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Quantum State Reconstruction and Random Evolution[1] CARLOS RIOFRIO, SETH MERKEL, University of New Mexico, STEVEN FLAMMIA, Perimeter Institute for Theoretical Physics, IVAN DEUTSCH, University of New Mexico — In order to perform quantum state reconstruction, the set of measured observables must be informationally complete. In this work, we explore the performance of the reconstruction algorithm developed by Silberfarb et al. (PRL 95, 030402(2005)) under the asumption that the quantum system undergoes random evolution. We show that in that case, although the measurements do not span the space of all density matrices, we are able to reconstruct the set of all pure states and almost-all mixed states with very high fidelities. We find that this is only possible after the inclusion of the physical constraint of positivity. Using as an example the quantum states stored in ground-electronic hyperfine manifold (F=3) of an ensemble of Cs atoms controlled by time-varying magnetic fields and nonlinear light-shift, we give a possible physical realization of this protocol provided that the dynamics exhibits a classically chaotic phase space. For this purpose, we chose the well studied quantum kicked top dynamics.

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