Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Quantum annealing via quantum diffusion mediated by environment VADIM SMELYANSKIY, Google, DAVIDE VENTURELLI, University Space Research Association, ALEJANDRO PERDOMO-ORTIZ, University of California Santa Cruz, SERGEI KNYSH, Stinger Ghaffarian Technologies, Inc, MARK DYKMAN, Department of Physics and Astronomy, Michigan State University — We show that quantum diffusion near the quantum critical point can provide an efficient mechanism of open-system quantum annealing. The analysis refers to an Ising spin chain in a slowly decreasing transverse field coupled to bosonic heat bath. The diffusion facilitates recombination of collective (multi-spin) excitations in the chain. It sharply slows down as the system moves away from the quantum critical region, leading to significant spatial fluctuations even in the absence of disorder. The excitation density reached by then non-monotonically depends on the annealing rate. We find that obtaining an approximate solution via diffusion-mediated quantum annealing can be faster than via classical Glauber dynamics or the closed-system Kibble-Zurek mechanism. We study the scaling of the excitation density with the temperature and coupling constant to environment.

vadim Smelyanskiy
Google

Date submitted: 06 Nov 2015 Electronic form version 1.4