量子物理学・ナノサイエンス第 365 回セミナー

Femtosecond manipulation of coherent magnetic excited states

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概　要

The wildly growing field of antiferromagnetic spintronics is currently addressing several fundamental questions. A major topic of investigation concerns the generation and manipulation of coherent magnons on the ultrafast timescale [1-3]. The development of novel pulsed-laser sources has enabled scientists to address the following scientific question: which magnetic excited state can be induced by resonantly driving coherent magnons throughout the Brillouin zone? In my talk, I will outline our approach to this open issue, which relies on the resonant drive of pairs of high-energy magnons in the weak ferromagnet α-Fe_2O_3 (hematite), with wavevector near the edges of the Brillouin zone. This unprecedented concept results in a strong perturbation of the entire magnetic system of the material, in particular: i) magnon modes with different wavevectors are excited and amplified; ii) the eigenfrequencies of magnons are modified, which demonstrates a modification of the magnon dispersion; iii) a coupling between magnon modes that are orthogonal eigenstates of the magnetic Hamiltonian of the material is observed. Additionally, the effect of light on the magnetic system is quantified by quantitatively estimating the modification of the magnetic interactions. All these observations are rationalised in view of a resonant impulsive stimulated Raman scattering mechanism. Our results offer perspectives to establish an all-optical arbitrary tailoring of the spectrum of the magnetic excitations of a given material on the fundamental timescales.

[1] T. Satoh *et al*. PRL **105**, 077402 (2010).
[2] A. V. Kimel *et al.* Nature **435**, 655 (2005).
[3] D. Bossini *et al.* Nature Comm. **7**, 10645 (2016).

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