Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

General-Purpose Quantum Simulation with Prethreshold Superconducting Qubits EMILY PRITCHETT, IQC Waterloo, COLIN BENJAMIN, University of Georgia, ANDREI GALIAUTDINOV, UC Riverside, MICHAEL GELLER, ANDREW SORNBORGER, PHILLIP STANCIL, University of Georgia, JOHN MARTINIS, UC Santa Barbara — We introduce a protocol for the fast simulation of n-dimensional quantum systems on n-qubit quantum computers with tunable couplings. A mapping is given between the control parameters of the quantum computer and the matrix elements of an n- dimensional real (but otherwise arbitrary) Hamiltonian that is simulated in the n- dimensional *single-excitation subspace* of the quantum simulator. A time- dependent energy/time rescaling minimizes the simulation time on hardware having a fixed coherence time. We demonstrate how three tunably coupled superconducting phase qubits can simulate a three-channel molecular collision using this protocol. The method makes a class of general-purpose time-dependent quantum simulation practical with today's sub-thershold-fidelity qubits.

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Date submitted: 11 Feb 2011 Electronic form version 1.4