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Griffiths singularities and algebraic order in the exact solution of an Ising model on a modular network MICHAEL HINCZEWSKI, TUBITAK - Bosphorus University Feza Gursey Institute — We use an exact renormalization-group transformation to study the Ising model on a modular network composed of tightly-knit clusters with a scale-free distribution of cluster sizes. By varying the ratio K/J of inter-cluster to intra-cluster interaction strengths, we obtain an unusual phase diagram: at high temperatures or small K/J the system exhibits a disordered phase with a Griffiths-like singularity in the free energy as a function of magnetic field, due to the effects of rare large clusters. As the temperature is lowered, true long-range order is not seen, but there is a transition to an algebraically ordered phase, with thermodynamic characteristics reminiscent of the XY model, but in a different universality class. The transition is infinite-order at small K/J, and becomes second-order above a threshold value $(K/J)^*$. We investigate the nature of pair correlations in the model, allowing us to test recent predictions on the relationship between network topology and correlations in cooperative systems. Despite the absence of magnetization in the low-temperature phase, we find that a subset of spin pairs (vanishingly small in the thermodynamic limit) remains strongly correlated at arbitrarily large distances.

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