

量子物理学・ナノサイエンス第 398 回セミナー

Chiral phononics: Controlling materials with a twist

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日程 : 10月16日(水) 15:00 -

場所 : 南5号館5階 503CD 大会議室

概要

Chiral phononics is an emerging field, in which the angular momentum of circularly polarized lattice vibrations is utilized to control the properties of materials. When chiral phonons are driven coherently with an ultrashort laser pulse, the light makes the ions in the material behave like electromagnetic coils, producing circular ionic currents around their equilibrium positions in the crystal. This induces real and effective magnetic fields that can reach the tesla scale, providing an unprecedented means for the manipulation of magnetic order. Here, I present our recent theoretical predictions of novel phenomena arising from chiral phonon excitation, specifically light-induced magnetization in antiferromagnets [1] and light-induced multiferroicity in nonmagnetic nonpolar materials [2]. Furthermore, I will show how light can be used to make achiral materials chiral through a phononic rectification process that breaks all improper rotation symmetries of the crystal structure. These predictions highlight phonon chirality as a fundamental tool to create new functional properties in solids.

[1] T. Kahana, D. A. Bustamante Lopez, and D. M. Juraschek, Light-induced magnetization from magnonic rectification, *Science Advances*, in press (2024) (Preprint arXiv:2305.18656)

[2] C. Paiva, M. Fechner, and D. M. Juraschek, Dynamically induced multiferroic polarization, arXiv:2404.16234 (2024)

ご来聴を歓迎いたします。

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