Intrinsic longitudinal magnetoresistance in non-magnetic and centro-symmetric metals

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Magnetoresistance is the change in resistivity of a system when a magnetic field is applied. For perpendicular electric (**E**) and magnetic (**B**) fields, a transversal magnetoresistance (TMR) arises. This TMR is explained by means of Lorentz force. For parallel **E** and **B**, a longitudinal magnetoresistance (LMR) appears, however, Lorentz force can not explain this contribution. Some mechanisms have been proposed to explain LMR. For instance, a positive LMR can be explained by considering anisotropic Fermi surfaces in systems without any topology, in low magnetic fields [1]. It can also be negative in the absence of any topological feature, but not kinetic in nature since it is related to the effect of the magnetic field in the density of states [2].
In high magnetic field in Weyl semimetals a negative LMR has been explained by means of chiral anomaly [3], then it requires the formation of Landau's levels. Without Landau's level formation, a semiclassical approach predicts a negative LMR related to the Berry curvature of the system [4].
Here, we predict a negative LMR in systems with inversion symmetry, isotropic dispersion relation and in low magnetic fields.
It arises due to a Zeeman activated Berry curvature that is formally independent of the strength of **B**. Then, the effect is traced back to the breaking of time reversal symmetry and applies to a broad range of centro-symmetric materials. In the figure we show the Berry curvature profile of the system under consideration.

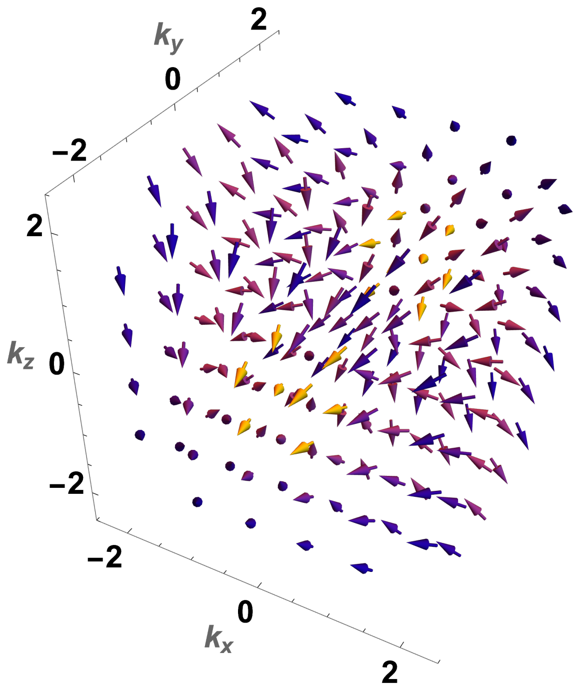

Figure 1: Berry curvature profile of the system

Since the magnetoresistance calculated here is proportional to the Berry curvature and independent of disorder, it can provide information of the intrinsic band structure of the system.

References

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