Spin spiral ground state and low energy excitations in antiferromagnets with Dzyaloshinsky-Moriya interactions : $Cu_2Te_2O_5X_2$.

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We investigate the unusual magnetic properties of $Cu_2Te_2O_5X_2$ (X=Br,Cl). In these compounds, the magnetic (S=1/2) Cu^{2+} ions form distorted and weakly (antiferromagnetically) coupled tetrahedra [1]. The antiferromagnetic couplings within the tetrahedra are not unambiguously determined [2]. Early studies suggested the presence of many low lying singlet states (total spin S=0) [3], but recently a long range magnetic order was experimentally observed [4]. Partial explanations were suggested [5, 6] but a global understanding is still lacking.

We first show that Dzyaloshinsky-Moriya interactions (DMI) are allowed by the symetry of the cristal and determine the possible **D** vectors (defining the DMI) which might appear in these compounds. We then introduce an effective magnetic hamiltonian which has both Heisenberg antiferromagnetic exchange interactions and anisotropic DMI. We then find a set of parameters of this hamiltonian which reproduces the experimentally observed incommensurate **k** wave vector. In a second step, we start from the classical ground state of this hamiltonian and perform a spin-wave calculation to obtain the low lying excitations. The results are compared with elastic and inelastic neutron scattering data [4, 7].

References

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