Universal Conductance Fluctuation in Quasi-1D Wires of Epitaxial Bi_2Se_3

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Bi_2Se_3 is a well-known excellent thermoelectric material and is recently invoking renewed interest as a typical example of a three-dimensional topological insulator. Although a few groups have already reported the conductance fluctuation in this material, its origin is still controversial [1,2].

Here we report the universal conductance fluctuation (UCF) in quasi-1D wires fabricated from epitaxial Bi_2Se_3 thin film. Our purpose is to quantitatively investigate the conductance fluctuation systematically.

We fabricated and measured the quasi-1D wires with the same width but with different lengths. In Fig.1, the typical experimental result of the magnetoresistance in quai-1D wire is shown. We checked the fluctuation in magnetoresistance is reproducible; therefore the fluctuation is intrinsic properties of the wire sample. We extracted the component of the conductance fluctuation, and then we investigated the scaling relationship between the size of the conductance fluctuation and the characteristic lengths such as the coherence length, the thermal diffusion length, and the wire length. Prior to this analysis, we analyzed the weak antilocalization phenomenon, namely the resistance dip structure near 0 T as shown in Fig. 1, and deduced the coherence lengths in each wire samples.

We found that the conductance fluctuation can be well explained as the universal conductance fluctuation.

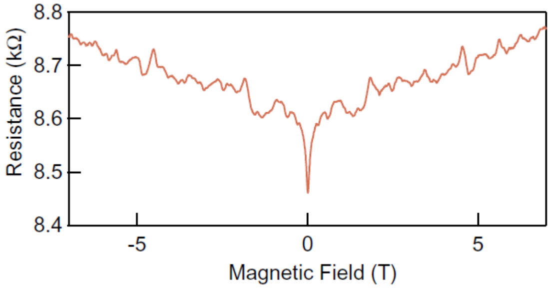

FIG. 1. Typical result of the magnetoresistance of our quasi-1D wire. There are two features; the dip due to the weak antilocalization and the fluctuation.

[1] J. G. Checkelsky, *et al.*, Phys. Rev. Lett. **103**, 246601 (2009)..
[2] S. Matsuo, *et al.*, Phys. Rev. B **85** 075440 (2012).