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Weak-field Hall conductivity in a single Dirac cone MASAKI NORO, SHUICHI MURAKAMI, Tokyo Institute of Technology — Weak-field Hall conductivity is calculated in a single Dirac cone within a self-consistent Born approximation. In this system, electronic orbital motion and Zeeman splitting term contribute to the Hall conductivity. The contribution from the electronic orbital motion agrees with the Hall conductivity in graphene apart from the factor of four coming from spin and valley degeneracy, where the electronic structure forms pseudospin Dirac cones. On the other hand, the contribution from the Zeeman splitting term, which is seen only in a single Dirac cone, shows unique behavior. The contribution from Zeeman splitting term is symmetric with respect to the Dirac point as a function of the Fermi energy, in contrast to the antisymmetric behavior of the orbital contribution. It does not depend so much on energy for high Fermi energy region, while it shows a dip around the Dirac point. Besides its singular behavior, we note that the size of this contribution is comparable with that of the electronic orbital motion when we apply experimentally reasonable parameters. Consequently, the total weak-field Hall conductivity is neither symmetric nor antisymmetric with respect to the Dirac point, We compare this result with experimental results on surfaces of topological insulators.

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