Three-axis anisotropic exchange coupling in the single-molecule magnets NEt4[MnIII2(5-Brsalen)2(MeOH)2 MIII(CN)6] (M=Ru, Os)

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Three-Axis Anisotropic Exchange Coupling in the Single-Molecule Magnets $NEt_4[Mn^{III}_2(5\text{-Brsalen})_2(MeOH)_2M^{III}(CN)_6]$ (M=Ru, Os)

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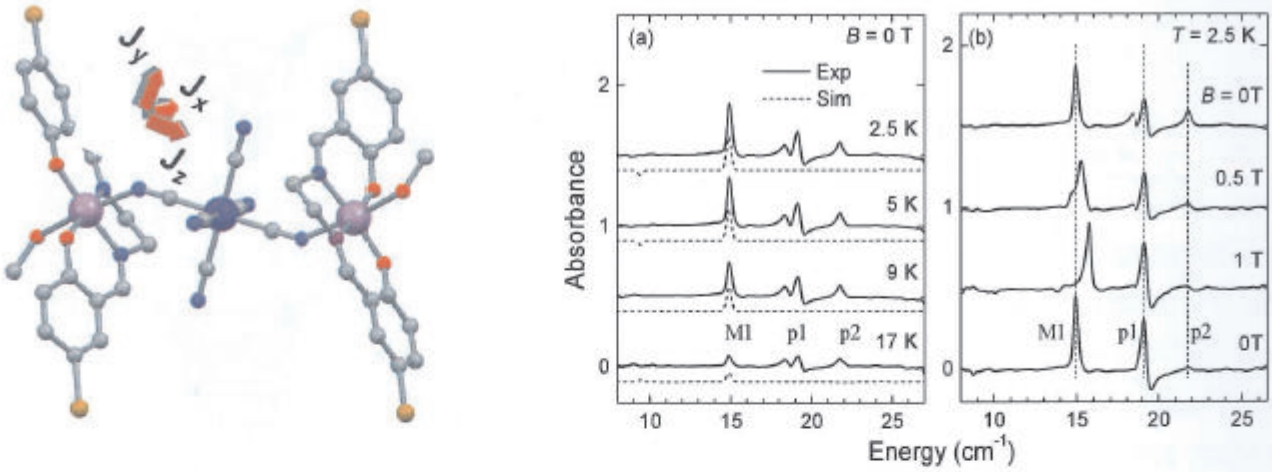
The introduction of 4d and 5d ions into single-molecule magnets (SMMs) represents an intriguing path to enhance their properties [1]. Strong spin-orbit coupling and the diffuse 4d and 5d orbitals as compared to the 3d case enable large magnetic anisotropies and strong exchange coupling. Here we study isostructural Mn-M-Mn trinuclear SMMs, with M=Ru and Os, by frequency-domain Fourier-transform THz electron paramagnetic resonance (FDFT-EPR), inelastic neutron scattering (INS) and SQUID magnetometry [2,3]. We find that the exchange coupling between Mn^{III} and Os^{III} ions is anisotropic and of three-axis type, i.e., it is antiferromagnetic along *x* and *z* axes while it is ferromagnetic along *y*. A further analysis yields that this is a consequence of orbitally dependent exchange [4,5] providing a profound understanding of the magnetic behavior of the orbitally degenerate Ru^{III} and Os^{III} ions.



(a) (b)

Figure: (a) Structure of the Mn-Os-Mn SMM from X-ray diffraction. The NEt_4^+ counterion and H atoms have been omitted. Color code: Mn, purple; Os, dark blue; O, red; N, blue; C, grey; Br, brown. (b) FDFT THz-EPR spectra obtained on Mn-Os-Mn.

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