Abstract Submitted
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Many-body Signature of Coulomb Implosion in Graphene[1] JIANHUI WANG, HERB FERTIG, Indiana University, GANPATHY MURTHY, University of Kentucky — We develop an asymptotic analysis for the scattering of a single electron off a Coulomb impurity in the Dirac equation description of (undoped) graphene, to demonstrate that the penetration of the centrifugal barrier that occurs in this problem may be assessed in a momentum representation. The method is directly generalizable to particle-hole scattering, which supports a similar phenomenon. We derive a Bethe-Salpeter equation for the 3-leg vertex for the sublattice antisymmetric response in the ladder approximation. We solve the integral equations for the lowest ($m = 0$) angular components numerically for both $q = 0$ and $q \ll 1$ but nonzero, where q is the momentum transfer. In the $q = 0$ case there is a clear power law behavior in the solution of the vertex function and the exponents become complex when the coupling constant is above a threshold. We also find that the response can have poles above a critical coupling constant, which we associate with a transition to an exciton condensate state. We can reproduce the poles by solving the integral equations with a model kernel analytically. However, we find that a small momentum cut-off is necessary for the existence of these poles in our analytical solution. In the case of nonzero but small q, we find that the correction to the antisymmetric response has a power law behavior in the coupling constant.

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