Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

High fidelity gates and states in a 5 Xmon qubit Josephson quantum processor, part II: multiqubit logic R. BARENDS, J. KELLY, A. MEGRANT, UC Santa Barbara, A. VEITIA, UC Riverside, E. JEFFREY, D. SANK, T. WHITE, J. MUTUS, J. BOCHMANN, B. CAMPBELL, Y. CHEN, Z. CHEN, B. CHIARO, A. DUNSWORTH, I. HOI, C. NEILL, P. O'MALLEY, C. QUINTANA, P. ROUSHAN, A. VAINSENCHER, J. WENNER, UC Santa Barbara, A. KOROTKOV, UC Riverside, A.N. CLELAND, J.M. MARTINIS, UC Santa Barbara — One of the critical challenges in quantum computing is to employ simultaneous, high fidelity quantum logic gates across a system. Here, we show how a novel implementation of a fast, adiabatic controlled-phase gate achieves fidelities between 99.0 and 99.4 % across all pairs in a 5 Xmon qubit quantum processor. We also show that nearest as well as next nearest neighbor qubits can be operated simultaneously without sacrificing fidelity. This, combined with low Z control crosstalk allows for direct control of single or multiqubit subspaces. To showcase the addressability of the qubits and modularity of the logic set, we use single and two-qubit gates to construct N=3, 4 and 5 Greenberger-Horne-Zeilinger states with fidelities of 96 %, 86 % and 82 %, characterized by quantum state tomography.

Rami Barends
UC Santa Barbara

Date submitted: 14 Nov 2013 Electronic form version 1.4