# Stony Brook University
# The Graduate School

Doctoral Defense Announcement

## Abstract

Anomalous Transport in Chiral Systems

By

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The experimental realization of Dirac and Weyl semimetals in 2014 and 2015 respectively has increased the interest in the topic. Similarly to graphene, the discovered materials are characterized by massless quasiparticles. In three dimensions these quasiparticles can be described by the Weyl Hamiltonian which exhibits so-called chiral anomaly at low energies. The chiral anomaly has a transport signature, namely, the enhancement of longitudinal conductivity along the direction of external magnetic field. This effect in new materials is the condensed matter version of the chiral magnetic effect (CME) predicted to happen in heavy ion collisions. Due to its topological nature the chiral anomaly it is believed to be robust with respect to the interaction strength and anomalous contribution to transport is believed to be universal and independent of the interaction.

This thesis is devoted to the study of magnetotransport in Dirac and Weyl metals. For that, we use the chiral kinetic theory to describe within the same framework both the negative magnetoresistance caused by chiral magnetic effect and quantum oscillations in the magnetoresistance due to the existence of the Fermi surface. In the second part, we refer to the hydrodynamics with gauge anomaly and study the non-dissipative transport using variational principle as a main tool. In the last part of the thesis we also apply variational approach to study the Hall viscosity in two-dimensional systems.

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