MONTE CARLO SIMULATIONS OF THE 3D ASHKIN-TELLER MODEL: CONTINUOUS PHASE TRANSITION LINES

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9.7 cm

The Hamiltonian of the Ashkin-Teller model is $-\beta\mathcal{H} = H = \sum_{[i,j]}\{K_2(s_i s_j + \sigma_i\sigma_j) + K_4 s_i\sigma_i s_j\sigma_j\}$, where $\beta = (k_B T)^{-1}$, k_B is the Boltzmann's constant, T the temperature, $[i,j]$ denotes summation over nearest neighboring lattice sites and K_i are the couplings, with $i = 2$ or 4.
In this paper we report the simulations of Monte Carlo type based on the invariance of the Binder cumulant Q, which is the ratio of the square of the second moment of the order parameter to its fourth moment, in the critical point [1]. The phase transition points T_c were determined from the analysis of the cumulant Q_L of cubic samples of the linear size $L \leq 30$. Gibbs distribution was sampled using the Metropolis algorithm. Each point on the phase diagram was calculated using 10^7 to 10^8 MCS.
We have applied the accurate estimates of the critical exponents of the 3D Ising model [1] in the finite-size-scaling analysis to calculate the locations of continuous phase transitions points on the (K_4, K_2) phase diagram of the 3D AT model. Owing to the application of finite-size-scaling analysis we not only allocated points on the phase diagram with a precision of at least 4 decimal digits, but also we confirmed the continuous Ising-like character of phase transitions.

[1] H.W.J. Blöte, E. Luijten, J.R. Heringa, J. Phys. A28 (1995) 6289

13.4 cm

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