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**The effect of electrode surface roughness on the motional heating rate of electromagnetic trapped ions** KUAN-YU LIN, GUANG HAO LOW, ISAAC CHUANG, Massachusetts Inst of Tech-MIT — Electric field noise is a major source of motional heating in trapped ion quantum computation. While it is well known that this noise is influenced by trap electrode geometry in patch potential and surface adsorbate models, this has only been analyzed for smooth surfaces. We investigate the dependence of electric field noise on the roughness of surface electrodes by deriving a Greens function describing this roughness, and evaluating its effects on adsorbate-surface binding energies. At cryogenic temperature, surface roughness is found to exponentially enhance or suppress heating rate, depending on the density distribution of surface adsorbates. Our result suggests that heating rates can be tuned over orders of magnitude by careful engineering of electrode surface profiles.

Reference

[1] Q. Turchette, B. King, D. Leibfried, D. Meekhof, C. Myatt, M. Rowe, C. Sackett, C. Wood, W. Itano, C. Monroe, et al., Physical Review A 61, 063418 (2000).

Kuan-Yu Lin  
Massachusetts Inst of Tech-MIT

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