

Abstract Submitted
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SiGe HBT cryogenic preamplification for higher bandwidth donor spin read-out¹ MATTHEW CURRY, CQuIC and Department of Physics and Astronomy, University of New Mexico, STEPHEN CARR, GREG TEN-EYCK, JOEL WENDT, TAMMY PLUYM, MICHAEL LILLY, MALCOLM CARROLL, Sandia National Laboratories — Single-shot read-out of a donor spin can be performed using the response of a single-electron-transistor (SET). This technique can produce relatively large changes in current, on the order of 1 (nA), to distinguish between the spin states. Despite the relatively large signal, the read-out time resolution has been limited to approximately 100 (kHz) of bandwidth because of noise. Cryogenic preamplification has been shown to extend the response of certain detection circuits to shorter time resolution and thus higher bandwidth. We examine a SiGe HBT circuit configuration for cryogenic preamplification, which has potential advantages over commonly used HEMT configurations. Here we present 4 (K) measurements of a circuit consisting of a Silicon-SET inline with a Heterojunction-Bipolar-Transistor (HBT). We compare the measured bandwidth with and without the HBT inline and find that at higher frequencies the signal-to-noise-ratio (SNR) with the HBT inline exceeds the SNR without the HBT inline. This work was performed, in part, at the Center for Integrated Nanotechnologies, a U.S. DOE, Office of Basic Energy Sciences user facility. The work was supported by the Sandia National Laboratories Directed Research and Development Program.

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