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Selection of semiconductor quantum dots for multi-qubit encoding using an optical microcavity ANGELA GAMOURAS, MATHEW BRITTON, Dalhousie University, DAN DALACU, PHILIP POOLE, DANIEL POITRAS, ROBIN L. WILLIAMS, National Research Council of Canada, KIMBERLEY C. HALL, Dalhousie University — Controlling the quantum states of excitons or spin-polarized carriers in semiconductor quantum dots (QDs) has been the focus of a considerable research effort in recent years due to the promise of using this approach to develop a solid state quantum computing architecture. In such experiments, the need to isolate the optical response of a single QD represents a formidable challenge, one that is greatest for QDs with emission wavelengths compatible with existing telecommunications infrastructure due to the lower quantum efficiency of the associated detectors. Encoding qubits in ensembles of QDs would greatly facilitate quantum state readout due to the larger optical signals involved, however the spread of optical transition energies limits the fidelity of the control process. Here we report time-resolved differential transmission experiments on QDs in a dielectric Bragg stack optical microcavity. Our results indicate that the angle dependent transmission resonance of the cavity allows for the separate excitation and detection of distinct subsets of QDs in the ensemble differentiated by their optical transition energies. These findings demonstrate the feasibility of developing a scalable computing architecture based on multi-qubit encoding using semiconductor QDs.

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