Phase diagram for the O(n) model with defects of "random local field" type and verity of the Imry-Ma theorem

A S Sigov
Moscow Technological University, Russian Federation

After the publication in 1975 the classical paper by Imry and Ma, the viewpoint was firmly established in the literature that at space dimensions d<4 the introduction of an arbitrarily small concentration of defects of the "random local field" type in a system with continuous symmetry of the *n*-component vector order parameter (O*(n)* model) leads to the long-range order collapse and to the occurrence of a disordered state, which in what follows will be designated as the Imry-Ma state and the statement given above will be named the Imry-Ma theorem. An anisotropic distribution of the directions of defect-induced random local fields in the order parameter *n*-dimensional space gives rise to the effective anisotropy in the system. Evaluation of the effective anisotropy constant K_{eff} for strong anisotropic distributions in the order of magnitude gives the value $K_{eff} \sim x(hl)^2$ / JS^2, where x is the defect concentration, h_l is the local field induced by l^{th} defect, J is the exchange interaction constant between neighboring spins and the brackets denote averaging over defects. The Imry-Ma theorem breaks down due to existence of the "easy axis" anisotropy induced by the defects designed initially for breaking down the long-range order. In the case of slightly anisotropic distribution of the fields, there exists a critical concentration of defects, if exceeded the Imry-Ma inhomogeneous state can exist as an equilibrium one. In the case of strongly anisotropic distribution of the fields, the Imry-Ma inhomogeneous state is completely suppressed and the state with the long-range ordering is realized at any defect concentration.

assigov@yandex.ru