

Heterogeneous nucleation in the low-barrier regime

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Abstract:

In simulations of the two-dimensional Ising model, we examine heterogeneous nucleation induced by a small impurity consisting of a line of l fixed spins. As l increases, we identify a limit of stability beyond which the metastable phase is not defined. We evaluate the free energy barrier for nucleation of the stable phase and show that, contrary to expectation, the barrier does not vanish on approach to the limit of stability. We also demonstrate that our values for the height of the barrier yield predictions for the nucleation time (from transition state theory) and the size of the critical cluster (from the nucleation theorem) that are in excellent agreement with direct measurements, even near the limit of stability.