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Experimental Demonstration of Quantum Imaging by Coherent Enhancement ROBERT MCCONNELL, COLIN BRUZEWICZ, MIT Lincoln Laboratory, GUANG HAO LOW, THEODORE YODER, MIT, JOHN CHIAVERINI, JEREMY SAGE, MIT Lincoln Laboratory, ISAAC CHUANG, MIT —
Classical (incoherent) imaging requires scattering many photons from a target to be imaged and provides resolution which improves statistically with the square root of the number of scattered photons, and hence with the square root of interrogation time. In contrast, quantum imaging by coherent enhancement [1] utilizes coherent excitation of the target to provide imaging resolution which improves linearly with time, achieving the Heisenberg limit for scaling. We present experimental progress towards the realization of quantum-enhanced imaging in a trapped-ion system. A narrow-linewidth laser drives a long-coherence-time transition in a confined $^{88}Sr^{+}$ ion; precise phase control over the excitation sequence allows an optimally narrow and unambiguous excitation of the ion as a function of laser intensity which results in very precise localization of the target within the profile of the addressing beam. This technique may have applications in radar imaging, where long-wavelength radiation is used to penetrate clouds or other obstructions but where large diffraction-limited spot size ordinarily limits resolution.
[1]. G. H. Low, T. J. Yoder, and I. L. Chuang, PRL **114**, 100801 (2015).

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