Abstract for GR-TR Conference on Statistical Mechanics and Dynamical Systems

Talk Invited — Invited Talk

Universality aspects of the random-bond Blume-Capel models on the square and simple cubic lattices

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The effects of bond randomness on the universality aspects of the ferromagnetic Blume-Capel models are investigated by "Extended Ensemble Monte Carlo" strategies, both square and simple cubic lattices are considered.

For the square lattice we implement a two stage Wang-Landau scheme. We find that, the second-order phase transition, emerging (under random bonds) from the second-order regime of the pure model, has the same values of critical exponents as the 2d Ising universality class, with the effect of the disorder on the specific heat being well described by double-logarithmic corrections. However, the emerging second-order transition from the first-order regime of the pure model belongs to a distinctive universality class.

In the case of the simple cubic lattice, we employ a MC scheme based on cluster algorithms and parallel tempering. We find that the emerging second-order phase transition from the second-order regime of the pure model, is compatible with the universality class of the 3d random Ising model. Furthermore, we find evidence that, the emerging second-order transition from the first-order regime of the pure model, belongs to a new universality class. The first finding reinforces the scenario of a single universality class for the 3d Ising model with the three well-known types of quenched uncorrelated disorder (bond randomness, site- and bond-dilution). The second, amounts to a strong violation of universality principle of critical phenomena. The present ex-first-order transition shows sharp differences from the corresponding ex-first-order transitions emerging from the weak and strong first-order transitions of the 3d three-state and four-state Potts models, respectively.

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[1] A. Malakis et. al., *Phys. Rev. E.* **79**, 011125 (2009).

[2] A. Malakis et. al., *Phys. Rev. E.* **81**, 041113 (2010).

[3] A. Malakis et. al., *Phys. Rev. E.* **85**, 061106 (2012).