Comprehensive cluster-theory analysis of the magnetic structures and excitations in CoCl₂·2H₂O

The magnetic properties of CoCl₂·2H₂O are analyzed in the mean-field/random-phase approximation using a basis of clusters with four spins along the c-axis chains of Co ions. The model gives a unifying account of the bulk properties, the spin waves, and the higher-order cluster-spin excitations. The theory describes accurately the neutron scattering measurements of the excited doublet of the S = 3/2 Co²⁺ ions in both the antiferromagnetic and the paramagnetic phases. The theory has been applied by Larsen et al. [Phys. Rev. B 96, 174424 (2017)] for analyzing the quantum phase transition at a transverse field of 160 kOe and is found to agree closely with their observations.