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Electric-Field Noise above a Thin Dielectric Layer on Metal Electrodes MUIR KUMPH, IBM, CARSTEN HENKEL, Universitaet Potsdam, PETER RABL, TU Wien, MICHAEL BROWNNUTT, The University of Hong Kong, RAINER BLATT, University of Innsbruck — The electric-field noise above a layered structure composed of a planar metal electrode covered by a thin dielectric is evaluated and it is found that the dielectric film considerably increases the noise level, in proportion to its thickness. Importantly, even a thin (mono) layer of a low-loss dielectric can enhance the noise level by several orders of magnitude compared to the noise above a bare metal. Close to this layered surface, the power spectral density of the electric field varies with the inverse fourth power of the distance to the surface, rather than with the inverse square, as it would above a bare metal surface. Furthermore, compared to a clean metal, where the noise spectrum does not vary with frequency (in the radio-wave and microwave bands), the dielectric layer can generate electric-field noise which scales in inverse proportion to the frequency. For various realistic scenarios, the noise levels predicted from this model are comparable to those observed in trapped-ion experiments. Thus, these findings are of particular importance for the understanding and mitigation of unwanted heating and decoherence in miniaturized ion traps.

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