

Abstract Submitted  
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**A qubit-photon controlled-NOT gate using a quantum dot strongly coupled to a cavity** HYOCHUL KIM, RANOJOY BOSE, THOMAS SHEN, University of Maryland, GLENN SOLOMON, Joint Quantum Institute, NIST, EDO WAKS, University of Maryland — Strong interactions between matter quantum bits (qubits) and photons play an essential role in quantum information. Quantum dots (QDs) provide a promising implementation of a matter qubit that can be strongly coupled to optical nanocavities, providing a direct light-matter interface. We use this light-matter interface to demonstrate a picosecond timescale controlled NOT logic gate between a QD and a photon, which is a fundamental building block for complex quantum logic. Coherent control of the QD qubit state by optical pulses results in a modification of cavity reflectivity, enabling a conditional bit-flip on the polarization state of a photon incident on the cavity.

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