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Exchange and Magnetic Anisotropic Interactions of Magnetic Ions in Antiferromagnetic Materials ALEXANDER BAZHAN, P.L.Kapitza Institute for Physical Problems, RAS, Moscow, Russia — Investigations of antiferromagnetic orderings, based on theory of crystallographic and magnetic symmetry, which indicates quadratic forms of thermodynamic potentials, invariant with respect to operations of magnetic symmetry groups and presented in irreducible representations of magnetic moments, are carried out, using vector magnetometry, introducing $\chi \cdot (1 - \chi_{//} (I_i^2) / \chi) \cdot (\gamma_i \mathbf{H})^2$ terms in discussions. Magnetic field dependencies of samples three magnetic moments components directly indicate magnetic ions interactions. Symmetric, Anderson, and antisymmetric, Dzyaloshinskii-Moriya, exchange interactions in antiferromagnetic orderings, in rhombohedral structures, as example, $H_{\text{ex}} = \sum_{i,j} J_{i,j} \cdot (\mathbf{S}_i \mathbf{S}_j) - \sum_{i,j} D_{i,j,z} \cdot (\mathbf{S}_{i,x} \mathbf{S}_{j,y} - \mathbf{S}_{i,y} \mathbf{S}_{j,x})$, determine weak ferromagnetic states at selected orientations of antiferromagnetic vectors. Weak ferromagnetic states, of second and higher orders interactions of magnetic ions, are presented in the report.

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