

Microscopic Theory and Symmetry of Extended Kitaev models

Hae-Young Kee^{1,2}

¹*Department of Physics, University of Toronto, Toronto, Ontario, Canada M5S 1A7*

²*Canadian Institute for Advanced Research, CIFAR Program in Quantum Materials,
Toronto, Ontario, Canada M5G 1M1*

In this tutorial, I will present a microscopic theory to derive extended Kitaev models with spin $S=1/2$ including the off-diagonal symmetric Gamma and Heisenberg interaction.[1] The extension to higher-spin S models will be also presented starting from multi-orbital and spins at both transition metal and ligand sites.[2] I will then show how to use the symmetry of the full Hamiltonian and hidden symmetries to find magnetic ordering states and a possible spin liquid under the magnetic field. The symmetry analysis also offers a way to determine the strength of Kitaev interaction out of the full Hamiltonian under special directions of magnetic field.[3] Proposed experimental set-ups will be discussed.

[1] J. Rau, E. K.-H. Lee, H.-Y. Kee, Phys. Rev. Lett. 112, 077204 (2014).

[2] P. P. Stavropoulos, D. Pereira, H.-Y. Kee, Phys. Rev. Lett. 123, 037203 (2019).

[3] J. Cen, H.-Y. Kee, Communications Physics 5, 119 (2022).