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High cooperativity in coupled microwave resonator - ferromagnetic insulator hybrids HANS HUEBL, CHRISTOPH ZOLLITSCH, JOHANNES LOTZE, FREDRIK HOCKE, MORITZ GREIFENSTEIN, ACHIM MARX, RUDOLF GROSS, SEBASTIAN T.B. GROSS, Walther-Meissner-Institut, Bayerische Akademie der Wissenschaften, Garching, Germany — Solid-state based quantum systems (e.g. single spin systems like NV centers in diamond or phosphor donors in silicon, superconducting qubits, nanomagnets) are building blocks for devices exploiting quantum physics phenomena. With different quantum systems available, schemes allowing to couple them move into focus. In particular, a coupling will enable the exchange of information between dressed states. Here, we report the observation of strong coupling between the exchange-coupled spins in gallium-doped yttrium iron garnet, and a superconducting coplanar microwave resonator made from Nb [1]. The measured coupling rate of 450 MHz is proportional to the square-root of the number of exchange-coupled spins and well exceeds the loss rate of 50 MHz of the spin system. This demonstrates that exchange-coupled systems are suitable for cavity quantum electrodynamics experiments, while allowing high integration densities due to their extraordinary high spin densities. Our results furthermore show that experiments with multiple exchange-coupled spin systems interacting via a single resonator are within reach. [1] H. Huebl, C. Zollitsch, J. Lotze, F. Hocke, M. Greifenstein, A. Marx, R. Gross, S.T.B. Goennenwein, arXiv: 1207.6039 (2012).

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