Undoing a quantum measurement

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In general, a quantum measurement yields an undetermined answer and alters the system to be consistent with the measurement result. This process maps multiple initial states into a single state and thus cannot be reversed. This has important implications in quantum information processing, where errors can be interpreted as measurements. Therefore, it seems that it is impossible to correct errors in a quantum information processor, but protocols exist that are capable of eliminating them if they affect only part of the system. In this work we present the deterministic reversal of a fully projective measurement on a single particle, enabled by a quantum error-correction protocol in a trapped ion quantum information processor. We further introduce an in-sequence, single-species recooling procedure to counteract the motional heating of the ion string due to the measurement.

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