

## Magnetic properties and peculiarity of magnetic states in dilute antiferromagnets $Mn_{1-x}Zn_xF_2$

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**Abstract.** The dependence of magnetic moment and susceptibility on temperature, magnetic field and frequency of some single crystals  $Mn_{1-x}Zn_xF_2$  ( $x \approx x_c = 0.75$ —percolation limit) were experimentally investigated. Our experiments show that (Bazhan and Petrov 1984; Cowley *et al* 1984; Villain 1984) in these crystals the nonequilibrium magnetic state of spin-glass type with finite correlation length appears as temperature decreases  $T < T_f$  in weak magnetic fields. This state is determined by fluctuation magnetic moments  $\sqrt{n}\mu$  (where  $n$  is the number of magnetic ions, corresponding to finite correlation length and  $\mu$  the magnetic moment  $Mn^{+2}$ ).

In the experiments in low magnetic fields and frequencies there are no peculiarities in the magnetic susceptibility temperature dependence at  $T \neq T_f$ . At temperatures  $T > T_f$  and  $T < T_f$  magnetic susceptibility is determined by

$$\chi(T > T_f) = \frac{N \langle \mu \rangle^2}{3k(T + \theta)} = \frac{N \langle \sqrt{n}\mu \rangle^2}{n 3k(T + \theta)} = \chi(T < T_f).$$

In strong magnetic fields and large frequencies there are peculiarities in the  $\chi(T)$  dependence at  $T = T_f$ . At  $T < T_f$  and strong magnetic fields  $\chi(T) = \chi_0$  and  $T < T_f$  and at large frequencies  $\chi(T) = \chi_0 + \alpha/T$ .

The dependences of magnetic susceptibility on the frequency are determined by the magnetic system relaxation. Calculations and comparison with experiments show that the relaxation of the investigated magnetic systems at  $T < T_f$  follows the relaxation law  $M(t) = M(0) \exp[-(t/\tau)^r]$ , suggested in Palmer *et al* (1984) for spin-glasses relaxation taking into account the time relaxation distribution  $\tau_0 \dots \tau_{max}$  in the system and its 'hierarchically' dynamics.

**Keywords.** Magnetic properties; antiferromagnets.

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### References

- Bazhan A N and Petrov S V 1984 *J. Exp. Theor. Phys.* **86** 2179  
 Cowley R A, Yoshizawa H, Shirane G, Hagen M and Birgeneau B J 1984 *Phys. Rev.* **B30** 6650  
 Palmer R G, Stein D I, Abrams E and Anderson P W 1984 *Phys. Rev. Lett.* **53** 958  
 Villain J 1984 *Phys. Rev. Lett.* **52** 1543