Large-scale Monte Carlo simulation of layered spin glasses

Yuki Rea Hamano[1], Hajime Yoshino[1,2]
[1]Dept. of Physics, Osaka Univ., [2]Cybermedia Center, Osaka Univ.

Purpose: To understand the complex low-temperature behavior of layered spin glasses.

Outling: Perform large-scale exchange Monte Carlo simulation of the p-spin spin glass model on a layered, sparse, random graph in order to verify the predictions made by the mean-field replica theory in the dense limit N>>c>>1, where N is the number of spins and c is the connectivity.

Results: The numerical simulations for an L=3 system show qualitative agreement with the theoretical results: (a) There is a glass transition to the apparent one-step RSB phase in layer 2 (see center panel in Fig. 1). (b) The apparent one-step RSB transition in layer 2 simultaneously induces a glass-to-glass transition to the mixed (full RSB + one-step RSB) phase in layer 1. On the other hand, the numerical simulations also raise the possibility that layer 2 is not in a pure one-step RSB phase at finite connectivity but instead may have a continuous, full RSB part, in contrast to the infinite-connectivity result. More in-depth research is required to elucidate this difference.

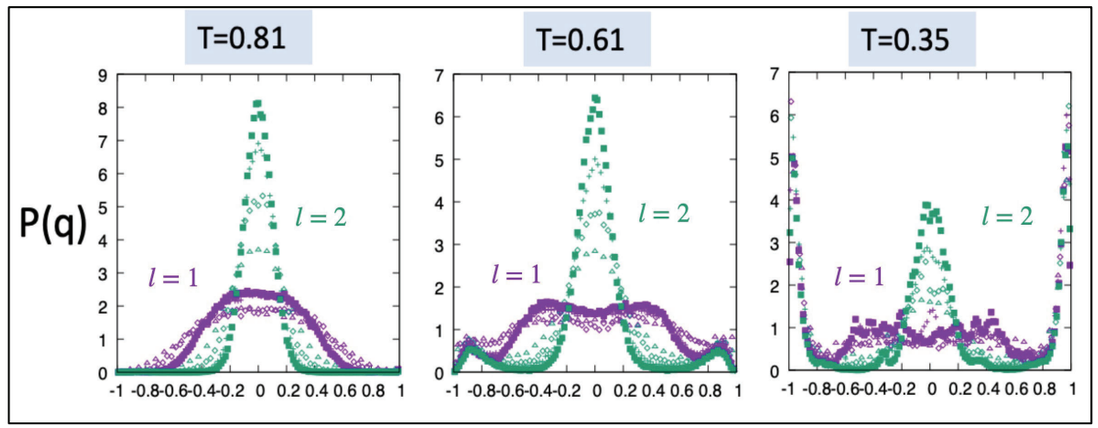

Figure 1. Overlap distribution P(q) of (L, c)=(3, 64) system at different temperatures and different widths N. Solid squares denote N=128.

System: SQUID General Purpose CPU nodes