Segregated transport channels in sidewall nanoribbons

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Abstract (

Conductance quantization is a defining feature of electronic transport in quasi-one dimensional conductors. In the absence of a magnetic field, confinement results in a sequence of transverse sub-bands with an increasing number of nodes across the device width.
Graphene nanoribbons grown on the sidewalls of silicon carbide (SiC) mesa structures have previously[1] been shown to present a 1D ballistic channel at the micron scale.
New 2-point measurements reveal additional quantised channels at shorter probe separations[2]. Surprisingly, these channels are localised in different regions across the ribbon width.
Here we demonstrate how this distribution of channels is consistent with a model accounting for both edge zigzag magnetism and asymmetric interfaces between the SiC and nanoribbon at each edge.

References

[1] J. Baringhaus et al, Nature 506 (2014) 349

[2] J. Aprojanz, S.R. Power et al, Nature Communications 9 (2018)4426

Figures

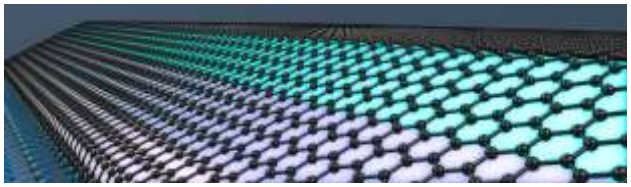

Figure 1: Electrons in sidewall nanoribbons propagate ballistically, in three separated channels [2].

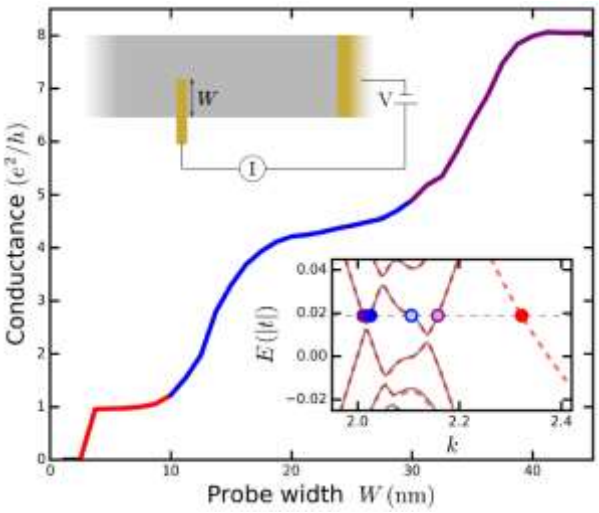

Figure 2: (*Simulation:*) The segregated channels lead to quantised conductance steps as one of the transport probes sweeps across the ribbon width [2].