Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Quantum Measurements of Coupled Systems L. FEDICHKIN, M. SHAPIRO, M. I. DYKMAN, Michigan State University — Quantum measurements are often performed on coupled systems. Such measurements are of interest for various proposed realizations of a quantum computer where the qubit-qubit coupling may not be completely turned off. Because of the coupling, the stationary state wave functions are not fully localized on individual qubits even where the energies of neighboring qubits are tuned away from each other. As a result, an instantaneous projective single-qubit measurement gives the state population with an error. We show that the error may be significantly reduced. This is accomplished by tuning the detector close to resonance with the measured qubit. The qubit- detector coupling should be small compared to the decay width γ of the excited level of the detector. For such tuning, there is a broad time interval where the probability of an error in detecting an excitation on the resonant qubit and distinguishing it from other excitations is smaller than that for a projective measurement by a factor $\sim (\gamma/\Delta E)^2$, where ΔE is the difference in the qubit energies. The results bear on the scalability of quantum computers with permanently coupled qubits.

Leonid Fedichkin
Michigan State University

Date submitted: 19 Nov 2008