Abstract submitted to the
NATO ADVANCED RESEARCH WORKSHOP
New materials for thermoelectric applications: theory and experiment
September 19 - 25, 2011 Hvar, Croatia

Entropy transport in (topological insulator) Bi_2Se_3

Benoit Fauqué[1], Kamran Behnia[1], Nicholas Butch [2], Johnpierre Paglione[2]

[1] *LPEM/ESPCI, 10 rue Vauquelin 75005 Paris*

[2] *Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, College Park, MD 20742*

Submitted : 00-00-2011

Keywords : entropy transport, quantum oscillation, topological insulator

Bi_2Se_3 and Bi_2Te_3 are well know compounds in the thermoelectricity community since they realize a high figure of merit[1]. More recently this compounds have been proposed as a host of a new class of quantum state of matter, namely topological insulator. Topological insulators are insulating materials that display massless, Dirac-like surface states in which the spin of the electron is locked perpendicular to its momentum by strong spin-orbit interaction[2]. However in practice, it is know from decade that Bi_2Se_3 is a low carrier concentration in bulk due to the result of charged Se vacancies.

Motivated by their high thermoelectric response, we start to explore the electronic grounds state of Bi_2Se_3 with a bulk carrier concentration from n$\approx 10^{19} cm^{-3}$ to $\approx 10^{17} cm^{-3}$ by entropy measurement. In this presentation we will report our measurement of S_{xx} and S_{xy} down to 300mK and up to 17T. We can resolved, as in the case of bismuth and graphite [3, 4], significant quantum oscillation in thermoelectricity response. By combining the Fermi surface topology deduce from our high field measurement and the low temperature and low field measurement of $\frac{S_{xx}}{T}$ and $\frac{\nu}{T}$, we will propose a simple description of the electronic and entropy transport measurement in Bi_2Se_3 (in the range of concentration studied). In deed, Bi_2Se_3 (a non compensated system) appears as a complementary system of bismuth and graphite (compensated system) to understand the low temperature thermoelectricity response in the low carrier concentration limit.

[1] G.S. Nolas, J. Sharp, H.J. Goldsmid Thermoelectrics Basic Principles and New Materials Developments, Springer.
[2] M. Z. Hasan and C. L. Kane Rev. Mod. Phys. **82**, 3045 (2010).
[3] K.Behnia et al, PRL, **98**, 166602 (2007)
[4] Z.Zhu et al, Nature Physics, **6**, 26-29 (2009)