Currently, we are investigating whether comparable phase transitions with a similar underlying mechanism are also present in the other three compounds.

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MS38 O4

$R_2Mo_2O_7$ pyrochlores under high pressure.

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$R_2Mo_2O_7$ (R=rare earth) pyrochlores show geometric magnetic frustration and a threshold transition from a ferromagnetic metal to an insulating spin glass state tuned by the rare earth ionic radius r_c. We studied their crystal structure under pressure by powder X ray diffraction using the synchrotron radiation, showing that they remain cubic with Fd-3m symmetry up to 36 GPa. The pressure induced changes in their microscopic magnetic state were studied throughout the threshold by powder neutron diffraction combined with μSR. In $Gd_2Mo_2O_7$, ferromagnet at the verge of the threshold ($r \sim r_c$), ferromagnetic long range order coexists with strong fluctuations and is strongly unstable under pressure [1]. In $Tb_2Mo_2O_7$ insulating spin glass ($r < r_c$), diluting Tb^{3+} ion by La^{3+} allows us to cross the threshold, inducing a canted ferromagnetic state akin to an ordered spin ice, where the Tb moments lie close to the local (111) anisotropy axes [2]. The spin glass state is recovered under pressure. In $Nd_2Mo_2O_7$ ferromagnet with (r>rc), a reentrant magnetic state is stabilized well below the Curie temperature, associated with a giant anomalous Hall effect [3]. We present new results in $Nd_2Mo_2O_7$ by neutron diffraction (at ambient and under pressure), small angle neutron scattering and μSR. Combining these three probes on the same sample allows us to precise the microscopic nature of the reentrant state and its evolution with temperature and pressure.

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MS38 O5

Simultaneous antiferromagnetic Fe^{3+} and Nd^{3+} ordering in $NdFe_3(^{11}BO_3)_4$ investigated by single crystal neutron diffraction,

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As promising materials for optoelectronics and with respect to interesting magnetic properties due to competing magnetic sublattices and magnetoelectric interactions, the family of borates $RM_3(BO_3)_4$ with R = rare earths or Y, La-Lu and M = Al, Ga, Cr, Fe, Sc is of current interest. $GdFe_3(BO_3)_4$ has been found [1,2] o exhibit a structural phase transition at 156 K, antiferromagnetic order of the magnetic Fe^{3+} moments at 36 K, followed by a spin reorientation phase transition at 9 K. Moreover there is evidence for an induced ferroelectric phase in this material in external magnetic fields which demonstrates a strong correlation between the magnetic order and the dielectric properties of $GdM_3(BO_3)_4$. Concerning technical applications such compounds, e.g. $YAl_3(BO_3)_4$, may be important materials for laser techniques and optical second harmonic generation [3].
By means of magnetic susceptibility and specific heat measurements, x-ray and unpolarized neutron diffraction investigations on powder and single-crystal samples, simultaneous long-range antiferromagnetic Fe and Nd ordering in $NdFe_3(^{11}BO_3)_4$ with *R 3 2* chemical structure has been found at temperatures below T_N = 30.5(5) K down to 1.6 K. At temperatures down to 20 K to the propagation vector is $\mathbf{k}_{hex}$ = [0,0,3/2] and becomes slightly incommensurate at lower temperatures. Symmetry analysis yields magnetic spiral configurations with the magnetic moments oriented parallel to hexagonal basal plane according to the irreducible representations τ_3 in the commensurate case. This is in agreement with the easy directions of magnetization perpendicular to the c-axis as determined by magnetic susceptibility measurements. At 1.6 K the magnetic Fe moment amounts to 4.9 μ_B close to the free ion moment of Fe^{3+}. The magnetic Nd^{3+} moment saturates presumably due to crystal-field effects at 2.7 μ_B [4]. There remains some dought that the chemical structure is *R 3* instead of *R 3 2*, a problem most likely to be solved by neutron single crystal diffraction at TriCS/SINQ and HEIDI/FRM-2.

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