Tailoring one-way transport and non-reciprocity in graphene-based devices.

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Abstract

Most often, charge transport in an electronic device is reciprocal, this is, the transmission probability from left to right equals the one from right to left. However, studies in optics [1] and acoustics [2] have successfully generated and exploited nonreciprocity allowing for unidirectional transport. Interestingly, the potentials generating this effect might also remain invisible to an observer analyzing the reflection on one side of the device, a phenomenon termed *unidirectional invisibility* [3].

In this talk we consider the electronic structure of different types of bilayer graphene systems allowing for a non-reciprocal band-structure. The non-reciprocity, evidenced as a *built-in* asymmetry between left and right moving states, is then exploited to obtain one-way transport of charge [4,5,6], valley [4,5,6,7] or spin [4]. This is demonstrated using simulations of three-terminal devices performing active functions [4-8].

References

[1] U. Leonhardt, "Optical conformal mapping", Science **312** (2006) 1777.
[2] S. A. Cummer and D. Schurig, "One path to acoustic cloaking", New Journal of Physics **9** (2007) 45.
[3] Z. Lin, H. Ramezani, T. Eichelkraut, T. Kottos, H. Cao, and D. N. Christodoulides, "Unidirectional invisibility induced by PT -symmetric periodic structures", Phys. Rev. Lett. **106** (2011) 213901.
[4] L. E. F. Foa Torres, V. Dal Lago, and E. Suarez Morell, "Crafting zero-bias one-way transport of charge and spin", Phys. Rev. B **93** (2016) 075438.
[5] V. Dal Lago, E. Suarez Morell, and L. E. F. Foa Torres, "One-way transport in laser-illuminated bilayer graphene: A Floquet isolator", Phys. Rev. B **96** (2017) 235409.
[6] M. Berdakin, J. E. Barrios-Vargas, L. E. F. Foa Torres, *to be published*.
[7] M. Berdakin, J. E. Barrios-Vargas, L. E. F. Foa Torres, *to be published*.
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