

Covariant chiral kinetic equation in non-Abelian gauge field from “covariant gradient expansion”

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We derive the chiral kinetic equation in 8 dimensional phase space in non-Abelian SU(N) gauge field within the Wigner function formalism. By using the “covariant gradient expansion”, we disentangle the Wigner equations in four-vector space up to the first order and find that only the time-like component of the chiral Wigner function is independent. After color decomposition, we present the non-Abelian covariant chiral kinetic equation for the color singlet and multiplet phase-space distribution functions. These phase-space distribution functions have non-trivial Lorentz transformation rules when we define them in different reference frames. The chiral anomaly from non-Abelian gauge field arises naturally from the Berry monopole in Euclidian momentum space in the vacuum or Dirac sea contribution. The anomalous currents as non-Abelian counterparts of chiral magnetic effect and chiral vortical effect have also been derived from the non-Abelian chiral kinetic equation.

Theory / experiment

Theory

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