Superlattice Effects on Transport in Graphene and Graphene Nanoribbons

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Motivated by interesting superlattice effects on bulk graphene such as the emergence of new Dirac points and an anisotropic velocity renormalization, we numerically investigated the effects of an one dimensional superlattice potential on the electronic properties of graphene nanoribbons (GNR). We found that the formation of the miniband structure depends on the direction of the ribbon axis. The arising minibandstructures of armchair GNR exhibit striking differences, depending on whether the ribbon is metallic or semiconducting. For zigzag GNR the miniband structure forms only for ribbons where the width has an even number of chains.

We also investigated the current voltage characteristic through modulated GNR which shows a negative differential conductance and an oscillatory behavior due to Bloch-oscillations in presence of Zener tunneling.

References