Readout and Control of Spin Systems with Superconducting Circuits

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All electrical readout and control of spin systems with superconducting circuitry is an attractive route for implementing hybrid quantum information processing. Isolated spins, in general, have much longer coherence times than present day superconducting qubits, and thus could be utilized as memory elements. Species with a zero-field splitting (ZFS), such as bismuth doped silicon or NV centers in diamond, are particularly attractive as the absence of a strong magnetic bias field facilitates compatibility with low-loss superconducting circuitry. We present progress towards observation of strong coupling between such spin systems and a superconducting resonator. Information swapping between the spin ensemble and a qubit via the resonator will also be discussed. Furthermore, we will present data on a dispersive nanoSQUID magnetometer with a flux sensitivity of 26 $n\Phi_0/Hz^{1/2}$, capable of detecting a small number of spins.