Central limit theorems for Ising model on random graphs

Maria Luisa Prioriello

University of Modena and Reggio Emilia, Italy
Eindhoven University of Technology, The Netherlands

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Abstract

The main goal of this work is to prove central limit theorems for the magnetization rescaled by $\sqrt{N}$ for the Ising model on random graphs. Both quenched and annealed measures are considered. We work in the uniqueness regime $\beta > \beta_c$ or $\beta > 0$ and $B \neq 0$, where β is the inverse temperature, β_c is the quenched or annealed critical inverse temperature and B is the external magnetic field. In the random quenched setting our results apply to general tree-like random graphs (as introduced by Dembo, Montanari and further studied by Dommers, Giardinà and van der Hofstad) and our proof follows that of Ellis in $\mathbb{Z}^d$. Both for the averaged quenched and annealed setting, we specialize to three random graph models, namely the 2-regular Configuration Model, the Configuration Model with degrees 1 and 2 and the Generalized Random Graph. Our proofs are based on explicit computations since in the annealed approximation the Ising model on the Generalized Random Graph is reduced to an inhomogeneous Curie-Weiss model, while the solution of the Configuration Models relies on that of the classical one-dimensional Ising model.