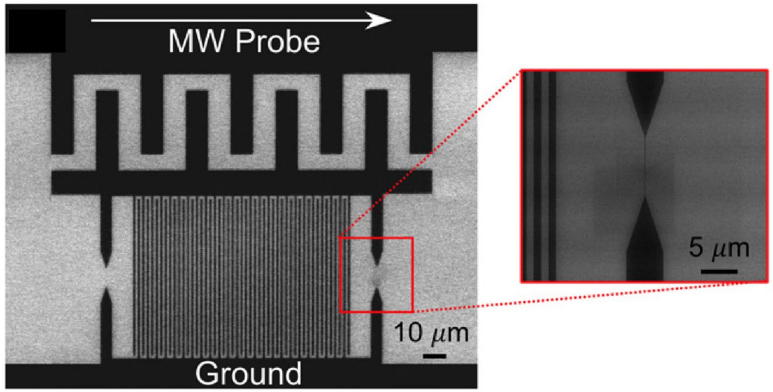
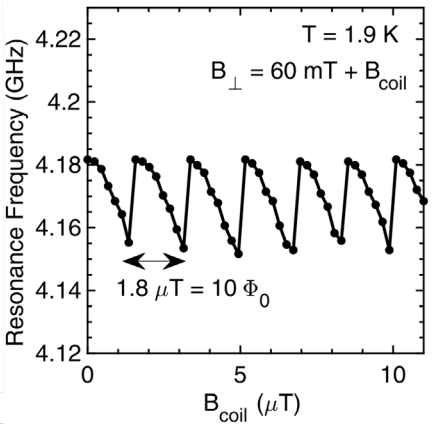
DMR MRSEC Program

Materials Research Science and Engineering Centers (Princeton MRSEC 1420541)

Intellectual Merit: Novel microwave resonators, which can be tuned to different frequencies within nanoseconds, have been developed for probing ultra-coherent electron spin systems. The resonators have enabled rapidly driving and measuring multiple spin systems before they decohere.

Broader Impacts: Sensing small changes in a large background magnetic field is a common but challenging task. For example, a source of decoherence for ultra-coherent spins is the presence of minute fluctuations in the large background applied magnetic field. Lumped-element resonators, incorporating nanoscale sections to enhance the kinetic inductance as seen in the upper figure (dark areas are NbTiN) have demonstrated unprecedented sensitivity (picoTeslas), while in the presence of a substantial (60mT in the lower figure) background magnetic fields.





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Current-tunable microwave resonators and magnetic field sensors using kinetic inductance (IRG-3)