Long range topological valley currents in single layer graphene superlattice near the main Dirac point

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In topological materials, topological bands generate Hall-like conductivity and topologically protected edge states in zero magnetic field. By placing single layer graphene (SLG) on hexagonal boron nitride (h-BN), it is possible to transform SLG into a topological phase by varying their crystallographic alignment. Recent measurements of nonlocal resistances (R_{nl})[1,2] in a narrow energy range focusing with the secondary Dirac point (SDP) [3] in SLG/h-BN superlattice Hall bars have been interpreted as arising due to the valley Hall effect and quantum valley Hall state. Here we report h-BN/SLG/h-BN Hall bars which have a negligible R_{nl} of SDPs, but at the main DP R_{nl} is reaching quantum-limit at 9 K. We investigate topological valley currents near the main Dirac point and also demonstrate nonlocal measurements over a distance of 15 µm indicating ballistic behavior.

References

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[2] C. R. Woods, *et al.*, Nat. Phys. **10**, 451 (2014).
[3] G. L. Yu, *et al.*, Nat. Phys. **10**, 525 (2014).

Figures

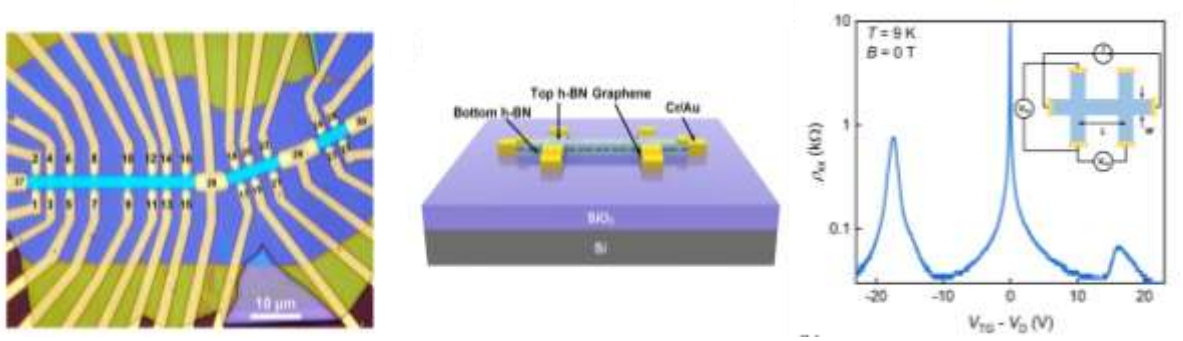

Figure 1. From left to right, h-BN/SLG/h-BN device structure via optical micrograph, schematic illustration of a typical device, Longitudinal resistivity (ρ_{xx}) *vs* gate voltage ($V_{TG} - V_D$) in zero magnetic field at 9 K. Inset shows schematic illustrations of the local measurement setup, where *L* is the distance between the current path and voltage probes, and *W* is the device width