Integer and fractional quantum Hall effect in suspended graphene in Corbino geometry

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We have succeeded in manufacturing high-quality suspended graphene samples in Corbino geometry. The Corbino geometry offers two important advantages when compared with standard quantum Hall bars. First, the longitudinal conductivity results can be directly compared with theory, without any need of a matrix inversion like in the case of Hall bar measurements. Second, it improves the resolution in the transport measurement regime where the longitudinal conductance is very small. These are important factors for our experiments aiming at shot noise mapping of charge carries in the fractional quantum Hall state of graphene.

In addition to electrical conductivity and noise, we have determined fundamental mechanical modes of our monolayer graphene Corbino device. In conductance experiments up to 9T field, we can clearly see the fractional states with filling factors 1/3 and 2/5. The mechanical resonance frequency is employed to yield additional information on the carrier density and dynamics near the integer and fractional QHE levels. In order to find out whether shot noise data in this geometry can be employed to determine the composite charge of the carriers in the FQHE state, we have paid special attention to studies of the coupling between the two counter-propagating edge states in our Corbino geometry. Possibility of tunneling between Luttinger liquid type of states is discussed.

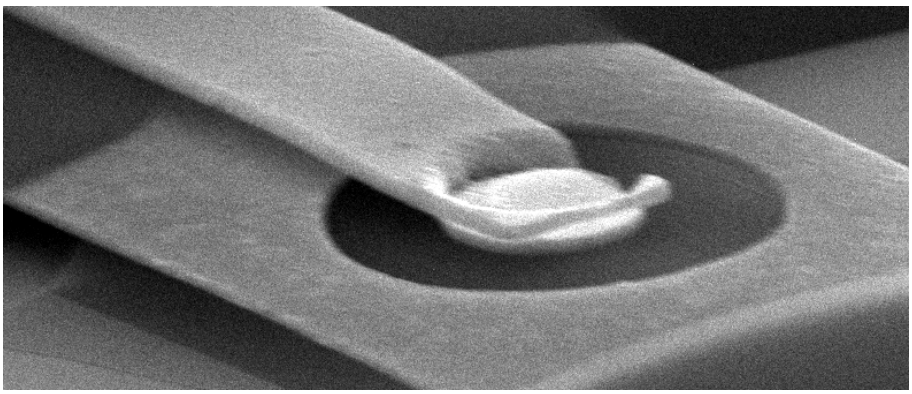

Fig. 1. SEM image of one of our graphene Corbino disk samples; all devices display corrugations, either radially or unidirectionally across the whole disk. The outer diameter of the Corbino disk is 800 nm.