MAGNETO-OPTIC SPECTROSCOPY USING A COMBINATION OF A FAR-INFRARED FREE ELECTRON LASER AND PULSED MAGNETIC FIELDS UP TO 65 T

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We report on results of the magnetic-resonance spectroscopic study in the multiferroic ferrimagnet Cu_2OSeO_3, a first known insulator that exhibits a skyrmion order. The low-temperature magnetic excitation spectrum was probed at applied magnetic fields up to 65 T and four field-induced absorption modes were revealed in the frequency range between 45 and 300 cm^{-1} (Fig.1.). The magnetic-field dependence of the resonance frequencies (Fig.2.) confirms the theoretical framework [1] claiming that the fundamental magnetic building blocks of this compound are rigid, highly entangled and weakly coupled tetrahedra with a total spin S =1. The excellent agreement with the theory provides coupling parameters of the microscopic spin-spin Hamiltonian, which cannot be readily extracted from thermodynamic and magnetization measurements. Also, we demonstrate that the combination of far-infrared free electron laser with pulsed-field magnets is a powerful tool to probe and quantify magnetic interactions in exchange-coupled spin systems [2].

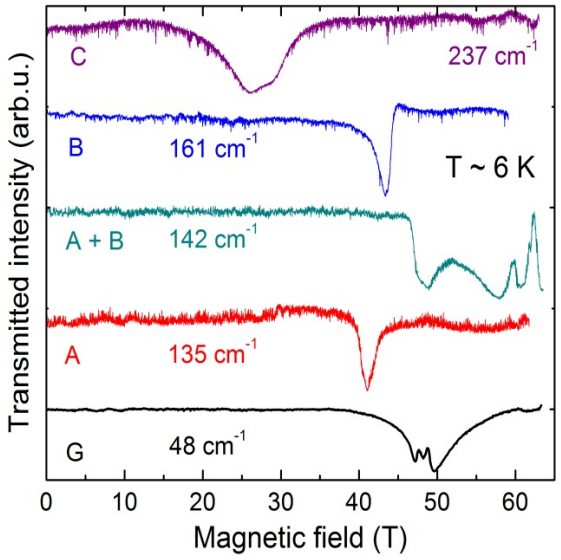

Fig. 1. Relative transmittance of Cu_2OSeO_3 at applied magnetic fields.

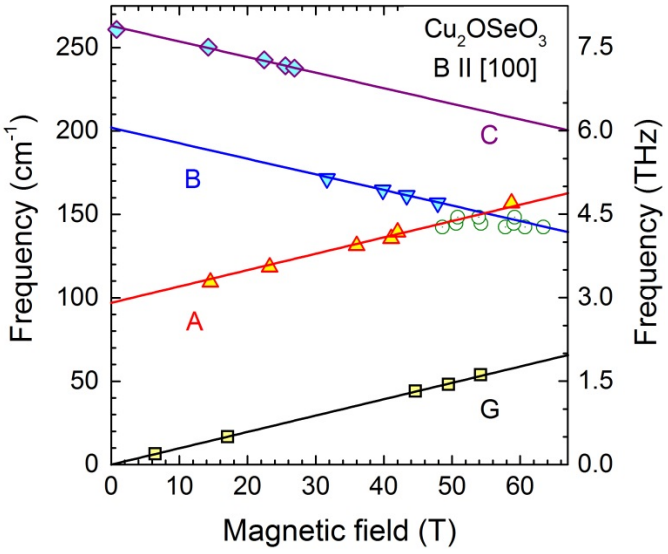

Fig. 2. Magnetic-field dependence of excitation energy in Cu_2OSeO_3 at the temperature about 6 K.

[1] O. Janson *et al*., Nature Communications **5**, 5376 (2014)
[2] M. Ozerov *et al,* Phys. Rev. Lett. **113**, 157205 (2014)

Category: MO
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