Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Toward Visible-Wavelength Multi-Species Trapped-Ion Quantum Logic COLIN BRUZEWICZ, ROBERT MCCONNELL, WILLIAM LOH, JEREMY SAGE, JOHN CHIAVERINI, MIT Lincoln Laboratory — Large-scale quantum information processing and quantum networking using trapped ions will likely require multiple atomic species to allow for sympathetic cooling of ion vibrational modes, quantum state measurement without decoherence of unmeasured qubits, and interfacing with flying qubits. Inter-species quantum logic and quantum state transfer are key components of these tasks, particularly in the cases of quantum-error-correction syndrome extraction or remote entanglement generation using sympathetic ions. Multi-species logic and manipulation in a large processor will require control light of several wavelengths delivered to many ion-trap array sites in parallel, a challenge at short wavelengths. We report on progress toward sympathetic cooling and intra- and inter-species logic using Sr^+ and Ca^+ ions in surface-electrode trap arrays. These species admit optical control fields that can be routed using photonic waveguides straightforwardly integrated into the trap-array structure as their relevant transitions are accessible using visible and near-infra-red light.

John Chiaverini
MIT Lincoln Laboratory

Date submitted: 29 Jan 2016 Electronic form version 1.4