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Operation of a microfabricated 2D trap array

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We investigate scalable surface ion traps for quantum simulation and quantum computing. We have developed a microfabricated surface trap consisting of two parallel linear trap arrays with 11 trapping sites each. The trap design requires two interconnected metal layers to address the island-like DC electrodes and a third to shield the substrate.
The trap fabrication is carried out by Infineon in an industrial facility, which allows for complex electrode designs and ensures high process reproducibility.
We demonstrate trapping and shuttling of multiple ions in the trap array, and form square and triangular ion-lattice configurations with up to six ions. We characterize stray electric fields and measure ion heating rates between 131(13) and 470(50) ph/s in several trapping sites [1].
Furthermore, the design of the trap array allows for tuning of the inter-ion distance across the lattice, which we will use to demonstrate motional coupling of ions in neighboring sites.
[1] Philip C. Holz et al., Adv. Quantum Technol. 3.11 (2020)

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