Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Decay of the Loschmidt echo in an open, out of equilibrium quantum system SILVIA VIOLA KUSMINSKIY, MARK THOMAS, Freie Universität Berlin, TORSTEN KARZIG, California Institute of Technology, FELIX VON OPPEN, Freie Universität Berlin — The dynamics of a classical heavy particle moving in a quantum environment is determined by a Langevin equation which encapsulates the effect of the environment-induced reaction forces on the particle. For an open quantum system these include a Born-Oppenheimer force, a dissipative force and a stochastic force due to shot and thermal noise. Recently it was shown that these forces can be expressed in terms of the scattering matrix of the system by considering the classical heavy particle as a time-dependent scattering center. At the same time, it is well known that small changes in a scattering potential can have a profound impact on a fermionic system due to the Anderson orthogonality catastrophe. A useful tool to study this effect on the dynamics of the quantum system is the Loschmidt echo. In this work we study the decay of the Loschmidt echo due to a small change in a scattering potential, for an open quantum system which is out of equilibrium due to an applied bias potential. With methods of scattering theory, and relying on the expressions obtained previously for the environment-induced forces on a heavy particle, we determine the decay of the Loschmidt echo in terms of the fluctuations and dissipation of the system.

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Date submitted: 15 Nov 2013 Electronic form version 1.4