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NIT-2Py

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We present thermodynamic and magnetic properties, as well as muSR spectroscopy results of a new organic magnet which is built from molecules in the nitronyl nitroxide family of free radicals. NIT-2Py exhibits a complex magnetic phase diagram at low temperatures and high magnetic fields. Susceptibility measurements at high temperatures show the paramagnetism of a free spin 1/2 with antiferromagnetic interactions. We saw the onset of bulk magnetic order at 1.3 K, as determined from specific heat Cp measurements. This anomaly in Cp is suppressed by magnetic fields above 3 T. In this field range, the sharp peak in Cp is replaced by a Schottky anomaly pointing to collective switching of all magnetic moments between two distinct levels. At a higher fields of 5 T, we observed a second sharp anomaly indicating a second magnetic phase. Magnetisation curves measured below the ordering temperature show magnetization plateau at half of the saturation value of 1 μB/molecule. In combination with the specific heat results, this behaviour suggests a new quantum spin ground state in NIT-2Py. In order to get a better understanding of the magnetic interactions between the molecules, we carried out electronic structure calculations. MuSR measurements show oscillations in the longitudinal signal in zero field indicative of an internal field below the phase transition. The temperature dependance of this internal field follows a mean field behaviour. This oscillation fits to a two frequencies model indicating two distinct muon sites. Applications of longitudinal fields up to 2 T did not show any longitudinal signal, typical in a Ising system without hard magnetic axes.

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