Microscopic World of Quantum Materials

Hae-Young Kee (hykee@physics.utoronto.ca)
Department of Physics, University of Toronto, Canada

Abstract: Quantum materials provide a fertile ground for investigating exotic phenomena such as topological insulators, unconventional magnetic orders and superconductors, and spin liquids. These diverse and intricate electronic states necessitate a concept of emergence that goes beyond the traditional picture of individual electrons carrying charge, orbit, and spin. In this talk, I will present the usage of effective Hamiltonians from the microscopic degrees of freedom of target materials, with particular emphasis on low-energy spin models in Mott insulators. I will also discuss a systematic approach for identifying candidate materials with the desired Hamiltonian that underlies their emergent electronic properties and offers avenue to discover new materials.

Bio: Hae-Young Kee is a professor of Physics at the University of Toronto, a Canada Research Chair in Theory of Quantum Materials, and a fellow of the Canadian Institute for Advanced Research in Quantum Materials. Kee is a theoretical physicist who specializes in condensed matter physics of complex quantum materials including quantum spin liquids, topological phases, high temperature superconductors, and frustrated magnets.