Ordering kinetics in systems with long-range interactions

Federico Corberi
Salerno University, Fisciano (sa), Italy

Focusing mainly on one dimensional models, we discuss the kinetics after a low temperature quench of ferromagnetic systems with long range interactions between spins at distance r decaying as $1/r^{\alpha}$. In the weak long range regime with $\alpha > d$, where d is space dimensionality, coarsening of competing domains of opposite sign is observed, without development of magnetization [1]. Dynamical exponents, as the one regulating the growth of the domains size, can be obtained analytically within a scaling approach and are shown to agree well with numerical simulations of the Ising model. For $\alpha=0$, i.e. mean field, all spins evolve coherently, without formation of domains, quickly driving the system towards a magnetised state. For strong long range, i.e. for $0 < \alpha \leq d$, a mixed behaviour is observed [2] where both a mean field like or a coarsening scenario are exhibited with an α-dependent relative probability. This whole pattern of behaviors is compared with the analytical solution of the voter model with long range interactions, where an agent takes the opinion of another agent at distance r with probability $1/r^{\alpha}$. In this case, one observes coarsening of domains for $\alpha > 2$ whereas, for $\alpha \leq 2$ the system attains consensus similarly to the mean field case.

References

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