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Achieving high contrast on/off ratios using the multipole circuit QED architecture RAVI NAIK, DAVID C. MCKAY, Physics Department and James Franck Institute, University of Chicago, LEV S. BISHOP, JQI and CMTC, University of Maryland, College Park, DAVID I. SCHUSTER, Physics Department and James Franck Institute, University of Chicago — An outstanding goal for scalable quantum information processing is to design gates (qubit-qubit interactions) that are fast, yet can be switched off with high contrast to permit high fidelity single qubit operations. We implement a possible candidate for such a gate using the multipole circuit QED architecture which consists of superconducting Josephson junction qubits coupled via multiple strongly interacting microwave cavities. In this architecture, the on/off ratio is expected to scale exponentially in the number of cavities (poles). Here we report on measurements of the off-resonant coupling rate for two flux-tuned transmon qubits coupled through three strongly coupled planar resonators (a 3-pole filter). We will also discuss progress towards a scheme to implement multipole QED for flux insensitive qubits in 3D microwave cavities where the longest coherence times for superconducting qubits have been demonstrated.

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