New Insights into the Mechanisms for Multiferroicity in Rare Earth Orthoferrites

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Magnetic rare-earth ortheferrites of the *RE*FeO_3 type (*RE* = rare earth element) are model systems for studies and theoretical considerations on magnetic structures in sixties of the last century [e.g. Ber68], have regained significant interest in the last decade. Their complex multiferroic and magnetocaloric features make them potential candidates for modern applications, e.g. in the area of spintronics.

We focused on the Mechanisms for multiferroicity in rare-earth orthoferrites, especially the Role of the Dzyaloshinskii-Moriya interaction in a DFG project (SA-3688/1-1). Using various experimental methods we were able to gain various exchange parameters of different magnetic exchange interactions, the Heisenberg-exchange, the Dzyaloshinskii-Morya interaction, the single-ion anisotropy and external magnetic fields for different *R*FeO_3 compounds by neutron diffraction and inelastic neutron scattering. The close quantitative examination and comparison with results from other groups revealed noticable differences between the different systems concerning the balance between the various magnetic interactions, resulting in very different magnetic phase diagrams e.g. for Ho, Tb and Yb system [Ovs22].

In addition to this, we recently collected information on $LuFeO_3$, $TmFeO_3$ and $DyFeO_3$, for instance magnon dispersions for the Lu and Dy system to extract magnetic interaction parameters and neutron diffraction data to determine the various magnetic phases of $TmFeO_3$ (unpolarized) and of $DyFeO_3$ (polarized and unpolarized). In the latter case we focused on the incommensurate ordering of the *RE* element without magnetic field, unique for Dy in this family of orthoferrites. In our presentation, we provide an overview of the results of the orthoferrites we examined.

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[Ovs22] A.K. Ovsyanikov et al. JMMM **507** (2020) 166855; JMMM **557** (2022) 169431; JMMM **563** (2022) 170025.

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