2021 年度 第 1 回早稲田物性セミナー開催のお知らせ

下記の通り、第 1 回早稲田物性セミナーを開催いたします。皆さまのご参加をお待ちしております。

Date：2021年5月24日(月) 13：30～

Place：オンライン（Zoom）

Title： DC electric-field controls of superexchange and Dzyaloshinskii-Moriya interactions in Mott insulators

Speaker： Shunsuke Furuya (Ibaraki University)，古谷峻介氏（茨城大学）

[Abstract]

Controlling quantum states of matter has been a long-standing subject of condensed-matter physics and other related fields. Controlling microscopic parameters of a compound will induce a phase transition and drag the compound into the desired quantum state. Lowering the temperature and applying the magnetic field are typical controlling methods in the field of magnetism. We recently showed that the DC electric field can also control the superexchange interaction mediated by an anion residing between magnetic ions [1]. The static electric potential, affecting the eigenenergies of atomic orbitals, eventually modulates the superexchange interaction. Strong but feasible DC electric fields, ~ O(1) MV/cm, controls the superexchange interaction and, in some cases, adds an interaction that was forbidden by symmetries (e.g., the bond alternation). A similar DC electric-field effect was also discussed in Ref.[2].

The hitherto considered DC electric-field effects on quantum magnets are only about the superexchange interaction [1,2]. Reference [3] further discusses DC electric-field controls of magnetism in the presence of spin-orbit couplings. The most prominent effect is the creation and annihilation of the Dzyaloshinskii-Moriya (DM) interaction by the DC electric field, which is directly related to switching on and off topological spin textures in ferromagnets [4,5]. In this talk, we discuss the essence of those microscopic DC electric-field controls of magnetic Mott insulators [1,3] without entering too much into technical details.

[1] SCF, K. Takasan and M. Sato, arXiv:2102.04607.
[2] K. Takasan and M. Sato, Phys. Rev. B 100, 060408(R) (2019).
[3] SCF and M. Sato, in preparation.
[4] S. Seki and M. Mochizuki, “Skyrmions in magnetic materials” (Springer) (2016).
[5] N. Kanazawa et al., Nat. Commun. 7, 11622 (2016).

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