

Materials overview of iridates: From quantum spin liquid to Dirac semimetal

Tomohiro Takayama

Max Planck Institute for Solid State Research

5d transition-metal oxides like iridates have recently emerged as a platform of novel electronic phases produced by the interplay between strong spin-orbit coupling, modest Coulomb interaction, electron kinetic energy and crystal field. One of the unique features of iridates is that they show totally different faces depending on their lattice network. For example, isotropic Heisenberg magnetic coupling is proposed and experimentally identified in Sr_2IrO_4 with corner-shared IrO_6 octahedra, while highly anisotropic magnetic coupling appearing in edge-shared IrO_6 network is discussed to give rise to Kitaev spin liquid.

In these lectures, I will overview the vast materials of iridates based on their crystal structures. The aim is how to see and understand their crystal structures from the simple prototypes. The materials include newly discovered ones by various synthetic techniques such as thin-film fabrication, high-pressure synthesis, and soft-chemical approach.

The first talk focuses on the perovskite and related materials, and in the second talk I will visit iridates with edge-shared IrO_6 network such as 2D and 3D honeycomb, spinel and hyperkagome.