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Applications of a Circuit QED Quantum Channel Constructor CHAO SHEN, KYUNGJOO NOH, VICTOR V. ALBERT, STEFAN KRASTANOV, MICHEL H. DEVORET, ROBERT J. SCHOELKOPF, S. M. GIRVIN, LIANG JIANG, Yale University — Quantum channels can describe all transformations allowed by quantum mechanics. We provide an explicit universal protocol to construct all possible quantum channels, using a single qubit ancilla with quantum non-demolition readout and adaptive control. Our construction is efficient in both physical resources and circuit depth, and can be demonstrated using superconducting circuits and various other physical platforms. There are many applications of quantum channel construction, including system stabilization and quantum error correction, Markovian and exotic channel simulation, implementation of generalized quantum measurements and more general quantum instruments. Efficient construction of arbitrary quantum channels opens up exciting new possibilities for quantum control, quantum sensing and information processing tasks.

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