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Sympathetic cooling and trapped-ion quantum logic gates[1] DAVID HANNEKE, NIST Ion Storage Group, J.D. JOST, J.P. HOME, J.M. AMINI, R. OZERI*, C. LANGER**, J.J. BOLLINGER, D. LEIBFRIED, D.J. WINELAND
— Motional excitation in a trapped-ion quantum information processor degrades the performance of quantum logic gates. Excitations arise from noise emanating from the electrodes and from shuttling ions. Additional ions of a different species can be used to sympathetically cool qubit ions' motion, re-initializing the ground state while leaving intact quantum information stored in the internal state of a qubit ion. Here, we describe an experimental demonstration of a two-qubit entangling operation implemented after sympathetic cooling. We avoid decoherence during ion transport by using a field-independent hyperfine transition of $^9Be^+$ as our qubit.
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