EXOTIC MAGNETIC PHASES IN FRUSTRATED J_1-J_2 CHAIN MAGNET $LiCuVO_4$

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Quantum-spin chains with frustrated exchange interactions were among the most interesting issues for both experimental and theoretical research in condensed matter physics in the past decade.[1-3]

The enhanced effect of quantum fluctuations imposed upon a fine balance of exchange interactions leads to a variety of novel ground states and phase transformations in these systems.[4-7] $LiCuVO_4$ is an example of a quasi-1D magnet (S=1/2), which unconventional magnetic phases result from a competition of ferromagnetic and antiferromagnetic exchange interactions between nearest-neighbor (J_1) and next-nearest neighbor (J_2) in-chain magnetic moments.

As a result of this particular combination of exchange interactions a helical incommensurate structure is stabilized in this system below T_N~ 2.3K.[8]

A strong reduction in the ordered spin component of Cu^{2+} ions in this state μ/μ_B~ 0.3 [8,9] provides evidence that the system partially retains properties of 1D chains.

Moderate applied magnetic fields 7-8 T induce a transformation of the spin helix into a collinear spin-modulated structure when all spins are parallel to the field, with their ordered components oscillating along the chain with an incommensurate period.

This transition may be related to the field evolution of short range chiral (transverse) and spin-density wave (longitudinal) correlations for the 1D, J_1-J_2 model.[10]

In the field range just below the saturation field the theory predicts the presence of a long-range nematic ordering.[7,11]

The experimental studies of magnetic structures of $LiCuVO_4$ in fields up to saturation will be overviewed in the report.

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