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Chaos, broken hyperscaling, and nonuniversality in a spin glass[1]
A. ALAN MIDDLETON, Syracuse University, CREIGHTON THOMAS, Texas A&M University, DAVID HUSE, Princeton University — Recently extended precise numerical methods and newly modified scaling arguments allow for a coherent picture of the glassy state in a two-dimensional spin glass to be assembled. This glassy state, where the correlation length is larger than the system size, is characterized by "chaos," the extreme sensitivity of the state to temperature. This chaos is shown to lead to a breakdown of hyperscaling in spin glasses. The length scale at which entropy becomes important is found to depend on the type of randomness, so that though there is a type of universality, the critical exponents depend on the distribution of disorder. The numerical simulations use multiprecision arithmetic to exactly compute the partition function in samples of sizes up to $L^2 = 512^2$ down to temperatures of less than $J/20$, where the typical strength of the disorder is J. These results can be used in support of studies of the non-equilibrium behavior of glassy models.

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