Abstract Submitted
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Stability of Dirac Liquids with Strong Coulomb Interaction[1] IGOR TUPITSYN, NIKOLAY PROKOF'EV, University of Massachusetts, Amhesrt —
We develop and apply the Diagrammatic Monte Carlo technique to address the problem of stability of the Dirac liquid state (in a graphene type system) against strong Coulomb interaction. So far, all attempts to deal with this problem in the field-theoretical framework were limited either to perturbative or RPA treatments. Our technique allows to deal with long-range interactions in a fully self-consistent, approximations free, manner and obtain final results with controlled accuracy by computing vertex corrections from higher-order skeleton diagrams. We establish the renormalization group flow of the effective Coulomb coupling constant and unambiguously show that with increasing the system size L (up to ln(L)˜40), the coupling constant always flows towards zero; i.e. the two dimensional Dirac liquid is an asymptotically free T=0 state. Our approach is general and can be applied to any graphene-type system with arbitrary dispersion relation featuring Dirac cones, both doped and undoped, and with arbitrary shape of the interaction potential.

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Igor Tupitsyn
University of Massachusetts, Amhesrt

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