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Microwave-driven two-qubit entangling gate with $^{9}Be^{+}$ ions in a scalable microfabricated surface-electrode ion trap

Two-qubit gates with high fidelities are an essential ingredient to perform universal operations on a quantum information processor.
One promising candidate to implement such a device are trapped ions in microfabricated surface-electrode ion traps as envisioned by the QCCD architecture [1, 2].
In this approach, the quantum information is encoded in the electronic spin states of the ions, which can be moved between highly specialized trap zones via ion transport.
In the work presented here, we demonstrate a QCCD-compatible module for entangling gate operations following the Mølmer-Sørensen protocol using near-field microwaves [3] instead of the typically used laser approach.
We utilize the microwave-driven gate interaction to entangle two $^{9}Be^{+}$ ions and find the resulting state preparation fidelity of a maximally entangled state to be higher than 98% [4].

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