The 0.7-anomaly in quantum point contacts: Evidence for a Nozières' Fermi liquid

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We present a microscopic theory for the 0.7-anomaly in the conductance of a quantum point contact, based on a one-dimensional model with a local interaction and a smooth potential barrier. Using the functional renormalization group to calculate the conductance $G(V_g, B)$ as function of gate voltage and magnetic field at zero temperature, we find qualitative agreement with previous and new experiments. Similar calculations for a one-dimensional quantum dot show that the low-energy phenomelogy of the 0.7-anomaly is related to that of the Kondo effect in quantum dots, in that both exhibit interaction-enhanced spin-fluctuations in regions of low charge density that can be described using a Fermi liquid theory a la Nozières. This observation leads to the prediction that the ratio T^*/B^* should be independent of gate voltage for both the Kondo effect and the 0.7-anomaly, where T^* and B^* are the characteristic temperature and magnetic field scales that govern the leading dependence of the conductance on temperature and magnetic field, respectively. We present new experimental data for the 0.7-anomaly that confirm this prediction and hence provide support for the Fermi liquid description proposed here.