

Ground-State Cooling of Multiple Trapped Ions to Initialize a Quantum Register¹ BRIAN KING, C.S. WOOD, C.J. MYATT, Q.A. TURCHETTE, D. LEIBFRIED, W.M. ITANO, C. MONROE, D.J. WINELAND, NIST Ion Storage Group, Boulder, CO — Preparing a register of *qubits* (two-level systems) in a pure state is a necessary step towards performing quantum logic operations to entangle the qubits. We report preparation by laser cooling of the ground state of the collective modes of motion of two $^9\text{Be}^+$ ions held in an elliptical rf (Paul) trap. We have found that heating of the non-center-of-mass modes is substantially suppressed relative to that of the center-of-mass modes, suggesting their importance in future experiments.

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