Arindam Ghosh
Amogh Kinikar, Md. Ali Aamir, Semonti Bhattacharyya, Paritosh Karnatak, T. Panindra Sai
Department of Physics, Indian Instutute of Science, Bangalore 560012, India

arindam@physics.iisc.ernet.in

Electrical access to protected conduction states in graphene

The zigzag (ZZ) edges of both single and bilayer graphene are perfect one dimensional (1D) conductors due to a set of zero energy gapless states that are topologically protected against backscattering. Competing effects of edge topology and electron-electron interaction in these channels have been probed with scanning probe microscopy, which reveal unique local thermodynamic and magnetic properties. A direct evidence of edge-bound electrical conduction, however, has remained experimentally elusive, primarily due to the lack of graphitic nanostructures with low structural and/or chemical edge disorder, as well as a clear understanding of the impact of edge disorder and confinement on electrical transport. In this talk I shall present a new method to observe ballistic edge-mode transport in suspended atomic-scale constrictions of single and multilayer graphene, created during nanomechanical exfoliation of graphite, which manifests in quantization of conductance close to multiples of e^2/h even at room temperature [1]. I shall highlight the specific case of electrically biased bilayer graphene, where the subgap conductance at low temperatures will be shown to possess non-trivial localization properties, outlining novel and unexpected effects of topological protection to edge states in the presence of intervalley scattering [2].

References

[1] A. Kinikar, T. P. Sai, S. Bhattacharyya, A. Agarwala, T. Biswas, S. Sarker, H. R. Krishnamurthy, M. Jain, V. Shenoy, A. Ghosh, Nature Nanotechnology (2017) doi:10.1038/nnano.2017.24.
[2] Md. A. Aamir, P. Karnatak and A. Ghosh (Under review).