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Title

Magnons and electromagnons in a spin-lattice-coupled frustrated magnet CuFeO(2) as seen via inelastic neutron scattering

Source

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Abstract

We have investigated spin-wave excitations in a four-sublattice (4SL) magnetic ground state of a frustrated magnet CuFeO(2), in which "electromagnon" (electric-field-active magnon) excitation has been discovered by recent terahertz time-domain spectroscopy [Seki et al., Phys. Rev. Lett. 105, 097207 (2010)]. In a previous study, we identified two spin-wave branches in the 4SL phase by means of inelastic neutron scattering measurements under applied uniaxial pressure [T. Nakajima et al., J. Phys. Soc. Jpn. 80, 014714 (2011)]. In the present study, we have performed high-energy-resolution inelastic neutron-scattering measurements in the 4SL phase, resolving fine structures of the lower-energy spin-wave branch near the zone center. Taking account of the spin-driven lattice distortions in the 4SL phase, we have developed a model Hamiltonian to describe the spin-wave excitations. The determined Hamiltonian parameters have successfully reproduced the spin-wave dispersion relations and intensity maps obtained in the inelastic neutron-scattering measurements. The results of the spin-wave analysis have also revealed physical pictures of the magnon and electromagnon modes in the 4SL phase, suggesting that collinear and noncollinear characters of the two spin-wave modes are the keys to understanding the dynamical coupling between the spins and electric dipole moments in this system.