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Coplanar photonic bandgap resonators for low temperature electron and nuclear magnetic resonance spectroscopy A. J. SIGILLITO, A. M. TYRYSHKIN, S. A. LYON, Department of Electrical Engineering, Princeton University — In recent years, superconducting coplanar waveguide (CPW) resonators have become a useful tool for low temperature pulsed electron spin resonance (ESR), even at dilution refrigerator temperatures. Their small mode volumes make CPW resonators particularly well suited to measuring small numbers of spins near the resonator surface, since in this region the spin sensitivity is very high. While these resonators have proven useful for ESR at single microwave frequencies, it is difficult to also manipulate nuclear spins in electron-nuclear-double resonance (ENDOR) experiments, since manipulation of nuclear spins requires radio frequency (RF) magnetic fields. Ideally one would simply generate these fields by passing RF currents through the CPW, but because conventional CPW resonators are capacitively coupled, they will not transmit low-frequency RF currents. In this talk, we discuss the use of one dimensional photonic bandgap (PBG) resonators to overcome this challenge. PBG resonators are a promising alternative to conventional CPW resonators since they offer high quality factors at microwave frequencies, while simultaneously allowing transmission of nonresonant RF currents below the photonic bandgap. Here, we will discuss PBG resonator designs and present data showing their use for low temperature ESR of donors in ^{28}Si. Initial ENDOR results will also be presented.

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