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Control of the cavity reflectivity using a single quantum dot spin SHUO SUN, HYOCHUL KIM, Univ of Maryland-College Park, GLENN SOLOMON, NIST, EDO WAKS, Univ of Maryland-College Park — The implementation of quantum network and distributive quantum information processing relies on interaction between stationary matter qubits and flying photons. The spin of a single electron or hole confined in a quantum dot is considered as promising matter qubit as it possesses microsecond coherence time and allows picosecond timescale control using optical pulses. The quantum dot spin can also interact with a photon by controlling the optical response of a strongly coupled cavity. Yet all the experimental demonstrations of the cavity spectrum control have used neutral dots. The spin-dependent cavity spectrum for a strongly coupled charged quantum dot and cavity system has not been reported. Here, we report an experimental realization of a spin-photon interface using a strongly coupled quantum dot and cavity system. We show large modulation of the cavity reflection spectrum by manipulating the spin states of the quantum dot. The spin-photon interface is crucial for realizing a quantum logic gate or generating hybrid entanglement between a quantum dot spin and a photon. Our results represent an important step towards semiconductor based quantum logic devices and on-chip quantum networks.

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