Graphene on GaAs

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We combine graphene nanostructures with high quality AlGaAs/GaAs two-dimensional electron systems (2DESs). The graphene flakes are placed in the region of interest using the transfer technique developed for boron nitride/graphene heterostructures [1]. We demonstrate that graphene can gate and be gated by the GaAs 2DES. Thus, a quantum point contact (QPC) is defined. Figure 1 a) is an atomic force micrograph of the graphene flake, which has been etched in the shape of two side-gates on the GaAs surface. The distance between the two graphene gates is 300nm. Figure 1 b) shows the differential conductance in the GaAs 2DES as a function of voltages applied to the graphene gates. Steps in the conductance occur until pinch-off, indicating the formation of discrete subbands between the gates.

Combining these two materials will allow us to use the GaAs 2DES to detect where localized states appear in graphene etched nanostructures. Moreover, graphene can simultaneously form top gates and very sensitive charge detectors, because nanoribbons are governed by Coulomb blockade [2, 3]. Graphene sensing gates can then be used for probing excitations in the quantum Hall regime in the GaAs.

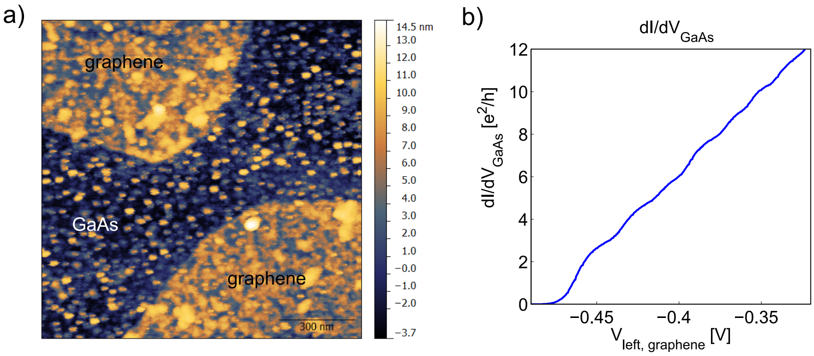

Figure 1: a) Scanning force microscope image of contacted and etched graphene gates (bright areas) defining a quantum point contact in the GaAs 2DES underneath. The dark area is the GaAs surface. Bright dots are grains of resist left from the processing. b) Differential conductance through the graphene defined QPC as a function of the two graphene gate voltages ($V_{\text{right}} = 0.59 + 2.89\,V_{\text{left}}$). A contact resistance of $R_{\text{C}} = 970\,\Omega$ has been subtracted. The presence of localizations in the GaAs QPC causes deviations from the expected values of conductance plateaux.

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