Slow dynamics on quenched complex networks

Quenched disorder is known to play a relevant role in dynamical processes and phase transitions. Its effects on the dynamics of complex networks have hardly been studied. Aimed at filling this gap, we analyzed the Contact Process with quenched disorder on complex networks. We found Griffiths phases and other rare region effects, leading rather generically to anomalously slow (algebraic, logarithmic,...) relaxation, on Erdos-Renyi networks. More surprisingly, we find that Griffiths phases can also emerge in the absence of quenched disorder, as a consequence of topological heterogeneity on networks with finite topological dimension [1,2,3].

On scale-free trees, exhibiting infinite topological dimension simulations, mean-field approximations [4] and spectral analysis [5] suggest power-laws crossing over to saturation in the thermodynamic limit, since high dimensional rare-regions can be ordered below the critical point. These results have a broad spectrum of implications for propagation phenomena and other dynamical process on networks, and are relevant for the analysis of both models and empirical data.

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