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Diamagnetism of Graphene with Long-Range Scatterers MASAKI NORO, Department of Physics, Tokyo Institute of Technology, MIKITO KOSHINO, Department of Physics, Tohoku University, TSUNEYA ANDO, Department of Physics, Tokyo Institute of Technology — We study weak-field orbital susceptibility of graphene containing scatterers with long-ranged potential. The effects of scattering from such impurities are taken up self-consistently by using Green's function technique within a self-consistent Born approximation. To see dependence on the potential range, we consider scatterers with a Gaussian potential and screened charged impurities. Because Green's function or self-energy for long-range impurities strongly depends on wave vector, we have to numerically calculate Green's function and vertex functions. In graphene, the susceptibility diverges at the Dirac point as a delta function of the Fermi energy. For the Gaussian potential, results show that the delta function in the ideal graphene is broadened by disorder, due to the mixing between the states at the Dirac point and other states. The susceptibility as a function of the Fermi energy rapidly decreases away from the Dirac point, with effective width determined by the potential range. As the scattering strength increases, the peak at the Dirac point is less prominent and the susceptibility has a long tail, corresponding to the strong mixing among states due to scattering. These behaviors are obtained only when the vertex corrections are properly taken into account. For charged impurities, the susceptibility shows a double-peak structure caused by the strong variation of the effective scattering strength as a function of the Fermi energy.

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