Title:
Chirality Meets Geometric Phase: Physical Consequences and Material Candidates

Abstract:
Chirality is one of the most important concepts of physics science. Structural chirality induces usual motion of electrons, which can lead to orbital- and spin-momentum lockings, nonreciprocal magnetoresistances, and circularly polarized luminescence etc. On the other hand, the geometric (Berry) phase has become a very important tool to understand various effects in condensed matter physics including topological materials, light-matter interaction, and charge polarization in crystalline solids. In this talk, I will introduce our recent works about chirality-driven or inversion-asymmetry-driven phenomena based on the concept of geometric phase: (i) Electronic orbital polarization effect in a chiral lattice, (ii) giant unidirectional magnetoresistance effect in twisted bilayer graphene, (iii) anomalous circularly polarized light emission induced by optical Berry curvature dipole, and (iv) orbital magnetoelectric coupling effect.

Title: Structural Chirality Driven Magnetoelectric Coupling in Chiral 1D Lattices

Abstract:
The ability to inter-manipulate electric and magnetic properties of materials by external conjugate fields, i.e. magnetoelectric (ME) effect, is crucial to many advanced technologies such as compact information storage. Here, based one the concept of geometric (Berry) phase, we discover a new type of structural chirality driven magnetoelectric (sCDME) coupling effect in chiral 1D lattices. We propose simple lattice models and possible material candidates to observe this effect.

So far most of the reported ME effects are limited in two- and three- dimensional bulk multiferroic or topological materials with strong spin-orbit coupling (SOC). However, possible ME effects in low-dimensional and weak-SOC systems remain rare. Here we report a new type of chirality driven topological ME (CDTME) effect without SOC in 1D chiral lattices. We propose simple lattice models and possible material candidates to observe this effect.