Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Unitarity, Feedback, Interactions – Dynamics Emergent from Repeated Measurements. PAULINA CORONA UGALDE, University of Waterloo, Institute for Quantum Computing, NATACHA ALTAMIRANO, ROBERT MANN, University of Waterloo, MAGDALENA ZYCH, University of Queensland — Modern measurement theory dispenses with the description of a measurement as a projection. Rather, the measurement is understood as an operation, whereby the system's final state is determined by an action of a completely positive trace non-increasing map and the outcomes are described by linear operators on the system, distributed according to a positive-operator valued measure (POVM). The POVM approach unifies the theory of measurements with a general description of dynamics, the theory of open quantum systems. Engineering a particular measurement and engineering a particular dynamics for the system are thus two complementary aspects of the same conceptual framework. This correspondence is directly applied in quantum simulations and quantum control theory . With this motivation, we study what types of dynamics can emerge from a model of repeated short interactions of a system with a set of ancillae. We show that contingent on the model parameters the resulting dynamics ranges from exact unitarity to arbitrary fast decoherence. For a series of measurements the effective dynamics includes feedback-control, which for a composite system yields effective interactions between the subsystems. We quantify the amount of decoherence accompanying such induced interactions. The simple framework used in the present study can find applications in devising novel quantum control protocols, or quantum simulations.

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Date submitted: 10 Nov 2016 Electronic form version 1.4