Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Critical dynamics of decoherence[1] BOGDAN DAMSKI, HAITAO QUAN, WOJCIECH ZUREK, Los Alamos National Laboratory — Quantum decoherence is the key to how the classical world emerges from the quantum substrate. Its understanding is also essential for creation of nanoscale devices that need long-time quantum coherence for their operation (e.g., quantum computers). Here we study for the first time how the non-equilibrium quench of the environment affects decoherence of the quantum system. Namely, we investigate decoherence of a central spin-1/2 surrounded by the environment that is driven through a quantum critical point. The quantum Ising model in the transverse field serves as the environment. Thus, we combine extensive studies of decoherence with rapidly growing field of dynamics of quantum phase transitions. We show that coherence of the central spin undergoes rapid decay that encodes critical exponents of the environment as well as exhibits certain periodicities that allow for identification of the central spin – environment coupling and ground state fidelity. Our discussion is based on a remarkably simple analytical expression verified through numerical simulations.

[1]This work is supported by U.S. Department of Energy through the LANL/LDRD Program

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Date submitted: 20 Nov 2009 Electronic form version 1.4