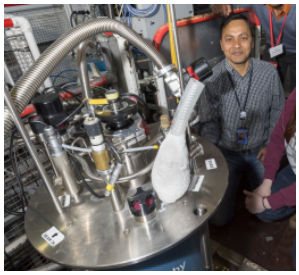

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Tunable magnetic frustration in PbM2Ni6Te3O18 (M = Mn, Fe, Co, Zn)

Monday, 11 September 2023 17:40 (10 minutes)

The pentanary oxides PbM2Ni6Te3O18, where M = Mn, Fe, Co, Zn, allow magnetic frustration to be tuned by changing the transition metal ion M. These compounds contain Ni2+ zigzag chains along the c- axis which order antiferromagnetically below TN, in addition to a kagome-like interchain structure in the a-b plane which becomes magnetically frustrated when coupled ferromagnetically. The competition between the ferromagnetic interchain exchanges J3 and J5 turns out to be crucial in determining the magnetic structures. By direct comparison of the muon-spin rotation (μSR) asymmetry, we demonstrate that when M = Mn, the larger M moment allows the M–Ni exchange J5 to dominate over the interchain (Ni–Ni) exchange J3 and suppresses magnetic frustration (see Figure 1b). But as J5 weakens (M = Fe, Co) and vanishes (M = Zn), J3 becomes increasingly significant and turns the system into a strongly frustrated one within the kagome-like structure. These results demonstrate beautifully how the nature of the magnetic ground state, whether fully ordered or strongly frustrated, can be constructed by the choice of a single magnetic ion in an isostructural family of materials containing zigzag chains.

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