Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Universal phase diagram between spinless topological nodal-line semimetals and Weyl semimetals RYO OKUGAWA, Tokyo Institute of Technology, SHUICHI MURAKAMI, Tokyo Institute of Technology, TIES — Topological nodal-line semimetals are realizable in systems without a spin-orbit interaction when time-reversal and inversion symmetries are present. On the other hand, Weyl semimetals appear in spinless systems if either time-reversal or inversion symmetry is absent. We theoretically study a general phase transition between the topological nodal-line semimetal and Weyl semimetal phases by breaking the time-reversal or inversion symmetry. We find that the topological nodal-line semimetal necessarily transits into the Weyl semimetal by breaking time-reversal symmetry when the topological nodal line encloses a time-reversal invariant momentum. However, topological nodal-line semimetals generally become insulating by breaking inversion symmetry. Meanwhile, we show that crystallographic symmetries determine band evolutions of the topological nodal lines. As a result, gapless nodes in the topological nodal-line semimetals are protected not only by topology but also by the crystallographic symmetries in many crystals. Because of the protection of the crystal symmetries, it is shown that the spinless Weyl semimetal or nodal-line semimetal can be realized after inversion symmetry is broken.

Ryo Okugawa
Tokyo Institute of Technology

Date submitted: 10 Nov 2016 Electronic form version 1.4