Nature of the Spin Glass State

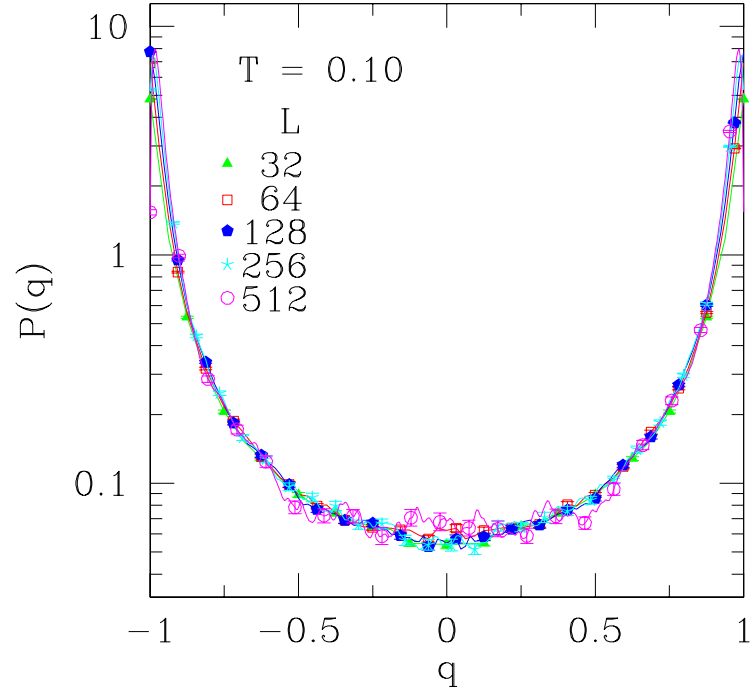
Peter Young, Santa Cruz. DMR 0086287

Young scientists trained: M. Palassini, H. G. Katzgraber

Spin Glasses at low temperature, are not in equilibrium. What is the state that they try to get to, but never reach? Two proposals:

- Droplet theory
- "Replica Symmetry breaking (RSB)"

Simulations are restricted to small sizes $N = L^3$ with $L \lesssim 10$. However, in one dimension, with long range interactions, a much bigger range of sizes can be studied, $L \lesssim 512$.



Results

- Droplet theory: "order parameter distribution" $P(q)$; contribution near $q = 0$ vanishes at large L.
- RSB: $P(q)$ should be finite at $q = 0$ even for large L.
- The simulations in 1-d find data in accord with RSB up to $L = 512$ (see figure).

Conclusions

- Droplet theory, if correct, only applies only for very large sizes. (Applicability to experiments?)
- From other simulations, actual situation seems to be intermediate between droplet and RSB.
- Consequences for non-equilibrium behavior of spin glasses and other "frustrated systems"?