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Multimode cavity QED 3: Universal quantum gates NELSON LEUNG, RAVI NAIK, 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 — A promising architecture for scalable quantum computation consists of photonic qubits in multimode superconducting cavities, coupled to superconducting qubits. In this talk, we describe schemes to implement pairwise universal gate operations between the photonic qubits. We use parametric sideband interactions [1] mediated by a superconducting qubit to realize arbitrary single photonic qubit gates, as well as the C-phase gate between arbitrary pairs of photonic qubits, thereby realizing universal gate operations. We also describe schemes to realize beam splitter and phase shifter elements in this multimode architecture, allowing for circuit QED realizations of linear optical quantum computation schemes.
[1] J. D. Strand et al, Physical Review B 87.22 (2013)

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