Low-lying thermal excitations on the border of ferromagnetism in the filled skutterudite NdOs$_4$As$_{12}$

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Single crystals of the filled-skutterudite compound NdOs$_4$As$_{12}$ were grown by mineralization in a molten Cd:As flux. Features related to a ferromagnetic transition at $\approx 1.1$ K are observed in both transport and thermodynamic properties. Magnetic entropy considerations combined with magnetization data point at a quartet ground state of the Nd$^{3+}$ multiplet being well separated from a first excited state. Unexpectedly, a Schottky anomaly with the maximum at $\approx 0.93$ K emerges on the border of the ferromagnetically ordered state. Additionally, a small magnetic field of 0.1 T shifts the Schottky peak above the Curie temperature. Thus, its origin cannot be related to the molecular-field splitting, as frequently observed for other ferromagnets. We attribute the Schottky anomaly with an energy separation $\Delta/k_B \approx 2.2$ K to a lowering of the $T_h$ cubic point symmetry of the Nd$^{3+}$ ions due to an unusual distortion of the Os cage, as recently proposed for PrOs$_4$Sb$_{12}$ and NdOs$_4$Sb$_{12}$ [1].

References: