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Fast transport of ions with reduced dependence on transport duration[1] S.L. TODARO, D.H. SLICHTER, National Institute of Standards and Technology Boulder, D.J. WINELAND, University of Oregon, A.C. WILSON, D. LEIBFRIED, National Institute of Standards and Technology Boulder — Despite recent progress in trapped-ion quantum computation, scaling to large numbers of qubits remains a challenge. For trapped-ion qubits, one proposal for extending beyond tens of ions in a single string is the 'quantum CCD (QCCD) architecture. In this approach, ion qubits are transported between trapping zones dedicated to memory, readout and logical operations. To maximize the clock speed of QCCD processors, fast ion transport with low motional excitation is needed. In most prior QCCD experiments, low motional excitation was achieved by slow (adiabatic) ion transport between trap zones, and ion transit times were much longer than typical laser-driven gate interactions. Faster-than-adiabatic transport between neighboring trap zones has been previously demonstrated in relatively large three-dimensional traps, but low motional excitation was only achieved with particular choices of the transport duration. We report multi-zone faster-than-adiabatic transport in a surface electrode trap with reduced dependence of the final motional excitation on the duration of the transport.

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S.L. Todaro
National Institute of Standards and Technology Boulder

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