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Prediction and retrodiction for a continuously monitored superconducting qubit DIAN TAN, KATER MURCH, Physics Department, Washington University, St. Louis, STEVEN WEBER, IRFAN SIDDIQI, Quantum Nanoelectronics Laboratory, Department of Physics, University of California, Berkeley CA, KLAUS MOELMER, Department of Physics and Astronomy, Aarhus University, Ny Munkegade 120, DK-8000 Aarhus C, Denmark, MURCH GROUP (WASHINGTON UNIVERSITY) TEAM, KLAUS MOELMER(AARHUS UNIVERSITY) COLLABORATION, SIDDIQI GROUP(UNIVERSITY OF CALIFORNIA, BERKELEY) COLLABORATION — We use weak measurement to track single trajectories of a superconducting qubit embedded in a three-dimensional cavity which is subjected to continuous monitoring and driven unitary evolution. The information inferred from the measurement record is incorporated in a density matrix ρ_t, which is conditioned on probe results until t, and in an auxiliary matrix E_t, which is conditioned on probe results obtained after t. We employ a stochastic master equation to propagate ρ_t forward in time to make predictions about weak and strong qubit measurements performed at time t. After these measurements, the system is subject to further probing and unitary evolution, and we propagate E_t backward in time to make retrodictions about past measurements. Our experiments show that the predictions conditioned on ρ and E are more confident and nontrivially different than the predictions based only on ρ.

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