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Title of the Presentation: Induced anomalous Hall effect of massive Dirac fermions in $ZrTe_5$ and $HfTe_5$ thin flakes

First Name: Yanzhao

Last Name: Liu

Affiliation: International Center for Quantum Materials, School of Physics, Peking University, Beijing, China

Email: liuyz@pku.edu.cn

Short Biography:

Yanzhao Liu obtained his PhD from the International Center for Quantum Materials, School of Physics, Peking University, where he studied quantum transport properties of topological materials under extreme conditions and was supervised by Prof. Jian Wang. He then continued his research in Prof. Jian Wang's group in 2021 as a postdoctoral fellow working on the fabrication and spectroscopic study of two-dimensional high-temperature superconducting systems.

Abstract:

Researches on anomalous Hall effect (AHE) have been lasting for a century to make clear the underlying physical mechanism. Generally, the AHE appears in magnetic materials, in which the extrinsic process related to scattering effects and intrinsic contribution connected with Berry curvature are crucial. Recently, AHE has been counterintuitively observed in non-magnetic topological materials and attributed to the existence of Weyl points. However, the Weyl point scenario would lead to unsaturated AHE even in large magnetic fields and contradicts the saturation of AHE in several tesla (T) in experiments. In this work, we investigate the Hall effect of $ZrTe_5$ and $HfTe_5$ thin flakes in static ultrahigh magnetic fields up to 33 T. We find the AHE saturates to 55 (70) $\Omega^{-1}\cdot cm^{-1}$ for $ZrTe_5$ ($HfTe_5$) thin flakes above ~ 10 T. Combining detailed magnetotransport experiments and Berry curvature calculations, we clarify that the splitting of massive Dirac bands without Weyl points can be responsible for AHE in non-magnetic topological materials $ZrTe_5$ and $HfTe_5$ thin flakes. This model can identify our thin flake samples to be weak topological insulators and serve as a new tool to probe the band structure topology in topological materials.

[1]Yanzhao Liu et al., Physical Review B 103, L201110 (2021).
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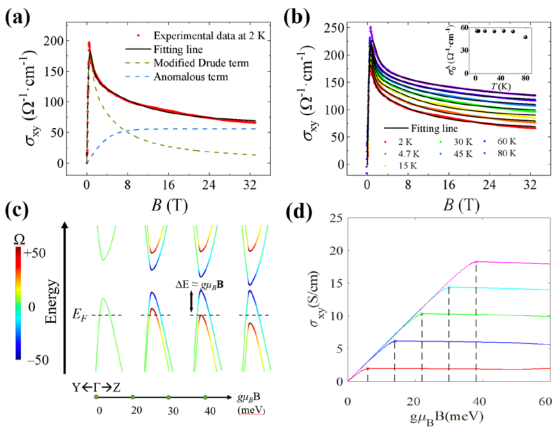

Fig. 1. Anomalous Hall effect in $ZrTe_5$ and $HfTe_5$ thin flakes. (a) Hall conductivity as a function of magnetic fields. (b) Magnetic field dependence of Hall conductivity at selected temperatures. (c) The band structure evolution with respect to the Zeeman splitting. (d) Calculated anomalous Hall conductivity with different carrier densities.