第78回トポロジカル物質科学セミナー
Topological Materials Science Seminar (78)

Axion electrodynamics and the quantized topological magnetoelectric effect in topological insulators

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Time: 10:30 -12:00

Place: Room 525, Science Bldg. 5 (Physics), Kyoto University

Abstract: Topological insulators have been proposed to be best characterized as bulk magnetoelectric materials that show response functions quantized in terms of fundamental physical constants. Here we lower the chemical potential of three-dimensional (3D) Bi_2Se_3 films to ~30 meV above the Dirac point, and probe their low-energy electrodynamic response in the presence of magnetic fields with high-precision time- domain terahertz polarimetry. For fields higher than 5 T, we observed quantized Faraday and Kerr rotations, whereas the DC transport is still semi-classical. A non-trivial Berry phase offset to these values gives evidence for axion electrodynamics and the topological magnetoelectric effect. The time structure used in these measurements allows a direct measure of the fine structure constant based on a topological invariant of a solid-state system. I'll also discuss our most recent measurements on topological insulator single crystals that give evidence for a half quantized Hall effect on the TI surfaces.

References:

1) On the matter of topological insulators as magnetoelectrics,
N.P. Armitage, Liang Wu, arXiv: 1810.01233.

2) Electric field modulated topological magnetoelectric effect in Bi_2Se_3,
M. Mondal, NP Armitage *et al.*, Phys. Rev. B **98**, 121106(R) (2018).

3) Quantized Faraday and Kerr rotation and axion electrodynamics of a 3D topological insulator,
L Wu, NP Armitage *et al*., Science **354**, 1124 (2016).

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