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Microfabricated Microwave-Integrated Surface Ion Trap[1]
MELISSA C. REVELLE, MATTHEW G. BLAIN, RAYMOND A. HALTLI, ANDREW E. HOLLOWELL, CHRISTOPHER D. NORDQUIST, PETER MAUNZ, Sandia National Laboratories, Albuquerque, NM — Quantum information processing holds the key to solving computational problems that are intractable with classical computers. Trapped ions are a physical realization of a quantum information system in which qubits are encoded in hyperfine energy states. Coupling the qubit states to ion motion, as needed for two-qubit gates, is typically accomplished using Raman laser beams. Alternatively, this coupling can be achieved with strong microwave gradient fields[2]. While microwave radiation is easier to control than a laser, it is challenging to precisely engineer the radiated microwave field. Taking advantage of Sandia's microfabrication techniques, we created a surface ion trap with integrated microwave electrodes with sub-wavelength dimensions. This multi-layered device permits co-location of the microwave antennae and the ion trap electrodes to create localized microwave gradient fields and necessary trapping fields. Here, we characterize the trap design and present simulated microwave performance with progress towards experimental results.

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[2]U. Warring *et al.,* PRL **110**, 173002 (2013); T. P. Harty *et al.,* PRL **117**, 140501 (2016).

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