Topological nodal-line semimetals arising from crystal symmetry

RYO TAKAHASHI, MOTOAKI HIRAYAMA, SHUICHI MURAKAMI, Tokyo Institute of Technology — Nodal line semimetals, one of the topological semimetals, has line-shaped degeneracy (nodal line) where the gap is closed. Usually, nodal lines appear accidentally, and it is considered to be impossible to determine whether nodal lines appear from crystal symmetry alone. In this presentation, we show that for spinless systems with certain space groups, presence of nodal lines results only from symmetry. The nodal lines appears on a glide plane, and their appearance is attributed to difference in glide eigenvalues on several axis on the glide plane. Using a model Hamiltonian, we demonstrate that the presence of the nodal line comes only from its space-group symmetry and time-reversal symmetry. We also show various space groups, under which spinless systems always have nodal lines coming from symmetry and illustrate how the nodal lines are located. We introduce some candidate materials.