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Supercomputer investigation of magnetic multilayer films in frame of classical Heisenberg model

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Text
In this paper, we present the results of simulation of multilayer magnetic films, which are structures of alternating magnetic and nonmagnetic layers. In the frame of our computer model of the multilayer film, the magnetic layer has a size of N×N×L, where L is thickness of a layer. In our software, it's possible to use different parameters for layers and types of interaction between Heisenberg spins. The developed software is based on the new, promising programming language Rust and also MPI was used for high performance calculations. For analyzing the obtained data and evaluating of the behavior of the system in dynamics, a web application was developed for visualizing the processes occurring in the spin system depending on the various parameters of simulation.

The thermodynamic characteristics of multilayer structures, such as the temperature behavior of magnetization, energy, and heat capacity, were studied using by the Monte Carlo methods. Hysteresis phenomena were studied and the behavior of the hysteresis loop for various simulation parameters were considered.

The further development of this research is studying of magnetic multilayer films with asymmetric Dzyaloshinskii–Moriya (DM) interaction, interfacing effects and skyrmions textures in multilayer magnetic films.

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