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Simultaneous Adiabatic Rapid Passage in Multiple Quantum Dots (G)

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The initialization and control of the quantum states of excitons in semiconductor quantum dots (QDs) may be achieved using coherent optical pulses, making these systems of interest for solid state approaches to quantum simulators [1] and single photon sources [2]. Quantum state control via adiabatic rapid passage (ARP), which is insensitive to variations in the QD parameters (dipole moment, transition energy) provides an effective strategy for achieving robust quantum state inversion, and has been the subject of intensive study in recent years [3,4]. Robust state inversion is essential for the development of triggered single and entangled photon sources [2,5] and all optical switches utilizing quantum dot states [6]. The extension of ARP to the control of ensembles of QDs would be beneficial for parallel state initialization [7], and may enable the formation of a Bose-Einstein condensate in a quantum dot ensemble [8]. Building on previous demonstrations of ARP in a single quantum dot using subpicosecond pulses [9] and simultaneous deterministic control of excitons in multiple quantum dots [10,11], we demonstrate simultaneous adiabatic rapid passage in multiple quantum dots and evaluate the inversion efficiency of ARP for a range of control pulse parameters.

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