

Condensed Matter Physics Seminar Series

Cross-correlation phenomena in altermagnets

Hitoshi Seo

Quantum Matter Theory Research Group, Center for Emergent Matter Science, Riken, Japan



Altermagnets are a type of antiferromagnet that exhibit an alternating spin order with a wave vector $q = 0$; in the limit where the spin-orbit interaction is zero, the net magnetization is canceled out. The simplest case is a system with two sublattices within a unit cell, in which up spins and down spins are ordered, respectively. If these sublattices are not connected by translational or inversion operations, the system breaks macroscopic time-reversal symmetry and exhibits characteristic cross-correlation phenomena not observed in ordinary antiferromagnets [1]. In this talk, we will discuss the phenomena expected in altermagnetic systems and their microscopic mechanisms: 1. non-relativistic spin splitting and spin current generation [2], 2. the anomalous Hall effect [3], and 3. the piezomagnetic effect [4]. Although there has already been extensive research on each of these, we will specifically demonstrate—using models of typical strongly correlated organic compounds—that the conditions for their emergence and the key factors involved differ. Furthermore, we will point out the similarity between the structure of molecular dimers in organic systems and the lattice distortion known

as the GdFeO_3 -type in inorganic perovskite-type compounds [5], and discuss the observation of these phenomena.

[1] As a review: M. Naka, Y. Motome, H. Seo, npj Spintronics 3, 1 (2025).

[2] M. Naka et al., Nat. Communications 10, 4305 (2019).

[3] M. Naka et al., Phys. Rev. B 102, 075112 (2020).

[4] M. Naka, Y. Motome, T. Miyazaki, H. Seo, J. Phys. Soc. Jpn. 94, 083702 (2025).

[5] M. Naka, Y. Motome, H. Seo, Phys. Rev. B 103, 125114 (2021); *ibid.*, Phys. Rev. B 106, 195149 (2022).

Tuesday, October 20th at 4pm via Zoom

<http://ucla.zoom.us/my/pab4330>

Meeting ID 459 501 9153

Hosted by Stuart Brown