2015/2016

Masterthesis

Suspened graphene quantum dots

Motivation

Since its discovery in 2004 which was awarded the Nobel Prize in 2010, graphene has gained increasing interest in the scientific community. Graphene exhibits unique electronic and mechanical properties making it a promising material for future nano-electronic applications. Because of the absence of the hyperfine field in ^{12}C representing 99% of natural carbon, graphene quantum devices will potentially allow the realization of spin-qubits with long coherence times. Important for further progress towards this goal a better understanding of the influence phononic states have on the excited state spectrum of graphene quantum dots. Suspending the quantum dot creates an additional mechanical degree of freedom which can be exploited by local gate structures positioned underneath the device.

Project

In this research project we will fabricate heterostructures of graphene and pre-structured hexagonal boron nitride exploiting a dry transfer technique to precisely align the structure with a pre-defined local gate. After fabricating the quantum dot by electron beam lithography and depositing contacts, we will perform transport measurements at cryogenic temperatures and explore the quantum nature of the device. For successfully accomplishing the proposed study we will work as well in the clean room to fabricate the device as at a dilution refrigerators to perform the transport measurements.

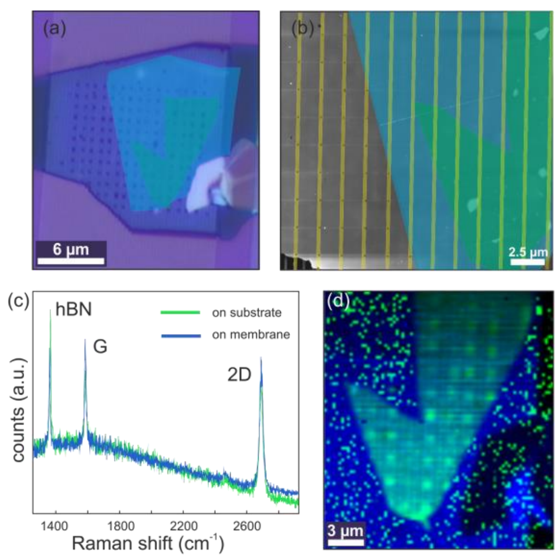

Fig.: (a) Optical image of an hBN (purple) / graphene (green) / hBN (blue) hetrostructure. (b) Atomic force micrograph of the same hetrostructure. The yellow lines depict the underling local gates which are aligned with the holes in the bottom hBN flake. (c) and (d) Single Raman spectrum on a supported (green) and a suspended (blue) part of the structure with the corresponding map of the hBN peak and graphene 2D peak intensity.

Suited for students from the Physics, Electrical Engineering and Material Science departments.

Contact

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