Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Measurement, modeling, and simulation of cryogenic SiGe HBT amplifier circuits for fast single spin readout TROY ENGLAND, Sandia National Laboratories, MATTHEW CURRY, CQuIC and Department of Physics and Astronomy, University of New Mexico, STEVE CARR, BRIAN SWARTZENTRUBER, MICHAEL LILLY, NATHAN BISHOP, MALCOLM CARROL, Sandia National Laboratories — Fast, low-power quantum state readout is one of many challenges facing quantum information processing. Single electron transistors (SETs) are potentially fast, sensitive detectors for performing spin readout of electrons bound to Si:P donors. From a circuit perspective, however, their output impedance and nonlinear conductance are ill suited to drive the parasitic capacitance typical of coaxial conductors used in cryogenic environments, necessitating a cryogenic amplification stage. We will discuss calibration data, as well as modeling and simulation of cryogenic silicon-germanium (SiGe) heterojunction bipolar transistor (HBT) circuits connected to a silicon SET and operating at 4 K. We find a continuum of solutions from simple, single-HBT amplifiers to more complex, multi-HBT circuits suitable for integration, with varying noise levels and power vs. bandwidth tradeoffs. This work was performed, in part, at the Center for Integrated Nanotechnologies, a U.S. DOE Office of Basic Energy Sciences user facility. Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a Lockheed-Martin Company, for the U. S. Department of Energy under Contract No. DE-AC04-94AL85000.

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Date submitted: 10 Nov 2014 Electronic form version 1.4