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Towards a wire-mediated coupling of trapped ions ROBERT CLARK, Institut für Quantenoptik und Quanteninformation, Innsbruck, Austria and Massachusetts Institute of Technology, Cambridge, MA, TONY LEE, NIKOS DANIILIDIS, SANKARANARAYANAN S., HARTMUT HÄFFNER, Institut für Quantenoptik und Quanteninformation, Innsbruck, Austria — Most schemes for ion trap quantum computation rely upon the exchange of information between ion-qubits in the same trap region, mediated by their shared vibrational mode. An alternative way to achieve this coupling is via the image charges induced in a conducting wire that connects different traps. This was shown to be theoretically possible by Heinzen and Wineland in 1990, but some important practical questions have remained unaddressed. Among these are how the presence of such a wire modifies the motional frequencies and heating rates of trapped ions. We thus have realized this system as a 1 mm-scale planar segmented rf ion trap combined with an electrically floating gold wire of 25 microns diameter and length 1 cm. This wire is placed close to trapped ions using a set of piezoelectric nanopositioners. We present here experimental measurements of the motional frequencies and heating rates of a single trapped calcium ion as the wire is moved from 3.0 mm to 0.2 mm away from the ion. We discuss the implications of these results for achieving wire-mediated coupling in the present apparatus, as well as in future improved setups.

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