Abstract Submitted
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Coupling of ions to superconducting circuits[1] SOENKE MOELLER, NIKOS DANIILIDIS, HARTMUT HAEFFNER, UC Berkeley — We present experimental progress towards coupling the motion of ion strings to the resonant mode of a superconducting high-quality tank circuit. We consider such a coupling as the first step towards interfacing trapped ions with superconducting qubits. In our demonstration experiment, we aim to reduce the temperature of the resonant mode of the tank circuit by extracting energy from the circuit via laser cooling an ion string. One of the main experimental challenges is to construct a tank circuit with such a high quality factor Q that the ion-resonator coupling exceeds the environment-resonator coupling. Currently, we achieve Q = 60 000 at a frequency of $\omega = 2\pi \cdot 5.7$ MHz. For this mode, the coupling time-scale to the environment is on the order of 50 Hz. We plan to use a trap with an ion-electrode distance on the order of 100 μm resulting in an ion-resonator coupling of 1 kHz. This coupling should reduce the electronic temperature of the resonant mode by a factor of 80 below the ambient temperature. For our trap geometry we expect a minimum trap depth of 50 meV for a trap drive frequency of 52 MHz with a 200 V amplitude. This results radial trap frequencies of 5.7 MHz.

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