proceedings

Abstract

Spin-Lattice Coupling in the Quantum Spin Ice Candidate $Tb_2Ti_2O_7$ Revealed by THz Spectroscopy †

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In geometrically frustrated magnetism, the very nature of the ground state of $Tb_2Ti_2O_7$, has remained a long standing conundrum. In this pyrochlore material, no conventional spin-ice or long-range magnetic order is stabilized, even at very low temperatures. Quantum fluctuations are suspected of being at the origin of such an exotic quantum phase, yet so far has lacked conclusive evidence. Using high-resolution synchrotron-based terahertz spectroscopy, we have probed the lowest energy excitations of $Tb_2Ti_2O_7$ (see Figure 1). It is revealed that a double hybridization of crystal-field-phonon modes is present across a broad temperature range from 200 k down to 6 K [1]. This so called vibronic process affects the electronic ground state that can no longer be described solely by electronic wave functions. We will present here new results obtained down to 250 mK in the exotic magnetic phase.

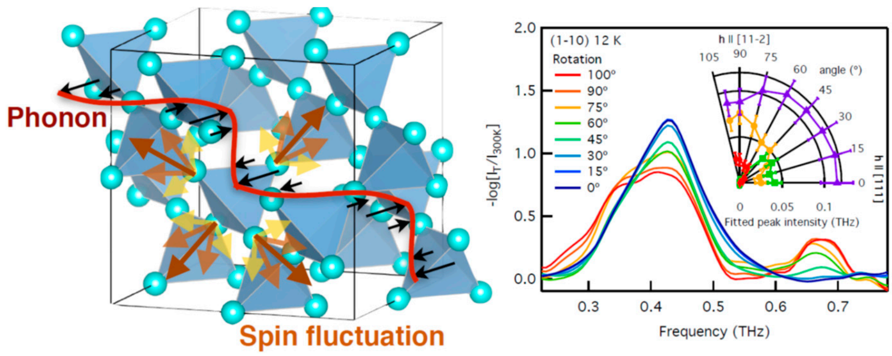

Figure 1. (**left**) Tb^{3+} Pyrochlore network and graphical description of the vibronic process that involves the hybridization between a phonon and a crystal field excitation. (**right**) Angular dependence of the THz spectra recorder at 12 K.

Reference

1. Constable, E.; Ballou, R.; Robert, J.; Decorse, C.; Brubach, J.B.; Roy, P.; Lhotel, E.; Del-Rey, L.; Simonet, V.; Petit, S.; et al. Double vibronic process in the quantum spin ice candidate $Tb_2Ti_2O_7$ revealed by terahertz spectroscopy. *Phys. Rev. B* **2017**, 95, 020415.