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The evolution from Non-equlibruim to equlibruim of 2D Ising model

Summary

We use the Metropolis algorithm to simulate the two-dimensional Ising system. At different temperature or different system size, the time required for the simulating system to reach equilibrium is different in the zero magnetic field. When the temperature is close to critical point Tc, the equilibrium time become large due to the critical fluctuation.

The correlation time τ is obtained by calculating the time-displacement autocorrelation function. At T=Tc,there is a maximum.At the critical point, the correlation time increases with the increase of system size, which is critical slowing down.
Calculating the shows a of the magnetization at vanishing external field, we find that the third-order moment, the fourth-order moment, and the sixth-order moment all have sign change at the critical point. Compared with equilibrium cumulants, non-equilibrium cumulants show a bigger error.

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