

SEMINAR ON MAGNETISM AND SUPERCONDUCTIVITY

We kindly inform You that on **Wednesday**

February 28th at 10:00

Dr. Eduard Zubov

(Kyiv Academic University)

will deliver the on-line lecture (the ZOOM link is provided on the IP PAS WEB page):

“Quantum effects and nonequilibrium thermodynamics of erbium orthoferrite,,

In this work a model of nonequilibrium thermodynamics of erbium orthoferrite is presented. It allows to give a possible mechanism of the exchange bias (EB) effect, which was experimentally detected as the traditional shift of the magnetization hysteresis loops near the compensation temperature T_{comp} . ErFeO_3 exhibits another specific phenomenon. The temperature driven spin switchings occurs in this ferrimagnet. The EB manifests itself as the temperature shift of the $M(T)$ loops, which occurs upon successive cooling and heating in a weak magnetic field. The hysteresis loops limiting the region of coexistence of negative and positive magnetization are shifted towards lower or higher temperatures, depending on the sign of the applied magnetic field, which causes the unidirectional EB anisotropy.

In order to determine the free energy of erbium orthoferrite and analyze possible magnetic structures, the authors proposed a microscopic model of two-sublattice magnet with a subsystem of iron ions, taking into account the exchange interactions with rare earth ions, as well as the anisotropic symmetric and antisymmetric Fe^{3+} - Fe^{3+} exchange interactions. In the mean field approximation, a unitary transformation is used to diagonalize the Hamiltonian of the whole magnetic system, that made it possible to establish an equation for the canting angles of Fe^{3+} spins.

The quantum-mechanical effects in arbitrary magnetic fields, related both to the direction of a general quantization axis and an influence of anisotropic exchange interactions on the magnetic structure, spin-reorientation phase transition, spin reversals, and hysteresis, are considered. The main parameters of the model Hamiltonian are determined, which point out a strongly competitive character of exchange interactions in erbium orthoferrite. Also, it has been established that with a certain cooling protocol in a magnetic field, the metastable structural displacements are possible, which are accompanied by an abrupt change in the values of the anisotropy parameters. A comparison of the experimental and calculated temperature and field dependences of magnetization exhibited satisfactory agreement between the experimental results and theory.

Seminar will be delivered in English.

We sincerely invite You

Roman Puźniak / Andrzej Szewczyk / Henryk Szymczak