

# The Finite-Size Scaling Study of the Specific Heat and the Binder Parameter of the Two-Dimensional Ising Model for the Fractals Obtained by Using the Model of Diffusion-Limited Aggregation

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The two-dimensional Ising model with nearest-neighbour pair interactions is simulated on the Creutz cellular automaton by using the finite-size lattices with the linear dimensions  $L = 80, 120, 160$ , and  $200$ . The temperature variations and the finite-size scaling plots of the specific heat and the Binder parameter verify the theoretically predicted expression near the infinite lattice critical temperature. The approximate values for the critical temperature of the infinite lattice  $T_c = 2.287(6)$ ,  $T_c = 2.269(3)$ , and  $T_c = 2.271(1)$  are obtained from the intersection points of specific heat curves, Binder parameter curves, and the straight line fit of specific heat maxima, respectively. These results are in agreement with the theoretical value ( $T_c = 2.269$ ) within the error limits. The values obtained for the critical exponent of the specific heat,  $\alpha = 0.04(25)$  and  $\alpha = 0.03(1)$ , are in agreement with  $\alpha = 0$  predicted by the theory. The values for the Binder parameter by using the finite-size lattices with the linear dimension  $L = 80, 120, 160$ , and  $200$  at  $T_c = 2.269(3)$  are calculated as  $g_L(T_c) = -1.833(5)$ ,  $g_L(T_c) = -1.834(3)$ ,  $g_L(T_c) = -1.832(2)$ , and  $g_L(T_c) = -1.833(2)$ , respectively. The value of the infinite lattice for the Binder parameter,  $g_L(T_c) = -1.834(11)$ , is obtained from the straight line fit of  $g_L(T_c) = -1.833(5)$ ,  $g_L(T_c) = -1.834(3)$ ,  $g_L(T_c) = -1.832(2)$ , and  $g_L(T_c) = -1.833(2)$  versus  $L = 80, 120, 160$ , and  $200$ , respectively.

*Key words:* Ising Model; Cellular Automaton; Finite-Size Scaling; Scanning Method.

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