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Quantum Undemolition: Undoing quantum measurement by erasing information ALEXANDER KOROTKOV, University of California, Riverside, ANDREW JORDAN, University of Rochester — Extensive research into controllable quantum systems and detectors has led to a reexamination of the very nature of quantum measurement in a condensed matter context. Quantum detectors used in recent experiments naturally give rise to weak quantum measurements, where the detector output is not perfectly correlated with the state of the measured system. According to textbook quantum measurements, wavefunction collapse of an unknown state is essentially an irreversible process; the measurement record is indelible. Contrary to this conventional wisdom, we will demonstrate how to undo a weak quantum measurement, showing that quantum information is written in pencil, not pen. The undoing procedure has a finite probability of success, and it is accompanied by a clear experimental indication of whether or not the undoing has been successful. Our proposed phenomenon can be experimentally realized using quantum dot (charge) or superconducting (phase) qubits.

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