Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Parallel single qubit gates in distant semiconductor quantum dots using engineered optical pulses ANGELA GAMOURAS, REUBLE MATHEW, Dalhousie University, SABINE FREISEM, DENNIS DEPPE, University of Central Florida, KIMBERLEY HALL, Dalhousie University — Semiconductor quantum dots are promising for the development of a scalable system of qubits as such a platform would benefit from established semiconductor fabrication capabilities. Here we report the demonstration of simultaneous high-fidelity π and 2π single qubit gates on excitons in two uncoupled self-assembled quantum dots within the micron-scale control laser focal spot by engineering the phase of the broad-bandwidth femtosecond control pulse. The pulse phase is engineered using optimal quantum control (OQC), which has been applied to the optimization of quantum gates in atomic and molecular systems in recent years [1] and is extended here to gate optimization in a system of solid state qubits. The deterministic control of two distant, uncoupled qubits we have achieved constitutes a step towards scaling of semiconductor-based quantum computing platforms, and may enable the development of small quantum simulators based on complex instruction set quantum computing using semiconductor quantum dots [2]. [1] Campbell et al. Phys. Rev. Lett. 105, 090502 (2010); Kirchmair et al., New J. Phys. 11, 023002 (2009); Amitay et al., Chem. Phys. Lett. 359, 8 (2002). [2] Sanders et al., Phys. Rev. A 59, 1098 (1999).

Kimberley Hall
Dalhousie University

Date submitted: 15 Nov 2013 Electronic form version 1.4