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Neutron diffraction study of S = $\frac{1}{2}$ triangular lattice Heisenberg antiferromagnet $Ba_3CoSb_2O_9$ in high magnetic fields

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A S = $\frac{1}{2}$ triangular lattice Heisenberg antiferromagnet (TLHAF) is its typical example, where combined effects of geometrical frustration and quantum fluctuations lead to stabilization of novel spin structures as function of external magnetic field. Hexagonal $Ba_3CoSb_2O_9$ (BCSO) compound exhibits magnetic properties typical of an ideal S = $\frac{1}{2}$ TLHAF, making it a perfect model system for testing theoretical predictions [1-2]. In this contribution we present the results of neutron scattering experiments on BCSO single crystal with a magnetic field applied both in-plane and out-of-plane [3-4]. A sequence of magnetic phase transitions, including the magnetization plateau phase and the new high-field phase at 22.5 T reported recently [1-2] has been followed at low temperatures as a function of field and modeled using the large-size cluster mean-field plus scaling method [5]. While our results show good agreement with the theoretical model for the field applied in-plane, for the out-of-plane field the model reproduces the experiment only qualitatively. The discrepancies between theory and experiment are discussed, suggesting further efforts are necessary to fully understand the TLHAF system in magnetic fields.

References:
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