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Magnetic Order in the Quasi-One-Dimensional Ising System RbCoCl3

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The magnetic order in RbCoCl3 was investigated in a series of neutron scattering experiments at SINQ, PSI, on powder and single-crystal samples between 1.5 K and 300 K. RbCoCl3 is a hexagonal perovskite of CsNiCl3 type structure. It crystallizes in space group P63/mmc with lattice parameters of a=7.0003(3) Å and c=5.9959(2) Å at room temperature. Upon cooling the octahedrally coordinated high-spin Co2+ ions show one-dimensional (1D) antiferromagnetic (AFM) interactions along the c-axis. At TN1=28 K 3D AFM order occurs with k=(1/3,1/3,1). The magnetic moments are aligned along the c-axis with μ z=3.97(2) μ B and an amplitude modulation in the ab-plane. A second magnetic phase transition is observed at TN2=13 K where the moments along the c-axis increase to μ z=4.08(1) μ B and two additional propagations k=(0,0,1) and k=(1/2,0,1) occur. The k-vectors were confirmed by single crystal neutron scattering. In agreement to the neutron scattering data, the magnetic susceptibility along the c-axis shows a broad maximum at 90 K due to 1D AFM interactions along the [CoCl6/2]- chains. The heat capacity shows a λ -anomaly at TN1 but no effect at TN2. Results from inelastic neutron scattering on RbCoCl3 will be presented separately.

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