Angle-Dependent Measurements on Ultra-Quantum Limit Graphite

Zhu, Z.; Mcdonald, R.D.; Harrison, N. (NHMFL, LANL)

Introduction

The physics beyond quantum limit in graphite is always elusive. Beyond the quantum limit of graphite which is 7.35T, there is transition around 22T and additional transition around 54T [1]. The electronic structure is analogue to a one-dimensional system which is expected to have various possibilities of instabilities[2]. The transition around 22T was assumed as the nesting between spin-up of electron pocket bringing the so-called charge density wave (CDW) was proposed by Yoshioka and Fukuyama (YF theory) [3]. YF theory was supported by several experimental evidences. Following this argument, the 54T was regarded as the destruction of the CDW [1].

Experimental

In order to clarify the transitions, we carried out detailed angle-dependent Rxx and Rzz namely in-plane and out-of-plane magnetoresistance measurements in 65T pulsed magnet at 1.4 K. The Rzz was measured up to 90T. A complete phase diagram about the transition is established.

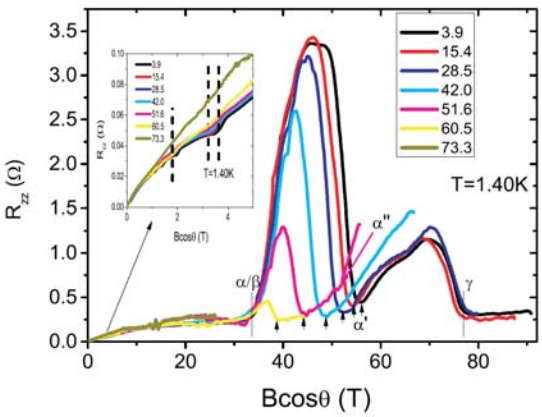

Fig.1 Angle-dependent out-of-plane Rzz in the pulsed field up to 90T at T =1.4 K

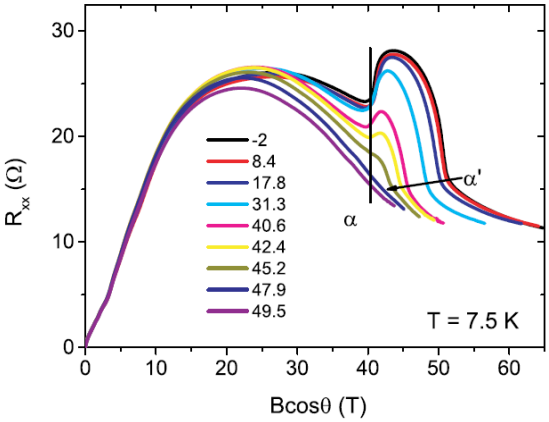

Fig.1 Angle-dependent in-plane at 7.5K

Results and Discussion

The results from Rzz and Rxx shows the so-called α transition is with Bcos θ when the field is tilted from c-axis. This behavior proves that the α transition is orbit-induced. On the other hand, the α 'transition does not have B cos θ , which tells the α 'transition is spin-related. But according to the YF theory, the α transition is from the spin-up electron pocket, is spin-related. The detailed origin of the transition might be modified.

Conclusions

We carried out anlge-dependent Rzz and Rxx measurement, with Rzz up to 90T. The clue of the orbit-related transition suggests the YF theory should be patched.

Acknowledgements

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