



Iranian Journal of Physics Research, Vol. 22, No. 1, 2022  
DOI: 10.47176/ijpr.22.1.71288

## Intrinsic anomalous Hall conductivity of Dirac band in presence of the normal magnetic field

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(Received 25 July 2021 ; in final form 26 October 2021)

### Abstract

We have studied the intrinsic contribution to anomalous Hall conductivity in presence of the normal magnetic field. A semiclassical approach for calculating the Hall conductivity in presence of the nontrivial Berry phase is used. This method is based on the semiclassical equations of motion with anomalous velocity correction and the Boltzmann transport equation. We present the formulation of anomalous Hall conductivity in this approach. We perform explicit calculations for a two-dimensional system which is described by Dirac Hamiltonian. At zero magnetic field, our results coincide with previous results which are obtained both using the semiclassical method and Kubo formalism. For the strong magnetic field, Hall conductivity decreases as a power-law. The exponent of the power-law behavior for the infinite energy band is  $1/3$  and for the finite energy band, there is a crossover from  $1/3$  to  $1$ .

**Keywords:** intrinsic anomalous Hall conductivity, Berry phase, Magnetic field, semiclassical approach

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