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Protecting a spin ensemble against decoherence in the strong-coupling regime of cavity QED STEFAN PUTZ, DMITRY KRIMER, ROBERT AMSUESS, ABHILASH VALOOKARAN, TOBIAS NOEBAUER, JOERG SCHMIEDMAYER, STEFAN ROTTER, JOHANNES MAJER, Technical University of Vienna — Hybrid quantum systems based on spin ensembles coupled to superconducting microwave cavities are promising candidates for robust experiments in cavity quantum electrodynamics (QED) and for future technologies employing quantum mechanical effects. We present recent experimental results of strong coupling between an ensemble of nitrogen-vacancy center electron spins in diamond and a superconducting microwave coplanar waveguide resonator. Although the coupling between a single spin and the electromagnetic field is typically rather weak, collective enhancement allows entering the strong coupling regime. Currently the main source of decoherence in these systems is inhomogeneous spin broadening, which limits their performance for the coherent transfer and storage of quantum information. Here we study the dynamics of a superconducting cavity strongly coupled to an ensemble of nitrogen-vacancy centers in diamond. We experimentally observe for the first time, how decoherence induced by inhomogeneous broadening can be suppressed in the strong-coupling regime, a phenomenon known as "cavity protection" (Putz, S. et al. Nat. Phys. 10, 720–724 (2014)). To demonstrate the potential of this effect for coherent control schemes, we show how appropriately chosen microwave pulses can increase the amplitude of coherent oscillations between the cavity and spin ensemble by two orders of magnitude.

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