Abstract

The thesis endeavours to theoretically understand electronic properties of finite trapezoidal shaped graphene sheets, and understand zero energy edge states. The motivation for this thesis is recent experimental work at Low Temperature Nano-electronics Laboratory under Prof. Arindam Ghosh[1]. This work systematically tries to understand graphene, a two dimensional material, and it's confinement in spacial dimensions. In Part I, we start with analytical study of bulk graphene with various hoppings in a tight-binding formulation and its band structure. Then we confine graphene in one-dimension to form semi-infinite graphene nanoribbons and numerically determine its energy spectra and wave-functions for sites along the finite direction.
In Part II, graphene is confined in both spacial dimensions and starting from simplest case of finite rectangular sheet, we move on to the two different ways in which graphene can be torn. Here, numerical studies were done to determine the density of states and local density of states.
Finally Parts III and IV are devoted to the study of disorders and how various kinds of disorders can be introduced in the system and their effect in localising the wave-functions along the edges.

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References

[1] Amogh Kinikar, T Phanindra Sai, Semonti Bhattacharyya, Adhip Agarwala, Tathagata Biswas, Sanjoy K Sarker, HR Krishnamurthy, Manish Jain, Vijay B Shenoy, and Arindam Ghosh. Quantized edge modes in atomic-scale point contacts in graphene. *Nature Nanotechnology*, 2017.