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Canonical and Non-Canonical Ising Spin Glass on Randomly Rewired Regular Lattices

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Abstract content
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Spin glass (SG) has been an active research field in theoretical and experimental condensed matter physics in the last four decades It is a random magnetic system mainly characterized by a frozen spin orientation at low temperatures. Frustration and randomness are considered to be the key ingredients for a system to exhibit SG behavior. The so-called non-canonical SG is a new type of SGs[1] where frustration and randomness are different from that of the canonical one where both ferromagnetic (FM) and antiferromagnetic (AF) couplings exist. It is a purely AF system on structures with random connectivity and frustration due to a topological factor. The existence of this new type of SGs on various structures, such as scale free network, rewired lattices and regular graphs for models such as Ising and Heisenberg spins has been reported by several previous studies [2, 3, 4, 5, 6].

Further elaboration of this system is required, in particular for a comparison to the canonical type of each corresponding model such as Ising and Heisenberg model on the same irregular structure. Here we study the Ising models on rewired regular lattices of both canonical and non-canonical SG model. We used Replica Exchange of Monte Carlo method [7] and calculate the SG order parameter to search for SG phase. We estimate the critical temperature and exponents of the SG phase observed.

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