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**Ultra-low power microwave manipulation of electron spin ensembles**[1] A.J. SIGILLITO, H. MALISSA[2], A.M. TYRYSHKIN, S.A. LYON, Department of Electrical Engineering, Princeton University — Superconducting coplanar waveguide (CPW) resonators are a promising alternative to standard dielectric resonators for many electron spin resonance experiments. Their high sensitivity and low power requirements make them particularly well suited to applications where the sample volume is small and when microwave heating is a concern. Experiments utilizing rectangular pulses are possible with a peak microwave power of less than 1uW for 400ns pi-rotations, and under 100 uW of peak power for 40ns pi-rotations. However, CPW resonators have an inherently inhomogeneous microwave magnetic field ($B_1$). Therefore, to uniformly rotate all spins in a sample, adiabatic microwave pulses must be used. Here we report on the use of such pulses to correct $B_1$ inhomogeneities spanning an order of magnitude. We also present data indicating single shot sensitivity to $1x10^7$ phosphorus donors in isotopically enriched $^{28}Si$ at 1.7K. These show that superconducting CPW resonators are fully compatible with experiments requiring rapid manipulation of spins in dilution refrigerators.

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