Abstract Submitted
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An ab-initio microscopic theory of anomalous heating in planar ion traps[1] H.R. SADEGHPOUR, ITAMP, Harvard-Smithsonian Center for Astrophysics, A. SAFAVI-NAINI, ITAMP/Dept of Physics MIT, P. RABL, IQOQI, Innsbruck, P.F. WECK, Advanced Systems Analysis, Sandia — Anomalous heating of trapped ions limits the scalability of the planar trap architecture for quantum computation. Measurements of the electric field noise present in ion traps indicate that the noise-induced heating scales as the inverse fourth power of the distance from the trap electrodes to the ion and its spectral density scales with the inverse of frequency [1]. These measurements also suggest that some thermally activated random process is at work. In this work, we present an ab-initio theory of this noise due to oscillating dipoles on the trap electrode surface [2]. The dipoles are formed when atoms are adsorbed on the trap surface, whose interaction with the surface is described with density functional theory (DFT). We present calculations for the spectral noise density and its distance, frequency and temperature dependencies. We consider both independent and correlated dipoles.

[1] Q. A. Turchette et. al., Phys. Rev. A. 61, 63418 (2000).
[2] A. Safavi-Naini, P. Rabl, P. F. Weck, H. R. Sadeghpour, Phys. Rev. A. 84, 023412 (2011).

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