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Spin dynamics of the spin-Peierls system $CuGeO_3$ using pulsed neutron scattering

Masaki FUJITA

Institute for Chemical Research, Kyoto University, Gokasyo, Uji 611-0011

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We investigated the spin dynamics of single crystal $CuGeO_3$, which undergoes spin-Peierls (SP) transition at T_{sp}=14K, using advantages of pulsed neutron scattering techniques. The full magnetic excitation spectrum characterized by continuous region was shown for the first time, suggesting strong spin fluctuations that are necessary for the SP transition. Though the outline of excitation continuum is very similar to a two-spinon continuum, its dynamical structure factor differs remarkably from *Müller ansatz* for S=1/2 one-dimensional (1D) Heisenberg model. The sharp intensity on the low-laying bound state mode persists in SP state and disappears suddenly on crossing T_{sp}. This observation indicates directly that large changes occur in spin correlation between the SP state and the uniform (U) state. In contrast, the features of spectrum at higher energies that include the bulging intensity on the upper boundary do not show changes and the continuum excitation remains above T_{sp}. In addition, the influences of next nearest neighbor (NNN) interaction along one-dimensional chain are seen in the spectrum and we made quantitative analyses of them. Our results show the existence of a large NNN interaction that enhances spin fluctuations.

KEYWORDS: spin-Peierls, neutron scattering, spin fluctuation