

Abstract Submitted  
for the MAR14 Meeting of  
The American Physical Society

**Efficient three-qubit entangling (Toffoli) gates via excited states in qubit-cavity systems.** THOMAS REINECKE, SOPHIA ECONOMOU, Naval Research Laboratory, Washington, District of Columbia 20375, DMITRY SOLENOV, National Research Council, National Academies, Washington, District of Columbia 20001 — Efficient multi-qubit quantum operations are crucial for further development of quantum information processing using available physical designs. We report our results on efficient three-qubit entangling operations in qubit-cavity systems. The proposed gate design is based on non-commutativity of single-qubit pulse controls that can be achieved for systems in which auxiliary states above the qubit subspace are available. It does not rely on dynamical tuning of energy states, and, unlike traditional decomposition approaches, it provides efficiency comparable to that of a single control-NOT operation. We will focus on the transmon qubit systems, which have recently demonstrated coherence times suitable for multi-qubit computation. Other systems will also be discussed.

Thomas Reinecke  
Naval Research Laboratory, Washington, District of Columbia 20375

Date submitted: 14 Nov 2013

Electronic form version 1.4