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The Theoretical Study of the Effects of Coulomb Interaction and Substrate Interaction on Charge gap in Paramagnetic State of Graphene

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Abstract. We address here a tight binding model Hamiltonian to describe the evolution of charge gap in paramagnetic state of graphene on substrate. The Hamiltonian consists of nearest neighbor electron hoppings between two sublattices and symmetry breaking effect arising due to graphene on different substrates. The Coulomb interaction in graphene is considered here within mean-field approximation in the paramagnetic limit. The temperature dependent charge gap is calculated by Zubarev's Green's function technique and is computed numerically. It is observed that the charge gap gradually increases with Coulomb interaction in paramagnetic state up to a critical Coulomb energy $U_c \approx 2.35\, t_1$ where t_1 is the nearest neighbor electron hopping. The charge gap is enhanced with enhancement of the substrate interaction.

Keywords. Graphene, Paramagnetism, Coulomb Interaction
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