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Control of nanodot-cavity-waveguide QED and solid-state quantum network REN-BAO LIU, WANG YAO, L. J. SHAM, University of California San Diego, Department of Physics — The interaction of an n-doped nanodot and its electromagnetic environment can be controlled by modifying the quantum states of the environment via cavities and waveguides and driving the dot with optical pulses. Thus an efficient quantum pathway is established to connect in sequence the electron spin states, the trion, the cavity mode, and the photon wavepacket in the waveguide. The photon flying in the directional quantum channel formed by the waveguide, with its shape well-controlled by the optical pulses, can be used either to dump the spin entropy or to carry the quantum information of the spin, which enables the implementations of ultrafast initialization of the spin qubit, quantum non-demolition readout, deterministic single photon sources, and faithful interface between stationary and flying qubits. With these functional elements in hand, scalable quantum networking in solid-state systems is feasible. This work was supported by ARDA/ARO DAAD19-02-1-0183, NSF DMR- 0099572, and QuIST/AFOSR F49620-01-1-0497.

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