Study of structural, electronic and magnetotransport properties of functional materials based on cobalt oxide, irradiated to improve operational characteristics in ultra-high-frequency spintronics devices

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This work is aimed at a comprehensive experimental study of exchange interactions, magnetotransport phenomena, spin and phase transitions in magnetic semiconductors, including complex cobalt oxides. It is assumed that samples were irradiated with electron and ion accelerator beams, followed by a study of the modified properties.
The research covers the investigation of functional materials exposed to new sources of strong pulsed magnetic fields, ion and electron irradiation with controlled dose, energy and pulse duration.
These compounds exhibit a variety of physical phenomena such as spin crossover, giant magnetoresistance, insulator-metal transition, orbital ordering, ferroelectric and magnetoelectric effects, structural phase transitions.
The study of such phenomena is one of the leading areas of modern physics of radiation materials science, both fundamental and applied. It should be noted that the microscopic mechanisms of formation of the properties of complex cobalt compounds remain poorly understood.
Modification of the structure and magneto-transport properties of ferro- and antiferromagnetic materials will be carried out at the NICA accelerator complex at the irradiation stations of the SOCHI station with an energy from 3.2 MeV/nucleon to 4 GeV/nucleon with intensities from 10^3 to 10^9 particles/sec, a pulse duration of 4 μs.
Preliminary results show that irradiation leads to a structural transformation in the studied compounds, including isotropization of the crystal structure and transition to a ferromagnetic phase with dose. However, the influence of irradiation parameters on the stability of the effect remains unclear.
The results of the studies would help us to reveal the relationship between lattice, electron and magnetic degrees of freedom, which would open opportunities for controlling their physical and chemical properties and creating new functional materials for their use.