Abstract Submitted
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**Quantum information experiments with a micro-fabricated, cryogenic, surface-electrode ion trap**[1] A.C. WILSON, K.R. BROWN, C. OSPELKAUS, Y. COLOMBE, D. LEIBFRIED, D.J. WINELAND, NIST — Although the basic components of a quantum information processor using trapped ions have been demonstrated, scaling to large numbers of qubits and operations so that algorithms and simulations of practical importance can be implemented remains a major challenge. This is technically challenging because it requires significant improvements in the precision with which quantum states of ions are prepared, manipulated and measured. Solutions are multi-disciplinary - involving micro-fabrication, cryogenics, integrated photonic devices, as wells as materials and surface science. Here we report progress from experiments that address a range of these issues. We use a micro-fabricated, cryogenic, surface-electrode ion trap, with two closely-spaced independently controlled potential wells. In the first experiment with this new apparatus, we implement a scheme for coupling two ions trapped in separate wells, and demonstrate tunable energy exchange at approximately the single quantum level. A second experiment investigates errors in single qubit gates (rotations) with the use of randomized bench-marking.

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