Current lensing and valley splitting with elastically deformed graphene

Nikodem Szpak[1]
Thomas Stegmann[2]

[1]*University of Duisburg-Essen, Duisburg, Germany*
[2]*Universidad Nacional Autonoma de Mexico, Cuernavaca, Mexico*

nikodem.szpak@uni-due.de

Abstract

The quantum transport in elastically deformed graphene can be effectively described by means of the relativistic Dirac equation coupled to a psuedo-magnetic field and curvature. Precise combination of these fields enables control of the current flow paths and valley polarization. It can give rise to interesting phenomena such as lensing and directing of currents and valley splitting depending on the deformation and placement of contacts. These effects can be applied to new types of graphene-based electronic and valleytronic nanodevices.
To obtain optimal results, we combine numerical current flow simulations with theoretical ray tracing methods. Implementing electron optics in ballistic graphene, we find configurations with optimal focusing properties. The developed computation methods are very efficient tools providing better understanding of the transport properties and help in designing new nano-systems with desired functionality.

References

[1] T. Stegmann and N. Szpak, New J. Phys, 18 (2016) 053016

Figures

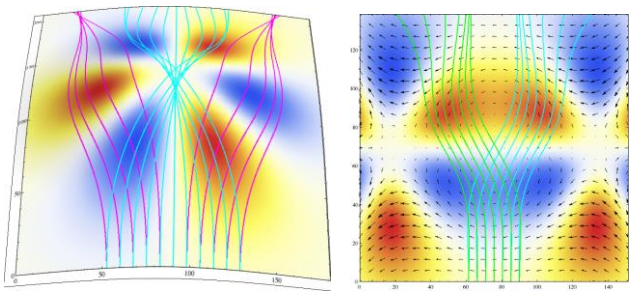

Figure 1: Theoretical model of current lensing and valley filtering based on classical trajectories

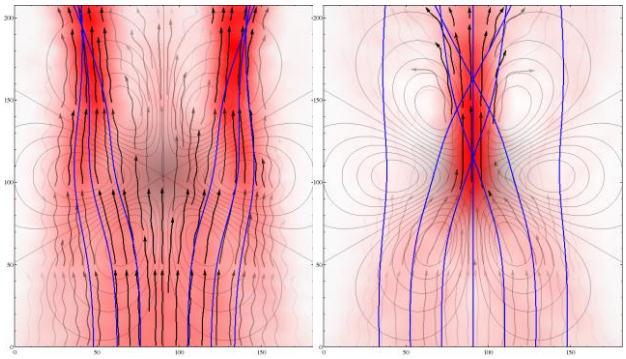

Figure 2: Numerical model of current lensing and valley filtering based on quantum transport calculations