On metastability and nucleation for a diluted lattice gas under Kawasaki dynamics at low temperature

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We consider a very diluted Ising lattice gas of density ρ evolving, at low temperature $1/\beta$, under the Kawasaki dynamics in a large finite box $\Lambda \subset \mathbb{Z}^2$ with periodic boundary conditions. We introduce a local version of this model and describe the typical nucleation pattern in the case giving rise to metastability, i.e. $\rho = e^{-\Delta\beta}$ with $\Delta \in (U, 2U)$, where $-U < 0$ is the binding energy felt by two neighbouring particles. This allows us to define, in this metastable case, a notion of "subcritical" and "supercritical" contours for the initial model, and to guess the typical time of the first nucleation for the system starting from the Gibbs measure restricted to the set of subcritical configurations. We give the main ideas to describe this nucleation and some of the key results to make them work out. These include the computation of a lower bound for the "non-colliding probability" in a system of N independent random walks with fixed obstacles in $\mathbb{Z}^2$, which does not depend on the initial configuration.

References

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