Abstract Submitted
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A high performance microfabricated surface ion trap DANIEL LOBSER, MATTHEW BLAIN, RAYMOND HALTLI, ANDREW HOLLOWELL, MELISSA REVELLE, DANIEL STICK, CHRISTOPHER YALE, PETER MAUNZ, Sandia National Labs — Microfabricated surface ion traps present a natural solution to the problem of scalability in trapped ion quantum computing architectures. We address some of the chief concerns about surface ion traps by demonstrating low heating rates, long trapping times as well as other high-performance features of Sandia's high optical access (HOA-2) trap. For example, due to the HOA's specific electrode layout, we are able to rotate principal axes of the trapping potential from 0 to 2π without any change in the secular trap frequencies. We have also achieved the first single-qubit gates with a diamond norm below a rigorous fault tolerance threshold [1,2], and a two-qubit Mølmer-Sørensen gate [3] with a process fidelity of 99.58(6). Here we present specific details of trap capabilities, such as shuttling and ion reordering, as well as details of our high fidelity single- and two-qubit gates. [1] R. Blume-Kohout et al. arXiv:1606.07674. [2] P. Aliferis and J. Preskill, Phys. Rev. A 79, 012332 (2009). [3] A. Sørensen and K. Mølmer, Phys. Rev. Lett. 82, 1971 (1999)

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