Low frequency noise suppression in nanostructure devices fabricated on modulation doped GaAs/AlGaAs heterostructures grown by Molecular Beam Epitaxy (MBE)

Electrostatically gated nanostructures such as quantum dots (QD) and quantum point contacts (QPC) fabricated on modulation doped GaAs/AlGaAs heterostructures are the essential building blocks in mesoscopic physics and are used to realize solid state qubits. These nanostructures may suffer from random telegraph noise and drift in operating voltage which cause instability in device performance. Although a few techniques are implemented to suppress charge noise, none of them address the root causes of noise and operating gate voltage drift in the heterostructures. I'll present measurements of low frequency charge noise in modulation doped GaAs/AlGaAs heterostructures grown by molecular beam epitaxy in which the silicon doping density has been varied from 2.4×10^{18} cm^{-3} (critically doped) to 6.0×10^{18} cm^{-3} (overdoped). QPCs fabricated on these heterostructures are used to detect fluctuations in the vicinity of QPC. Current noise through quantum point contact (QPC) has been measured on the riser of the first quantized conductance plateau at T=4.2K. A correlation has been found between doping density and amount of noise level. By shifting the placement of Si doping away from the Schottky contact, further reduction observed in charge noise and voltage drift in these heterostructures. The underlying physical processes responsible for this observations will be discussed.