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Integration of single-photon from a trapped ion into a photonic chip[1] UDAY SAHA, JAMES D. SIVERNS, JOHN HANNEGAN, University of Maryland, College Park, MIHIKA PRABHU, ERIC BERSIN, SAUMIL BANDYOPADHYAY, JACQUES CAROLAN, Massachusetts Institute of Technology, QUDSIA QURAISHI, United States Army Research Laboratory, DIRK ENGLUND, Massachusetts Institute of Technology, EDO WAKS, University of Maryland, College Park — Trapped ions are promising qubit systems for implementing quantum networks because of their long coherence times, ability to generate entangled photons as well as high fidelity single- and two-qubit gates. To establish quantum networks in a scalable way, we need photonic integrated circuits to interfere single photons from trapped ions and entangle different trapped ion systems on-demand. However, every trapped ion has strong dipole transitions in ultra-violet and visible wavelength and emits entangled single photons in that regime making them incompatible for present-day photonic foundry. In this work, we integrate the single photons from a trapped barium ion in a photonic Mach-Zehnder interferometer which can be used as a building block of photonic processors for implementing large quantum networks. For this integration, we first generate C-band telecom single photons from barium ions. Then, we integrate and route these single photons into foundry fabricated silicon nitride Mach-Zehnder interferometer. These results will enable a new generation of compact and reconfigurable integrated photonic devices that can serve as efficient quantum interconnects for quantum computers and sensors.

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