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Using a Superconducting Resonator with Frequency-Compensated Tunable Coupling to Transfer a Quantum State Deterministically and Directly JAMES WENNER, C. NEILL, C. QUINTANA, B. CAMPBELL, Z. CHEN, B. CHIARO, A. DUNSWORTH, P. O'MALLEY, A. VAINSENCHER, University of California, Santa Barbara, T. WHITE, R. BARENDS, Y. CHEN, A. FOWLER, E. JEFFREY, J. KELLY, E. LUCERO, A. MEGRANT, J. MUTUS, M. NEELEY, P. ROUSHAN, D. SANK, Google, Santa Barbara, JOHN M. MARTINIS, University of California and Google, Santa Barbara — Deterministic direct quantum state transfer between devices on different chips requires the ability to transfer quantum states between traveling qubits and fixed logic qubits. Reflections must be minimized to avoid energy loss and phase interference; this requires tunable coupling to an inter-chip line while the two devices are at equal frequencies. To achieve this, we use a 6GHz superconducting coplanar resonator with tunable coupling to a 50 Ohm transmission line. We compensate for the resulting shift in resonator frequency by simultaneously tuning a second SQUID. We measure the device coherence and demonstrate the ability to release a single-frequency shaped pulse into the transmission line, efficiently capture a shaped pulse, and deterministically and directly transfer a quantum state.

James Wenner
University of California, Santa Barbara

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