Magnetic properties of disordered quasi-two-dimensional Heisenberg antiferromagnets

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We study the effect of bond disorder on the quasi-two-dimensional frustrated quantum Heisenberg antiferromagnet piperazinium hexachlorodicuprate ($C_4H_{12}N_2Cu_2Cl_6$, PHCC) [1]. In an external magnetic field of $H_c \sim 10$ T, the disorder-free material undergoes a quantum phase transition to a magnetically ordered state, by virtue of a Bose-Einstein condensation of magnons. Bond randomness is introduced by partially substituting Cl^- ions by Br^-. This affects the Cu-Cl-Cl-Cu superexchange pathways and therefore the spin interaction strengths. Concentrations of up to 10% Br are realized in well-charachterized single crystal samples. With increasing bond randomization, the field-induced transition is replaced by a broad crossover to a short-range ordered state. This behavior is manifest in magnetic, calorimetric and neutron scattering experiments performed in magnetic fields up to 15 T. We interpret the results in terms of the formation of magnon Bose glass phase. It remains unclear whether a truly long-range ordered BEC phase survives in disorder PHCC at any field values.

[1]M. Stone *et al.*, New Journal of Physics, **9**, 31 (2007).