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Chiral and spin kinetic theory from Wigner function appoach

Summary

The covariant Wigner function formalism is a powerful and systematic quantum kinetic approach. In this talk, we will discuss how the chirality and spin transport in relativistic plasma can be described from Wigner function approach. It provides very natural and systematic method to describe the chiral effects and spin effects in heavy ion collisions. We find that the massless fermion systems in a background EM field can be described sufficiently by one distribution function and one equation up to any order of $\hbar$. For the massive fermions, we need four independent Wigner functions and four independent transport equations. We have demonstrated that various chiral or spin effects such as the chiral anomaly, chiral magnetic effect, chiral vortical effect, chiral separate effect, quantum magnetization effect and global polarization effect can arise successfully and naturally from the Wigner function approach.

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