Odd viscosity and anomalous Hall effect in two dimensional electronic systems with smooth disorder

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In recent years, technological advances have enabled the experimental realization of ultraclean systems, where the momentum relaxation length caused by electron-impurity scattering exceeds the system dimensions. This enables the realization of new transport regimes, particularly hydrodynamic one [1], where novel effects arise that are not related to conventional, diffuse transport. This transport regime can also give rise to new phenomena associated with spin degrees of freedom, particularly, affecting the spin and anomalous Hall effects [2].
In our work, we study the influence of the spin-orbit interaction on the viscosity in a two-dimensional electron gas with nonzero spin polarization [3]. We consider the case of a smooth static disorder, which leads to a quasi-hydrodynamic type of transport, where the relaxation time of the second harmonic distribution function becomes significantly shorter than the momentum relaxation time, even without taking electron-electron collisions into account. The long-range potential of impurities makes a contribution to the odd (off-diagonal) viscosity of the gas, proportional to the spin polarization level of the electron system. This viscosity, arising as a result of spin-orbit interaction, gives an additional contribution to the anomalous Hall effect.

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