MAGNETIC EXITATIONS IN SPIN-1/2 TRIANGULAR-LATTICE ANTIFERROMAGNETS: HIGH-FIELD ESR STUDIES

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The spin-1/2 Heisenberg antiferromagnet (AF) on a triangular lattice is the paradigmatic model in quantum magnetism, which was intensively studied since several decades. In spite of numerous theoretical studies (which predict a rich variety of grounds states, ranging from a gapless spin liquid to Néel order), many important details of its phase diagram remain controversial or even missing. To test the theory experimentally, a precise information on the spin-Hamiltonian parameters for the materials of interest is highly demanded. Here, we present results of high-field electron spin resonance (ESR) studies of spin-1/2 Heisenberg AF Cs_2CuCl_4 and Cs_2CuBr_4 with distorted triangular-lattice structures. In the magnetically saturated phase, quantum fluctuations are fully suppressed, and the spin dynamics is defined by ordinary spin waves (magnons). This allows us to accurately describe the magnetic excitation spectra in both materials and to determine their exchange parameters using the harmonic spin-wave theory [1].

The viability of the proposed method was first proven by applying it to Cs_2CuCl_4, revealing good agreement with inelastic neutron-scattering results. For the isostructural Cs_2CuBr_4 we obtain J/k_B=14.9 K, J'/k_B=6.1 K, [J'/J~0.41], providing exact and conclusive information on the exchange coupling parameters in this frustrated spin system. We argue, that the proposed approach can have a broader impact, potentially used for *any* quantum AF with reduced (e.g., by the staggered Dzyaloshinskii-Moriya interaction) translational symmetry, resulting, as predicted, in emergence of a new exchange mode above the saturation field.

In addition, we show that the presence of a substantial zero-field gap, ~10 K, observed in the ESR spectrum of Cs_2CuBr_4 below as well as above T_N, can be interpreted in the frame of the triangular-lattice AF model, indicating good agreement with results of spin-wave calculations [2]. The peculiarities of the ESR spectrum will be discussed taking into account the effect of the Dzyaloshinskii-Moriya interaction present in both materials.

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