Title: "Novel topological phases of matter and their material realizations"

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Abstracts:

Symmetry and topology are organizing principles for understanding matters, enabling the discoveries of novel topological phases, such as topological insulators and topological superconductors. More recent discoveries at the forefront of condensed matter physics are protected degeneracies in the electronic structures of materials that guarantee semimetallic behavior, such as Weyl semimetal and Dirac semimetals. In the line of the efforts to discover novel electronic phases and realize them in feasible materials, we have recently identified new symmetry-protected topological phases, such as layered topological crystalline insulators [1], Dirac line node semimetals [2], and double Dirac semimetals [3], and their corresponding material realizations using first-principles calculations. In this talk, we briefly review the general theory of topological materials, and introduce these symmetry-protected topological phases. We will also discuss possible future research directions in the field of topological materials.

Reference:

[1] Youngkuk Kim, Eugene J. Mele, Charles L. Kane, and Andrew M. Rappe, "Layered topological crystalline insulators", Phys. Rev. Lett. **115**, 086802 (2015)

[2] Youngkuk Kim, Benjamin J. Wieder, Charles L. Kane, and Andrew M. Rappe, "Dirac line node in inversion symmetric crystals", Phys. Rev. Lett. **115**, 036806 (2015)

[3] Benjamin J. Wieder, Youngkuk Kim, Andrew M. Rappe, and Charles L. Kane, "Double Dirac semimetals in Three Dimensions", Phys. Rev. Lett. **116**, 186402 (2016)