Gateless *p-n* Junction Sharpness in Millimeter-Scale Epitaxial Graphene

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We have demonstrated the millimeter-scale fabrication of monolayer epitaxial graphene *p-n* junction devices using simple ultraviolet photolithography [1], thereby significantly reducing device processing time compared to that of electron beam lithography typically used for obtaining sharp junctions. This work presents measurements yielding nonconventional, fractional multiples of the typical quantized Hall resistance at $\nu = 2$ ($R_H \approx 12906\ \Omega$) that take the form: $a/b*R_H$. Here, *a* and *b* have been observed to take on values such 1, 2, 3, and 5 to form various coefficients of R_H. Additionally, we provide a framework for exploring future device configurations using the LTspice circuit simulator as a guide to understand the abundance of available fractions one may be able to measure. These results support the potential for simplifying device processing time and may possibly be used for other two-dimensional materials.

References

[1] A F Rigosi, D Patel, M Marzano, M Kruskopf, H M Hill, H Jin, J Hu, A R Hight Walker, M Ortolano, L Callegaro, C-T Liang, D B Newell, Carbon, 154 (2019) 230-237.

Figures

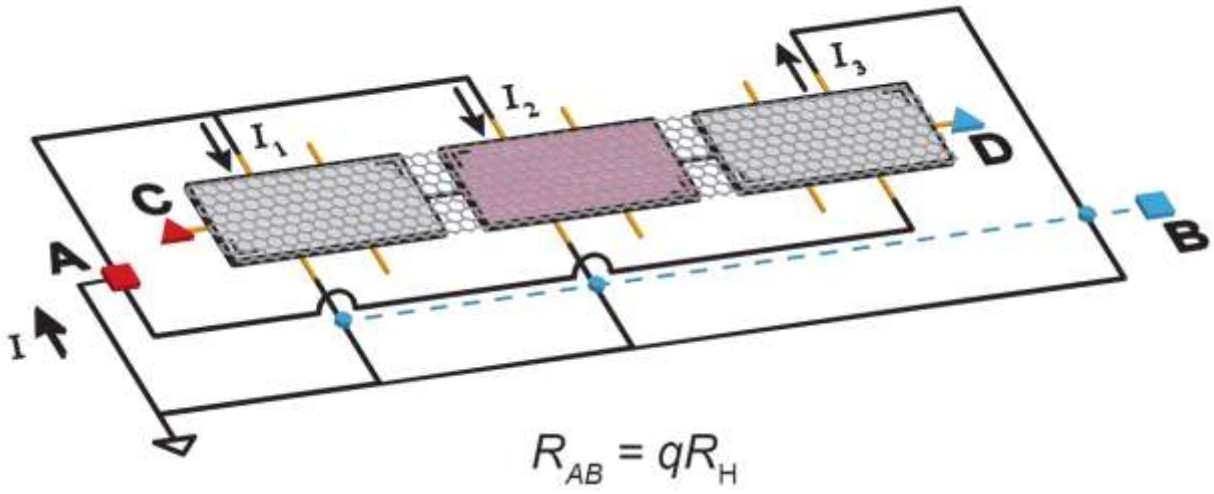

Figure 1: An illustration of the circuit model implemented by the spice circuit simulator is shown. A total current (*I*) of 1 μA is used and split among up to three distinct injection points on the device, shown as I_1, I_2, and I_3. Though only one example is shown here, the measured resistances of several different configurations of current injection yield nonconventional multiples of R_H.