

Disordered magnets

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Abstract. The physics of strongly-disordered magnets and especially that of spin glass is an example of a scientific problem whose ideas and results are widely used in different and sometimes rather distant areas (up to biology, for example). This is the consequence of the paradoxical nature of the main question of this problem: how does ordering occur in systems which do not possess any apparent order at all? In other words, how can one find genuine (but hidden) internal variables which determine dynamics (and thermodynamics) of the system having no macroscopic order parameter.

From the theoretical point of view the "generic model" for such a system is the well-studied model of spin glass with infinite-range interaction. The next necessary step is to understand the degree of applicability of the results of infinite-range models to real systems. Further there are a number of phenomena which are completely beyond the frame of this model and are governed by fluctuation effects. The theory of fluctuation phenomena in strongly disordered magnets is at the very beginning of its development. In this report we discuss some relevant problems which have been well studied. In the case of genuine spin glasses the problems are as follows: whether there exists a thermodynamic phase transition to the spin glass phase and how does it occur? What is the physics of non-exponential relaxation far above the transition point? Further there are a number of systems belonging to the spin glass universality class (in the sense of phase-transition theory) but possessing the same sort of short-range order. We consider the following spin glasses with local helical order (for example, the diluted yttrium-based alloys YEr, YDy); amorphous magnets with strong random-axis anisotropy; disordered magnets with strong dipolar interaction. We discuss mainly the structures of low-temperature phases in these systems.

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