Mechanisms for Multiferroicity in Rare Earth Orthoferrites: An Overview

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Magnetic rare-earth ortheferrites of the $RFeO_3$ type (R = rare earth element, model systems for studies and theoretical considerations on magnetic structures in sixties of the last century [[Whi69, Mar70, 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 [Tok12, Lee11].

We recently completed an extended project, *Mechanisms for multiferroicity in rare-earth orthoferrites: Role of the Dzyaloshinskii-Moriya interaction*, funded by the DFG (SA-3688/1-1). In this project we used various experimental methods to gain an overview of the exchange parameters of different magnetic exchange interactions, the Heisenberg-exchange, the Dzyaloshinskii-Morya interaction, the single-ion anisotropy and external magnetic fields for different $RFeO_3$ compounds. A close quantitative examination and comparisons with results from other groups reveal that the different parameters differ significantly between the different systems [Ovs22a, Ovs22c], . This causes a fragile balance between them and results in very different magnetic phase diagrams e.g. for $HoFeO_3$, $TbFeO_3$ and $YbFeO_3$. [Ovs22a, Art12, Ovs22c], In addition, we also looked at $TmFeO_3$ and $DyFeO_3$ as part of our project and wWe were also able to achieve initial information for them. In our presentation, we provide an overview of the results of the orthoferrites we examined.

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