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Current-Tunable NbTiN Coplanar Photonic Bandgap Resonators

A. ASFAW, A. J. SIGILLITO, A. M. TYRYSHKIN, S. A. LYON, Princeton University — Coplanar waveguide resonators have been used in several experimental settings, from superconducting qubits to electron spin resonance. In our particular application of electron spin resonance, these resonators provide increased sensitivity to electron spins due to the small mode volume. Experiments have shown that these resonators can be used to readout as few as 300 spins per shot. Recently, photonic bandgap resonators have been shown to extend the advantages of traditional CPW resonators by allowing spin manipulation both at microwave and radio frequencies, thereby enabling both electron and nuclear spin resonance within the same resonator. We present measurements made using photonic bandgap resonators fabricated with thin NbTiN films which demonstrate microwave tunability of the resonator by modulating the kinetic inductance of the superconductor. Driving a small direct current through the center pin of the resonator allows us to tune the resonant frequency by over 30 MHz around 6.4 GHz while maintaining a quality factor over 8000 at 4.8K. This provides fast and simple tunability of coplanar waveguide resonators and opens new possibilities for multiple frequency electron spin resonance experiments.

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