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Stochastic master equation approach for analysis of remote entanglement with Josephson parametric converter amplifier[1] M. SILVERI, Department of Physics, Yale University, E. ZALYS-GELLER, M. HATRIDGE, Z. LEGHTAS, M.H. DEVORET, Department of Applied Physics, Yale University, S.M. GIRVIN, Department of Physics, Yale University — In the remote entanglement process, two distant stationary qubits are entangled with separate flying qubits and the which-path information is erased from the flying qubits by interference effects. As a result, an observer cannot tell from which of the two sources a signal came and the probabilistic measurement process generates perfect heralded entanglement between the two signal sources. Notably, the two stationary qubits are spatially separated and there is no direct interaction between them. We study two transmon qubits in superconducting cavities connected to a Josephson Parametric Converter (JPC). The qubit information is encoded in the traveling wave leaking out from each cavity. Remarkably, the quantum-limited phase-preserving amplification of two traveling waves provided by the JPC can work as a which-path information eraser. By using a stochastic master approach we demonstrate the probabilistic production of heralded entangled states and that unequal qubit-cavity pairs can be made indistinguishable by simple engineering of driving fields. Additionally, we will derive measurement rates, measurement optimization strategies and discuss the effects of finite amplification gain, cavity losses, and qubit relaxations and dephasing.

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