Contribution ID: **39** Type: **not specified**

Relaxation dynamics and the free energy near the phase boundary of the 3D kinetic Ising model

Thursday, 27 November 2025 17:16 (1 minute)

We study the relaxation dynamics of the three-dimensional kinetic Ising model along the phase boundary, focusing on the relaxation behavior [1] and the evolution of the underlying free-energy landscape[2]. We find that the average equilibration time increases significantly as the temperature moves far below the critical point T_c, and exhibits ultraslow relaxation along the first-order phase transition line. Dynamic scaling persists both near T_c and at T « T_c, with the latter showing a larger dynamic exponent. By tracking the time evolution of the free-energy landscape, we show that complex fine structures emerging at low temperatures trap random initial configurations, producing a strong delay in equilibration - the effect we identify as ultra-slow relaxation. This phenomenon is characterized by a self-divergence of the relative variance of equilibration times, revealing a previously unrecognized dynamic signature of first-order phase transitions.
[1]Xiaobing Li, Ranran Guo, Mingmei Xu et al., Phys. Rev. E 111, 064115 (2025).
[2] Ranran Guo, Xiaobing Li,Yuming Zhong et al., arXiv:2504.14878v2.

Primary authors: 郭, 冉冉 (ccnu); 李, 笑冰; 许, 明梅 (CCNU); 吴, 元芳 (CCNU)

Presenter: 郭, 冉冉 (ccnu)

Session Classification: Poster