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Experimental recovery of a partially-collapsed qubit JEFFREY SHERMAN, National Institute of Standards and Technology, Boulder, Colorado, USA, MICHAEL CURTIS, DAVID SZWER, DAVID ALLCOCK, GERGELY IMREH, DAVID LUCAS, ANDREW STEANE, University of Oxford — We implemented and tested a process for recovering quantum information following a weak measurement whereby a qubit may spontaneously decay outside the computational basis. Alike in spirit and form to a classical spin echo, the recovery protocol and expected fidelity is, in principle, perfect and independent of the initial qubit state. To demonstrate the partial decay and recovery process, we engineered a novel qubit from the Zeeman spin-states of a single trapped $^{40}Ca^{+}$ ion's excited $3D_{5/2}$ electronic state. Tuning the strength of a near-resonant laser pulse allows us to realize a variable qubit decay rate. Even with a spontaneous decay probability of 0.8, we demonstrated recovery of the qubit's state vector with a fidelity of $F = 0.986$, a better result than is achievable merely by post-selection of results from un-decayed qubits.

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