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Impurity Effect and the Quantized Thermoelectric Power in the Quantum Nernst Effect

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We theoretically study the Nernst effect and the Seebeck effect in a two-dimensional electron gas in a strong magnetic field and a temperature gradient under adiabatic condition.

For a pure system in the quantum Hall regime, we predicted that the Nernst coefficient is strongly suppressed and the thermal conductance is quantized due to the quantum ballistic transport. However the effect of the impurity scattering of the electrons in the Landau levels is not negligible for the electric transport in the realistic system.

Taking account of impurities, we compute the Nernst coefficient and the Seebeck coefficient when the chemical potential coincides with a Landau level.

We adopt the Green's function method introducing the self-energy part due to the impurity effect in the Landau levels, and we consider the linear transport equations of the thermal electric transport induced by the temperature gradient.

The thermal conductance and the Nernst coefficient are slightly modified from the pure case and the Seebeck coefficient newly appears because of the impurity scattering of electrons in the bulk states.