Investigating topological phase transitions in graphene through

Monte-Carlo simulations

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Abstract

It has been shown within the framework of the tight-binding theory, that the density of states of non-interacting graphene exhibits Van Hove singularities which divide the band structure into regions governed by the relativistic Dirac equation and by the non-relativistic Schroedinger equation [1]. When the Fermi surface crosses these points (driven by a chemical potential) a topological neck-disrupting Lifshitz transition occurs which is manifest as a divergence of the number susceptibility. It is our goal to investigate the effect of interactions on this transition through Hybrid-Monte-Carlo simulations using a code which has been successfully applied in studies of the semi-metal insulator phasetransition [2, 3]. This code is based on the framework which was developed in Ref. [4]. Since a regular chemical potential causes a Fermion sign-problem (a complex Fermion determinant which cannot be interpreted as a probability measure), we instead consider a ”staggered” potential, which has a different sign for the two spin orientations of the electrons.

References

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