Commun. Math. Phys. 106, 41–89 (1986)

Communications in Mathematical Physics

A Mean Field Spin Glass with Short-Range Interactions

J. T. Chayes[1,*], L. Chayes[1,**], James P. Sethna[1,***], and D. J. Thouless[2,****]

[1] Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853, USA

[2] Department of Physics, University of Washington, Seattle, WA 98195, USA

Abstract. We formulate and study a spin glass model on the Bethe lattice. Appropriate boundary fields replace the traditional self-consistent methods; they give our model well-defined thermodynamic properties. We establish that there is a spin glass transition temperature above which the single-site magnetizations vanish, and below which the Edwards-Anderson order parameter is strictly positive. In a neighborhood below the transition temperature, we use bifurcation theory to establish the existence of a nontrivial distribution of single-site magnetizations. Two properties of this distribution are studied: the leading perturbative correction to the Gaussian scaling form at the transition, and the (nonperturbative) behavior of the tails.

Table of Contents

* Research supported by the NSF under Grant No. DMR-8314625
** Research supported by the DOE under Grant No. DE-AC02-83ER13044
*** Research supported by the NSF under Grant No. DMR-8503544
**** Research supported by the NSF under Grant No. DMR-8319301