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最先端融合科学イノベーション教育研究コンソーシアム（CIAiS）

「Spin Wave Tomography」

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Abstract

I will report the experimental observation of the band dispersion structures of pure-magnetostatic spin waves achieved via the development of a table-top all-optical spectroscopy named spin-wave tomography (SWaT). A spin wave is a collective spin excitation in magnetic materials, which typically results in precession of the magnetization. The characteristics of spin waves depend strongly on their wavenumber (k), and are encoded in their dispersion relations. Depending on the k-value, spin waves have been classified into exchange spin waves, dipole-exchange spin waves, and magnetostatic spin waves. So far, the dispersion relations of the exchange spin waves and the dipole-exchange spin waves have been observed by neutron scattering and Brillouin light scattering experiments. However, the experimental observation of the dispersion relation of the pure-magnetostatic spin waves has been elusive. SWaT is based on the observation of the propagation dynamics of optically-excited spin waves by time-resolved magneto-optical imaging method. The dispersion relation of the spin waves is reconstructed by analyzing the propagation dynamics of spin waves employing Fourier transform. This new method realizes spin wave spectroscopy with high k-resolution, allowing to visualize the dispersion relations of the pure-magnetostatic spin waves. Moreover, we demonstrate the time-resolved measurements of the SWaT spectra and discuss the energy transfer from optically-generated phonons to spin waves via the magnetoelastic coupling.

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