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Exchange and correlation energies for gapped helical systems: Graphene and three-dimensional topological insulators ANDRII IUROV, Hunter College CUNY, GODFREY GUMBS, Hunter College CUNY and Donostia International Physics Center (DIPC), San Sebastian, Spain, DANHONG HUANG, Air Force Research Laboratory — A formalism is presented for calculating the exchange and correlation energies of gapped graphene as well as three-dimensional topological insulators(3D TI's). With our theory, we investigate the conditions which are required to achieve entangled states of electrons in graphene and 3D TI's. These calculations are performed within the random-phase approximation (RPA). We obtain the dynamical polarization function for imaginary frequencies, which is determined by both the valence and conduction energy bands in conjunction with the overlap of the spin wave functions. We compare and specify both the differences and similarities between graphene and effective surface states in 3D TIs. The application of our derived results to quantum computation will also be explored.

Andrii Iurov
Hunter College CUNY

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