Center for Artificial Low D Electronic Systems

2020 Fall Seminar
with CALDES, IBS & SRC, POSTECH

- ✓ **Date&Time:** September 18 (Fri), 3:00PM~
- ✓ **Venue:** Online (Zoom)
- ✓ **Speaker & Title**

1) 3:00PM~ Prof. Bohm-Jung Yang (Seoul Nat'l Univ.)
Quantum distance and anomalous Landau levels of flat bands

2) 4:10PM~ Prof. Heung-Sik Kim (Kangwon National University)
Dynamical magnetoelectric coupling and optical effect in Ni3TeO6:
from ab-initio simiulation of optical d-d excitation spectra

Organized by Prof. Jun Sung Kim (js.kim@postech.ac.kr, 054-279-2098)
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- **3:00PM~**

Quantum distance and anomalous Landau levels of flat bands

Bohm-Jung Yang
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The geometry of quantum states is one of the central concepts underlying diverse physical phenomena, ranging from the Aharonov-Bohm effect to the topological phases of matter. However, compared to the physics of the Berry curvature, the effects of the quantum metric on physical phenomena are less understood, especially in solids. In this seminar, I am going to propose a way of measuring the quantum distance of Bloch states in solids by applying magnetic field. More specifically, I will describe the energy spectrum under magnetic field of flat bands in the kagome and checkerboard lattices, and the observed anomalous Landau level spreading arising from the flat band. Surprisingly, it is found that the total energy spreading of the flat band's Landau level is solely determined by the maximum quantum distance between the Bloch states of the flat band. Namely, the quantum distance of the Bloch states in solids can be measured by applying magnetic field to two-dimensional materials with flat bands. It is expected that this results would provide a critical step towards the complete understanding of geometrical properties of quantum states in solids

Reference

[1] J. W. Rhim and B. -J. Yang, "Classification of flat bands according to the band-crossing singularity of Bloch wave functionsClassification of flat bands according to the band-crossing singularity of Bloch wave functions", Phys. Rev. B, 99, 045107 (2019).
[2] J. W. Rhim, K. Kim, and B. –J. Yang, "Quantum distance and anomalous Landau levels of flat bands", Nature 584, 59-63 (2020).

- **4:10PM~**

Dynamical magnetoelectric coupling and optical effect in Ni3TeO6: from ab-initio simiulation of optical d-d excitation spectra

Heung-Sik Kim
Department of Physics, Kangwon National University

Nonreciprocal directional dichroism is an unusual light-matter interaction that gives rise to diode-like behavior in low symmetry materials. The chiral varieties of nonreciprocal directionaldichroism are particularly scarce due to the requirements for strong spin-orbit coupling, broken time reversal symmetry, and a chiral axis. We bring together magneto-optical spectroscopy and first principles calculations to reveal high energy, broad band nonreciprocaldirectional dichroism in Ni3TeO6 with special focus on behavior in the metamagnetic phase above 52 T. Using first-principles-based methods it is shown how the Ni2+ d-to-d on-site excitations develop magnetoelectric character via relativistic spin-orbit coupling,which present a microscopic model that unlocks the door to theory-driven discovery of chiral magnets with nonreciprocal directional dichroism.