Planar Hall effect in noble metal doped type II Dirac Semimetal $PdTe_2$

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Abstract

The study of planar Hall effect (PHE) in topological semimetals has gained tremendous research interest lately. However, there is no clear picture about the origin of PHE in these systems due to the coexistence of chiral anomaly and orbital magnetoresistance (MR). Palladium ditelluride ($PdTe_2$) is a type-II Dirac semimetal with positive longitudinal MR, which makes it a good candidate to host topological superconducting states [1, 2]. It shows superconductivity below 1.7 K and exhibit topologically non-trivial surface states [3]. The intercalation of 5% Cu enhances the superconducting transition temperature to 2.6 K [4]. Recently there have been reports of PHE in $PdTe_2$ [5, 6], that stimulated our interest in studying the PHE in the Cu and Ag intercalated compound; $Cu_{0.05}PdTe_2$, $Ag_{0.05}PdTe_2$. We observed positive longitudinal MR, linear field dependence of the amplitude of PHE, and the tilted prolate shaped orbits in parametric plot that point toward the importance of Fermi surface anisotropies in understanding the origin of PHE in a system like $PdTe_2$. The existence of positive MR and PHE raises a doubt over the notion of chiral anomaly as an origin of PHE in the systems [7, 8]

References

[1] 1) H. J. Noh et al., Phys. Rev. Lett. 119, 016401 (2017).
[2] F. Fei et al., Phys. Rev. B 96, 041201 (2017).
[3] Amit and Yogesh Singh, Physical Review B 97, 054515 (2018).
[4] Ryu G., J. Supercond. Nov. Magn., 28 3275 (2015).
[5] S. Xu et al., arXiv:1811.06767 (2018).
[6] Meng et al., J. Phys.: Condens. Matter 32, 015702 (2020).
[7] Sonika et al. Appl. Phys. Lett. 119, 261904 (2021)
[8] Sonika et al. unpublished

Figures

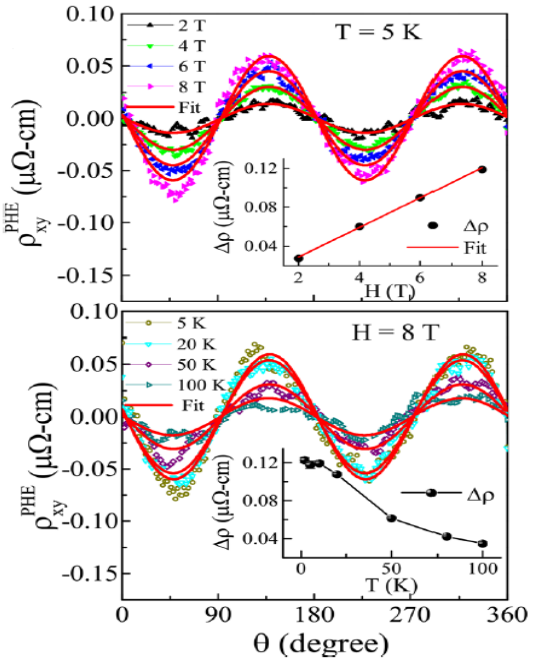

Figure 1: Planar Hall Resistivity at T = 5 K (upper) and H = 8 T (lower) for $Cu_{0.05}PdTe_2$.