

LINKING TRAPPED IONS AND PHOTONS

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Trapped atomic ions form the most reliable quantum memories, owing to the extreme isolation of internal electronic states such as ground-state hyperfine levels from the environment. Quantum gates between nearby trapped ion qubit memories are realized by applying optical spin-dependent forces and relying on the ions' mutual Coulomb interaction. A promising hybrid approach to extend trapped ion gates over long distances is through an optical photonic coupling. We report the entanglement of the two trapped ion qubit memories at a distance of 1 meter, with near-perfect detection efficiency of the qubits. While this entanglement resource is probabilistic, it is not post-selective and therefore can be utilized for long-distance quantum communication and large-scale quantum computation.