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Adaptive Quantum State Detection through Repetitive Mapping[1] DAVID HUME, NIST/ University of Colorado, TILL ROSENBAND, DAVID WINELAND, JIM BERGQUIST, NIST — State detection plays an important role in quantum information processing and quantum-limited metrology. In some quantum systems direct detection is impossible or inefficient. This can be overcome by coupling the primary quantum system to an ancillary system used for measurement [1]. The measurement process consists of mapping the primary state to the ancilla followed by ancilla detection. If the measurement does not affect the projected populations of the primary system, it may be repeated yielding higher fidelity. Using two trapped ion species ($^{27}Al^{+}$and $^{9}Be^{+}$) as the primary and ancillary systems, we demonstrate high-fidelity measurement despite imperfect information transfer and ancilla detection. An adaptive measurement strategy allows for multiple qubit state discrimination with one ancilla. This opens the way for several applications in quantum information processing and advances our optical clock effort. [1] P.O. Schmidt, et. al. Science 309 749 (2005)

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