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Deterministic Creation of an Inter-Chip Bell State without Feedback JAMES WENNER, C. NEILL, Z. CHEN, B. CHIARO, A. DUNSWORTH, B. FOXEN, C. QUINTANA, University of California, Santa Barbara, JOHN M. MARTINIS, Google and University of California, Santa Barbara, GOOGLE QUANTUM HARDWARE TEAM — Creating Bell states between qubits on separate chips deterministically and without feedback requires the transfer of quantum states via a traveling photonic mode. Efficient transfer requires a shaped release to the photonic mode and managing the capture of this mode to minimize reflections. We implement this using 5GHz coplanar resonators on separate chips with tunable coupling to an inter-chip transmission line. We characterize the device coherence and demonstrate the ability to release a single-frequency shaped pulse into the transmission line and efficiently capture a shaped pulse. By combining these, we transfer single qubit states along with the single-qubit half of a Bell state with optimally-shaped transfer waveforms. We achieve a 68% fidelity for the inter-chip Bell state. This inter-chip entanglement will allow for quantum computation using more qubits beyond what fits on a single chip.

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