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Optical Control of an Electron Spin in a Single Self-Assembled Quantum Dot[1] KATHERINE TRUEX, ERIK D. KIM[2], BO SUN, XIAODONG XU[3], DUNCAN G. STEEL, University of Michigan, ALLAN BRACKER, DANIEL GAMMON, Naval Research Laboratory, LU SHAM, University of California San Diego — Optically driven self-assembled quantum dots are a leading candidate for next generation quantum computers because of their high speed and potential for relatively compact design. In this approach, each dot is charged with a single electron (or hole) whose spin serves as the quantum bit ("qubit"). We present our recent experimental results demonstrating qubit initialization, rotation through a stimulated Raman excitation, and optical readout, as well as a geometric phase gate. Optically induced coupling between the dots through the negatively charged exciton should allow for the critical entangling operations and for conditional two-qubit gates. Conditional gates combined with single qubit gates form the building blocks from which any quantum computing algorithm can be constructed.

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