Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

High fidelity all-microwave controlled-phase gate for superconducting qubits by cavity vacuum displacement HANHEE PAIK, Raytheon BBN Technologies and Yale University, D. ZHOU, M.D. REED, G. KIRCHMAIR, L. FRUNZIO, S.M. GIRVIN, R.J. SCHOELKOPF, Yale University — We demonstrate a new all-microwave controlled phase entangling gate for the superconducting qubits in the three-dimensional circuit QED (3D cQED) architecture. The gate exploits the strong coupling between qubits and a cavity, wherein the cavity frequency dispersively shifts depending on the qubit register state. We off-resonantly displace the cavity vacuum state; each computational state evolves a different phase due to the dispersive coupling, yielding a conditional phase. While designed to exploit the advantages of the 3D cQED architecture, the gate requires only dispersive coupling, making the gate applicable to a wide variety of superconducting qubit architectures. We demonstrate 98% gate fidelity evaluated by quantum process tomography, and will discuss how appropriate choices of system parameters could increase this number and how we could minimize the gate infidelity due to measurement induced dephasing and non-adiabatic gate procedure.

Hanhee Paik
Raytheon BBN Technologies and Yale University

Date submitted: 17 Jan 2013 Electronic form version 1.4