Contribution ID: **3** Type: **Contributed**

Non-Equilibrium Anomalous Transport of Chiral Fluids from Kinetic Theory

Tuesday, March 20, 2018 5:05 PM (20 minutes)

The chiral kinetic theory (CKT) is a useful tool to investigate anomalous transport pertinent to quantum anomalies in and out of equilibrium for weyl-fermion systems, which has been widely applied to study chiral magnetic/vortical effects (CME/CVE) in heavy ion collisions (HIC). However, there exist some fundamental issues such as Lorentz covariance and systematic inclusion of collisions in CKT. Such issues have been recently addressed via phenomenological approaches. Nevertheless, a first-principle derivation based on quantum field theories (QFT) is desired.
In this talk, we introduce the QFT derivation of CKT from the Wigner-function approach, which consistently manifests side jumps and non-scalar distribution functions associated with Lorentz covariance and incorporates both background fields and collisions. Moreover, we implement such a formalism to investigate second-order responses of chiral fluids near local equilibrium. Such non-equilibrium anomalous transport is dissipative and affected by interactions. For the study of anomalous transport in closed systems preserving energy-momentum conservation such as quark gluon plasmas, contributions from both quantum corrections in anomalous hydrodynamic equations of motion and those from the CKT and Wigner functions are considered under the relaxation-time (RT) approximation. We obtain anomalous charge Hall currents engendered by background electric fields and temperature/chemical-potential gradients. Furthermore, CME/CVE currents receive viscous corrections as non-equilibrium modifications stemming from the interplay between side jumps, magnetic-moment coupling, and chiral anomaly. On the other hand, the quantum corrections upon the charge density and energy-density current vanish in the classical RT approximation, which agree with the matching conditions led by CKT with energy-momentum conservation.

This talk will be based on the works in arXiv:1801.08253, arXiv:1710.00278 (Phys. Rev. D 97 (2018) no.1, 016004), arXiv:1612.04630 (Phys.Rev. D95 (2017) no.9, 091901, Rapid Communication).

Primary authors: Dr YANG, Di-Lun (RIKEN); Dr PU, Shi (Uni. of Tokyo); Dr HIDAKA, Yoshimasa (RIKEN)

Presenter: Dr YANG, Di-Lun (RIKEN)