THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

SEMINAR

Anomalous Transport Properties of The Skyrmion Compound EuPtSi

by

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ALL INTERESTED ARE WELCOME
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Abstract

A magnetic skyrmion is a local vortex-like whirl of the spin configuration in a magnetic material. The rare-earth compound EuPtSi, crystallizing in a non-centrosymmetric chiral structure with the $P2_13$ space group, similar to that of MnSi, orders helimagnetically below T_N=4.05 K. The so-called A-phase of EuPtSi has recently been confirmed to have the triple-*q* ordering characteristic of a skyrmion lattice, as well as a topological Hall effect contribution.

The first part of our work focuses on the low-field (H < 5 T) magnetic phases that are observed in EuPtSi below the ordering temperature T_N for the three main directions H || [110], H || [111] and H || [100]. From the angular dependence of the resistivity under magnetic field, we confirmed the presence of anomalous phases: for the direction H || [111] the so-called skyrmion lattice A-phase, and for the H || [100] direction the skyrmion-related A' and B phases. By studying these phases with various transport probes, we have established the magnetic phase diagram with precision. We have also evidenced the presence of additional anomalies at low-temperature related to the skyrmion phases.

Our temperature-dependent results for the H || [111] and H || [100] directions evidence the metastable behavior of the A, A' and B phases under field cooling. From the peculiar metastable state for the H || [100] direction, further field sweeps show that both the A' and the B phases exist in the supercooled regime with phase lines between them.

The second part of our work focuses on the Fermi surface of EuPtSi, studied with quantum oscillations in the thermoelectric power. The temperature dependence of the quantum oscillations recovers the effective mass of the carriers for each Fermi surface branch, with results comparable to the literature. From the field-dependence of the quantum oscillations, we have recovered the Dingle temperature and mean-free path of the carriers using a new analysis framework for the thermoelectric power, indicating that the latter is an extremely sensitive probe to detect quantum oscillations.