Non-equilibrium critical dynamics of pure and diluted 2D XY model

Ivan S. Popov, Pavel V. Prudnikov
Department of Theoretical Physics, Omsk State University, Omsk 644077, Russia

The study of systems characterized by slow dynamics is attracting considerable interest from both theoretical and experimental point of view [1]. This is due to the predicted and observed aging in slow evolution from non-equilibrium initial state and violation of the fluctuation-dissipation theorem [2]. The two-dimensional XY-model refers to systems that demonstrate an abnormally slow dynamics, and the main distinguishing feature is that the two-dimensional XY-model shows an anomalous behavior is not only near the phase transition temperature Berezinskii-Kosterlitz-Thouless T_{BKT}, but for all low-temperature phase. The aging is unusual phenomenon of the growth of the relaxation time of the system with the increasing of the "age" of the material. "Age" is the time elapsed since the sample preparation [3].

Relevance of the study of two-dimensional XY-model is due to a wide range of physical systems whose behavior can be described. Examples of such systems include [4-7]: Co and Ni films; important class of planar magnets; two-dimensional crystals; surface superconductors; superconducting thin film; Bose liquid film; superfluid liquid He; Josephson junction array; array of superconductor-ferromagnet-superconductor contacts; behavior of birds flocks; behavior mycetozes fungus-like organism; the behavior of some colonies of bacteria.

In this work a comprehensive study of the aging and the violation of the fluctuation-dissipation theorem in a pure and structurally disordered two-dimensional XY-model were carried out. The effects of coarsening and the temperature dependence of the rigidity in the low-temperature phase were discovered. It was obtained the dependence of the critical temperature on the defects concentration.

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