

量子物理学・ナノサイエンス第 456 回セミナー

Harnessing Light to Generate and Probe Magnons in Two-Dimensional Magnets

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概 要

Two-dimensional magnetic materials provide a versatile platform for controlling collective spin excitations and exploring their topological and quantum-geometric properties. Of particular interest is the generation and manipulation of magnon spin currents, which could enable low-dissipation information transport, while topological magnons offer the prospect of robust, directional spin transport protected against imperfections. Beyond topology, the quantum geometry of magnon bands contains information about the magnon wavefunctions that is inaccessible from the excitation spectrum alone, providing a new avenue for characterizing magnetic materials. In this talk, I will discuss how light can be used both to control and to probe these phenomena. I will present mechanisms for the all-optical generation of magnon spin currents [1], as well as optical approaches to access the topology and quantum geometry of magnon bands [2, 3]. Combined with an optical cavity, these mechanisms can be leveraged to generate steady states of squeezed magnon pairs [4]. Finally, I will discuss how THz spectroscopy and cavity coupling can reveal signatures of topological magnon edge states [5]. Together, these theoretical results demonstrate how light–magnon interactions provide powerful tools to generate, probe, and characterize magnon transport and collective excitations in two-dimensional magnetic materials.

References:

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