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Impact of surface cleaning and ion-electrode distance on trapped ion motional heating JONATHON SEDLACEK, MIT Lincoln Laboratory, JULES STUART, Massachusetts Institute of Technology, COLIN BRUZEWICZ, ROBERT MCCONNELL, JEREMY SAGE, JOHN CHIAVERINI, MIT Lincoln Laboratory — Motional heating of trapped ions can limit the fidelity of quantum logic operations as well as the accuracy and precision of ion-based atomic clocks. Hence, there is a clear need to characterize and understand the underlying mechanisms of this heating, and ultimately, reduce its magnitude. Here, we perform both *in situ* and *ex situ* plasma cleaning as well as *ex situ* ion milling to reduce the motional heating rates measured using surface-electrode ion traps at room temperature. Following surface treatment, we observe a significant change in the electrode-temperature dependence of the measured heating rate. Results showing the ion-electrode distance dependence having $1/d^4$ scaling in an uncleaned trap will also be presented. Strategies to mitigate motional heating and constraints put on current theoretical models will be discussed.

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