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Hall conductivity as the topological invariant in phase space

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It is well known that in the absence of interactions the quantum Hall (QHE) conductivity in the presence of constant magnetic field is expressed through the topological TKNN invariant. The same invariant is responsible for the intrinsic anomalous quantum Hall effect (AQHE), which, in addition, may be represented as one in momentum space composed of the two point Green function. We propose the generalization of this expression to the QHE in the presence of non-uniform magnetic field. The proposed expression is the topological invariant in phase space composed of the Wigner transformation of the two-point Green function. It is applicable to a wide range of non-uniform tight-binding models, including the interacting ones.

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