Superlattice Effects on Electronic- and Transport Properties of Graphene Nanoribbons

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As recently discoverded by various groups[1,2] the electronic properties of two dimensional systems such as graphene show interesting characteristics in presence of superlattices, including the emergence of extra Dirac points accompanied by an anisotropic velocity renormalization. Other interesting effects are Bloch-oscillations in presence of resonant Zener tunneling[3] giving rise to a negative differential conductance in the current voltage characteristics.
We focus on a scalar superlattice system extended by a constant mass term which opens a gap between the valance and conduction band in the miniband structure. Analytical calculations within the effective Dirac model show that it is possible to tune the energy gap by variation of the superlattice amplitude. By additional numerical calculations based on the tight-binding model we confirm the analytical results. The method allows us to design the electronic structure of the systems.

References:
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