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Observation of Collective Strong Coupling between a Superconducting Resonator and Bismuth Dopants in Silicon NATANIA ANTLER, R. VIJAY, UC Berkeley, CHRISTOPH WEIS, Lawrence Berkeley National Laboratory, ELI LEVENSON-FALK, UC Berkeley, THOMAS SCHENKEL, Lawrence Berkeley National Laboratory, IRFAN SIDDIQI, UC Berkeley — 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 results on the interaction of a tunable superconducting resonator and an ensemble of Bi spins implanted in an epitaxial layer of 28Si. As the resonator tunes through the ZFS, we observe an avoided crossing indicative of collective strong coupling. We discuss coherence properties as a function of spin density as well as progress on the detection of a small number of spins using a dispersive nanoSQUID magnetometer.

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