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Quantum mirror transport of qudits and continuous variables and an implementation in Circuit-QED JASON TWAMLEY, GERARDO ANDRES PAZ SILVA, STOJAN REBIC, Centre for Quantum Computer Technology, Macquarie University, Sydney — We expand on our previous work [J. Fitzsimons and J. Twamley, Phys. Rev. Lett. 97, 090502 (2006)], to derive a globally controlled automata-like protocol for the perfect transmission of quantum information in a chain made up of qudits or a chain made up of harmonic oscillators. The resulting protocol results in perfect spatial reflection of the entire quantum state of the chain about its midpoint. Quantum information can be encoded and then processed in continuous variables if one can engineer highly squeezed states [S. Lloyd and S. L. Braunstein, Phys. Rev. Lett. 82, 1784 (1999)]. We show that appropriately driving a superconducting coplanar microwave cavity coupled to a Cooper-pair box qubit can generate very high squeezings of the cavity mode. We consider a linear array of coplanar cavities nearest-neighbor coupled by Cooper-pair boxes. By controlling the coupling strengths of the cavities to the coupling-CPB qubits and the decoherence rates of the latter with time, we show that we can initialize the cavities to be in highly squeezed CV states, and then execute globally controlled quantum mirroring of the entire chain of CV qubits. We finally show that with extra control on the end cavities of the chain we can further execute universal CV quantum computation.

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