Quantum Transport in Deformed Graphene via Dirac Equation in Curved Space

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As is well-known, low energy excitations in graphene can be effectively described by the 2-dimensional Dirac equation. A natural question arises, to what extent (elasitically) deformed graphene can be described by a version of the Dirac equation in a curved 2D-space. This analogy would enable for an effective treatment of diverse local and global (topological) modifications of regular graphene sheets and calculations of their transport properties.

We address this question in more detail, explain the effective continuous picture and point out some difficulties appearing in the geometric interpretation of various terms (in particular, between the pseudo-magnetic and “gravitational” potentials). We also give some practical examples, like geometric (“gravitational”) lensing of electric currents in presence of a localized bump.

References

[1] N. Szpak, A sheet of graphene – quantum field in a discrete curved space, Proceedings “Relativity and Gravitation”, Prague 2012

Figures