About the paper “REFLECTIONLESS QUANTUM TRANSPORT AND FUNDAMENTAL BALLISTIC-RESISTANCE STEPS IN MICROSCOPIC CONSTRICTIONS by Glazman L. I. , Lesovik G. B., Khmel'nitskii D. E., Shekhter R. I. (1988)»

The paper [1] was aimed at explaining the quantized conductance of a point contact formed in a two-dimensional electron gas (2DEG). The quantization was observed (see Refs. [2] and [3] in the paper) in experiments with contacts formed in GaAs heterostructures by means of gate depletion of 2DEG. The two-terminal conductance was varying with the gate voltage controlling the width of the contact in steps of fundamental height, $2e^2/h$. The quantization effect was puzzling: first, it was observed in the absence of a magnetic field, so it had nothing to do with the quantum Hall effect; second, the conductance quantization ran contrary to the conventional ideas of electron diffraction in scattering off obstacles.

In the paper [1] the point contact is considered as a constriction of 2DEG with boundaries smooth on the scale of Fermi wavelength. That allowed us to use a version of the Born-Oppenheimer approximation to solve the quantum transport problem for electrons moving through the constriction. In our case, the “slow” and “fast” degrees of freedom were, respectively, the electron motion in the directions along and across the constriction. The corresponding adiabatic separation of variables was controlled by a small parameter d/R, *i.e.*, by the ratio of the width of the constriction d to the curvature radius of its boundaries R. The very same parameter ensured the dichotomy between the electron modes reflected from and propagating through the constriction, and, as a consequence, the sharpness of steps between the conductance plateaus. The relative width of the steps in the considered model is of the order of $(d/2\pi^4R)^{1/2}$. Note the fortunate presence of a small numerical factor in the estimate, which makes the steps sharp even for $R \sim d$. (The conjecture of smooth boundaries got support from the developed later [2] microscopic understanding of the electrostatic depletion of 2DEG used to form the constrictions.)

The paper [1] introduced the concept of adiabatic electron transport in mesoscopic semiconductor devices. Among the numerous applications of this concept, probably the most interesting ones are those treating the electron interaction in constrictions and quantum wires, see, *e.g.*, [3,4] for early works in that direction. Current interest to this paper is associated, in part, with the investigation of mesoscopic thermopower and Coulomb drag effect [5], electron kinetics in one dimension [6], and with attempts [7] to explain a mysterious “0.7 anomaly” in the conductance of quantum point contacts.

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