



Abstract ID : 67

Friday 21 Oct, 11:45

The short-ranged order in the van der Waals spin glass $\text{Mn}_{0.5}\text{Fe}_{0.5}\text{PS}_3$

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MnPS_3 and FePS_3 are both layered, van der Waals compounds that adopt long-ranged antiferromagnetic order below their relatively high Néel temperatures of 78 K and 120 K respectively. $\text{Mn}_{0.5}\text{Fe}_{0.5}\text{PS}_3$, however, is magnetically frustrated and instead is a spin glass with a freezing temperature of 35 K. The frustration is due to a competition between the nearest-neighbour magnetic exchanges, which are antiferromagnetic in MnPS_3 and ferromagnetic in FePS_3 . We have studied the neutron diffuse scattering from both powdered and single crystal $\text{Mn}_{0.5}\text{Fe}_{0.5}\text{PS}_3$, using the D7 diffractometer with polarization analysis to separate the different contributions. The data were analysed using Reverse Monte-Carlo methods to determine the atomic structure and spin-spin correlations. The results from our analysis will be presented and described using a model based on a comparison of the ordered magnetic structures of the two parent compounds. We are further able to study the temperature-dependence of the magnetic correlations to determine the nature of the moment-freezing on entering the spin glass state.

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