

Abstract for GR-TR Conference on Statistical Mechanics and Dynamical Systems

Topic: Complex Networks

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Critical Exponents on Scale Free Networks from Spectral Renormalization Group

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Abstract

We generalize the field theoretic Renormalization Group (RG) à la Wilson [1] to arbitrary networks, by expanding the fluctuations of the order parameter in the eigenvectors of the graph Laplacian and eliminating the modes with the largest eigenvalues [2]. We obtain the eigenvectors and eigenvalue distributions of the graph Laplacian for periodic, hierarchical and Barabas-Albert networks [3] with different degree distributions, and explicitly perform numerical integrations over the effective Gaussian hamiltonian in order to compute the renormalization factors and thereby the critical exponents. We are able to recover the known values for the exponents of the Gaussian model on periodic lattices in two and three dimensions. Work is under way to incorporate the ψ^4 type of terms and compare with the existing literature on critical phenomena on networks. The Laplace spectrum is known to directly yield information on the dynamics [4]. Therefore extending the field theoretic RG method in this manner opens the way to the investigating the dynamics of systems living on complex networks, such as amorphous materials and structural glasses.

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