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Kinetic Gaussian Model with Long-Range Interactions

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Abstract: In this paper dynamical critical phenomena of the Gaussian model with long-range interactions decaying as $1/r^{d+\delta}$ ($\delta>0$) on d-dimensional hypercubic lattices (d=1, 2, and 3) are studied. First, the critical points are exactly calculated, and it is found that the critical points depend on the value of δ and the range of interactions. Then the critical dynamics is considered. We calculate the time evolutions of the local magnetizations and the spin-spin correlation functions, and further the dynamic critical exponents are obtained. For one-, two- and three-dimensional lattices, it is found that the dynamic critical exponents are all z=2 if $\delta>2$, which agrees with the result when only considering nearest neighboring interactions, and that they are all δ if $0<\delta<2$. It shows that the dynamic critical exponents are independent of the spatial dimensionality but depend on the value of δ.

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