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Spin dynamics of V-based molecular magnets with integer spin values

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In the present work, we investigate the spin dynamics of one-dimensional spin-integer molecular nanomagnets $((CH_3)_2NH_2)V_7MF_8(O_2CtBu)_{162}C_7H_8$, with M=Ni/Mn, in short V_7M [1,2,3], by means of magnetization, susceptibility and MuSR measurements. These heterometallic nanomagnets contain seven vanadium ions (s=1) and one Ni^{2+} (s=1) or Mn^{2+} (s=5/2) ion, arranged in the form of regular rings. The theoretical studies of rings with a finite number of integer spins indicate a gapped ground state and a significant deviation from the Landé rule, valid for semi-integer spins [4,5]. On the other hand, the infinite spin-integer chain exhibits a topological Haldane gap between the ground state and the first excited state [6]. As confirmed by experimental data, the ground state of V_7Ni and V_7Mn is expected to be antiferromagnetic, similarly to the molecular nanomagnet V_7Zn [1,2,7], and the exchange coupling constants among the nearest neighbour magnetic ions are estimated to be of the order of a few Kelvin degrees. Susceptibility and magnetization measurements at low temperatures display anisotropy effects when an external magnetic field is applied. The muon longitudinal relaxation rate λ vs temperature, at magnetic fields $\mu_0 H \geq 500$ G, in the range $1.5 \leq T \leq 100K$, follows a heuristic Bloembergen-Purcell-Pound model [8]. No effect related to a topological gap is evinced.

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