Edge transport channel on a graphene nanoribbon

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Recently, Scanning Gate Microscopy (SGM) experiment on a graphene nanoribbon by our collaborators has shown a clear evidence of the existence of an edge electronic transport channel; a remarkable SGM signal enhancement has been observed on the ribbon edge.

Charge accumulation on the edge of doped graphene nanoribbons has been studied by Silvestrov *et.al*.

For such a doped graphene nanoribbon, the effective local Dirac point deviates from the Fermi level depending on the local excess charge density, which is almost constant except the ribbon edge where charge is seriously accumulated.

We have investigated the electronic band structures and transport properties of such doped nanoribbons especially with zigzag edge structures and have further studied their responses to an additional local gate potential given by the SGM tip.

We have found that, once a graphene is doped, the energies of localized edge states of a zigzag graphene nanoribbon, which give a flat band for a neutral one, follow the shifted local Dirac point on the edge bending the corresponding flat band line.

Based on this, we have further showed that one can control the bent edge-state band line using SGM tip gating resulting in single-channel conductance enhancement that was seen in the expriment.

Our theory predicts that such conductance enhancement occurs when the polarity of the local tip potential is against the type of doping which is in good agreement with the experimental results. We have further confirmed that the phenomena persists on general edge structurs.