[QMS2020 invited talk]

Identification of a Kitaev Quantum Spin Liquid via Magnetic Field Angle Dependence

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Enomously entangled quantum states may appear in quantum magnets. Prime examples include quantum spin liquids with Majorana fermions, which have been suggested as a future platform of quantum entanglement control, and their identification is one of the key issues in modern condensed matter. Here, we argue that a non-abelian Kitaev quantum spin liquid (KQSL) may be identified by magnetic field angle dependence of physical observables. A spin model with the Kitaev, Heisenberg, and off-diagonal symmetric terms on a hexagonal lattice is studied by exact-diagonalization, spin-wave theory, and parton mean field analysis, and characteristic magnetic field angle dependence of a non-abelian KQSL is uncovered. Namely, we demonstrate that zero-energy excitations must appear along lines of the directions of an applied magnetic field. The zero-energy lines are intrinsically associated with topological phase transitions of a KQSL [1], and they may be naturally related with an exact-diagonalization result of a finite-size spin model. We also provide smoking-gun signatures of physical quantities such as heat capacity for a candidate material, a-$RuCl_3$[2].

[1] A. Go, J. Jung, and E.-G. Moon, Phys. Rev. Lett. **122**, 147203 (2019).

[2] A. Go, K. Hwang, J. Seung, and E.-G. Moon, in preparation.