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Quantum interference of two photons emitted by two trapped Yb ions[1] KELLY C. YOUNGE, DAVID L. MOEHRING, STEVEN OLMSCHENK, DZMITRY MATSUKEVICH, PETER MAUNZ, MARTIN J. MADSEN, LUMING DUAN, CHRIS MONROE, FOCUS Center and Department of Physics, University of Michigan — Distant, entangled qubits represent a universal resource for quantum communication protocols and distributed quantum computing. One method to entangle two distant particles involves detecting a single photon from each particle after the photons have interfered. We demonstrate this two-photon quantum interference by using an ultrafast laser to excite two ytterbium ions trapped in spatially separated rf Paul traps. The emitted photons are transmitted through optical fibers to achieve high, stable mode overlap on a beam splitter. Two-photon interference, along with the excellent state preparation and detection available in trapped ion systems, should allow the two ions to be entangled without involving their motion. Such a quantum link can be used as a fundamental resource for large-scale quantum networks and scalable quantum computers.

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