Information and Metrology M. D. STEWART, JR., J. M. POMEROY, CURT A. RICHTER, RICHARD M. SILVER, NEIL M. ZIMMERMAN, K. J. DWYER, JOSEPH A. HAGMANN, BINHUI HU, HYUNSOO KIM, ROY MURRAY, PRADEEP NAMBOODIRI, A. N. RAMANAYAKA, RYAN STEIN, KE TANG, XIQIAO WANG, JOHNATHON WYRICK, National Institute of Standards and Technology, Gaithersburg, MD, 20899 USA — Devices consisting of precisely placed phosphorus atoms in silicon fabricated through STM lithography show great promise for quantum information applications due to the intrinsic reproducibility of using single atoms as qubits and the long coherence times measured in the system. Moreover, these devices have applications in traditional computation, dimensional, and electrical metrology. However, fabrication of these devices remains challenging, requiring extremely clean surfaces, high STM pattern fidelity, restricted thermal budgets coupled with high-quality Si epitaxy, accurate alignment between STM and ex-situ fabrication for robust electrical contact, and device modeling. As an initial step toward our goal of fabricating atomically precise devices completely encased in enriched ^{28}Si, we present electrical measurements of STM patterned, phosphorus wires of different widths as well as tunnel junctions of differing geometry. We will discuss these results in the context of the materials, fabrication, and metrology challenges above and our methods for overcoming them.

Michael Stewart
National Institute of Standards and Technology, Gaithersburg, MD, 20899 USA

Date submitted: 11 Nov 2016 Electronic form version 1.4