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Electrical Conduction of Folded Graphene in Magnetic Fields

When a strong magnetic field is applied to a high-mobility two-dimensional electron gas (2DEG), the Hall resistance is quantized due to the quantum Hall effect (QHE), which has been observed in many 2DEG systems such as semiconductor heterojunctions, MOS structures, and graphene. One of the way to understand the QHE is an idea of the edge channel that carries the current flowing in a specific direction determined by the confinement potential gradient and the magnetic field direction.

In this study, we are interested in the electron transport of 2DEG in highly-inhomogeneous magnetic fields shown in Fig.1(a), where the strong magnetic field is inverted abruptly across a boundary x=0. The edge current in such a situation depicted in the figure means there should be dissipation even in QH state. Similar situation appears in 2DEG with inhomogeneous carrier density realized by local gating, which has been investigated rather extensively [1][2].

Experimentally it seems almost impossible to realize such field distribution. So, we employ an alternative method shown in Fig.1(b): we fold a 2DEG sheet and apply a homogeneous strong magnetic field. In this case, edge current direction is just the same as Fig.1(a). We prepare a thin insulating film covered with CVD-graphene [3], fold it in water bath, and put the folded film between a silicon substrate and a glass substrate where the electrodes are patterned in advance. Figure 2 shows an example of the sample. The detail of the fabrication methods and results will be presented.

Acknowledgements

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References

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Figures,

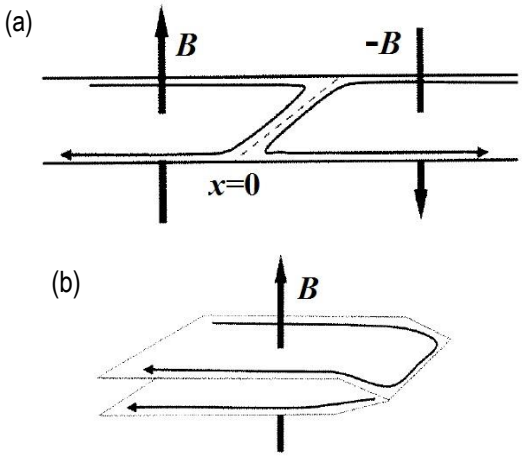

Figure 1: (a) Edge current of 2DEG in overturned magnetic fields. (b) Edge current of folded 2DEG in magnetic field.

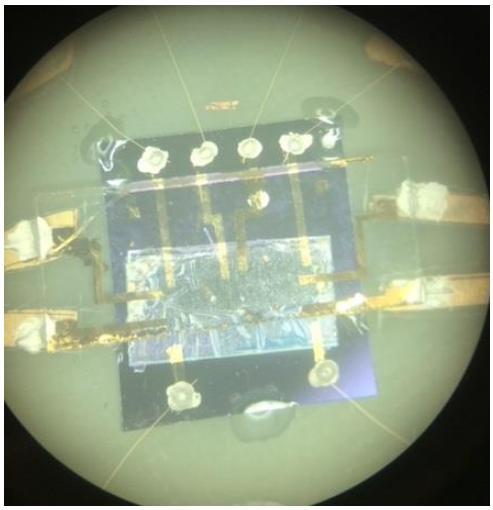

Figure 2: Folded graphene sample