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Magneto-vortical effect and response functions from chiral kinetic theory in magnetized plasma

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The chiral magnetic effect and chiral vortical effect enable us to probe possible local parity violation in hot dense matter created in heavy ion collisions. While equilibrium description is simple, the situation in heavy ion collisions can be quite far from equilbirum: the axial charge is likely to peak at early stage of the collisions [1-3], and the magnetic field and vorticity are also dominant at early stage. These require theoretical frameworks for out-of-equilibirum dynamics for chiral fermions. Chiral kinetic theory (CKT) offers such a framework. It has been derived based on field theory [4,5]. Previous works on CKT are organized as an expansion in hbar, which is valid for weak magnetic field. Its simplicity is lost at second order [6]. Recently, the CKT from Landau level basis is derived[7], which is valid for arbitrary magnetic field. In strong magnetic field limit, it reduces to CKT in the lowest Landau level approximation [8]. We will present a covariant chiral kinetic theory with Landau level basis. We use it to investigate a magnetized plasma with a transverse electric field and a steady vorticity as perturbations. We also study two-point functions from the above chiral kinetic theory which characterize the response to perturbative vector and axial gauge fields in magnetized chiral plasma.

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Present via

Primary authors: YANG, Lixin (Sun Yat-sen University); LIN, Shu

Presenter: YANG, Lixin (Sun Yat-sen University)

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