Graphene properties from curved space Dirac equation

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Abstract

From the perspective of high energy physics, graphene can provide us a real framework to study what is believed to be (as close as possible) a quantum field in a curved space-time, with measurable effects pertaining to the electronic properties of the sample itself. The peculiar structure of a graphene sheet determines a natural description of its properties in terms of massless, relativistic Dirac pseudoparticles, giving the possibility to study quasi-relativistic particle behaviour at sub-light speed regime. The charge carriers' behaviour at Dirac points in curved graphene can be thus obtained exploiting a massless Dirac spectrum description for particles living in a curved bidimensional background in the large wavelength approximation [1,2].
The study of particular curved configurations, together with the quantization of some physical quantities due to the particular geometry of the manifold, can lead to characteristic observable effects. In particular, some optical responses of the graphene sheet can be obtained in peculiar ranges of energy including the visible light energy spectrum [3].

References

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Figures

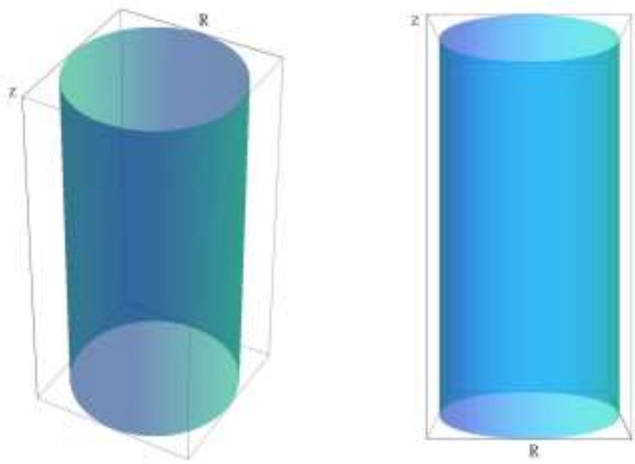

Figure 1: Graphene cylindrical sheet.

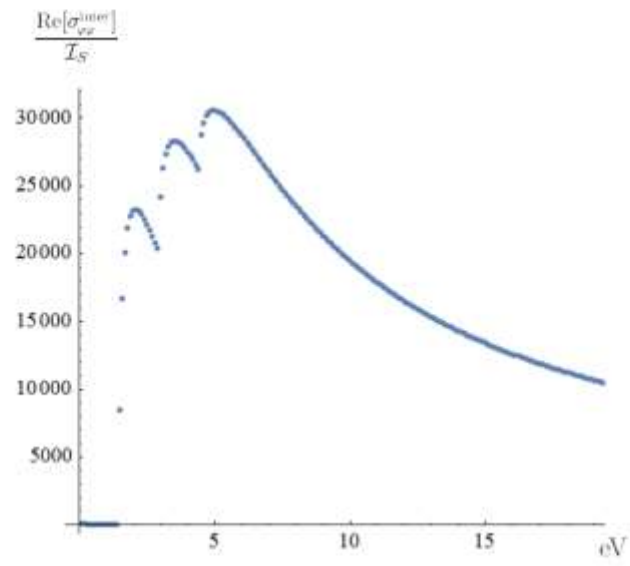

Figure 2: Real part of transverse interband Kubo optical conductivity for a wrapped graphene cylindrical layer.