Ising model with invisible states on scale-free networks

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We consider the Ising model with invisible states on scale-free networks [1]. Our goal is to investigate the interplay between the entropic and topological influence on a phase transition. The former is manifest through the number of invisible states r, while the latter is controlled by the network node-degree distribution decay exponent λ. We show that the phase diagram, in this case, is characterised by two marginal values $r_{c1}(\lambda)$ and $r_{c2}(\lambda)$, which separate regions with different critical behaviours. Below the $r_{c1}(\lambda)$ line the system undergoes only second order phase transition; above the $r_{c2}(\lambda)$ only a first order phase transition occurs; and in-between the lines both of these phase transitions occur at different temperatures. This behaviour differs from the one, observed on the lattice, where the Ising model with invisible states is only characterised with one marginal value $r_c \simeq 3.62$ separating the first and second order regimes [2].

1. P. Sarkanych, M. Krasnytska, *arXiv preprint* 1904.06563.

2. M. Krasnytska, P. Sarkanych, B. Berche, Yu. Holovatch, and R. Kenna, *J. Phys. A: Math. Theor.*, **49**(25), 255001 (2016).