

Homogeneous and not homogeneous nucleation in the three-state Blume-Capel model

Vanessa Jacquier

March 22, 2023

We study the metastable behavior of the stochastic Blume-Capel model evolving according to the Glauber dynamics with zero boundary conditions. We will show that, due to the three-state character of the Blume-Capel model, the metastability scenario proven for periodic boundary conditions changes deeply when different boundary conditions are considered. The Hamiltonian of the Blume-Capel model depends on the magnetic field h and the chemical potential λ . We study the heuristic in the whole region $\lambda, h > 0$, where the chemical potential term equally favors minus and plus spins with respect to zeroes and the magnetic field favors pluses and disadvantages minuses with respect to the zeroes, and we compare our results with the Blume-Capel model with periodic boundary conditions. Then, we analyze in detail the region $\lambda > h > 0$. In this region, we identify the unique metastable state $\underline{-1}$, we compute the energy barrier from $\underline{-1}$ to the stable state $\underline{+1}$, and we find an estimate for the asymptotic behavior of the transition time from the metastable to the stable state as $\beta \rightarrow \infty$, where β is the inverse of the temperature.