Chiral anomaly and anomalous Hall effect in Hexagonal-Mn3+δGe

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Topological quantum materials have attracted enormous attention since their discovery due to the observed anomalous transport properties, which originate from the non-zero Berry curvature. Mn3+δGe has gained special attention because of its large anomalous transport effects that persist starting from Néel temperature (365 K) down to 2 K [1]. Due to the specific mirror symmetry of the triangular antiferromagnetic structure, Anomalous transport effects are expected to be observed when magnetic field (B) is applied along the x or y 57 crystallographic axis [1]. Chiral anomaly, which is one of the prominent signatures of Weyl semimetals, has not been extensively investigated in the case of Mn3+δGe. We have performed planar Hall effect (PHE) and longitudinal magneto-resistance (LMR) measurements with varying angle, temperature, and magnetic field. In general, chiral anomaly effects should strengthen with the increase in magnetic field [2]. However, in the case of Mn3+δGe, chiral anomaly was observed to be suppressed in LMR and PHE measurements, when the magnetic field is increased at low temperature, which is surprising. Our single crystal neutron diffraction measurement did not show any anomaly in magnetic parameters below room temperature. However, X-Ray diffraction has shown maxima in lattice parameters near 235 K, below which change in electrical transport behavior was observed. Therefore, it can be argued that the chiral anomaly and position of Weyl points are much more sensitive to the change in lattice parameters, in comparison with magnetic parameters.
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