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Quantum State Detection through Repetitive Mapping D. B. HUME, University of Colorado, T. ROSENBAND, J. C. BERGQUIST, D. J. WINELAND, NIST, Boulder, Colorado — State detection plays an important role in quantum information processing and quantum-limited metrology. In some cases the quantum system of interest can only be detected with poor efficiency. One approach to overcoming this limitation is to couple the primary quantum system to an ancillary quantum system used for measurement [1]. The measurement process consists of mapping the primary state to the ancilla followed by ancilla detection. If this can be done without affecting the projected populations of the primary system, the measurement may be repeated. In this case, detection fidelity can be significantly higher than both the fidelity of state transfer and the intrinsic measurement fidelity of the ancillary system. Using two ions as the primary and ancillary systems ($^{27}Al^{+}$and $^{9}Be^{+}$ respectively) held in a harmonic trap, we demonstrate near unit fidelity measurement despite imperfect information transfer and ancilla detection.

[1] P.O. Schmidt, et. al. Science 309 749 (2005)

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