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Unconventional Hall Effect induced by Berry Curvature

Abstract

Berry phase and curvature play a key role in the development of topology in physics [1, 2] and have been included in the semiclassical theory as they do contribute to the thermodynamics and transport properties in solid state systems [3, 4]. In this work, we firstly report the novel nonzero Hall effect in topological material $ZrTe_5$ flakes when in-plane magnetic field is parallel and perpendicular to the current [5]. Surprisingly, both symmetric and antisymmetric components with respect to magnetic field are detected in the in-plane Hall resistivity. Further theoretical analysis suggests that the magnetotransport properties originate from the anomalous velocity induced by Berry curvature in a tilted Weyl semimetal. Our work not only enriches the Hall family but also provides new insight into the Berry phase effect in topological materials.

References

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Figures

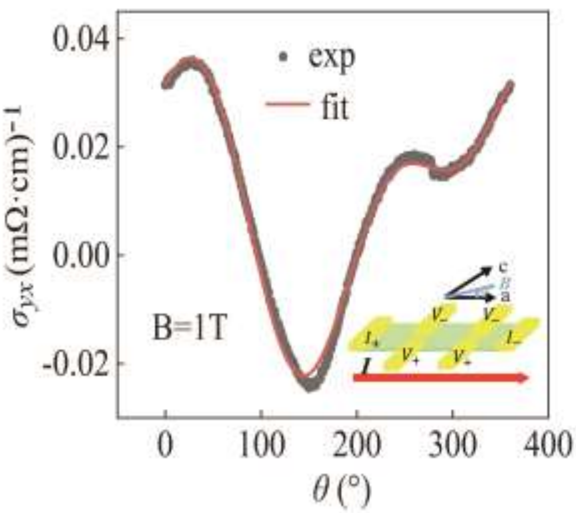

Figure 1: Angular dependence of in-plane Hall conductivity in $ZrTe_5$ device s2. Inset shows the schematic structure for the angular-dependent magnetotransport measurements in *ac* plane of $ZrTe_5$ device. Nonzero Hall conductivity at $\theta = 0°$ $(B \parallel I)$ and $\theta = 90° (B \perp I)$ can be clearly observed in the detected in-plane Hall conductivity(black curve). The theoretical fitting curve(red curve) is well consistent with the experimental data.[5]