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Integrated Technologies for Large-Scale Trapped-Ion Quantum Information Processing C. SORACE-AGASKAR, S. BRAMHAVAR, D. KHARAS, MIT Lincoln Laboratory, K.K. MEHTA, Massachusetts Institute of Technology, W. LOH, R. PANOCK, C.D. BRUZEWICZ, R. MCCONNELL, MIT Lincoln Laboratory, R.J. RAM, Massachusetts Institute of Technology, J.M. SAGE, J. CHIAVERINI, MIT Lincoln Laboratory — Atomic ions trapped and controlled using electromagnetic fields hold great promise for practical quantum information processing due to their inherent coherence properties and controllability. However, to realize this promise, the ability to maintain and manipulate large-scale systems is required. We present progress toward the development of, and proof-of-principle demonstrations and characterization of, several technologies that can be integrated with ion-trap arrays on-chip to enable such scaling to practically useful sizes. Of particular use are integrated photonic elements for routing and focusing light throughout a chip without the need for free-space optics. The integration of CMOS electronics and photo-detectors for on-chip control and readout, and methods for monolithic fabrication and wafer-scale integration to incorporate these capabilities into tile-able 2D ion-trap array cells, are also explored.

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