Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Quantum annealing of a semiclassical spin chain with defects MARK DYKMAN, Michigan State Univ, VADIM SMELYANSKIY, NASA Ames Research Center — We consider an Ising chain of ferromagnetically coupled large spins in a varying transverse magnetic field $H \equiv H_x$. The analysis is semiclassical. When the transverse field is strong, the energy spectrum has a gap. Once this gap goes to zero with decreasing H, for $H = H_c$ there is formed a Bogoliubov-type spatially uniform "condensate", where the spin projections on the z-axis are $\propto (H_c - H)^{1/2}$. This opens a gap for excitations $\propto H_c - H$. We then consider a point defect that corresponds to the change δJ_n in the coupling constant between n and $n+1$ spins. For $\delta J_n > 0$, there emerges a pair of localized excitations for large H. As H decreases, for some δJ_n-dependent $H > H_c$ there is formed a local cloud of spins with nonzero z-component around the defect. It grows with further decreasing H. Remote defects interact very weakly. For small but nonzero temperatures, different defects should be able to align in the opposite directions, leading to nucleation of kinks between them. We study the evolution of the system as H decreases, the possibility of forming kinks, kink tunneling, and the ultimate approach of the system to the ground state. We also study the case of antiferromagnetic defects.

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Date submitted: 14 Nov 2014 Electronic form version 1.4