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Charge noise in InAs/GaAs coupled quantum dot devices[1]
CAMERON JENNINGS, PARVEEN KUMAR, CYPRIAN CZARNOCKI, Univ of California - Merced, ALLAN BRACKER, SAMUEL CARTER, DANIEL GAMMON, Naval Research Laboratory, MICHAEL SCHEIBNER, Univ of California - Merced — Semiconductor quantum dots (QDs) trap individual charge carriers in discrete metastable bound states, optically addressable through interband absorption and photoluminescence. Tunnel-coupled QD pairs (CQDs) additionally host interdot exciton states whose large electric dipole moment allows for in-situ tuning of the transition energy over tens of meV with an applied electric field, conversely acting as a sensitive probe of local electric field. Measurements of the photoluminescence and absorption spectra in diode-embedded InAs/GaAs CQDs reveal interdot states with a significantly broader optical transition linewidth than the shorter-lived single-dot states, indicating spectral wandering from a noisy local charge environment, which limits the resolution obtainable with CQD-based metrology. We gain insight into the spatial distribution and dynamics of charged lattice defects and techniques to minimize fluctuation-induced broadening by analyzing the dependence of the lineshape on optical excitation conditions in different CQD diode samples, in conjunction with Monte Carlo simulations of fluctuating charge traps.

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