A single electron spin in an external magnetic field forms a two-level system that can be used to create a spin qubit. Single spins are controlled using electron spin resonance and nearest neighbor spin couplings are achieved using the exchange interaction. A major challenge is to develop methods for coherently coupling spin qubits that are separated by large distances. I will describe our recent efforts to couple a spin qubit to a superconducting quantum bus in the circuit quantum electrodynamics architecture. Our results show that spin dynamics can be controlled using electric fields and the spin-orbit interaction. We find that the microwave field of the superconducting resonator is sensitive to single spin dynamics. Our results suggest that a spin-cavity coupling rate of ~1 MHz may be feasible, allowing spatially separated spin qubits to be coupled by a microwave field.

References: