

R.R.Levitskii, S.I.Sorokov, A.S.Vdovych
Institute for Condensed Matter Physics of the National Academy of
Sciences of Ukraine, 1 Svientsitskii St., 79011 Lviv-11, Ukraine

SPIN MODEL WITH ESSENTIAL SHORT-RANGE COMPETING INTERACTION

We study the spin-glass model with an arbitrary range of competing interactions within two-particle cluster approximation for the free energy (exact expression for Bethe lattice) and within symmetric replica approach. We suggested a system of integral equations for distribution functions of $Z_i - 1$ cluster fields of the i -th coordination sphere. A spin-glass model with essential short-range interactions (first coordination sphere with distribution $-aK, K$) and weak long-range interactions (linear approximation) is considered. For the first coordination sphere we show that iteration procedure for an integral equation for distribution functions of $Z-1$ cluster fields converges rapidly if a Gaussian form for the trial function is used. The free energy calculated with the Gaussian distribution function, found from the extremum conditions, and free energy calculated with the distribution function, found from the integral equation, are close. For spin-glass model with Gaussian cluster field and weak long-range interactions, the phase diagram, entropy, order parameters, specific heat, and susceptibility are calculated. The obtained asymmetry of the phase diagram is due to taking into account of the long-range interactions and due to asymmetry of the distribution function of short-range interactions.