Abstract Submitted
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Flexible Low-power SiGe HBT Amplifier Circuits for Fast Single-shot Spin Readout[1] TROY ENGLAND, MICHAEL LILLY, Sandia National Labs, MATTHEW CURRY, CQuIC and the Dept. of Physics and Astronomy, University of New Mexico, STEPHEN CARR, MALCOLM CARROLL, Sandia National Labs — 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 of coaxial conductors used in cryogenic environments, necessitating a cryogenic amplification stage. We will introduce two new amplifier topologies that provide excellent gain versus power tradeoffs using silicon-germanium (SiGe) heterojunction bipolar transistors (HBTs). The AC HBT allows in-situ adjustment of power dissipation during an experiment and can provide gain in the millikelvin temperature regime while dissipating less than 500 nW. The AC Current Amplifier maximizes gain at nearly 800 A/A. We will also show results of using these amplifiers with SETs at 4 K. 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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