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Exchange interaction in lanthanides LIVIU CHIBOTARU, NAOYA IWAHARA, VEACESLAV VIERU, Theory of Nanomaterials Group, KU Leuven, THEORY OF NANOMATERIALS GROUP, KU LEUVEN TEAM — Anderson's superexchange model is applied for analytical derivation of exchange interaction between total magnetic moments $\mathbf{J}_1$ and $\mathbf{J}_2$ corresponding to ground atomic multiplets of two exchange-coupled lanthanide ions. Despite the common belief that the exchange interaction is of $\sim \mathbf{J}_1 \cdot \mathbf{J}_2$ form, we find it corresponding to convolution of tensors $\mathrm{O}_{kq}(\mathbf{J}_1)$ and $\mathrm{O}_{k'q'}(\mathbf{J}_2)$ of ranks $k, k' \leq 7$. All contributions are of the same order as the term $\sim \mathbf{J}_1 \cdot \mathbf{J}_2$ and cannot be neglected. In the case of exchange-coupled lanthanide ion ($\mathbf{J}$) and isotropic magnetic center ($\mathbf{S}$) the exchange interaction is described by convolutions of tensors $\mathrm{O}_{kq}(\mathbf{J})$, $k = 1, 3, 5, 7$ with the spin $\mathbf{S}$. Among these contributions $\sim \mathbf{J} \cdot \mathbf{S}$ is not the dominant term, as was commonly assumed, hence all tensorial components should be taken into account.

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