第 56 回トポロジカル物質科学セミナー
Topological Materials Science Seminar (56)

Spin-orbit Mott insulators: from Kitaev model to Higgs mode

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

Abstract:

Spin-orbit coupling entangles the spin and orbital subspaces leading to a rich variety of effective Hamiltonians and exotic phases depending on lattice geometry and orbital structure. An example is the Kitaev honeycomb model with spin liquid ground state that can be realized in spin-orbit J = 1/2 compounds [1]. In this talk, I will focus on spin-orbit J = 0 Mott insulators with gapped singlet-triplet excitations. Exchange interactions and crystalline electric fields may close the spin gap, resulting in a Bose condensation of spin-orbit excitons.

In addition to usual magnons, a Higgs amplitude mode, most prominent near quantum critical point, is expected. Upon electron doping, ferromagnetic correlations and triplet superconductivity may emerge. These predictions [2,3] will be discussed in the context of recent neutron and Raman light scatering experiments [4,5] in ruthenium oxides.

[1] G. Jackeli and G. Khaliullin, Phys. Rev. Let. **102**, 017205 (2009).
[2] G. Khaliullin, Phys. Rev. Let. **111**, 197201 (2013).
[3] J. Chaloupka and G. Khaliullin, Phys. Rev. Let. **116**, 017203 (2016).
[4] A. Jain *et al.*, Nature Phys. **13**, 633 (2017).
[5] M. Souliou *et al.*, Phys. Rev. Let. **119**, 067201 (2017).

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