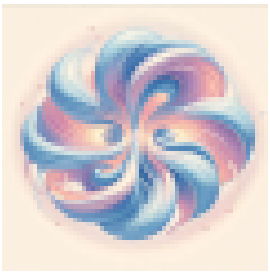

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Helical effects in fermionic plasma

lundi 22 juillet 2024 17:55 (5 minutes)

A quantum fluid in thermal equilibrium can be described in the grand canonical ensemble using the density operator ρ. At finite temperature and chemical potential, the expectation values of the energy-momentum tensor and the charge current reveal the well-known thermodynamics of the Fermi-Dirac fluid. When the system is rotating or immersed in a magnetic field, deviations from the Fermi-Dirac thermodynamics can be seen, a particular form of which gives rise to anomalous transport.

Anomalous transport was originally uncovered at the level of the axial current: a rotating fluid exhibits a flow of chirality along the rotation vector (the chiral vortical effect). Similarly, Dirac fermions in a magnetic field exhibit the chiral separation effect, by which vector charge imbalance drives a flow of chirality. Conversely, chiral imbalance drives a flow of vector charge (the chiral magnetic effect).

In this poster, we address similar effects at the level of the helicity current, describing the flow of helicity (as opposed to chirality) at finite rotation and in the presence of a magnetic field. Because the helicity has opposite charge conjugation parity compared to chirality, these transport laws complement each other. At high temperature and under rotation, the axial conductivity is dominant; while under a magnetic field, the helical conductivity becomes dominant.

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