

Abstract Submitted  
for the MAR16 Meeting of  
The American Physical Society

**Multimode cavity QED 1: State preparation and readout**

RAVI NAIK, NELSON LEUNG, SRIVATSAN CHAKRAM, YAO LU, NATHAN EARNEST, Physics Department and James Franck Institute, University of Chicago, PETER GROSZKOWSKI, JENS KOCH, Department of Physics and Astronomy, Northwestern University, DAVID SCHUSTER, Physics Department and James Franck Institute, University of Chicago — Quantum information processing requires the creation of scalable architectures with long lived, highly coherent, readily addressable quantum states. A promising architecture consists of Fock states of photons in coupled superconducting microwave cavity arrays, with state preparation and readout achieved by coupling to superconducting qubits via circuit QED. We describe experiments on such multimode circuit QED devices consisting of 1D chains of 10-20 tunnel coupled 2D high-Q microwave resonators coupled to a single, flux-tunable transmon qubit. We use parametric sideband transitions [1], implemented via flux modulation of the transmon, to realize arbitrary states of the photonic qubits. We also discuss ongoing efforts to engineer multimode architectures comprised of coupled 3D microwave cavities in which photon lifetimes can exceed 10 ms [2]. [1] J. D. Strand et al, Physical Review B 87.22 (2013) [2] M. Reagor et al, Applied Physics Letters 102, 192604 (2013)

Ravi Naik  
Physics Department and James Franck Institute, University of Chicago

Date submitted: 06 Nov 2015

Electronic form version 1.4