Non-adiabatic graphene quantum pumps

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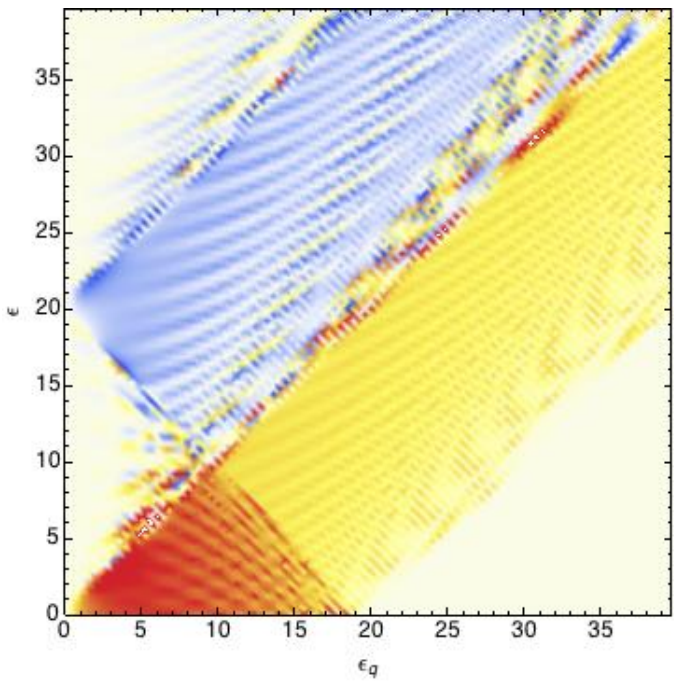
We present a theoretical study of the non-adiabatic operation of graphene-based quantum pumps, along with a comparison to the semiconductor-based analogues. We show that due to the open nature of graphene contacts resulting from quasiparticle chirality conservation, the current pumped through evanescent modes scales linearly with frequency, and may allow for a competitive advantage respect to the semiconductor-based alternative. Moreover, the scale-free nature of graphene pumps at the neutrality point results in a universal weak-pumping response, reminiscent of that previously identified in the adiabatic regime [1]. In contrast to the latter, however, the differential pumping response becomes maximum at the neutrality point. We provide a full analytical solution of the pumping problem in the weak pumping regime.

References

[1] E. Prada, P. San-Jose and H. Schomerus, *Phys. Rev. B* **80**, 245414 (2009)

Figures



Differential pumping response $dI/d\epsilon$ as a function of Fermi energy ϵ and transverse momentum $\epsilon_q = \hbar v_F q$ in a single parameter graphene quantum pump. The red region, extending up to the pumping frequency $\epsilon_q=\omega$ at the neutrality point $\epsilon=0$, represents efficient pumping of evanescent modes.