Abstract Submitted
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Experimental purification of two-atom entanglement in an ion trap array[1] D. LEIBFRIED, R. REICHLE, E. KNILL, J. BRITTON, R. B. BLAKESTAD, J. D. JOST, C. LANGER, R. OZERI, S. SEIDELIN, D. J. WINELAND, National Institute of Standards and Technology, Boulder, Colorado 80305, USA — Entanglement is a crucial resource for quantum information processing and quantum communication. Distributed entanglement is created by preparing an entangled pair of quantum particles in one location and transporting one member of the pair to another location. Decoherence during transport reduces the fidelity of the entanglement. "Entanglement purification" [C. Bennett *et al.*, Phys. Rev. Lett. **76**, 722 (1996)] can improve the fidelity after the transport using local quantum operations and classical communication between locations to distill high fidelity entangled pairs from lower fidelity ones. Proof-of-principle experiments distilling entangled photon pairs have previously been carried out, however, distilled pairs were obtained with low probability of success and required destruction of the entangled pairs, making them unavailable for further processing. We have implemented efficient and non-destructive entanglement purification with atomic (ion) quantum bits in a multi-zone trap. Two noisy entangled pairs were created and distilled into one higher fidelity pair available for further use. Success probabilities were above 35 %.

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