Shot noise of CdTe/CdMgTe Quantum Point Contact

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Shot noise, a non-equilibrium current fluctuations in electronic devices, occurs due to the discreteness of electric charge and stochastic nature of electron transmission processes. As it is well known, the noise spectroscopy of low-dimensional nanostructures provides a unique information on carrier statistics, their mutual correlations, quasi-particle charges, dephasing mechanisms, and others. For example, a suppression of the noise relative to that predicted by theory for spin degenerate transport is observed in GaAs/AlGaAs Quantum Point Contacts (QPCs) near so-called "0.7 anomaly" (for conductance $G \approx 0.7$ in $G_0 = 2e^2/h$ units) [1]. Observed results are well accounted for within a model in which the twofold degeneracy of one-dimensional channel is lifted by the electron-electron correlation effects [2].

Recently we have reported on fabrication and low temperature magneto-transport measurements of QPCs patterned from a novel two-dimensional electron system — CdTe/CdMgTe modulation doped heterostructure [3]. It is expected that the correlation effects in CdTe are more important, as compared to GaAs, since the effective mass is larger and the dielectric constant is smaller. Indeed, we have provided evidence for a spontaneous formation of a quasi bound state in short and nominally symmetric QPCs, which appearance is caused by stronger *e-e* interaction. One of the arguments relied on the observation of a plateau-like feature at $G \approx 0.25\, G_0$. Calculations suggest [4], that if a weakly bound state is present in the constriction, its local density of states follows Fermi energy when gate voltage V_g is changed and the pinning of the resonant level leads to the appearance of an additional "kink" on G vs V_g curve. Such "0.25-anomaly" was measured before only for rather long (0.4 to 1.0 μm) GaAs quantum wires [5].

In this work we report, for the first time, on shot noise signatures related to the "0.25-anomaly", measured for CdTe/CdMgTe QPC at $T = 0.3$ K. We find a *suppression* of Schottky noise around the anomalous conductance plateau. That gives an experimental evidence that near the 0.25 feature electrons are transported by two non-degenerate one-dimensional channels, each with a different transmission coefficient. This agrees with the previous results obtained for "0.7" plateau. Therefore we suggest, that the weakly bound state, formed within the constriction, is at least partially spin polarized and that the exchange energy plays an important role in its formation.

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