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Frustration in Sm-based pyrochlores

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Samarium based pyrochlores have two important peculiarities relative to other rare-earth pyrochlores systems: the very small ordered magnetic moment of the Sm3+ ion and the high neutron absorption of its natural isotopic abundance hinder a better characterization of its magnetic properties at low temperatures. Apart from it, Sm2Ti2O7 and Sm2Sn2O7 present many of the same magnetic behavior of their isomorphic sister compounds, which include the suppression of long-range magnetic order down to sub-Kelvin temperatures due to the geometrical frustration imposed by the pyrochlore lattice. In this work, we present bulk and neutron measurements performed on isotopic enriched samples of the aforementioned compounds. The field susceptibility versus temperature shows that both pyrochlores present a weak antiferromagnetic coupling with a small negative Curie-Weiss temperature. Magnetization curves versus field measured down to 2 K reveal that the crystal field ground state of the Sm ions can be regarded as a well isolated Kramers doublet with Ising single-ion anisotropy. Heat capacity of Sm2Ti2O7 and Sm2Sn2O7 present a sharp anomaly at 350 mK and 450 mK, respectively. This anomaly is shown to correspond to the onset of an all-in-all-out long-range order in the stannate sample.

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