

Correlation spectroscopy with multi-qubit-enhanced phase estimation

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Precision spectroscopy on trapped ions subject to correlated dephasing can reveal a multitude of information in the absence of any single-particle coherences. We present measurements of ion-ion distances, transition frequency shifts and single-shot measurements of laser-ion detunings by analyzing multi-particle correlations in linear and planar Coulomb crystals of up to 91 ions. We show that the information contained in N-particle correlations reduces the measurement uncertainty as compared to the case where only two-particle correlations are analyzed.

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