Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Pulse Sequences for Exchange-Based Quantum Computation NICK BONESTEEL, ROBERT CIPRI, DANIEL ZEUCH[1], Dept. of Physics and NHMFL, Florida State University — Switching on and off, or pulsing, the isotropic exchange interaction between pairs of spin-1/2 particles (e.g. electrons in an array of quantum dots) is universal for quantum computation, provided the logical qubits of the computer are suitably encoded. A specific scheme for carrying out such exchange-based quantum computation was provided by DiVincenzo et al.[2] who, through numerical minimization of a cost function, found a sequence of 19 pulses that carry out a CNOT (up to single qubit rotations) on two logical qubits. In this scheme, the logical qubits are encoded using triplets of spin-1/2 particles with total spin 1/2, and so the total spin of any two qubits can be either 0 or 1. One limitation of the pulse sequence found in Ref. 2 is that it works only if this total spin is 1 (a requirement which can, in principle, be met by initialing the computer in a magnetic field). We present a new class of pulse sequences which carry out two-qubit gates on logical qubits using the same encoding as Ref. 2 but which work regardless of the value of this total spin. These new sequences, consisting of approximately 50 pulses, are obtained analytically, without the need for numerical minimization.

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[2]D. DiVincenzo et al., Nature **408**, 339 (2000).

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Date submitted: 20 Nov 2009 Electronic form version 1.4