Dirac and Weyl Physics in Thermal Transport

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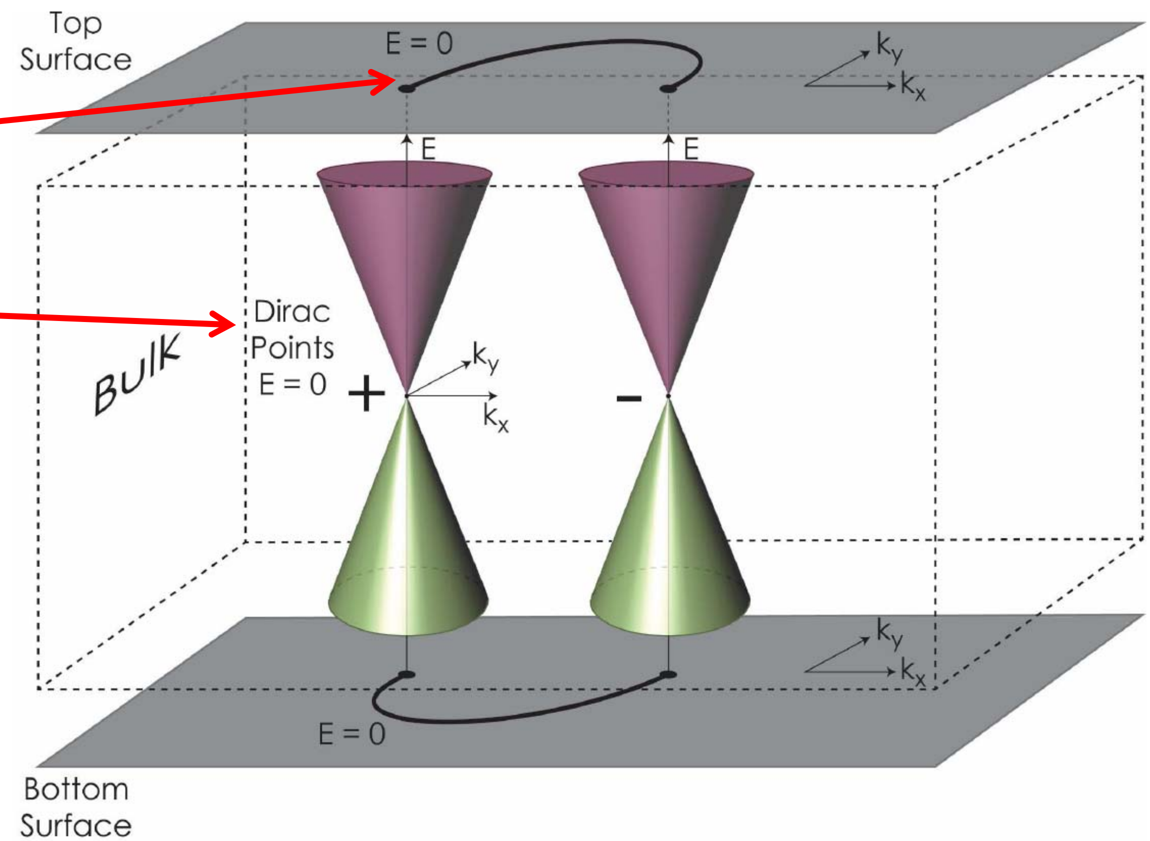
Weyl semimetals

Surface states: arcs at precise values of the k-vector

Bulk states: Dirac dispersions, only characterized by velocity $\boldsymbol{v}$

Chirality: Berry curvature $\boldsymbol{\Omega}$



There are three levels of physics to explore in transport properties:

1. Semimetal physics, similar to bismuth
2. Dirac Physics, massless Dirac dispersion
3. Weyl physics: Berry curvature

   Surface states arcs.

Outline

- Introduction
  - Weyl semimetals: NbP, $YbMnBi_2$
  - Transport: resistivity, Hall, Seebeck, Nernst, Thermal conductivity.
- Dirac physics: large and non-monotonic Nernst coefficient
  - Experiments on NbP
  - Comparison with theory, no adjustable parameters.
  - Nernst contains the signature of the Dirac bands
- Weyl physics 1: Berry curvature
  - non-zero Nernst effect at zero field
  - Experiments on $YbMnBi_2$
- Weyl physics 2: The arcs
  - Theory only: arcs form conveyer-belt entropy transport channels
  - Magneto-thermal conductivity

S. Watzman et al. , arXiv: 1703.04700 (2017)
T. McCormick & al., arXiv 1703.04606
U. Stockert et al. J. Phys. Cond. Matter ***29****, 325701 (2017)*